Applied Corporate Finance: Second Edition, 2004

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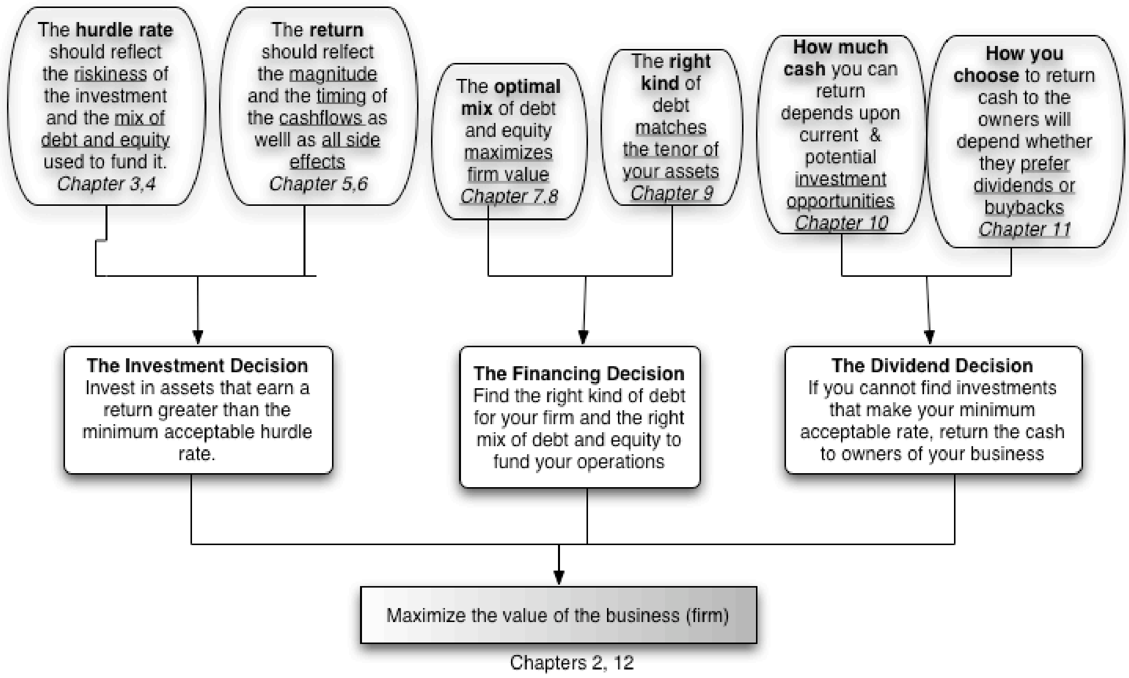
Books are like children. It is tough to pick favorites, but of all the books that I have written, this one is closest to my heart in terms of both what I think about finance as a subject and how I like to teach. I have put this second edition online, ahead of it going to print, in the hope that you will help me edit the manuscript and fix problems before they show up in the printed version.

Preface

Let me begin this preface with a confession of a few of my own biases. First, I believe that theory, and the models that flow from it, should provide us with the tools to understand, analyze and solve problems. The test of a model or theory then should not be based upon its elegance but upon its usefulness in problem solving. Second, there is little in corporate financial theory, in my view, that is new and revolutionary. The core principles of corporate finance are common sense ones, and have changed little over time. That should not be surprising. Corporate finance is only a few decades old and people have been running businesses for thousands of years, and it would be exceedingly presumptuous of us to believe that they were in the dark until corporate finance theorists came along and told them what to do. To be fair, it is true that corporate financial theory has made advances in taking common sense principles and providing them with structure, but these advances have been primarily on the details. The story line in corporate finance has remained remarkably consistent over time.

Talking about story lines allows me to set the first theme of this book. This book tells a story, which essentially summarizes the corporate finance view of the world. It classifies all decisions made by any business into three groups - decisions on where to invest the resources or funds that the business has raised, either internally or externally (the investment decision), decisions on where and how to raise funds to finance these investments (the financing decision) and decisions on how much and in what form to return funds back to the owners (the dividend decision). As I see it, the first principles of corporate finance can be summarized in figure 1, which also lays out a site map for the book. Every section of this book relates to some part of this picture, and each chapter is introduced with it, with emphasis on that portion that will be analyzed in that chapter. (Note the chapter numbers below each section). Put another way, there are no sections of this book that are not traceable to this framework.



As you look at the chapter outline for the book, you are probably wondering where the chapters on present value, option pricing and bond pricing are, as well as the chapters on short-term financial management, working capital and international finance. The first set of chapters, which I would classify as "tools" chapters are now contained in the appendices, and I relegated them there, not because I think that they are unimportant, but because I want the focus to stay on the story line. It is important that we understand the concept of time value of money, but only in the context of mesuring returns on investments better and valuing business. Option pricing theory is elegant and provides impressive insights, but only in the context of looking at options embedded in projects and financing instruments like convertible bonds. The second set of chapters I excluded for a very different reason. As I see it, the basic principles of whether and how much you should invest in inventory, or how generous your credit terms should be, are no different than the basic principles that would apply if you were building a plant or buying equipment or opening a new store. Put another way, there is no logical basis for the differentiation between investments in the latter (which in most corporate finance books is covered in the capital budgeting chapters) and the former (which are considered in the

working capital chapters). You should invest in either if and only if the returns from the investment exceed the hurdle rate from the investment; the fact the one is short term and the other is long term is irrelevant. The same thing can be said about international finance. Should the investment or financing principles be different just because a company is considering an investment in Thailand and the cash flows are in Thai Baht instead of in the United States and the cash flows are in dollars? I do not believe so, and separating the decisions, in my view, only leaves readers with that impression. Finally, most corporate finance books that have chapters on small firm management and private firm management use them to illustrate the differences between these firms and the more conventional large publicly traded firms used in the other chapters. While such differences exist, the commonalities between different types of firms vastly overwhelm the differences, providing a testimonial to the internal consistency of corporate finance. In summary, the second theme of this book is the emphasis on the universality of corporate financial principles, across different firms, in different markets and across different types of decisions.

The way I have tried to bring this universality to life is by using four firms through the book to illustrate each concept; they include a large, publicly traded U.S. corporation (Disney), a small, emerging market company (Aracruz Celulose, a Brazilian paper and pulp company), a financial service firm (Deutsche Bank) and a small private business (Bookscape, an independent New York city book store). While the notion of using real companies to illustrate theory is neither novel nor revolutionary, there are, I believe, two key differences in the way they are used in this book. First, these companies are analyzed on every aspect of corporate finance introduced in this book, rather than used selectively in some chapters. Consequently, the reader can see for himself or herself the similarities and the differences in the way investment, financing and dividend principles are applied to four very different firms. Second, I do not consider this to be a book where applications are used to illustrate the theory. I think of it rather as a book where the theory is presented as a companion to the illustrations. In fact, reverting back to my earlier analogy of theory providing the tool box for understanding problems, this is a book where the problem solving takes center stage and the tools stay in the background.

Reading through the theory and the applications can be instructive and, hopefully, even interesting, but there is no substitute for actually trying things out to bring home both the strengths and weaknesses of corporate finance. There are several ways I have tried to make this book a tool for active learning. One is to introduce *concept questions* at regular intervals which invite responses from the reader. As an example, consider the following illustration from chapter 7:

7.2. ☞: **The Effects of Diversification on Venture Capitalist**

You are comparing the required returns of two venture capitalists who are interested in investing in the same software firm. One venture capitalist has all of his capital invested in only software firms, whereas the other venture capitalist has invested her capital in small companies in a variety of businesses. Which of these two will have the higher required rate of return?

- ❒ The venture capitalist who is invested only in software companies
- ❒ The venture capitalist who is invested in a variety of businesses
- ❒ Cannot answer without more information

This question is designed to check on a concept introduced in an earlier chapter on risk and return on the difference between risk that can be eliminated by holding a diversified portfolio and risk that cannot, and then connecting it to the question of how a business seeking funds from a venture capitalist might be affected by this perception of risk. The answer to this question, in turn, will expose the reader to more questions about whether venture capital in the future will be provided by diversified funds, and what a specialized venture capitalist (who invests in one sector alone) might need to do in order to survive in such an environment. I hope that this will allow readers to see what, for me at least, is one of the most exciting aspects of corporate finance, which is its capacity to provide a framework which can be used to make sense of the events that occur around us every day and make reasonable forecasts about future directions. The second way in which I have tried to make this an active experience is by introducing what I call *live*

Concept Questions

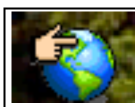
Active learning

Live Case Studies

case studies at the end of each chapter. These case studies essentially take the concepts introduced in the chapter and provide a framework for applying these concepts to any company that the reader chooses. Guidelines on where to get the information to answer the questions is also provided.

While corporate finance provides us with an internally consistent and straight forward template for the analysis of any firm, information is clearly the lubricant that allows us to do the analysis. There are three steps in the information process - acquiring the information, filtering that which is useful from that which is not and keeping the information updated. Accepting the limitations of the printed page on all of these aspects, I have tried to put the power of online information and the internet to use in several ways.

1. The case studies that require the information are accompanied by *links to web sites* that carry this information.
2. The *data sets* that are difficult to get from the internet or are specific to this book, such as the updated versions of the tables, are available on my web site and intergrated into the book. As an example, the table that contains the dividend yields and payout ratios by industry sectors for the most recent quarter is referenced in chapter 9 as follows:



http:www.stern.nyu.edu/~adamodar/datasets/dividends.html

There is a dataset on the web that summarizes dividend yields and payout ratios for U.S. companies, categorized by sector.

3. The *spreadsheets* that are used to analyze the firms in the book are also available on my web site, and referenced in the book. For instance, the spreadsheet used to estimate the optimal debt ratio for Disney in chapter 8 is referenced as follows:

http://www.stern.nyu.edu/~adamodar/spreadsheets/capstru.xls

This spreadsheet allows you to compute the optimal debt ratio firm value for any firm, using the same information used for Disney. It has updated interest coverage ratios and spreads built in.

As I set out to write this book, I had two objectives in mind. One was to write a book that not only reflects the way I teach corporate finance in a classroom, but more importantly, conveys the fascination and enjoyment I get out of the subject matter. The second was to write a book for practitioners that students would find useful, rather than the other way around. I do not know whether I have fully accomplished either objective, but I do know I had an immense amount of fun trying. I hope you do too!

CHAPTER 1

THE FOUNDATIONS

"It's all corporate finance" *My unbiased view of the world*

Every decision made in a business has financial implications, and any decision that involves the use of money is a corporate financial decision. Defined broadly, everything that a business does fits under the rubric of corporate finance. It is, in fact, unfortunate that we even call the subject corporate finance, since it suggests to many observers a focus on how large corporations make financial decisions, and seems to exclude small and private businesses from its purview. A more appropriate title for this book would be Business Finance, since the basic principles remain the same, whether one looks at large, publicly traded firms or small privately run businesses. All businesses have to invest their resources wisely, find the right kind and mix of financing to fund these investments and return cash to the owners if there are not enough good investments.

In this chapter, we will lay the foundation for the rest of the book by listing the three fundamental principles that underlie corporate finance – the investment, financing and dividend principles – and the objective of firm value maximization that is at the heart of corporate financial theory.

The Firm: Structural Set up

In the chapters that follow, we will use **firm** generically to refer to any business, large or small, manufacturing or service, private or public. Thus, a corner grocery store and Microsoft are both firms.

The firm's investments are generically termed **assets**. While assets are often categorized by accountants into fixed assets, which are long-lived, and current assets, which are short-term, we prefer a different categorization. The assets that the firm has already invested in are called **assets-in-place**, whereas those assets that the firm is expected to invest in the future are called **growth assets**. While it may seem strange that a firm can get value from investments it has not made yet, high-growth firms get the bulk of their value from these yet-to-be-made investments.

To finance these assets, the firm can raise money from two sources. It can raise funds from investors or financial institutions by promising investors a fixed claim (interest payments) on the cash flows generated by the assets, with a limited or no role in the day-to-day running of the business. We categorize this type of financing to be **debt**. Alternatively, it can offer a residual claim on the cash flows (i.e., investors can get what is left over after the interest payments have been made) and a much greater role in the operation of the business. We term this **equity**. Note that these definitions are general enough to cover both private firms, where debt may take the form of bank loans, and equity is the owner's own money, as well as publicly traded companies, where the firm may issue bonds (to raise debt) and stock (to raise equity).

Thus, at this stage, we can lay out the financial balance sheet of a firm as follows:

Assets			**Liabilities**
Existing Investments Generate cashflows today Includes long lived (fixed) and short-lived(working capital) assets	Assets in Place	Debt	Fixed Claim on cash flows Little or No role in management *Fixed Maturity* *Tax Deductible*
Expected Value that will be created by future investments	Growth Assets	Equity	Residual Claim on cash flows Significant Role in management *Perpetual Lives*

We will return this framework repeatedly through this book.

First Principles

Every discipline has its first principles that govern and guide everything that gets done within that discipline. All of corporate finance is built on three principles, which we will title, rather unimaginatively, as the investment Principle, the financing Principle and the dividend Principle. The investment principle determines where businesses invest their resources, the financing principle governs the mix of funding used to fund these investments and the dividend principle answers the question of how much earnings should be reinvested back into the business and how much returned to the owners of the business.

- ***The Investment Principle***: Invest in assets and projects that yield a return greater than the minimum acceptable hurdle rate. The hurdle rate should be higher for riskier projects and should reflect the financing mix used - owners' funds (equity) or borrowed money (debt). Returns on projects should be measured based on cash flows generated and the timing of these cash flows; they should also consider both positive and negative side effects of these projects.

- ***The Financing Principle***: Choose a financing mix (debt and equity) that maximizes the value of the investments made and match the financing to nature of the assets being financed.
- ***The Dividend Principle***: If there are not enough investments that earn the hurdle rate, return the cash to the owners of the business. In the case of a publicly traded firm, the form of the return - dividends or stock buybacks - will depend upon what stockholders prefer.

While making these decisions, corporate finance is single minded about the ultimate objective, which is assumed to be maximizing the value of the business. These first principles provide the basis from which we will extract the numerous models and theories that comprise modern corporate finance, but they are also common sense principles. It is incredible conceit on our part to assume that until corporate finance was developed as a coherent discipline starting a few decades ago, that people who ran businesses ran them randomly with no principles to govern their thinking. Good businessmen through the ages have always recognized the importance of these first principles and adhered to them, albeit in intuitive ways. In fact, one of the ironies of recent times is that many managers at large and presumably sophisticated firms with access to the latest corporate finance technology have lost sight of these basic principles.

The Objective of the Firm

No discipline can develop cohesively over time without a unifying objective. The growth of corporate financial theory can be traced to its choice of a single objective and the development of models built around this objective. The objective in conventional corporate financial theory when making decisions is to maximize the value of your business or firm. Consequently, any decision (investment, financial, or dividend) that increases the value of a business is considered a ‘good’ one, whereas one that reduces firm value is considered a ‘poor’ one. While the choice of a singular objective has provided corporate finance with a unifying theme and internal consistency, it has come at a cost. To the degree that one buys into this objective, much of what corporate financial theory suggests makes sense. To the degree that this objective is flawed, however, it can be argued that the theory built on it is flawed as well. Many of the disagreements between corporate financial theorists and others (academics as well as practitioners) can be traced to fundamentally different views about the correct objective for a business. For instance, there are some critics of corporate finance who argue that firms should have multiple objectives where a variety of interests (stockholders, labor, customers) are met, while there are others who would have firms focus on what they view as simpler and more direct objectives such as market share or profitability.

Given the significance of this objective for both the development and the applicability of corporate financial theory, it is important that we examine it much more carefully and address some of the very real concerns and criticisms it has garnered: it assumes that what stockholders do in their own self-interest is also in the best interests of the firm; it is sometimes dependent on the existence of efficient markets; and it is often blind to the social costs associated with value maximization. In the next chapter, we will consider these and other issues and compare firm value maximization to alternative objectives.

The Investment Principle

Firms have scarce resources that must be allocated among competing needs. The first and foremost function of corporate financial theory is to provide a framework for firms to make this decision wisely. Accordingly, we define investment decisions to include not only those that create revenues and profits (such as introducing a new product line or expanding into a new market), but also those that save money (such as building a new and more efficient distribution system). Further, we argue that decisions about how much and what inventory to maintain and whether and how much credit to grant to customers that are traditionally categorized as working capital decisions, are ultimately investment decisions, as well. At the other end of the spectrum, broad strategic decisions regarding which markets to enter and the acquisitions of other companies can also be considered investment

Hurdle Rate: A hurdle rate is a minimum acceptable rate of return for investing resources in a project.

decisions.

Corporate finance attempts to measure the return on a proposed investment decision and compare it to a minimum acceptable hurdle rate in order to decide whether or not the project is acceptable or not. The hurdle rate has to be set higher for riskier projects and has to reflect the financing mix used, i.e., the owner's funds (equity) or borrowed money (debt). In chapter 3, we begin this process by defining risk and developing a procedure for measuring risk. In chapter 4, we go about converting this risk measure into a hurdle rate, i.e., a minimum acceptable rate of return, both for entire businesses and for individual investments.

Having established the hurdle rate, we turn our attention to measuring the returns on an investment. In chapter 5, we evaluate three alternative ways of measuring returns - conventional accounting earnings, cash flows and time-weighted cash flows (where we consider both how large the cash flows are and when they are anticipated to come in). In chapter 6, we consider some of the potential side-costs which might not be captured in any of these measures, including costs that may be created for existing investments by taking a new investment, and side-benefits, such as options to enter new markets and to expand product lines that may be embedded in new investments, and synergies, especially when the new investment is the acquisition of another firm.

The Financing Principle

Every business, no matter how large and complex it is, is ultimately funded with a mix of borrowed money (debt) and owner's funds (equity). With a publicly trade firm, debt may take the form of bonds and equity is usually common stock. In a private business, debt is more likely to be bank loans and an owner's savings represent equity. While we consider the existing mix of debt and equity and its implications for the minimum acceptable hurdle rate as part of the investment principle, we throw open the question of whether the existing mix is the right one in the financing principle section. While there might be regulatory and other real world constraints on the financing mix that a business can use, there is ample room for flexibility within these constraints. We begin this section in chapter 7, by looking at the range of choices that exist for both private businesses and publicly traded firms between debt and equity. We then turn to the question of whether the existing mix of financing used by a business is the "optimal" one, given our objective function of maximizing firm value, in chapter 8. While the tradeoff between the benefits and costs of borrowing are established in qualitative terms first, we also look at two quantitative approaches to arriving at the optimal mix in chapter 8. In the first approach, we examine the specific conditions under which the optimal financing mix is the one that minimizes the minimum acceptable hurdle rate. In the second approach, we look at the effects on firm value of changing the financing mix.

When the optimal financing mix is different from the existing one, we map out the best ways of getting from where we are (the current mix) to where we would like to be (the optimal) in chapter 9, keeping in mind the investment opportunities that the firm has and the need for urgent responses, either because the firm is a takeover target or under threat of bankruptcy. Having outlined the optimal financing mix, we turn our attention to the type of financing a business should use, i.e., whether it should be long term or short term, whether the payments on the financing should be fixed or variable, and if variable, what it should be a function of. Using a basic proposition that a firm will minimize its risk from financing and maximize its capacity to use borrowed funds if it can match up the cash flows on the debt to the cash flows on the assets being financed, we design the perfect financing instrument for a firm. We then add on additional considerations relating to taxes and external monitors (equity research analysts and ratings agencies) and arrive at fairly strong conclusions about the design of the financing.

The Dividend Principle

Most businesses would undoubtedly like to have unlimited investment opportunities that yield returns exceeding their hurdle rates, but all businesses grow and mature. As a consequence, every business that thrives reaches a stage in its life when the cash flows generated by existing investments is greater than the funds needed to take on good investments. At that point, this business has to figure out ways to return the excess cash to owners. In private businesses, this may just involve the owner withdrawing a portion of his or her funds from the business. In a publicly traded corporation, this will involve either dividends or the buying back of stock. In chapter 10, we introduce the basic trade off that determines whether cash should be left in a business or taken out of it.

For stockholders in publicly traded firms, we will note that this decision is fundamentally one of whether they trust the managers of the firms with their cash, and much of this trust is based upon how well these managers have invested funds in the past. In chapter 11, we consider the options available to a firm to return assets to its owners - dividends, stock buybacks and spin offs - and investigate how to pick between these options.

Corporate Financial Decisions, Firm Value and Equity Value

If the objective function in corporate finance is to maximize firm value, it follows that firm value must be linked to the three corporate finance decisions outlined above - investment, financing, and dividend decisions. The link between these decisions and firm value can be made by recognizing that the value of a firm is the present value of its expected cash flows, discounted back at a rate that reflects both the riskiness of the projects of the firm and the financing mix used to finance them. Investors form expectations about future cash flows based upon observed current cash flows and expected future growth, which, in turn, depends upon the quality of the firm's projects (its investment decisions) and the amount reinvested back into the business (its dividend decisions). The financing decisions affect the value of a firm through both the discount rate and, potentially, through the expected cash flows.

This neat formulation of value is put to the test by the interactions among the investment, financing, and dividend decisions, and the conflicts of interest that arise between stockholders and lenders to the firm, on the one hand, and stockholders and managers, on the other. We introduce the basic models available to value a firm and its equity in chapter 12, and relate them back to management decisions on investment, financial and dividend policy. In the process, we examine the determinants of value and how firms can increase their value.

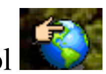
A Real World Focus

The proliferation of news and information on real world businesses making decisions every day suggests that we do not need to use hypothetical businesses to illustrate the principles of corporate finance. We will use four businesses through this book to make our points about corporate financial policy:

1. *Disney Corporation*: Disney Corporation is a publicly traded firm with wide holdings in entertainment and media. While most people around the world recognize the Mickey Mouse logo and have heard about or visited Disney World or seen some or all of the Disney animated classics, it is a much more diversified corporation than most people realize. Disney's holdings include real estate (in the form of time shares and rental properties in Florida and South Carolina), television (ABC and ESPN), publications, movie studios (Miramax, Touchstone and Disney) and retailing. Disney will help illustrate the decisions that large diversified corporations have to make as they are faced with the conventional corporate financial decisions – Where do we invest? How do we finance these investments? How much do we return to our stockholders?
2. *Bookscape Books*: is a privately owned independent book store in New York City, one of the few left after the invasion of the bookstore chains such as Barnes and Noble and Borders Books. We will take Bookscape Books through the corporate financial decision making process to illustrate some of the issues that come up when looking at small businesses with private owners.
3. *Aracruz Cellulose*: Aracruz Cellulose is a Brazilian firm that produces Eucalyptus pulp, and operates its own pulp-mills, electrochemical plants and port terminals. While it markets its products around the world for manufacturing high-grade paper, we will use it to illustrate some of the questions that have to be dealt with when analyzing a company in an environment where inflation is high and volatile, and where the economy itself is in transition.
4. *Deutsche Bank*: Deutsche Bank is the leading commercial bank in Germany and is also a leading player in investment banking with its acquisition of Morgan Grenfell, the U.K investment bank, and Banker's Trust in the United States. We will use Deutsche Bank to illustrate some of the issues the come up when a financial service firm has to make investment, financing and dividend decisions.

A Resource Guide

In order to make the learning in this book as interactive and current as possible, we will employ a variety of devices:

- The first are illustrative examples using the four companies described above, where we will apply corporate finance principles to these firms. These examples will be preceded by the symbol ✍
- The second are spreadsheet programs that can be used to do some of the analysis that will be presented in this book. For instance, there are spreadsheets that calculate the optimal financing mix for a firm as well as valuation spreadsheets. These will be preceded by the symbol 
- The third supporting device we will use are updated data on some of the inputs that we need and use in our analysis that is available on the web site for this book. Thus, when we estimate the risk parameters for firms, we will draw attention to the data set that is maintained on the web site that reports average risk parameters by industry. These data sets will be preceded by the symbol 
- At regular intervals, we will also stop and ask readers to answer questions relating to a topic. These questions, which will generally be framed using real world examples, will help emphasize the key points made in a chapter. They will be preceded by the symbol ☞
- Finally, we will introduce a series of boxes titled "In Practice", which will look at issues that are likely to come up in practice and ways of addressing these issues. These will be preceded by the symbol ✂.

Some Fundamental Propositions about Corporate Finance

There are several fundamental arguments we will make repeatedly throughout this book.

1. <u>Corporate finance has an internal consistency</u> that flows from its choice of maximizing firm value as the only objective function and its dependence upon a few bedrock principles: risk has to be rewarded; cash flows matter more than accounting income; markets are not easily fooled; every decision a firm makes has an effect on its value.

2. <u>Corporate finance must be viewed as an integrated whole</u>, rather than as a collection of decisions. Investment decisions generally affect financing decisions, and vice versa; financing decisions generally affect dividend decisions, and vice versa. While there are

circumstances under which these decisions may be independent of each other, this is seldom the case in practice. Accordingly, it is unlikely that firms that deal with their problems on a piecemeal basis will ever resolve these problems. For instance, a firm that takes poor investments may soon find itself with a dividend problem (with insufficient funds to pay dividends) and a financing problem (because the drop in earnings may make it difficult for them to meet interest expenses).

3. Corporate finance matters to everybody. There is a corporate financial aspect to almost every decision made by a business; while not everyone will find a use for all the components of corporate finance, everyone will find a use for at least some part of it. Marketing managers, corporate strategists human resource managers and information technology managers all make corporate finance decisions every day and often don't realize it. An understanding of corporate finance may help them make better decisions.

4. Corporate finance is fun. This may seem to be the tallest claim of all. After all, most people associate corporate finance with numbers, accounting statements and hardheaded analyses. While corporate finance is quantitative in its focus, there is a significant component of creative thinking involved in coming up with solutions to the financial problems businesses do encounter. It is no coincidence that financial markets remain the breeding grounds for innovation and change.

5. The best way to learn corporate finance is by applying its models and theories to real world problems. While the theory that has been developed over the last few decades is impressive, the ultimate test of any theory is in applications. As we show in this book, much, if not all, of the theory can be applied to real companies and not just to abstract examples, though we have to compromise and make assumptions in the process.

Conclusion

This chapter establishes the first principles that govern corporate finance. The investment principle, that specifies that businesses invest only in projects that yield a return that exceeds the hurdle rate, the financing principle, that suggests that the right financing mix for a firm is one that maximizes the value of the investments made and the dividend principle, which requires that cash generated in excess of "good project" needs be returned to the owners, are the core for what follows.

CHAPTER 2

THE OBJECTIVE IN DECISION MAKING

"If you do not know where you are going, it does not matter how you get there"

Anonymous

Corporate finance's greatest strength and its greatest weaknesses is its focus on value maximization. By maintaining that focus, corporate finance preserves internal consistency and coherence, and develops powerful models and theory about the "right" way to make investment, financing and dividend decisions. It can be argued, however, that all of these conclusions are conditional on the acceptance of value maximization as the only objective in decision-making.

In this chapter, we consider why we focus so strongly on value maximization and why, in practice, the focus shifts to stock price maximization. We also look at the assumptions needed for stock price maximization to be the right objective, the things that can go wrong with firms that focus on it and at least partial fixes to some of these problems. We will argue strongly that, even though stock price maximization is a flawed objective, it offers far more promise than alternative objectives because it is self-correcting.

Choosing the Right Objective

Let us start with a description of what an objective is, and the purpose it serves in developing theory. An objective specifies what a decision maker is trying to accomplish and by so doing, provides measures that can be used to choose between alternatives. In most firms, it is the managers of the firm, rather than the owners, who make the decisions about where to invest or how to raise funds for an investment. Thus, if stock price maximization is the objective, a manager choosing between two alternatives will choose the one that increases stock price more. In most cases, the objective is stated in terms of maximizing some function or variable, such as profits or growth, or minimizing some function or variable, such as risk or costs.

So why do we need an objective, and if we do need one, why cannot we have several? Let us start with the first question. If an objective is not chosen, there is no systematic way to make the decisions that every business will be confronted with at some point in time. For instance, without an objective, how can Disney's managers decide whether the investment in a new theme park is a good one? There would be a menu of approaches for picking projects, ranging from reasonable ones like maximizing return on investment to obscure ones like maximizing the size of the firm, and no statements could be made about their relative value. Consequently, three managers looking at the same project may come to three separate conclusions about it.

If we choose multiple objectives, we are faced with a different problem. A theory developed around multiple objectives of equal weight will create quandaries when it comes to making decisions. To illustrate, assume that a firm chooses as its objectives maximizing market share and maximizing current earnings. If a project increases market share and current earnings, the firm will face no problems, but what if the project being analyzed increases market share while reducing current earnings? The firm should not invest in the project if the current earnings objective is considered, but it should invest in it based upon the market share objective. If objectives are prioritized, we are faced with the same stark choices as in the choice of a single objective. Should the top priority be the maximization of current earnings or should it be maximizing market share? Since there is no gain, therefore, from having multiple objectives, and developing theory becomes much more difficult, we would argue that there should be only one objective.

There are a number of different objectives that a firm can choose between, when it comes to decision making. How will we know whether the objective that we have chosen is the 'right' objective? A good objective should have the following characteristics --

(a) It is *clear and unambiguous*. An objective that is ambiguous will lead to decision rules that vary from case to case and from decision-maker to decision-maker. Consider, for instance, a firm that specifies its objective to be increasing growth in the long term. This is an ambiguous objective since it does not answer at least two questions. The first is growth in what variable - Is it in revenue, operating earnings, net income or earnings per share? The second is in the definition of the long term: Is it 3 years, 5 years or a longer period?

(b) It comes with a *clear and timely measure* that can be used to evaluate the success or failure of decisions. Objectives that sound good but that do not come with a measurement mechanism are likely to fail. For instance, consider a retail firm that defines its objective as "maximizing customer satisfaction". How exactly is customer satisfaction defined and how is it to be measured? If no good mechanism exists for measuring how satisfied customers are with their purchases, not only will managers be unable to make decisions based upon this objective, but stockholders will also have no way of holding them accountable for any decisions that they do make.

(c) It *does not create costs for other entities or groups* that erase firm-specific benefits and leave society worse off overall. As an example, assume that a tobacco company defines its objective to be revenue growth. Managers of this firm would then be inclined to increase advertising to teenagers, since it will increase sales. Doing so may create significant costs for society that overwhelm any benefits arising from the objective.

Some may disagree with the inclusion of social costs and benefits and argue that a business only has a responsibility to its stockholders and not to society. This strikes us as short sighted because the people who own and operate businesses are part of society.

The Classical Objective

There is general agreement, at least among corporate finance theorists that the objective when making decisions in a business is to maximize value. There is some disagreement on whether the objective is to maximize the value of the stockholder's stake in the business or the value of the entire business (firm), which includes besides stockholders, the other financial claim holders (debt holders, preferred stockholders etc.). Furthermore, even among those who argue for stockholder wealth maximization, there is a question about whether this translates into maximizing the stock price. As we will see in this chapter, these objectives vary in terms of the assumptions that are needed to justify them. The least restrictive of the three objectives, in terms of assumptions needed, is to maximize the firm value and the most restrictive is to maximize the stock price.

Multiple Stakeholders and Conflicts of Interest

In the modern corporation, stockholders hire managers to run the firm for them; these managers then borrow from banks and bondholders to finance the firm's operations.

Investors in financial markets respond to information about the firm revealed to them by the managers and firms have to operate in the context of a larger society. By focusing on maximizing stock price, corporate finance exposes itself to several risks. First, the managers who are hired to operate the firm for stockholders may have their own interests that deviate from those of stockholders. Second, stockholders can sometimes be made wealthier by decisions that transfer wealth from those who have lent money to the firm. Third, the information that investors respond to in financial markets may be misleading, incorrect or even fraudulent, and the market response may be out of proportion to the information. Finally, firms that focus on maximizing wealth may create significant costs for society that do not get reflected in the firm's bottom line.

These conflicts of interests are exacerbated further when we bring in two additional stakeholders in the firm. First, the employees of the firm may have little or no interest in stockholder wealth maximization and may have a much larger stake in improving wages, benefits and job security. In some cases, these interests may be in direct conflict with stockholder wealth maximization. Second, the customers of the business will probably prefer that products and services be priced lower to maximize their utility, but this again may conflict with what stockholders would prefer.

Potential Side Costs of Value Maximization

If the objective when making decisions is to maximize firm value, there is a possibility that what is good for the firm may not be good for society. In other words, decisions that are good for the firm, insofar as they increase value, may create social costs. If these costs are large, we can see society paying a high price for value maximization and the objective will have to be modified to allow for these costs. To be fair, however, this is a problem that is likely to persist in any system of private enterprise and is not peculiar to value maximization. The objective of value maximization may also face obstacles when there is separation of ownership and management, as there is in most large public corporations. When managers act as agents for the owners (stockholders), there is the potential for a conflict of interest between stockholder and managerial interests, which in turn can lead to decisions that make managers better off at the expense of stockholders.

When the objective is stated in terms of stockholder wealth, the conflicting interests of stockholders and bondholders have to be reconciled. Since stockholders are the decision-makers, and bondholders are often not completely protected from the side effects of these decisions, one way of maximizing stockholder wealth is to take actions that expropriate wealth from the bondholders, even though such actions may reduce the wealth of the firm.

Finally, when the objective is narrowed further to one of maximizing stock price, inefficiencies in the financial markets may lead to misallocation of resources and bad decisions. For instance, if stock prices do not reflect the long term consequences of decisions, but respond, as some critics say, to short term earnings effects, a decision that increases stockholder wealth (which reflects long term earnings potential) may reduce the stock price. Conversely, a decision that reduces stockholder wealth, but increases earnings in the near term, may increase the stock price.

Why Corporate Finance Focuses on Stock Price Maximization

Much of corporate financial theory is centered on stock price maximization as the sole objective when making decisions. This may seem surprising given the potential side costs listed above, but there are three reasons for the focus on stock price maximization in traditional corporate finance.

- Stock prices are the <u>most observable</u> of all measures that can be used to judge the performance of a publicly traded firm. Unlike earnings or sales, which are updated once every quarter or even once every year, stock prices are updated constantly to reflect new information coming out about the firm. Thus, managers receive instantaneous feedback from investors on every action that they take. A good illustration is the response of markets to a firm announcing that it plans to acquire another firm. While managers consistently paint a rosy picture of every acquisition that they plan, the stock price of the acquiring firm drops in roughly half of all acquisitions, suggesting that markets are much more skeptical about managerial claims.
- If investors are rational and markets are efficient, stock prices will reflect the long-term effects of decisions made by the firm. Unlike accounting measures like

earnings or sales measures such as market share, which look at the effects on current operations of decisions made by a firm, the value of a stock is a function of the long-term health and prospects of the firm. In a rational market, the stock price is an attempt on the part of investors to measure this value. Even if they err in their estimates, it can be argued that a noisy estimate of long-term value is better than a precise estimate of current earnings.

- Finally, choosing stock price maximization as an objective allows us to make categorical statements about what the best way to pick projects and finance them is.

2.1. ☞: **Which of the following assumptions do you need to make for stock price maximization to be the only objective in decision making?**

a. Managers act in the best interests of stockholders
b. Lenders to the firm are fully protected from expropriation.
c. Financial markets are efficient.
d. There are no social costs.
e. All of the above
f. None of the above

In Practice: What is the objective in decision making in a private firm or a non-profit organization?

The objective of maximizing stock prices is a relevant objective only for firms that are publicly traded. How, then, can corporate finance principles be adapted for private firms? For firms that are not publicly traded, the objective in decision-making is the maximization of firm value. The investment, financing and dividend principles we will develop in the chapters to come apply for both publicly traded firms, which focus on stock prices, and private businesses, that maximize firm value. Since firm value is not observable and has to be estimated, what private businesses will lack is the feedback, sometimes unwelcome, that publicly traded firms get from financial markets, when they make major decisions.

It is, however, much more difficult to adapt corporate finance principles to a not-for-profit organization, since it's objective is often to deliver a service in the most efficient way possible, rather than to make profits. For instance, the objective of a hospital may be stated as delivering quality health care at the least cost. The problem, though, is that someone has to define the acceptable level of care and the friction between cost and quality will underlie all decisions made by the hospital.

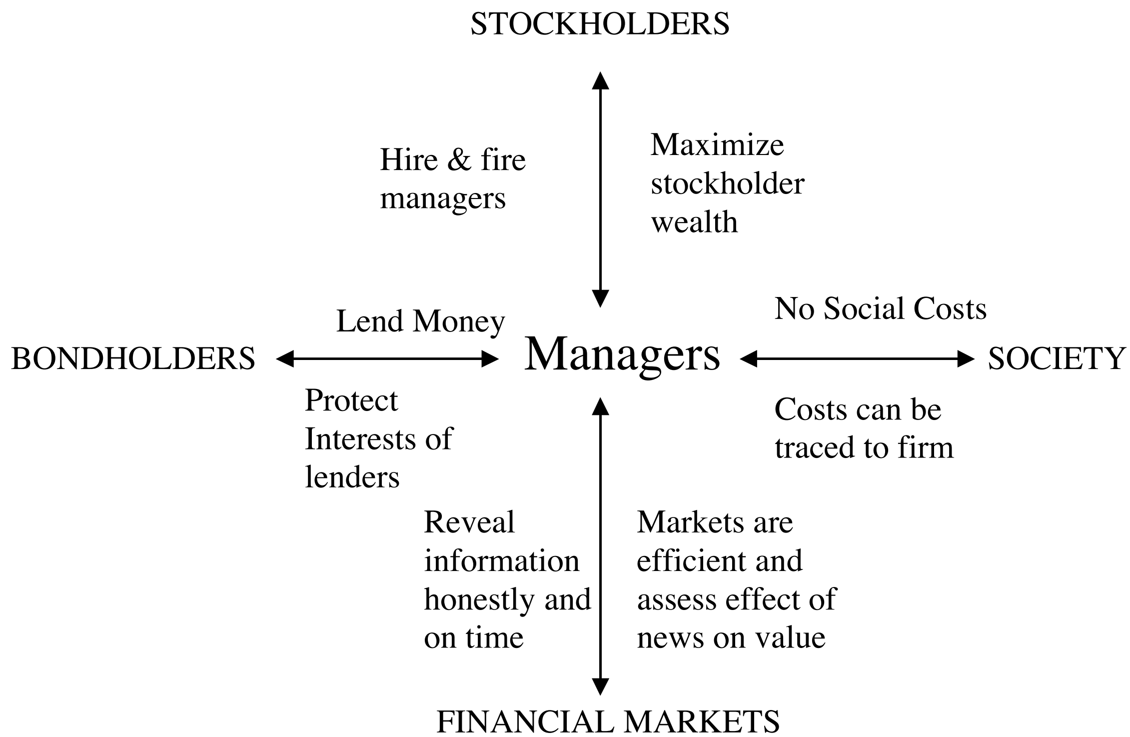
Maximize Stock Prices: The Best Case Scenario

If corporate financial theory is based on the objective of maximizing stock prices, it is worth asking when it is reasonable to ask managers to focus on this objective to the exclusion of all others. There is a scenario where managers can concentrate on maximizing stock prices to the exclusion of all other considerations and not worry about side costs. For this scenario to unfold, the following assumptions have to hold:

1. *The managers of the firm put aside their own interests and focus on maximizing stockholder wealth*. This might occur either because they are terrified of the power stockholders have to replace them (through the annual meeting or the board of directors) or because they own enough stock in the firm that maximizing stockholder wealth becomes their objective as well.
2. *The lenders to the firm are fully protected from expropriation by stockholders*. This can occur for one of two reasons. The first is a reputation effect, i.e., that stockholders will not take any actions that hurt lenders now if they feel that doing so might hurt them when they try to borrow money in the future. The second is that lenders might be able to protect themselves fully when they lend by writing in covenants proscribing the firm from taking any actions that hurt them.
3. *The managers of the firm do not attempt to mislead or lie* to financial markets about the firm's future prospects, and there is sufficient information for markets to make judgments about the effects of actions on long-term cash flows and value. Markets are assumed to be *reasoned and rationa*l in their assessments of these actions and the consequent effects on value.
4. *There are no social costs or social benefits*. All costs created by the firm in its pursuit of maximizing stockholder wealth can be traced and charged to the firm.

With these assumptions, there are no side costs to stock price maximization. Consequently, managers can concentrate on maximizing stock prices. In the process, stockholder wealth and firm value will be maximized and society will be made better off. The assumptions needed for the classical objective are summarized in pictorial form in figure 2.1.

Figure 2.1: Stock Price Maximization: The Costless Scenario



Maximize Stock Prices: Real World Conflicts of Interest

Even a casual perusal of the assumptions that we need for stock price maximization to be the only objective when making decisions suggests that there are potential shortcomings in each one. Managers might not always make decisions that are in the best interests of stockholders, stockholders do sometimes take actions that hurt lenders, information delivered to markets is often erroneous and sometimes misleading and there are social costs that cannot be captured in the financial statements of the company. In the section that follows, we will consider some of the ways in which real world problems might trigger a break down in the stock price maximization objective.

Stockholders and Managers

In classical corporate financial theory, stockholders are assumed to have the power to discipline and replace managers who do not maximize their wealth. The two mechanisms that exist for this power to be exercised are the annual meeting, where stockholders gather to evaluate management performance, and the board of directors, whose fiduciary duty it is to ensure that managers serve stockholders' interests. While the legal backing for this assumption may be reasonable, the practical power of these institutions to enforce stockholder control is debatable. In this section, we will begin by looking at the limits on stockholder power and then examine the consequences for managerial decisions.

The Annual Meeting

Every publicly traded firm has an annual meeting of its stockholders, during which stockholders can both voice their views on management and vote on changes to the corporate charter. Most stockholders, however, do not go to the annual meetings, partly because they do not feel that they can make a difference and partly because it would not make financial sense for them to do so.[1] It is true that investors can exercise their power with proxies[2], but incumbent management starts of with a clear advantage[3]. Many stockholders do not bother to fill out their proxies, and even among those who do, voting for incumbent management is often the default option. For institutional stockholders, with significant holdings in a large number of securities, the easiest option, when dissatisfied with incumbent management, is to vote with their feet, i.e., sell their stock and move on. An activist posture on the part of these stockholders would go a long way towards making managers more responsive to their interests, and there are trends towards more activism, which will be documented later in this chapter.

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[1] An investor who owns 100 shares of stock in Coca Cola will very quickly wipe out any potential returns he makes on his investment if he flies to Atlanta every year for the annual meeting.

[2] A proxy enables stockholders to vote in absentia for boards of directors and for resolutions that will be coming to a vote at the meeting. It does not allow them to ask open-ended questions of management.

[3] This advantage is magnified if the corporate charter allows incumbent management to vote proxies that were never sent back to the firm. This is the equivalent of having an election where the incumbent gets the votes of anybody who does not show up at the ballot box.

The Board of Directors

The board of directors is the body that oversees the management of a publicly traded firm. As elected representatives of the stockholders, the directors are obligated to ensure that managers are looking out for stockholder interests. They can change the top management of the firm and have a substantial influence on how it is run. On major decisions, such as acquisitions of other firms, managers have to get the approval of the board before acting.

The capacity of the board of directors to discipline management and keep them responsive to stockholders is diluted by a number of factors.

(1) Most individuals who serve as directors do not spend much time on their fiduciary duties, partly because of other commitments and partly because many of them serve on the boards of several corporations. Korn Ferry[4], an executive recruiter, publishes a periodical survey of directorial compensation and time spent by directors on their work illustrates this very clearly. In their 1992 survey, they reported that the average director spent 92 hours a year on board meetings and preparation in 1992, down from 108 in 1988, and was paid $32,352, up from $19,544 in 1988[5]. While their 1998 survey did not measure the hours directors spent on their duties, it does mention that their average compensation has climbed to $ 37,924. As a result of scandals associated with lack of board oversight at companies like Enron and Worldcom, directors have come under more pressure to take their jobs seriously. The Korn-Ferry survey in 2002 noted an increase in hours worked by the average director to 183 hours a year and a corresponding surge in compensation.

(2) Even those directors who spend time trying to understand the internal workings of a firm are stymied by their lack of expertise on many issues,

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[4]Korn-Ferry surveys the boards of large corporations and provides insight into their composition.

[5] This understates the true benefits received by the average director in a firm, since it does not count benefits and perquisites - insurance and pension benefits being the largest component. Hewitt Associates, an executive search firm, reports that 67% of 100 firms that they surveyed offer retirement plans for their directors.

especially relating to accounting rules and tender offers, and rely instead on outside experts.

(3) In some firms, a significant percentage of the directors work for the firm, can be categorized as insiders and are unlikely to challenge the CEO. Even when directors are outsiders, they are not independent, insofar as the company's Chief Executive Officer (CEO) often has a major say in who serves on the board. Korn Ferry's annual survey of boards also found, in 1988, that 74% of the 426 companies it surveyed relied on recommendations by the CEO to come up with new directors, while only 16% used a search firm. In its 1998 survey, Korn Ferry did find a shift towards more independence on this issue, with almost three-quarters of firms reporting the existence of a nominating committee that is, at least, nominally independent of the CEO. The 2002 survey confirmed a continuation of this shift.

(4) The CEOs of other companies are the favored choice for directors, leading to a potential conflict of interest, where CEOs sit on each other’s boards.

(5) Most directors hold only small or token stakes in the equity of their corporations, making it difficult for them to empathize with the plight of shareholders, when stock prices go down. In a study in the late 1990s, Institutional Shareholder Services, a consultant, found that 27 directors at 275 of the largest corporations in the United States owned *no* shares at all, and about 5% of all directors owned fewer than five shares.

The net effect of these factors is that the board of directors often fails at its assigned role, which is to protect the interests of stockholders. The CEO sets the agenda, chairs the meeting and controls the information, and the search for consensus generally overwhelms any attempts at confrontation. While there is an impetus towards reform, it has to be noted that these revolts were sparked not by board members, but by large institutional investors.

Greenmail: Greenmail refers to the purchase of a potential hostile acquirer’s stake in a business at a premium over the price paid for that stake by the target company.

The failure of the board of directors to protect stockholders can be illustrated with numerous examples from the United States, but this should not blind us to a more troubling fact. Stockholders exercise more power over management in the United States than in any other financial market. If the annual meeting and the board of directors are, for the most part, ineffective in the United States at exercising control over management, they are even more powerless in Europe and Asia as institutions that protect stockholders.

The Consequences of Stockholder Powerlessness

If the two institutions of corporate governance -- annual meetings and the board of directors -- fail to keep management responsive to stockholders, as argued in the previous section, we cannot expect managers to maximize stockholder wealth, especially when their interests conflict with those of stockholders. Consider the following examples.

1. Fighting Hostile Acquisitions

When a firm is the target of a hostile takeover, managers are sometimes faced with an uncomfortable choice. Allowing the hostile acquisition to go through will allow stockholders to reap substantial financial gains but may result in the managers losing their jobs. Not surprisingly, managers often act to protect their interests, at the expense of stockholders:

> ***Golden Parachute:*** A golden parachute refers to a contractual clause in a management contract that allows the manager to be paid a specified sum of money in the event control of the firm changes, usually in the context of a hostile takeover.

- The managers of some firms that were targeted by acquirers (raiders) for hostile takeovers in the 1980s were able to avoid being acquired by buying out the raider's existing stake, generally at a price much greater than the price paid by the raider and by using stockholder cash. This process, called greenmail, usually causes stock prices to drop but it does protect the jobs of incumbent managers. The irony of using money that belongs to stockholders to protect them against receiving a higher price on the stock they own seems to be lost on the perpetrators of greenmail.
- Another widely used anti-takeover device is a golden parachute, a provision in an employment contract that allow for the payment of a lump-sum or cash flows over a period, if the manager covered by the contract loses his or her job in a takeover. While there are economists who have justified the payment of golden parachutes

as a way of reducing the conflict between stockholders and managers, it is still unseemly that managers should need large side-payments to do that which they are hired to do-- maximize stockholder wealth.

- Firms sometimes create poison pills, which are triggered by hostile takeovers. The objective is to make it difficult and costly to acquire control. A flip over rights offer a simple example. In a flip over right, existing stockholders get the right to buy shares in the firm at a price well above the current stock price as long as the existing management runs the firm; this right is not worth very much. If a hostile acquirer takes over the firm, though, stockholders are given the right to buy additional shares at a price much lower than the current stock price. The acquirer, having weighed in this additional cost, may very well decide against the acquisition.

Poison Pill: A poison pill is a security or a provision that is triggered by the hostile acquisition of the firm, resulting in a large cost to the acquirer.

Greenmail, golden parachutes and poison pills generally do not require stockholder approval and are usually adopted by compliant boards of directors. In all three cases, it can be argued, managerial interests are being served at the expenses of stockholder interests.

2. Anti-takeover Amendments:

Anti-takeover amendments have the same objective as greenmail and poison pills, i.e., dissuading hostile takeovers, but differ on one very important count. They require the assent of stockholders to be instituted. There are several types of anti-takeover amendments, all designed with the objective of reducing the likelihood of a hostile takeover. Consider, for instance, a **super-majority amendment**; to take over a firm that adopts this amendment, an acquirer has to acquire more than the 51% that would normally be required to gain control. Anti-takeover amendments do increase the bargaining power of managers when negotiating with acquirers and could work to the benefit of stockholders[6], but only if managers act in the best interests of stockholders.

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[6] As an example, when AT&T tried to acquire NCR in 1991, NCR had a super-majority anti-takeover amendment. NCR's managers used this requirement to force AT&T to pay a much higher price for NCR

2.2. ☞: Anti-takeover Amendments and Management Trust

If as a stockholder in a company, you were asked to vote on an amendment to the corporate charter which would restrict hostile takeovers of your company and give your management more power, in which of the following types of companies would you be most likely to vote yes to the amendment?

a. Companies where the managers promise to use this power to extract a higher price for you from hostile bidders
b. Companies which have done badly (in earnings and stock price performance) in the last few years
c. Companies which have done well (in earnings and stock price performance) in the last few years
d. I would never vote for such an amendment

Paying too much on acquisitions

There are many ways in which managers can make their stockholders worse off - by investing in bad projects, by borrowing too much or too little and by adopting defensive mechanisms against potentially value-increasing takeovers. The quickest and perhaps the most decisive way to impoverish stockholders is to overpay on a takeover, since the amounts paid on takeovers tend to dwarf those involved in the other decisions listed above. Of course, the managers of the firms doing the acquiring will argue that they never[7] overpay on takeovers, and that the high premiums paid in acquisitions can be justified using any number of reasons -- there is synergy, there are strategic considerations, the target firm is undervalued and badly managed, and so on. The stockholders in acquiring firms do not seem to share the enthusiasm for mergers and

Synergy: Synergy is the additional value created by bringing together two entities, and pooling their strengths. In the context of a merger, synergy is the difference between the value of the merged firm, and sum of the values of the firms operating independently.

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shares than their initial offer.

[7] One explanation given for the phenomenon of overpaying on takeovers is given by Roll, who posits that it is managerial hubris (pride) that drives the process.

acquisitions that their managers have, since the stock prices of bidding firms decline on the takeover announcements a significant proportion[8] of the time.

These illustrations are not meant to make the case that managers are venal and selfish, which would be an unfair charge, but are manifestations of a much more fundamental problem; when there is conflict of interest between stockholders and managers, stockholder wealth maximization is likely to take second place to management objectives.

This data set has the break down of CEO compensation for many U.S. firms for the most recent year.

Illustration 2.1: Assessing Disney's Board of Directors

Over the last decade Disney has emerged as a case study of weak corporate governance, where a powerful CEO, Michael Eisner, has been given free rein by a captive board of directors. We will look at Disney's board of directors in 1997, when Fortune magazine ranked it as having the worst board of the Fortune 500 companies and again in 2002, when it made the list of the five most improved boards.

At the end of 1996, Disney had 15 members on its board and the board members are listed in table 2.1, categorized by whether they work or worked for Disney (insiders) or not (outsiders).

Table 2.1: Disney's Board of Directors – 1996

Insiders	*Outsiders*
Michael D. Eisner, 54: CEO Roy E. Disney, 66: Head of animation department. Sanford M. Litvack, 60: Chief of corporate operations. Richard A. Nunis, 64: Chairman of Walt	Reveta F. Bowers, 48: Head of school for the Center for Early Education, *where Mr. Eisner's children attended class.* Ignacio E. Lozano Jr., 69: Chairman of Lozano Enterprises, publisher of La Opinion newspaper in Los Angeles.

[8] Jarrell, Brickley and Netter (1988) in an extensive study of returns to bidder firms note that excess returns on these firms' stocks around the announcement of takeovers have declined from an average of 4.95% in the sixties to 2% in the seventies to -1% in the eighties. You, Caves, Smith and Henry (1986) examine 133 mergers between 1976 and 1984 and find that the stock prices of bidding firms declined in 53% of the cases.

Disney Attractions. *Raymond L. Watson, 70: Disney chairman in 1983 and 1984. *E. Cardon Walker, 80: Disney chairman and chief executive, 1980-83 *Gary L. Wilson, 56: Disney Chief Financial Officer, 1985-89 * Thomas S. Murphy, 71: Former chairman and chief executive of Capital Cities/ABC Inc. * Ex-officials of Disney	George J. Mitchell, 63: Washington, D.C. attorney, former U.S. senator. *Disney paid Mr. Mitchell $50,000 for his consulting on international business matters in 1996. His Washington law firm was paid an additional $122,764.* Stanley P. Gold, 54: President and chief executive of Shamrock Holdings Inc., which *manages about $1 billion in investments for the Disney family*. The Rev. Leo J. O'Donovan, 62: President of Georgetown University, where one of Mr.Eisner's children attended college. *Mr. Eisner sat on Georgetown board and has contributed more than $1 million to the school*. Irwin E. Russell, 70: Beverly Hills, Calif., attorney *whose clients include Mr. Eisner*. * Sidney Poitier, 69: Actor. Robert A.M. Stern, 57: New York architect *who has designed numerous Disney projects*. He received $168,278 for those services in fiscal 1996.

Note that eight of the sixteen members on the board are or were Disney employees and that Michael Eisner, in addition to being CEO, chaired the board. Of the eight outsiders, at least five had potential conflicts of interests because of their ties with either Disney or Michael Eisner. The potential conflicts are listed in italics in table 2.1. Given the composition of this board, it should come as no surprise that it failed to assert its power against incumbent management.[9]

In 1997, Calpers, the California public employee pension fund, suggested a series of checks to see if a board was likely to be effective in acting as a counter-weight to a powerful CEO including:

- Are a majority of the directors outside directors?

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[9] One case where it cost Disney dearly was when Mr. Eisner prevailed on the board to hire Michael Ovitz, a noted Hollywood agent, with a generous compensation. A few years later, Ovitz left the company after falling out with Eisner, creating a multi-million liability for Disney. A 2003 lawsuit against Disney's board members in 1996 contended that they failed in their fiduciary duty by not checking the terms of the compensation agreement before assenting to the hiring.

- Is the chairman of the board independent of the company (and not the CEO of the company)?
- Are the compensation and audit committees composed entirely of outsiders?

When Calpers put the companies in the S&P 500 through these tests in 1997, Disney was the only company that failed all of the tests, with insiders on every one of the key committees.

Disney came under pressure from stockholders to modify its corporate governance practices between 1997 and 2002 and did make some changes to its board. Table 2.2 lists the board members in 2002.

Table 2.2: Disney's Board of Directors – 2002

Board Members	*Occupation*
Reveta Bowers	Head of school for the Center for Early Education,
John Bryson	CEO and Chairman of Con Edison
Roy Disney	Head of Disney Animation
Michael Eisner	CEO of Disney
Judith Estrin	CEO of Packet Design (an internet company)
Stanley Gold	CEO of Shamrock Holdings
Robert Iger	Chief Operating Officer, Disney
Monica Lozano	Chief Operation Officer, La Opinion (Spanish newspaper)
George Mitchell	Chairman of law firm (Verner, Liipfert, et al.)
Thomas S. Murphy	Ex-CEO, Capital Cities ABC
Leo O'Donovan	Professor of Theology, Georgetown University
Sidney Poitier	Actor, Writer and Director
Robert A.M. Stern	Senior Partner of Robert A.M. Stern Architects of New York
Andrea L. Van de Kamp	Chairman of Sotheby's West Coast
Raymond L. Watson	Chairman of Irvine Company (a real estate corporation)
Gary L. Wilson	Chairman of the board, Northwest Airlines.

Note that many of the board members with conflicts of interests from 1996 continue to serve on the board. On a positive note, the number of insiders on the board has dropped from eight to six but the board size remains sixteen members. In summary, while the board itself may be marginally more independent in 2002 than it was in 1997, it is still far from ideal in its composition.

Illustration 2.2: Corporate Governance at Aracruz: Voting and Non-voting Shares

Aracruz Cellulose, like most Brazilian companies, had multiple classes of shares at the end of 2002. The common shares had all of the voting rights and were held by incumbent management, lenders to the company and the Brazilian government. Outside investors held the non-voting shares, which were called preferred shares[10], and had no say in the election of the board of directors. At the end of 2002, Aracruz was managed by a board of seven directors, composed primarily of representatives of those who own the common (voting) shares, and an executive board, composed of three managers of the company.

Without analyzing the composition of the board of Aracruz, it is quite clear that there is the potential for a conflict of interest between voting shareholders who are fully represented on the board and preferred stockholders who are not. While Brazilian law provides some protection for the latter, preferred stockholders have no power to change the existing management of the company and little influence over major decisions that can affect their value.

Illustration 2.3: Corporate Governance at Deutsche Bank: Cross Holdings

Deutsche Bank follows the German tradition and legal requirement of having two boards. The board of managing directors, which is composed primarily of incumbent managers, develops the company's strategy, reviews it with the Supervisory Board and ensures its implementation. The Supervisory Board appoints and recalls the members of the Board of Managing Directors and, in cooperation with the Board of Managing Directors, arranges for long-term successor planning. It also advises the board of Managing Directors on the management of business and supervises it in its achievement of long-term goals.

A look at the supervisory board of directors at Deutsche provides some insight into the differences between the US and German corporate governance systems. The supervisory board at Deutsche Bank consists of twenty members, but eight are representatives of the employees. While the remaining twelve are elected by shareholders, employees clearly have a much bigger say in how companies are run in Germany and can sometimes exercise veto power over company decisions. Deutsche Bank's corporate governance structure is also muddied by cross holdings. Deutsche is the

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[10] This can create some confusion for investors in the United States, where preferred stock is stock with a fixed dividend and resembles bonds more than conventional common stock.

largest stockholder in Daimler Chrysler, the German automobile company, and Allianz, the German insurance company, is the largest stockholder in Deutsche.

In Practice: Is there a payoff to better corporate governance?

While academics and activist investors are understandably enthused by moves towards giving stockholders more power over managers, a practical question that is often not answered is what the payoff to better corporate governance is. Are companies where stockholders have more power over managers managed better and run more efficiently? If so, are they more valuable? While no individual study can answer these significant questions, there are a number of different strands of research that offer some insight:

- In the most comprehensive study of the effect of corporate governance on value, a governance index was created for each of 1500 firms based upon 24 distinct corporate governance provisions.[11] Buying stocks that had the strongest investor protections while simultaneously selling shares with the weakest protections generated an annual excess return of 8.5%. Every one point increase in the index towards fewer investor protections decreased market value by 8.9% in 1999 and firms that scored high in investor protections also had higher profits, higher sales growth and made fewer acquisitions. These findings are echoed in studies on firms in Korea[12] and Germany[13].
- Actions that restrict hostile takeovers generally reduce stockholder power by taking away one of the most potent weapons available against indifferent management. In 1990, Pennsylvania considered passing a state law that would have protected incumbent managers against hostile takeovers by allowing them to override stockholder interests if other stakeholders were adversely impacted. In

[11] Gompers, P.A., J.L. Ishii and A. Metrick, 2003, *Corporate Governance and Equity Prices*, Quarterly Journal of Economics, v118, 107-155. The data for the governance index was obtained from the Investor Responsibility Research Center which tracks the corporate charter provisions for hundreds of firms.

[12] Black, B.S., H. Jang and W. Kim, 2003, *Does Corporate Governance affect Firm Value? Evidence from Korea*, Stanford Law School Working Paper.

[13] Drobetz, W., 2003, *Corporate Governance: Legal Fiction or Economic Reality*, Working Paper, University of Basel.

the months between the time the law was first proposed and the time it was passed, the stock prices of Pennsylvania companies declined by 6.90%.[14]

- There seems to be little evidence of a link between the composition of the board of directors and firm value. In other words, there is little to indicate that companies with boards that have fewer insiders trade at higher prices than companies with insider dominated boards. [15]
- While this is anecdotal evidence, the wave of corporate scandals – Enron, Worldcom and Tyco - in the United States 2000 and 2001 indicated a significant cost to having a compliant board. A common theme that emerged at problem companies was an ineffective board that failed to ask tough questions of an imperial CEO,

Stockholders and Bondholders

In a world where what is good for stockholders in a firm is also good for its bondholders (lenders), the latter might not have to worry about protecting themselves from expropriation. In the real world, however, there is a risk that bondholders, who do not protect themselves, may be taken advantage of in a variety of ways - by stockholders borrowing more money, paying more dividends or undercutting the security of the assets on which the loans were based.

The Source of the Conflict

The source of the conflict of interest between stockholders and bondholders lies in the differences in the nature of the cash flow claims of the two groups. Bondholders generally have first claim on cash flows, but receive fixed interest payments, assuming that the firm makes enough income to meet its debt obligations. Equity investors have a claim on the cashflows that are left over, but have the option in publicly traded firms of declaring bankruptcy if the firm has insufficient cash flows to meet its financial

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[14] Karpoff, J.M. and P.H. Malatesta, 1990, The Wealth Effects of Second-Generation State Takeover Legislation, Journal of Financial Economics, v25, 291-322.

[15] Bhagat, Sanjai & Bernard Black. 1999. The Uncertain Relationship Between Board Composition and Firm Performance. *Business Lawyer*. v54, 921-963.

obligations. Bondholders do not get to participate on the upside if the projects succeed, but bear a significant portion of the cost, if they fail. As a consequence, bondholders tend to view the risk in investments much more negatively than stockholders. There are many issues on which stockholders and bondholders are likely to disagree.

Some Examples of the Conflict

Existing bondholders can be made worse off by increases in borrowing, especially if these increases are large and affect the default risk of the firm, and these bondholders are unprotected. The stockholders' wealth increases concurrently. This effect is dramatically illustrated in the case of acquisitions funded primarily with debt, where the debt ratio increases and the bond rating drops significantly. The prices of existing bonds fall to reflect the higher default risk.[16]

Dividend policy is another issue on which a conflict of interest may arise between stockholders and bondholders. The effect of higher dividends on stock prices can be debated in theory, with differences of opinion on whether it should increase or decrease prices, but the empirical evidence is clear. Increases in dividends, on average, lead to higher stock prices, while decreases in dividends lead to lower stock prices. Bond prices, on the other hand, react negatively to dividend increases and positively to dividend cuts. The reason is simple. Dividend payments reduce the cash available to a firm, thus making debt more risky.

The Consequences of Stockholder-Bondholder Conflicts

As these two illustrations make clear, stockholders and bondholders have different objectives and some decisions can transfer wealth from one group (usually bondholders) to the other (usually stockholders). Focusing on maximizing stockholder wealth may result in stockholders taking perverse actions that harm

> ***Bond Covenants:*** Covenants are restrictions built into contractual agreements. The most commom reference in corporate finance to covenants is in bond agreements, and they represent restrictions placed by lenders on investment, financing and dividend decisions made by the firm.

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[16] In the leveraged buyout of Nabisco, existing bonds dropped in price 19% on the day of the acquisition, even as stock prices zoomed up.

the overall firm, but increase their wealth at the expense of bondholders.

It is possible that we are making too much of the expropriation possibility, for a couple of reasons. Bondholders are aware of the potential of stockholders to take actions that are inimical to their interests, and generally protect themselves, either by writing in covenants or restrictions on what stockholders can do, or by taking an equity interest in the firm. Furthermore, the need to return to the bond markets to raise further funds in the future will keep many firms honest, since the gains from any one-time wealth transfer are likely to by outweighed by the reputation loss associated with such actions. These issues will be considered in more detail later in the book.

The Firm and Financial Markets

There is an advantage to maintaining an objective that focuses on stockholder or firm wealth, rather than stock prices or the market value of the firm, since it does not require any assumptions about the efficiency or otherwise of financial markets. The downside, however, is that stockholder or firm wealth is not easily measurable, making it difficult to establish clear standards for success and failure. It is true that there are valuation models, some of which we will examine in this book, that attempt to measure equity and firm value, but they are based on a large number of essentially subjective inputs on which people may disagree. Since an essential characteristic of a good objective is that it comes with a clear and unambiguous measurement mechanism, the advantages of shifting to an objective that focuses on market prices is obvious. The measure of success or failure is there for all to see. Successful manager raises their firms' stock price and unsuccessful managers reduce theirs.

The trouble with market prices is that the investors who assess them can make serious mistakes. To the extent that financial markets are efficient and use the information that is available to make measured and unbiased estimates of future cash flows and risk, market prices will reflect true value. In such markets, both the measurers and the measured will accept the market price as the appropriate mechanism for judging success and failure.

There are two potential barriers to this. The first is that information is the lubricant that enables markets to be efficient. To the extent that this information is hidden, delayed or misleading, market prices will deviate from true value, even in an otherwise efficient market. The second problem is that there are many, both in academia and in practice who argue that markets are not efficient, even when information is freely available. In both cases, decisions that maximize stock prices may not be consistent with long-term value maximization.

2.3. ☞: **The Credibility of Firms in Conveying Information**

Do you think that the information revealed by companies about themselves is usually

a. timely and honest?

b. biased?

c. fraudulent?

The Information Problem

Market prices are based upon information, both public and private. In the world of classical theory, information about companies is revealed promptly and truthfully to financial markets. In the real world, there are a few impediments to this process. The first is that information is sometimes suppressed or delayed by firms, especially when it contains bad news. While there is significant anecdotal evidence of this occurrence, the most direct evidence that firms do this comes from studies of earnings and dividend announcements made by firms. A study of earnings announcements, noted that those announcements that had the worst news tended to be delayed the longest, relative to the expected announcement date.[17] In a similar vein, a study of earnings and dividend announcements by day of the week for firms on the New York Stock Exchange between 1982 and 1986 found that the announcements made on Friday, especially after the close of trading, contained more bad news than announcements made on any other day of the

Public and Private Information: Public information refers to any information that is available to the investing public, whereas private information is information that is restricted to only insiders or a few investors in the firm.

[17] Penman, S. H., 1987, The Distribution Of Earnings News Over Time And Seasonalities In Aggregate Stock Returns, Journal of Financial Economics, v18(2), 199-228.

week.[18] This suggests that managers try to release bad news when markets are least active or closed, because they fear that markets will over react.

The second problem is a more serious one. Some firms, in their zeal to keep investors happy and raise market prices, release intentionally misleading information about the firm's current conditions and future prospects to financial markets. These misrepresentations can cause stock prices to deviate significantly from value. Consider the example of Bre-X, a Canadian gold mining company that claimed to have found one of the largest mines in the world in Indonesia in the early 1990s. The stock was heavily touted by equity research analysts in the United States and Canada, but the entire claim was fraudulent. When the fraud came to light in 1997, the stock price tumbled, and analysts professed to be shocked that they had been misled by the firm. The more recent cases of Enron, WorldCom and Parmalat suggest that this problem is not restricted to smaller, less followed companies and can persist even with strict accounting standards and auditing oversight.

The implications of such fraudulent behavior for corporate finance can be profound, since managers are often evaluated on the basis of stock price performance. Thus Bre-X managers with options or bonus plans tied to the stock price probably did very well before the fraud came to light. Repeated violations of investor trust by companies can also lead to a loss of faith in equity markets and a decline in stock prices for all firms.

2.4. ☞ **: Reputation and Market Access**

Which of the following types of firms is more likely to mislead markets?

a. Companies that access markets infrequently to raise funds for operations - they raise funds internally.

b. Companies that access markets frequently to raise funds for operations

Explain.

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[18] Damodaran, A., 1989, The Weekend Effect In Information Releases: A Study Of Earnings And Dividend Announcements, Review of Financial Studies, v2(4), 607-623.

2. The Market Problem

The fear that managers have of markets over reacting or not assimilating information well into prices may be justified. Even if information flowed freely and with no distortion to financial markets, there is no guarantee that what emerges as the market price will be an unbiased estimate of true value. In fact, there are many who would argue that the fault lies deeper and that investors are much too irrational and unreliable to come up with a good estimate of the true value. Some of the criticisms that have been mounted against financial markets are legitimate, some are overblown and some are flat out wrong, but we will consider all of them.

1. *Financial markets do not always reasonably and rationally assess the effects of new information on prices.* Critics using this line of argument note that markets can be volatile, reacting to no news at all in some cases; in any case, the volatility in market prices is usually much greater than the volatility in any of the underlying fundamentals. The argument that financial markets are much too volatile, given he underlying fundamentals, has some empirical support.[19] As for the irrationality of markets, the frequency with which you see bubbles in markets from the tulip bulb mania of the 1600s in Holland to the dot-com debacle of the late 1990s seems to be proof enough that emotions sometime get ahead of reason in markets.
2. *Financial markets sometimes over react to information.* Analysts with this point of view point to firms that reports earnings that are much higher or much lower than expected and argue that stock prices jump too much on good news and drop too much on bad news. The evidence on this proposition is mixed, though, since there are other cases where markets seem to under react to news about firms. Overall, the only conclusion that all these studies agree on is that markets make mistakes in assessing the effect of news on value.
3. *There are cases where insiders move markets to their benefit and often at the expense of outside investors.* This is especially true with illiquid stocks and is exacerbated in markets where trading is infrequent. Even with widely held and

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[19] Shiller , R. J., 2000, *Irrational Exuberance*, Princeton University Press, Princeton.

traded stocks, insiders sometimes use their superior access to information to get ahead of other investors.[20]

Notwithstanding these limitations, we cannot take away from the central contribution of financial markets. They assimilate and aggregate a remarkable amount of information on current conditions and future prospects into one measure -- the price. No competing measure comes close to providing as timely or as comprehensive a measure of a firm's standing. The value of having market prices is best illustrated when working with a private firm as opposed to a public firm. While managers of the latter may resent the second-guessing of analysts and investors, there is a great deal of value to knowing how investors perceive the actions that the firm takes.

2.5. ☞: **Are markets short term?**

Focusing on market prices will lead companies towards short term decisions at the expense of long term value.

a. I agree with the statement

b. I do not agree with this statement

Allowing managers to make decisions without having to worry about the effect on market prices will lead to better long term decisions.

a. I agree with this statement

b. I do not agree with this statement

Illustration 2.4: Interaction with financial markets – A Case Study with Disney

The complex interaction between firms and financial markets is best illustrated by what happens around earnings announcements. Consider, for instance, Disney's earnings report for the last quarter of 2002 that was released to financial markets on February 1, 2003. The report contained the news that net income at the company dropped 42% from the prior year's level. The stock price increased by about 2% on the announcement of this bad news, because the reported earnings per share of 17 cents per share was higher than the 16 cents per share expected by analysts.

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[20] This is true even in the presence of strong insider trading laws, as is the case in the United States. Studies that look at insider trades registered with the SEC seem to indicate that insider buying and selling does precede stock prices going up and down respectively. The advantage is small, though.

There are several interesting points that are worth making here. The first relates to the role that analysts play in setting expectations. In early 2003, for example, there were 17 analysts working at brokerage houses and investment banks who provided estimates of earnings per share for Disney.[21] The lowest of the estimates was 13 cents per share, the highest was 20 cents per share and the average (also titled consensus) estimate was for 16 cents per share. The second relates to the power of expectations. Any news that a company reports has to be measured relative to market expectations before it can be categorized as good or bad news. Thus, a report of a drop in earnings (as was the case with Disney for the last quarter of 2002) can be good news because it did not drop as much as expected. Conversely, Disney reported an increase of 12% in earnings for the last quarter of 2003 (in February 2004) and saw its stock price decline slightly on the news because the increase was smaller than expected.

In Practice: Are markets short term?

There are many who believe that stock price maximization leads to a short-term focus for manager - see for instance Michael Porter's book on competitive strategy. The reasoning goes as follows: Stock prices are determined by traders, short term investors and analysts, all of whom hold the stock for short periods and spend their time trying to forecast next quarter's earnings. Managers who concentrate on creating long-term value, rather than short-term results, will be penalized by markets. Most of the empirical evidence that exists suggests that markets are much more long term than they are given credit for:

1. There are hundreds of firms, especially small and start-up firms, which do not have any current earnings and cash flows, do not expect to have any in the near future, but which are still able to raise substantial amounts of money on the basis of expectations of success in the future. If markets were in fact as short term as the critics suggest, these firms should be unable to raise funds in the first place.

[21] These analysts are called sell-side analysts because their research is then offered to portfolio managers and other clients. The analysts who work for mutual funds are called buy side analysts and toil in relative obscurity since their recommendations are for internal consumption at the mutual funds and are not publicized.

2. If the evidence suggests anything, it is that markets do not value current earnings and cash flows enough and value future earnings and cash flows too much. Studies indicate that stocks with low price-earnings ratios, i.e., high current earnings, have generally been under priced relative to stocks with high price-earnings ratios.
3. The market response to research and development and investment expenditure is not uniformly negative, as the 'short term' critics would lead you to believe. Instead, the response is tempered, with stock prices, on average, rising on the announcement of R&D and capital expenditures.

Do some investors and analysts focus on short term earnings and not on long term value? Of course. In our view, financial managers cater far too much to these investors and skew their decisions to meet their approval, fleeting though it might be.

The Firm and Society

Most management decisions have social consequences, and the question of how best to deal with these consequences is not easily answered. An objective of maximizing firm or stockholder wealth implicitly assumes that the social side-costs are either trivial enough that they can be ignored or that they can be priced and charged to the firm. In many cases, neither of these assumptions is justifiable.

There are some cases where the social costs are considerable but cannot be traced to the firm. In these cases, the decision-makers, though aware of the costs, may choose to ignore the costs and maximize firm wealth. The ethical and moral dilemmas of forcing a managers to choose between their survival (which may require stockholder wealth maximization) and the broader interests of society can be debated but there is no simple solution that can be offered in this book.

In the cases where substantial social costs exist, and firms are aware of these costs, ethicists might argue that wealth maximization has to be sublimated to the broader interests of society, but what about those cases where firms create substantial social costs without being aware of these costs? John Manville Corporation, for instance, in the fifties and sixties produced asbestos with the intention of making a profit, and was unaware of the potential of the product to cause cancer. Thirty years later, the lawsuits from those afflicted with asbestos-related cancers have driven the company to bankruptcy.

To be fair, conflicts between the interests of the firm and the interests of society are not restricted to the objective of maximizing stockholder wealth. They may be endemic to a system of private enterprise, and there will never be a solution to satisfy the purists who would like to see a complete congruence between the social and firm interests.

2.6. ☞: **Can laws make companies good citizens?**

It has often been argued that social costs occur because governments do not have adequate laws on the books to punish companies that create social costs. The follow-up is that passing such laws will eliminate social costs.

a. I agree with the statement

b. I do not agree with this statement

Illustration 2.5: Assessing Social Costs

The ubiquity of social costs is made clear when we look at the three companies we are analyzing – Disney, Aracruz and Deutsche Bank. These companies, in spite of their many differences, have social costs to consider:

- Disney was built and continues to market itself as the ultimate family oriented company. When its only businesses were theme parks and animated movies, it faced relatively few conflicts. With its expansion into the movie business and television broadcasting, Disney has exposed itself to new problems. To provide an illustration, the Southern Baptist Convention voted in 1997 to boycott Disney theme parks and movies in response to the airing of "Ellen" a show on the ABC network, starring Ellen de Generes as a gay bookstore owner. It is because of this fear of a backlash that Disney maintains separate movie studios – Touchstone/Miramax for grown-up movies and Disney Studios for animated movies.
- Aracruz is at the center of the controversy about the deforestation of the rain forests in South America. In the later 1990s, Aracruz was accused by

environmental groups of replacing old growth forests in Brazil with eucalyptus plantations and displacing native and indigenous peoples from these areas.[22]

- Deutsche Bank has been challenged for its role as banker for the Nazis during the holocaust. Its acquisition of Bankers Trust in 2000 was almost derailed by accusations that it had helped fund the construction of the concentration camp at Auschwitz during the Second World War. Both Deutsche Bank and Dresdner Bank were sued by survivors of the holocaust for profiting from gold and other assets stolen from concentration camp victims during World War II.[23]

For all three companies, these accusations are serious not only because they damage their reputations but can also create serious economic costs. All three aggressively defended themselves against the charges and spend a substantial number of pages in their annual reports detailing what they do to be good corporate citizens.

In Practice: Stakeholder Wealth Maximization and Balanced Scorecards

Some theorists have suggested that the best way to consider the interests of all of the different stakeholders in a modern corporation is to replace stockholder wealth maximization with a broader objective of stakeholder wealth maximization, where stakeholders include employees and society. While it sounds wonderful as a concept, we believe that it is not a worthwhile alternative for the following reasons:

- When you have multiple stakeholders, with very different objectives, you will inevitably have to choose between them. For instance, laying off employees at a firm that is overstaffed will make stockholders and bondholders better off while creating costs and society. Stakeholder wealth maximization provides little direction on the proper way to balance these competing interests.
- Adding to the problem is the fact that not all of the costs and benefits to some stakeholders can be quantified. This is especially true of social costs and benefits, leaving the assessment to analysts who have their own biases.

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[22] In the 1990s, the Tupinikim and Guarani Indians launched an international campaign against Aracruz in the state of Espirito Santo to recover and expand their traditional territories

[23] A 1946 investigation by the US military recommended Deutsche Bank be liquidated and its top officials be tried as war criminals.

- Most importantly, stakeholder wealth maximization makes managers accountable to no one by making them accountable to every one. Managers can essentially go before each stakeholder and justify their failures by arguing that other stakeholder interests were being considered.

It may still useful for firms to go beyond the proverbial bottom line, which is what a balanced scorecard attempts to do. As devised by Robert Kaplan, a Harvard strategy professor, balanced scorecards try to go beyond financial measures and look at customer satisfaction and internal business processes.[24]

The Real World - A Pictorial Representation

We have spent the last few pages chronicling the problems, in the real world, with each of the linkages -- managers and stockholders, stockholders and bondholders, firms and financial markets and firms and society. Figure 2.2 summarizes the problems with each linkage in a pictorial representation.

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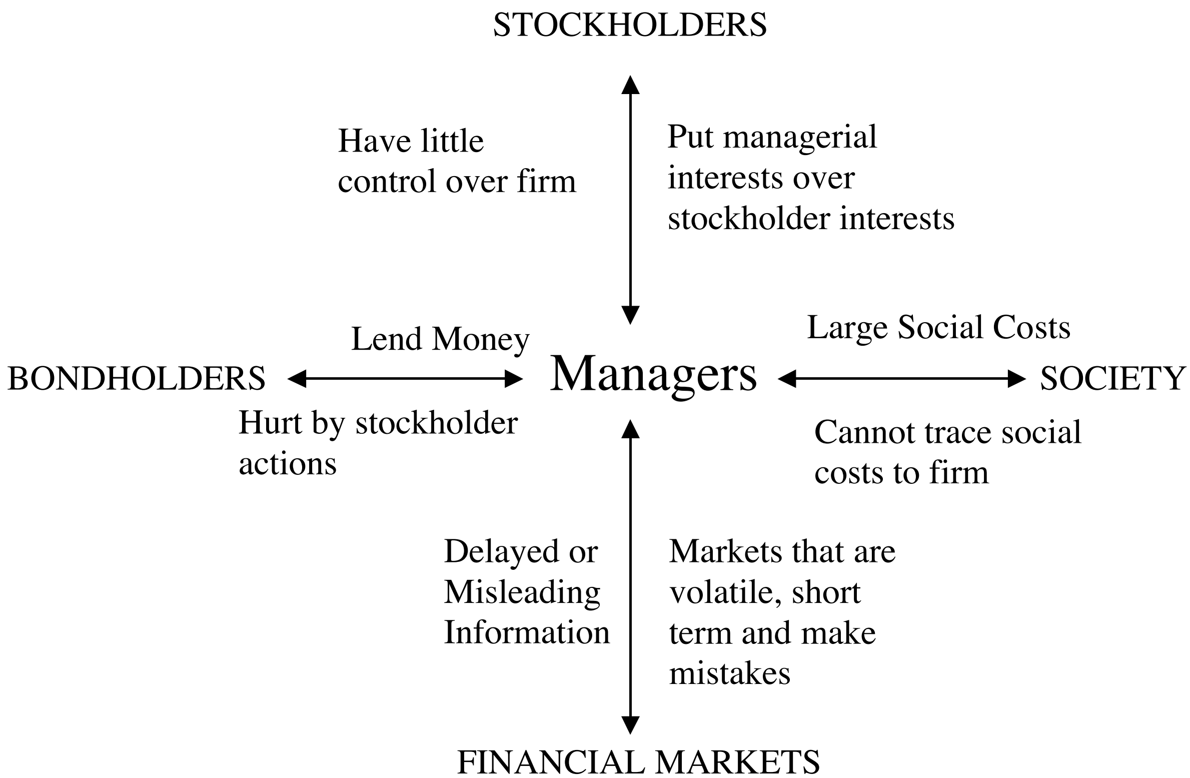
[24] *The Balanced Scorecard: Translating Strategy into Action*, 1996, Robert.S. Kaplan and David P. Norton, Harvard Business School Press.

Figure 2.2: Stock Price Maximization in the Real World



Alternatives to Stock Price Maximization

There are obvious problems associated with each of the linkages underlying wealth maximization. Stockholders often have little power over managers, and managers consequently put their interests above those of stockholders. Lenders who do not protect their interests often end up paying a price, when decisions made by firms transfer wealth to stockholders. Information delivered to financial markets is often erroneous, misleading or delayed, and there are significant differences between price and market value. Finally, firms that maximize wealth may do so while creating large costs for society.

Given these problems, there are alternative courses of action that we can follow. One is to find a different system for keeping errant management in check. The second is to find an alternative objective for the firm. In this section, we will consider these alternatives.

A Different System for Disciplining Management (Corporate Governance)

In the system we have described thus far, stockholders bear the burden of replacing incompetent management; we can call this a market-based corporate governance system, where investors in financial markets govern how corporations are run. There are some who believe that this is too much of a responsibility to put on investors who, as they see it, often operate with poor information and have short time horizons. Michael Porter, a leading thinker on corporate strategy, has argued that firms in the United States are hamstrung by the fact that investors are short term and demand quick returns. He contrasts them with Japanese firms, which he argues can afford to adopt strategies that make sense in the long term, even though they might not maximize profits in the short term. He suggests that investors should form long-term relationships[25] with firms and work with them to devise long-term strategies. His view of the world is not unique and is shared by many corporate executives, even in the United States.

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[25] There is some movement towards "relationship investing" in the United States, where funds such as Allied Partners (run by Dillon Read), Corporate Partners (run by Lazard Freres) and Lens (run by activist Robert Monks) have attempted to create long term relationships with the managers of firms.

These executives argue that there are alternatives to the market-based corporate governance systems, where stockholders act to discipline and replace errant managers and stock prices measure their success. In the German and Japanese systems[26] of corporate governance, firms own stakes in other firms and often make decisions in the best interests of the industrial group they belong to, rather their own. In these systems, the argument goes, firms will keep an eye on each other, rather than ceding power to the stockholders. In addition to being undemocratic - the stockholders are after all the owners of the firm -- these systems suggests a profound suspicion of how stockholders might use the power if they get it and is heavily skewed towards maintaining the power of incumbent managers.

While this approach may protect the system against the waste that is a by-product of stockholder activism and inefficient markets, it has its own disadvantages. Industrial groups are inherently more conservative than investors in allocating resources and thus are much less likely to finance high risk and venture capital investments by upstarts who do not belong to the group. The other problem is that entire groups can be dragged down by individual firms that have made bad decisions[27]. In fact, the troubles that Japanese firms have had dealing with poor investments in the 1990s suggests to us that these alternative corporate governance systems, while efficient at dealing with individual firms that are poorly run, have a more difficult time adapting to and dealing with problems that are wide-spread. These problems, consequently, tend to fester and grow over time. For instance, while financial markets pushed corporate banks in the United States to confront their poor real estate loans in the late 1980s, Japanese banks spent much of the 1990s denying the existence of such loans on their books[28].

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[26] There are subtle differences between the Japanese and the German systems. The Japanese industrial groups called keiretsus are based primarily on cross-holdings of companies and evolved from family owned businesses. The German industrial groups revolve around leading commercial banks, like Deutsche Bank or Dresdner, with the bank holding substantial stakes in a number of industrial concerns.

[27] Many Korean industrial groups (called chaebols), that were patterned after the Japanese keiretsu, were pushed to the verge of bankruptcy in 1990s because one or two errant firms in the group made bad real estate loans.

[28] Kaplan, S.N., 1997, *Corporate Governance and Corporate Performance, A Comparison of German, Japan and the United States*, Journal of Applied Corporate Finance, v9(4), 86-93.. He compares the U.S.,

Is there a way in which we can measure the effectiveness of alternative corporate governance systems? One suggestion is that corporate governance systems be measured on three dimensions - the capacity to restrict management's ability to obtain private benefits from control, easy access of firms that want capital to financial markets and the ease with which inefficient management is replaced. It can be argued that corporate governance system in the United States does a better job than alternative systems on all three counts.[29]

Choosing an alternative objective

Given its limitations, the easy answer would be to cast aside stock price maximization as an objective. The tough part is replacing it with another objective. It is not that there are no alternatives, but that the alternatives come with their own sets of problems and it is not at all obvious that there is a benefit to switching. This is especially true when the alternative objective is evaluated on the three criteria we used to evaluate the wealth maximization objective - Is the objective clear and unambiguous? Does it come with a timely measure that can be used to evaluate success and failure? Does it create side costs that exceed the overall benefits? Let us consider three commonly offered alternatives to stock price maximization.

1. Maximize Market Share

In the 1980s, Japanese firms inundated global markets with their products and focused their attention on increasing market share. Their apparent success at converting this market share to profits led other firms, including some in the United States, to also target market share as an objective. In concrete terms, this meant that investments that increased market share more were viewed more favorably than investments that increased them less. Proponents of this objective note that market share is observable and

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German and Japanese corporate governance systems. He finds that the U.S. system provides better incentives for firms performing well and that it is easier for companies in the U.S. to return cash to the stockholders.

[29] Macey, J.R., 1998, Measuring the Effectiveness of Different Corporate Governance Systems: Towards a more Scientific Approach, Journal of Applied Corporate Finance, v10(4), 16-25.

measurable like market price, and does not require any of the assumptions about efficient financial markets that are needed to justify the stock price maximization objective.

Underlying the market share maximization objective is the belief (often unstated) that higher market share will mean more pricing power and higher profits in the long term. If this is, in fact, true, maximizing market share is entirely consistent with our objective of maximizing firm value. If however, higher market share does not yield higher pricing power, and the increase in market share is accompanied by lower or even negative earnings, firms that concentrate on increasing market share can be worse off as a consequence. In fact, many of the same Japanese firms that were used by corporate strategists as their examples for why the focus on market share was a good one discovered the harsh downside of this focus in the 1990s.

II. Profit Maximization Objectives

There are objectives that focus on profitability rather than value. The rationale for them is that profits can be measured more easily than value, and that higher profits translate into higher value in the long term. There are at least two problems with these objectives. First, the emphasis on current profitability may result in short term decisions that maximize profits now at the expense of long-term profits and value. Second, the notion that profits can be measured more precisely than value may be incorrect, given the leeway that accountants have to shift profits across periods.

In its more sophisticated forms, profit maximization is restated in terms of accounting returns (such as return on equity or capital) rather than dollar profits or even as excess returns (over a cost of capital). While these variants may remove some of the problems associated with focusing on dollar profits next period, the problems with accounting measurements carry over into them as well.

III. Size/Revenue Objectives

There are a whole set of objectives that have little to do with stockholder wealth but focus instead on the size of the firm. In the 1970s, for instance, firms like Gulf and Western and ITT, with strong CEOs at their helm, were built up through acquisitions into giant conglomerates. There seemed to be no strategic imperative to these acquisitions, other than the desire on the part of the CEOs to increase the sizes of their corporate empires. Empire building may no longer be in vogue, but there have been cases where corporations have made decisions that increase their size and perceived power at the expense of stockholder wealth and profitability.

Maximize Stock Prices: Salvaging a Flawed Objective

The alternatives to stock price maximization – a corporate governance system build around self-governance or a different objective – have their own limitations. In this section, we consider the case for salvaging stock price maximization as an objective, but consider ways in which we can reduce some of the problems highlighted in the earlier section. In particular, we consider ways in which we can reduce the conflicts of interest between stockholders, bondholders and managers, and the potential for market failures. We also present an argument for stock price maximization based upon the market's capacity to correct systematic mistakes quickly and effectively.

Conflict Resolution: Reducing Agency Problems

If the conflicts between stockholders, managers and bondholders lie at the heart of the problems with stock price maximization, reducing these conflicts should make it a more palatable objective. In this section, we examine the linkages between stockholders and managers, stockholders and bondholders, firms and financial markets and firms and society and look at how best we can reduce the side costs to maximizing stock prices.

Stockholders and Managers

There are clearly conflicts of interests between stockholders and managers, and the traditional mechanisms for stockholder control -- annual meetings and boards of directors -- often fail at their role of discipline management. This does not mean, however, that the chasm between the two groups is too wide to be bridged, either by closing the gap between their interests or by increasing stockholder power over managers.

Making managers think more like stockholders

As long as managers have interests that are distinct and different from the interests of the stockholders they serve, there is potential for conflict. One way to reduce this conflict is to provide managers with an equity stake in the firms they manage, either by providing them with stock or warrants on the stock. If this is done, the benefits that accrue to management from higher stock prices may provide an inducement to maximize stock prices.

> ***Warrants:*** A warrant is a security issued by a company that provides the holder with the right to buy a share of stock in the company at a fixed price during the life of the warrant.

There is a downside to doing this, which is that while it reduces the conflict of interest between stockholders and managers, it may exacerbate the other conflicts of interest highlighted in the prior section. It may increase the potential for expropriation of wealth from bondholders and the probability that misleading information may be conveyed to financial markets.

There is a final distinction that we need to make between stock based compensation and warrant based compensation. As we will see in the coming chapters, options can sometimes become more valuable as you increase the risk in a business. Consequently, managers who have substantial option holdings and little in common stock may be tempted to take on far more risk than would be desired by other shareholders in the firm.

2.7. ☞**: Stockholder Interests, Managerial Interests and Management Buyouts**

In a management buyout, the managers of the firm buy out the existing stockholders and make the company a private firm. Is this a way of reducing the conflict of interests between stockholders and managers?

a. Yes

b. No

Explain.

More Effective Boards of Directors

In the last few years, there have been encouraging trends both in the composition and the behavior of boards, making them more effective advocates for stockholders. Korn Ferry's survey of boards of directors at 900 large US corporations in 1998 revealed the following:

- Boards have become smaller over time. The median size of a board of directors has decreased from 16 to 20 in the 1970s to between 9 and 11 in 1998. The smaller boards are less unwieldy and more effective than the larger boards.
- There are fewer insiders on the board. In contrast to the 6 or more insiders that many boards had in the 1970s, only two directors in most boards in 1998 were insiders.
- Directors are increasingly compensated with stock and options in the company, instead of cash. In 1973, only 4% of directors received compensation in the form of stock or options, whereas 78% did so in 1998. This stock compensation makes it more likely that directors will think like stockholders.
- More directors are identified and selected by a nominating committee rather than being chosen by the CEO of the firm. In 1998, 75% of boards had nominating committees; the comparable statistic in 1973 was 2%.

Is there a payoff to a more active board? MacAvoy and Millstein (1998) present evidence that companies with more activist boards, where activism was measured based both up assessments by CALPERS and indicators of board behavior, earned much higher returns on their capital than firms that had less active boards.

Increasing stockholder power

There are many ways in which stockholder power over management can be increased. The first is to provide stockholders with better and more updated information, so that they can make better judgments on how well the management is doing. The second is to have a large stockholder become part of incumbent management, and have a direct role in decisions that the firm makes. The third is to have more 'activist' institutional stockholders, who play a larger role in issues such as the composition of the board of directors, the question of whether to pass anti-takeover amendments and overall management policy. In recent years, some institutional investors have used their considerable power to pressure managers into becoming more responsive to their needs. Among the most aggressive of these investors has been the California Public Employees Retirement System (CALPERS), one of the largest institutional investors in the country. Unfortunately, the largest institutional investors – mutual funds and pension fund companies – have remained largely apathetic. The fourth change, pushed by these activist stockholders, is to make boards of directors more responsive to stockholders, by reducing the number of insiders on these boards and making them more independent of CEOs.

It is also critical that institutional constraints on stockholders exercising their power be reduced. All common shares should have the same voting rights and state restrictions on takeovers have to be eliminated and shareholder voting should be simplified. The legal system should come down hard on managers (and boards of directors) who fail to do their fiduciary duty. Ultimately, though, stockholders have to awake to the reality that the responsibility for monitoring management falls to them. Like voters in a democracy, shareholders get the managers they deserve.

2.8. ☞: **Inside Stockholders versus Outside Stockholders**

There are companies like Microsoft where a large stockholder (Bill Gates) may be the on the inside as the manager of the concern. Is it possible that what is in Bill Gates' best interests as an "inside" stockholder may not be in the interests of a stockholder on the outside?

a. Yes. Their interests may deviate.

b. No. Their interests will not deviate

If yes, provide an example of an action that may benefit the inside stockholder but not the outside stockholder.

The Threat of a Takeover

The perceived excesses of many takeovers in the eighties drew attention to the damage created to employees and society some of them. In movies and books, the raiders who were involved in these takeovers were portrayed as 'barbarians', while the firms being taken over were viewed as hapless victims. While this may have been true in some cases, the reality was that in most cases, companies that were taken over deserved to be taken over. One analysis found that target firms in hostile takeovers in 1985 and 1986 were generally much less profitable than their competitors, had provided sub-par returns to their stockholders and that managers in these firms had significantly lower holdings of the equity. In short, badly managed firms were much more likely to become targets of hostile takeover bids.[30]

An implication of this finding is that takeovers operate as a disciplinary mechanism, keeping managers in check, by introducing a cost to bad management. Often, the very threat of a takeover is sufficient to make firms restructure their assets and become more responsive to stockholder concerns. It is not surprising, therefore, that legal attempts to regulate and restrict takeovers have had negative consequences for stock prices.

2.9. ☞**: Hostile Acquisitions: Who do they hurt?**

Given the information presented in this chapter, which of the following groups is likely to be the most likely to be protected by a law banning hostile takeovers?

a. Stockholders of target companies
b. Managers and employees of well-run target companies
c. Managers and employees of badly-run target companies
d. Society

Illustration 2.6: Restive Stockholders and Responsive Managers: The Disney Case

In 1997, Disney was widely perceived as having an imperial CEO in Michael Eisner and a captive board of directors. After a series of missteps including the hiring and firing of Michael Ovitz and bloated pay packages, Disney stockholders were restive but there were no signs of an impending revolt at that time. As Disney's stock price slid between 1997 and 2000, though, this changed as more institutional investors made their displeasure with the state of corporate governance at the company. As talk of hostile takeovers and proxy fights filled the air, Disney was forced to respond. In its 2002 annual report, Disney listed the following corporate governance changes:

- Required at least two executive sessions of the board, without the CEO or other members of management present, each year.

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[30] Bhide, A., 1989, *The Causes and Consequences of Hostile Takeovers*, Journal of Applied Corporate Finance, v2, 36-59.

- Created the position of non-management presiding director, and appointed Senator George Mitchell to lead those executive sessions and assist in setting the work agenda of the board.
- Adopted a new and more rigorous definition of director independence.
- Required that a substantial majority of the board be comprised of directors meeting the new independence standards.
- Provided for a reduction in committee size and the rotation of committee and chairmanship assignments among independent directors.
- Added new provisions for management succession planning and evaluations of both management and board performance
- Provided for enhanced continuing education and training for board members.

What changed between 1997 and 2002? While we can point to an overall shift in the market towards stronger corporate governance, the biggest factor was poor stock price performance. The truth is that stockholders are often willing to overlook poor corporate governance and dictatorial CEOs if stock prices are going up but are less tolerant when stock prices decrease.

Towards the end of 2003, Roy Disney and Stanley Gold resigned from Disney's board of directors, complaining both about the failures of Michael Eisner and his autocratic style.[31] When the board of directors announced early in 2004 that Michael Eisner would receive a $6.25 million bonus for his performance in 2003, some institutional investors voiced their opposition. Soon after, Comcast announced a hostile acquisition bid for Disney. At Disney's annual meeting in February 2004, Disney and Gold raised their concerns about Eisner's management style and the still-captive board of directors and 43% of the stockholders voted against Eisner as director at the meeting. In a sense, the stars were lining up for the perfect corporate governance storm at Disney, with Eisner in the eye of the storm. Soon after the meeting, Disney announced that Eisner would step down as chairman of the board even though he would continue as CEO until his term expired in 2006.

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[31] You can read Roy Disney's letter of resignation on the web site for the book.

In Practice: Proxy Fights

In the section on annual meetings, we pointed out that many investors who are unable to come to annual meetings also fail to return their proxies, thus implicitly giving incumbent managers their votes. In a proxy fight, activist investors who want to challenge incumbent managers approach individual stockholders in the company and solicit their proxies, which they then can use in votes against the management slate.

In one very public and expensive proxy fight in 2002, David Hewlett, who was sitting on the board of Hewlett Packard (HP) at the time, tried to stop HP from buying Compaq by soliciting proxies from HP stockholders. After eight months of acrimony, HP finally won the fight with the bare minimum 51% of the votes. How did Hewlett come so close to stopping the deal? One advantage he had was that the Hewlett and Packard families owned a combined 18% of the total number of shares outstanding. The other was that Hewlett's position on the board and his access to internal information gave him a great deal of credibility when it came to fighting for the votes of institutional investors. The fact that he failed, even with these advantages, shows how difficult it is to win at a proxy fight. Even a failed proxy fight, though, often has the salutary effect of awakening incumbent managers to the need to at least consider what shareholders want.

Stockholders and Bondholders

The conflict of interests between stockholders and bondholders can lead to actions that transfer wealth to the former from the latter. There are ways in which bondholders can obtain at least partial protection against some of these actions.

The Effect of Covenants

The most direct way for bondholders to protect themselves is to write in covenants in their bond agreements specifically prohibiting or restricting actions that may be wealth expropriating. Many bond (and bank loan) agreements have covenants that do the following:

(1) Restrict the firm's investment policy: Investing in riskier projects than anticipated can lead to a transfer of wealth from bondholders to stockholders. Some bond agreements put restrictions on where firms can invest and how much

risk they can take on in their new investments, specifically to provide bondholders with the power to veto actions that are not in their best interests.

(2) Restrict dividend policy: In general, increases in dividends increase stock prices while decreasing bond prices, because they reduce the cash available to the firm to meet debt payments. Many bond agreements restrict dividend policy, by tying dividend payments to earnings.

(3) Restrict additional leverage: Some bond agreements require firms to get the consent of existing lenders before borrowing more money. This is done to protect the interests of existing secured bondholders.

While covenants can be effective at protecting bondholders against some abuses, they do come with a price tag. In particular, firms may find themselves having to turn down profitable investments because of bondholder-imposed constraints and having to pay (indirectly) for the legal and monitoring costs associated with the constraints.

Taking an Equity Stake

Since the primary reason for the conflict of interests between stockholders and bondholders lies in the nature of their claims, another way that bondholders can reduce the conflict of interest is by owning an equity stake in the firm. This can take the form of buying stock in the firm at the same time as bonds, or it can be accomplished by making bonds convertible into stock at the option of the bondholders. In either case, bondholders who feel that equity investors are enriching themselves at the lenders' expense, can become stockholders and share in the spoils.

Bond Innovations

In the aftermath of several bond market debacles in the late 1980s, bondholders became increasingly creative in protecting themselves with new types of bonds. While we will consider these innovations in more detail later in this book, consider the example of puttable bonds. Unlike a conventional bond, where you are constrained to hold the bond to maturity, the holders of a puttable bond can put the bond back to the issuing company and get the face value of the bond if the company violates the conditions of the bond. For instance, a sudden increase in borrowing or a drop in bond ratings can trigger this action.

Firms and Financial Markets

The information that firms convey to financial markets is often erroneous, and sometimes misleading. The market price that emerges from financial markets can be wrong, partly because of inefficiencies in markets and partly because of the errors in the information. There are no easy or quick fix solutions to these problems. In the long term, however, there are actions that will improve information quality and reduce deviations between price and value.

Improving the Quality of Information

While regulatory bodies like the Securities and Exchange Commission can require firms to reveal more information and penalize firms that provide misleading and fraudulent information, the quality of information cannot be improved with information disclosure laws alone. In particular, firms will always have a vested interest in when and what information they reveal to markets. To provide balance, therefore, an active market for information, where analysts, who are not hired and fired by the firms that they follow, collect and disseminate information, has to exist. While these analysts are just as likely to make mistakes as the firm, they presumably should have a greater incentive to unearth bad news about the firm and to disseminate that information to their clients. For this system to work, analysts have to be given free rein to search for good as well as bad news and to make positive or negative judgments about a firm.

Making Markets more efficient

Just as better information cannot be legislated into existence, markets cannot be made more efficient by edict. In fact, there is widespread disagreement on what is required to make markets more efficient. At the minimum, these are necessary (though not sufficient) conditions for more efficient markets --

a. Trading should be both inexpensive and easy. The higher transactions costs are, and the more difficult it is to execute a trade, the more likely it is that markets will be inefficient.
b. There should be free and wide access to information about firms.
c. Investors should be allowed to benefit when they pick the right stocks to invest in and to pay the price when they make mistakes.

Restrictions imposed on trading, while well intentioned, often lead to market inefficiencies. For instance, restricting short sales, where investors who don't own a stock can borrow and sell it if they feel it is overpriced, may seem like good public policy, but it can create a scenario where negative information about stocks cannot be reflected adequately in prices.

Firms and Society

There will always be social costs associated with actions taken by firms, operating in their own best interests. The basic conundrum is as follows; social costs cannot be ignored in making decisions, but they are also too nebulous to be factored explicitly into analyses. One solution is for firms to maximize firm or stockholder value, subject to a 'good citizen' constraint, where attempts are made to minimize or alleviate social costs, even though the firm may not be under any legal obligation to do so. The problem with this approach, of course, is that the definition of a 'good citizen' is likely to vary from firm to firm and from manager to manager.

Ultimately, the most effective way to make companies more socially responsible is to make it in their best economic interests to behave well. This can occur in two ways. First, firms that are construed as socially irresponsible could lose customers and profits. This was the galvanizing factor behind a number of specialty retailers in the United States disavowing the use of sweatshops and underage labor in other countries in making their products. Second, investors might avoid buying stock in these companies. As an example, many college and state pension plans in the United States have started reducing or eliminating their holding of tobacco stocks to reflect their concerns about the health effects of tobacco. In fact, investors now have access to "ethical mutual funds" which invest only in companies that meet a social consciousness threshold.[32] Figure 2.3 summarizes the ways in which we can reduce potential side costs from stock price maximization.

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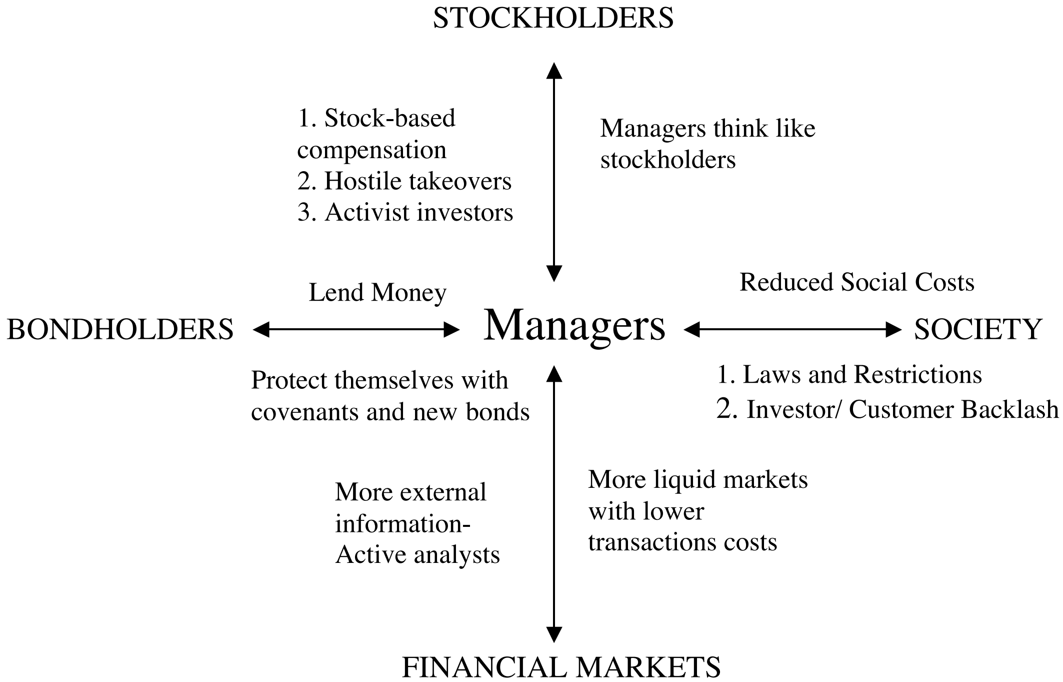
[32] Studies of these funds indicate that they earn returns comparable to conventional mutual funds.

Figure 2.3: Maximize Stock Prices but minimize side costs



In Practice: Can you add value while doing good?

Does doing social good hurt or help firms? On the one side of this argument stand those who believe that firms that expend considerable resources to generate social good are misguided and are doing their stockholders a disservice. On the other side, there are those who believe that socially conscious firms are rewarded by consumers and investors. The evidence is mixed and will undoubtedly disappoint both sides:

- Studies indicate that the returns earned by stockholders in socially conscious firms are no different than the returns earned by stockholders in the rest o the market. Studies of ethical mutual funds find that they neither lag nor lead other mutual funds.
- There is clearly a substantial economic cost borne by companies that are viewed by society as beyond the pale when it comes to creating social costs. Tobacco firms, for instance, have seen stock prices slide as investors avoid their shares and profits hurt by legal costs.

- When firms are profitable and doing well, stockholders are usually willing to give managers the flexibility to use company money to do social good. Few investors in Microsoft begrudged its decision in 1998 to give free computers to public libraries around the country. In firms that are doing badly, stockholders tend to be much more resistant to meeting society's ills.

Summarizing this evidence, we can draw some conclusions. First, a firm's foremost obligation is to stay financially healthy and to increase value; firms that are losing money cannot afford to be charitable. Second, firms that create large social costs pay a high price in the long term. Finally, managers should not keep stockholders in the dark about the company's charitable giving; after all, it is the stockholder's money that is being used for the purpose.

An Argument for Stockholder Wealth Maximization

Let us start off by conceding that all of the alternatives - choosing a different corporate governance system, picking an alternative objective and maximizing stockholder wealth with constraints – have their limitations and lead to problems. The questions then become how each alternative deals with mistakes and how quickly errors get corrected. This is where stock price maximization does better than the alternatives. It is the only one of the three that is self-correcting, in the sense that excesses by any stakeholder attract responses in three waves.

1. *Market reaction*: The first and most immediate reaction comes from financial markets. Consider again the turmoil created when we have well publicized failures like Enron. Not only did the market punish Enron (by knocking its stock and bond price down) but it punished other companies that it perceived as being exposed to the same problems as Enron – weak corporate governance and opaque financial statements - by discounting their values as well.
2. *Group Activism*: Following on the heels of the market reaction to any excess is outrage on the part of those who feel that they have been victimized by it. In response to management excesses in the 1980s, we saw an increase in the number of activist investors and hostile acquisitions, reminding managers that there are limits to their power. In the aftermath of well-publicized scandals in the late

1980s where loopholes in lending agreements were exploited by firms, banks and bondholders began playing more active roles in management.

3. *Market Innovations*: Markets often come up with innovative solutions to problems. In response to the corporate governance scandals in 2002 and 2003, Institutional Shareholder Services began scoring corporate boards on independence and effectiveness and selling these scores to investors. After the accounting scandals of the same period, the demand for forensic accounting, where accountants go over financial statements looking for clues of accounting malfeasance, increased dramatically. The bond market debacles of the 1980s gave birth to dozens of innovative bonds designed to protect bondholders. Even in the area of social costs, there are markets that have developed to quantify the cost.

Note that we have not mentioned another common reaction to scandal, which is legislation. While the motives for passing new laws to prevent future excesses may be pure, laws are blunt instruments that are often ineffective for three reasons. First, they are almost never timely. It takes far more time for legislation to be put together than for markets to react, and the outrage has often subsided before the laws becomes effective. Second, laws written to prevent past mistakes often prove ineffective at preventing future mistakes, as circumstances change. Third, laws often have unintended consequences, where in the process of correcting one distortion, they create new ones.

A postscript - The limits of corporate finance

Corporate finance has come in for more than its share of criticism in the last decade. There are many who argue that the failures of corporate America can be traced to its dependence on stock price maximization. Some of the criticism is justified and based upon the limitations of a single-minded pursuit of stockholder wealth. Some of it, however, is based upon a misunderstanding of what corporate finance is about.

Economics was once branded the gospel of Mammon, because of its emphasis on money. The descendants of those critics have labeled corporate finance as unethical, because of its emphasis on the 'bottom line' and market prices, even if this focus implies that workers lose their jobs and take cuts in pay. In restructuring and liquidations, it is true that value maximization for stockholders may mean that other stakeholders, such as customers and employees, lose out. In most cases, however, decisions that increase market value also make customers and employees better off. Furthermore, if the firm is really in trouble, either because it is being undersold by competitors or because its products are technologically obsolete, the choice is not between liquidation and survival, but between a speedy resolution, which is what corporate financial theory would recommend, and a slow death, while the firm declines over time, and costs society considerably more in the process.

The conflict between wealth maximization for the firm and social welfare is the genesis for the attention paid to ethics in business schools. There will never be an objective and therefore decision rules that perfectly factor in societal concerns, simply because many of these concerns are difficult to quantify and are subjective. Thus, corporate financial theory, in some sense, assumes that decision makers will not make decisions that create large social costs. This assumption that decision makers are, for the most part, ethical and will not create unreasonable costs for society or for other stakeholders, is unstated but underlies corporate financial theory. When it is violated, it exposes corporate financial theory to ethical and moral criticism, though the criticism may be better directed at the violators.

2.10. ☞**: What do you think the objective of the firm should be?**

Having heard the pros and cons of the different objectives, the following statement best describes where I stand in terms of the right objective for decision making in a business.

a. Maximize stock price or stockholder wealth, with no constraints
b. Maximize stock price or stockholder wealth, with constraints on being a good social citizen.
c. Maximize profits or profitability
d. Maximize market share
e. Maximize Revenues
f. Maximize social good
g. None of the above

Conclusion

While the objective in corporate finance is to maximize firm value, in practice we often adopt the narrower objective of maximizing a firm's stock price. As a measurable and unambiguous measure of a firm's success, stock price offers a clear target for managers in the course of their decision-making.

Stock price maximization as the only objective can be problematic when the different players in the firm – stockholders, managers, lenders and society – all have different interests and work at cross purposes. These differences, which result in agency costs can result in managers who put their interests over those of the stockholders who hired them, stockholders who try to take advantage of lenders, firms that try to mislead financial markets and decisions that create large costs for society. In the presence of these agency problems, there are many who argue for an alternative to stock price maximization. While this path is alluring, each of the alternatives, including using a different system of corporate governance or a different objective, comes with its own share of limitations.

Given the limitations of the alternatives, stock price maximization is the best of a set of imperfect choices for two reasons. First, we can reduce the agency problems between the different groups substantially by trying the align the interests of stockholders, managers and lenders (using both rewards and punishment), and by punishing firms that lie to financial markets or create large social costs. Second, stock price maximization as an objective is self correcting. In other words, excesses by any one of the groups (whether it be managers or stockholders) lead to reactions by the other groups that reduce the likelihood of the behavior being repeated in future periods.

Problems and Questions

1. There is a conflict of interest between stockholders and managers. In theory, stockholders are expected to exercise control over managers through the annual meeting or the board of directors. In practice, why might these disciplinary mechanisms not work?

2. Stockholders can transfer wealth from bondholders through a variety of actions. How would the following actions by stockholders transfer wealth from bondholders?

(a) An increase in dividends

(b) A leveraged buyout

(c) Acquiring a risky business

How would bondholders protect themselves against these actions?

3. Stock prices are much too volatile for financial markets to be efficient. Comment.

4. Maximizing stock prices does not make sense because investors focus on short term results, and not on the long term consequences. Comment.

5. There are some corporate strategists who have suggested that firms focus on maximizing market share rather than market prices. When might this strategy work, and when might it fail?

6. Anti-takeover amendments can be in the best interests of stockholders. Under what conditions is this likely to be true?

7. Companies outside the United States often have two classes of stock outstanding. One class of shares is voting and is held by the incumbent managers of the firm. The other class is non-voting and represents the bulk of traded shares. What are the consequences for corporate governance?

8. In recent year, top managers have been given large packages of options, giving them the right to buy stock in the firm at a fixed price. Will these compensation schemes make managers more responsive to stockholders? Why or why not? Are lenders to the firm affected by these compensation schemes?

9. Reader's Digest has voting and non-voting shares. About 70% of the voting shares are held by charitable institutions, which are headed by the CEO of Reader's Digest. Assume that you are a large holder of the non-voting shares. Would you be concerned about this set-up? What are some of the actions you might push the firm to take to protect your interests?

10. In Germany, large banks are often large lenders and large equity investors in the same firm. For instance, Deutsche Bank is the largest stockholder in Daimler Chrysler, as well as its largest lender. What are some of the potential conflicts that you see in these dual holdings?

11. It is often argued that managers, when asked to maximize stock price, have to choose between being socially responsible and carrying out their fiduciary duty. Do you agree? Can you provide an example where social responsibility and firm value maximization go hand in hand?

12. Assume that you are advising a Turkish firm on corporate financial questions, and that you do not believe that the Turkish stock market is efficient. Would you recommend stock price maximization as the objective? If not, what would you recommend?

13. It has been argued by some that convertible bonds (i.e., bonds which are convertible into stock at the option of the bondholders) provide one form of protection against expropriation by stockholders. What is this argument based on?

14. Societies attempt to keep private interests in line by legislating against behavior that might create social costs (such as polluting the water). If the legislation is comprehensive enough, does the problem of social costs cease to exist? Why or why not?

15. One of the arguments made for having legislation restricting hostile takeovers is that unscrupulous speculators may take over well run firms and destroy them for personal gain. Allowing for the possibility that this could happen, do you think that this is sensible? If so, why? If not, why not?

Live Case Study

I. Corporate Governance Analysis

Objective: To analyze the corporate governance structure of the firm and to assess where the power in the firm lies – with incumbent management or with stockholders in the firm?

Key Questions:

- Is this a company where there is a separation between management and ownership? If so, how responsive is management to stockholders?
- Is there a potential conflict between stockholders and lenders to the firm? If so, how is it managed?
- How does this firm interact with financial markets? How do markets get information about the firm?
- How does this firm view its social obligations and manage its image in society?

Framework for Analysis:

1. *The Chief Executive Officer*
    - Who is the CEO of the company? How long has he or she been CEO?
    - If it is a "family run" company, is the CEO part of the family? If not, what career path did the CEO take to get to the top? (Did he or she come from within the organization or from outside?)
    - How much did the CEO make last year? What form did the compensation take? (Salary, bonus and option components)
    - How much stock and options in the company does the CEO own?
2. *The Board of Directors*
    - Who is on the board of directors of the company? How long have they served as directors?
    - How many of the directors are "inside" directors?
    - How many of the directors have other connections to the firm (as suppliers, clients, customers..)?
    - How many of the directors are CEOs of other companies?
    - Do any of the directors have large stockholdings or represent those who do?

3. *Bondholder Concerns*
    - Does the firm have any publicly traded debt?
    - Are there are bond covenants (that you can uncover) that have been imposed on the firm as part of the borrowing?
    - Do any of the bonds issued by the firm come with special protections against stockholder expropriation?
4. *Financial Market Concerns*
    - How many analysts follow the firm?
    - How much trading volume is there on this stock?
5. *Societal Constraints*
    - What does the firm say about its social responsibilities?
    - Does the firm have a particularly good or bad reputation as a corporate citizen?
    - If it does, how has it earned this reputation?
    - If the firm has been a recent target of social criticism, how has it responded?

Information Sources:

For firms that are incorporated in the United States, information on the CEO and the board of directors is primarily in the filings made by the firm with the Securities and Exchange Commission. In particular, the 14-DEF will list out the directors in the firm, their relationship with the firm and details on compensation for both directors and top managers. You can also get information on trading done by insiders from the SEC filings. For firms that are not listed in the United States, this information is much more difficult to obtain. However, the absence of readily accessible information on directors and top management is more revealing about the power that resides with incumbent managers.

Information on a firm's relationships with bondholders usually resides in the firm's bond agreements and loan covenants. While this information may not always be available to the public, the presence of constraints shows up indirectly in the firm's bond ratings and when the firm issues new bonds.

The relationship between firms and financial markets is an uneasy one. The list of analysts following a firm can be obtained from publications such as the Nelson Directory of Securities Research. For larger and more heavily followed firms the archives of financial publications (the Financial Times, Wall Street Journal, Forbes, Barron's) can be useful sources of information.

Finally, the reputation of a firm as a corporate citizen is the toughest area to obtain clear information on, since it is only the outliers (the worst and the best corporate citizens) that make the news. The proliferation of socially responsible mutual funds, however, does give us a window on those firms that pass the tests (arbitrary, though they sometimes are) imposed by these funds for a firm to be viewed as "socially responsible".

Online sources of information:

http://www.stern.nyu.edu/~adamodar/cfin2E/project/data.htm

CHAPTER 3

THE BASICS OF RISK

Risk, in traditional terms, is viewed as a negative and something to be avoided. Webster's dictionary, for instance, defines risk as "exposing to danger or hazard". The Chinese symbols for risk, reproduced below, give a much better description of risk –

危機

The first symbol is the symbol for "danger", while the second is the symbol for "opportunity", making risk a mix of danger and opportunity. It illustrates very clearly the tradeoff that every investor and business has to make – between the "higher rewards" that potentially come with the opportunity and the "higher risk" that has to be borne as a consequence of the danger. The key test in finance is to ensure that when an investor is exposed to risk that he or she is "appropriately" rewarded for taking this risk.

In this chapter, we will lay the foundations for analyzing risk in corporate finance and present alternative models for measuring risk and converting these risk measures into "acceptable" hurdle rates.

Motivation and Perspective in Analyzing Risk

Why do we need a model that measures risk and estimates expected return? A good model for risk and return provides us with the tools to measure the risk in any investment and uses that risk measure to come up with the appropriate expected return on that investment; this expected return provides us with the hurdle rate in project analysis.

What makes the measurement of risk and expected return so challenging is that it can vary depending upon whose perspective we adopt. When analyzing Disney's risk, for instance, we can measure it from the viewpoint of Disney's managers. Alternatively, we can argue that Disney's equity is owned by its stockholders, and that it is their perspective on risk that should matter. Disney's stockholders, many of whom hold the stock as one investment in a larger portfolio, might perceive the risk in Disney very differently from Disney's managers, who might have the bulk of their capital, human and financial, invested in the firm. In this chapter, we will argue that risk in an equity investment has to be perceived through the eyes of investors in the firm. Since firms like Disney often have thousands of investors, often with very different perspectives, we will go further. We will assert that risk has to be measured from the perspective of not just any investor in the stock, but of the **marginal investor**, defined to be the investor most likely to be trading on the stock at any given point in time. The objective in corporate finance is the maximization of firm value and stock price. If we want to stay true to this objective, we have to consider the viewpoint of those who set the stock prices, and they are the marginal investors.

Finally, the risk in a company can be viewed very differently by investors in its stock (equity investors) and by lenders to the firm (bondholders and bankers). Equity investors who benefit from upside as well as downside tend to take a much more sanguine view of risk than lenders who have limited upside but potentially high downside. We will consider how to measure equity risk in the first part of the chapter and risk from the perspective of lenders in the latter half of the chapter.

We will be presenting a number of different risk and return models in this chapter. In order to evaluate the relative strengths of these models, it is worth reviewing the characteristics of a good risk and return model.

1. It should come up with a measure of risk that applies to all assets and not be asset-specific.
2. It should clearly delineate what types of risk are rewarded and what are not, and provide a rationale for the delineation.
3. It should come up with standardized risk measures, i.e., an investor presented with a risk measure for an individual asset should be able to draw conclusions about whether the asset is above-average or below-average risk.
4. It should translate the measure of risk into a rate of return that the investor should demand as compensation for bearing the risk.
5. It should work well not only at explaining past returns, but also in predicting future expected returns.

Equity Risk and Expected Returns

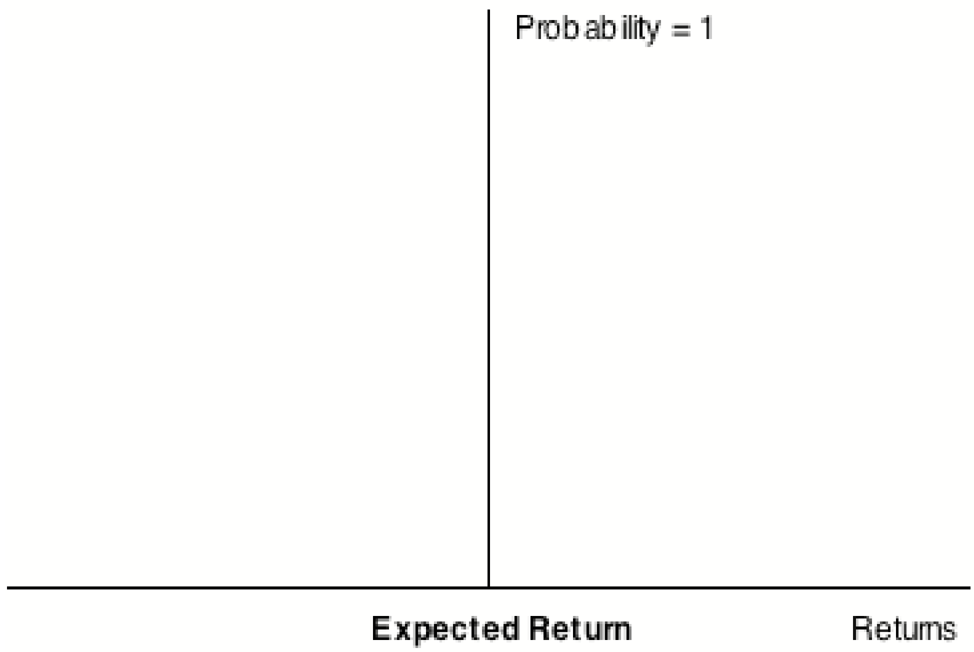
To understand how risk is viewed in corporate finance, we will present the analysis in three steps. First, we will define risk in terms of the distribution of actual returns around an expected return. Second, we will differentiate between risk that is specific to an investment or a few investments and risk that affects a much wider cross section of investments. We will argue that when the marginal investor is well diversified, it is only the latter risk, called market risk that will be rewarded. Third, we will look at alternative models for measuring this market risk and the expected returns that go with this risk.

I. Measuring Risk

Investors who buy an asset expect to make a return over the time horizon that they will hold the asset. The actual return that they make over this holding period may by very different from the expected return, and this is where the risk comes in. Consider an investor with a 1-year time horizon buying a 1-year Treasury bill (or any other default-free one-year bond) with a 5% expected return. At the end of the 1-year holding period, the actual return that this investor would have on this investment will always be 5%, which is equal to the expected return. The return distribution for this investment is shown in Figure 3.1.

Variance in Returns: This is a measure of the squared difference between the actual returns and the expected returns on an investment.

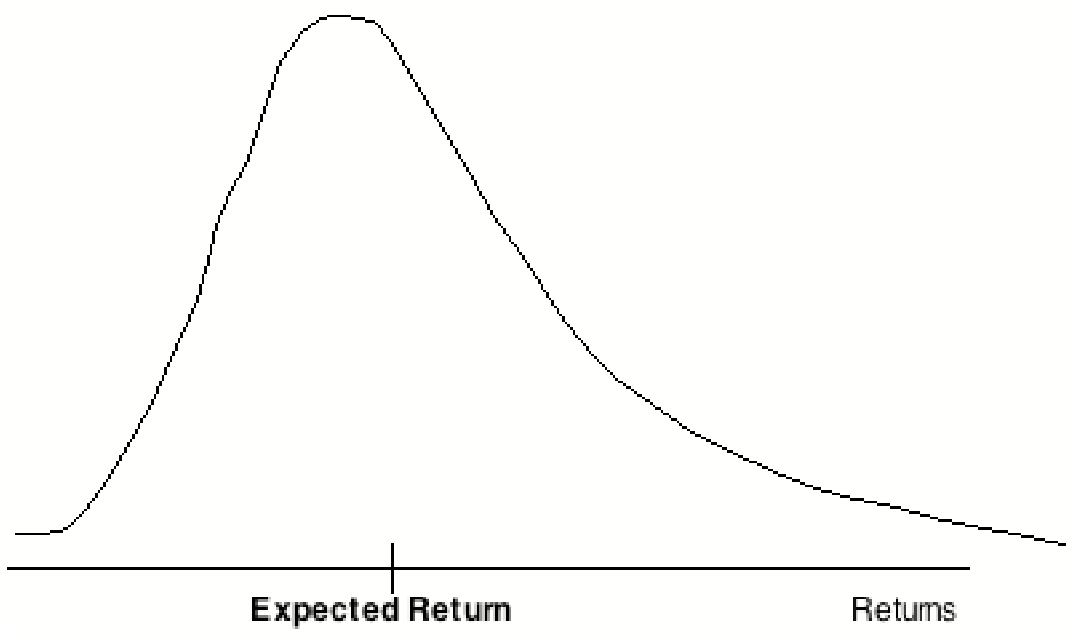
Figure 3.1: Returns on a Riskfree Investment



This is a riskless investment, at least in nominal terms.

To provide a contrast, consider an investor who invests in Disney. This investor, having done her research, may conclude that she can make an expected return of 30% on Disney over her 1-year holding period. The actual return over this period will almost certainly not be equal to 30%; it might be much greater or much lower. The distribution of returns on this investment is illustrated in Figure 3.2:

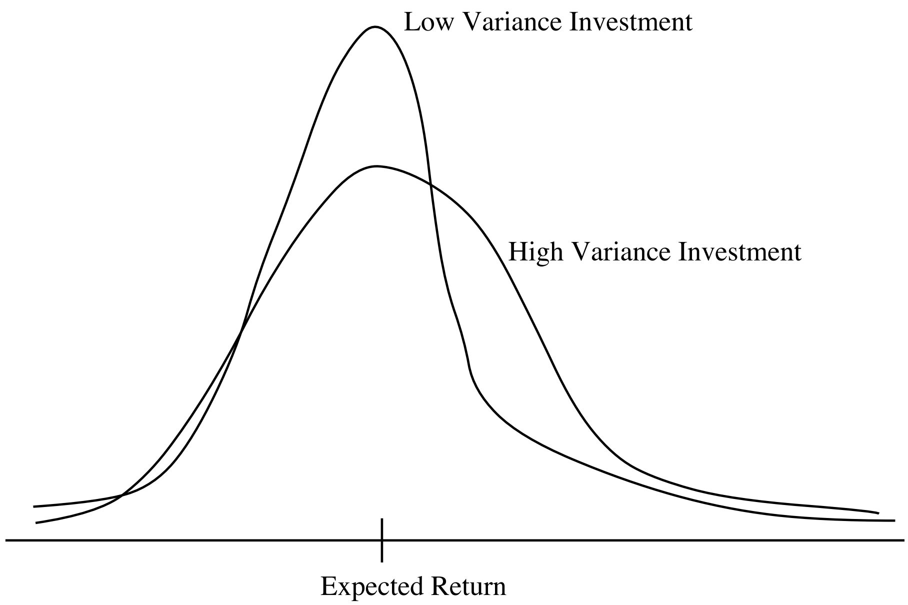
Figure 3.2: Probability Distribution for Risky Investment



In addition to the expected return, an investor now has to consider the following. First, the spread of the actual returns around the expected return is captured by the variance or standard deviation of the distribution; the greater the deviation of the actual returns from expected returns, the greater the variance. Second, the bias towards positive or negative returns is captured by the skewness of the distribution. The distribution above is positively skewed, since there is a greater likelihood of large positive returns than large negative returns. Third, the shape of the tails of the distribution is measured by the kurtosis of the distribution; fatter tails lead to higher kurtosis. In investment terms, this captures the tendency of the price of this investment to “jump” in either direction.

In the special case of the normal distribution, returns are symmetric and investors do not have to worry about skewness and kurtosis, since there is no skewness and a normal distribution is defined to have a kurtosis of zero. In that case, it can be argued that investments can be measured on only two dimensions - (1) the 'expected return' on the investment comprises the reward, and (2) the variance in anticipated returns comprises the risk on the investment. Figure 3.3 illustrates the return distributions on two investments with symmetric returns-

Figure 3.3: Return Distribution Comparisons



In this scenario, an investor faced with a choice between two investments with the same standard deviation but different expected returns, will always pick the one with the higher expected return.

In the more general case, where distributions are neither symmetric nor normal, it is still conceivable, though unlikely, that investors still choose between investments on the basis of only the expected return and the variance, if they possess utility functions[1] that allow them to do so. It is far more likely, however, that they prefer positive skewed distributions to negatively skewed ones, and distributions with a lower likelihood of jumps (lower kurtosis) over those with a higher likelihood of jumps (higher kurtosis). In this world, investors will trade off the good (higher expected returns and more positive skewness) against the bad (higher variance and kurtosis) in making investments. Among

[1] A utility function is a way of summarizing investor preferences into a generic term called 'utility' on the basis of some choice variables. In this case, for instance, investor utility or satisfaction is stated as a function of wealth. By doing so, we effectively can answer questions such as – Will an investor be twice as happy if he has twice as much wealth? Does each marginal increase in wealth lead to less additional utility than the prior marginal increase? In one specific form of this function, the quadratic utility function, the entire utility of an investor can be compressed into the expected wealth measure and the standard deviation in that wealth, which provides a justification for the use of a framework where only the expected return (mean) and its standard deviation (variance) matter.

the risk and return models that we will be examining, one (the capital asset pricing model or the CAPM) explicitly requires that choices be made only in terms of expected returns and variances. While it does ignore the skewness and kurtosis, it is not clear how much of a factor these additional moments of the distribution are in determining expected returns.

In closing, we should note that the return moments that we run into in practice are almost always estimated using past returns rather than future returns. The assumption we are making when we use historical variances is that past return distributions are good indicators of future return distributions. When this assumption is violated, as is the case when the asset's characteristics have changed significantly over time, the historical estimates may not be good measures of risk.

☞: 3.1: Do you live in a mean-variance world?

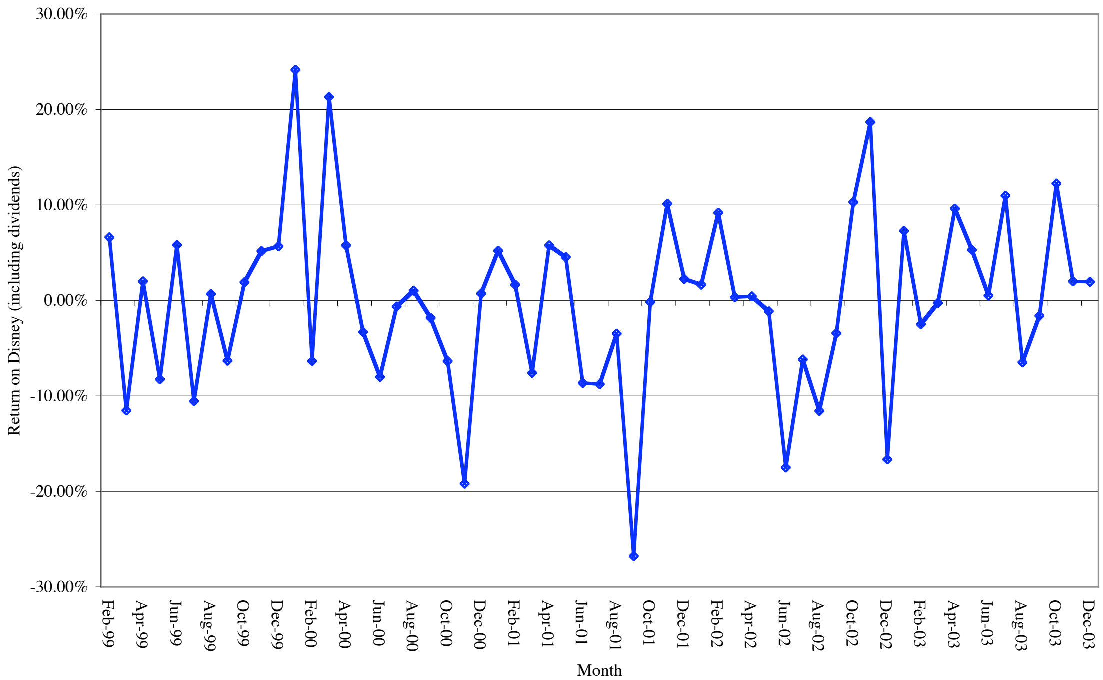
Assume that you had to pick between two investments. They have the same expected return of 15% and the same standard deviation of 25%; however, investment A offers a very small possibility that you could quadruple your money, while investment B's highest possible payoff is a 60% return. Would you

a. be indifferent between the two investments, since they have the same expected return and standard deviation?
b. prefer investment A, because of the possibility of a high payoff?
c. prefer investment B, because it is safer?

Illustration 3.1: Calculation of standard deviation using historical returns: Disney

We collected the data on the returns we would have made on a monthly basis for every month from January 1999 to December 2003 on an investment in Disney stock. The monthly returns are graphed in figure 3.4:

Figure 3.4: Returns on Disney: 1999- 2003



The average monthly return on Disney over the 59 months was –0.07%. The standard deviation in monthly returns was 9.33% and the variance in returns was 86.96%.[2] To convert monthly values to annualized ones:

Annualized Standard Deviation = 9.33% *√12 = 32.31%

Annualized Variance = 86.96% * 12 = 1043.55%

Without making comparisons to the standard deviations in stock returns of other companies, we cannot really draw any conclusions about the relative risk of Disney by just looking at its standard deviation.

optvar.xls is a dataset on the web that summarizes standard deviations and variances of stocks in various sectors in the United States.

☞: 3.2. Upside and Downside Risk

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[2] The variance is percent squared. In other words, if you stated the standard deviation of 9.96% in decimal terms, it would be 0.0996 but the variance of 99.15% would be 0.009915 in decimal terms.

You are looking at the historical standard deviations over the last 5 years on two investments. Both have standard deviations of 35% in returns during the period, but one had a return of -10% during the period, whereas the other had a return of +40% during the period. Would you view them as equally risky?

a. Yes

b. No

Why do we not differentiate between "upside risk" and "downside risk" in finance?

In Practice: Estimating only downside risk

The variance of a return distribution measures the deviation of actual returns from the expected return. In estimating the variance, we consider not only actual returns that fall below the average return (downside risk) but also those that lie above it (upside risk). As investors, it is the downside that we generally consider as risk. There is an alternative measure called the semi-variance that considers only downside risk. To estimate the semi-variance, we calculate the deviations of actual returns from the average return only if the actual return is less than the expected return; we ignore actual returns that are higher than the average return.

$$\text{Semi-variance} = \sum_{t=1}^{t=n} \frac{(R_t - \text{Average Return})^2}{n}$$

n = number of periods where actual return < Average return

With a normal distribution, the semi-variance will generate a value identical to the variance, but for any non-symmetric distribution, the semi-variance will yield different values than the variance. In general, a stock that generates small positive returns in most periods but very large negative returns in a few periods will have a semi-variance that is much higher than the variance.

II. Rewarded and Unrewarded Risk

Risk, as we have defined it in the previous section, arises from the deviation of actual returns from expected returns. This deviation, however, can occur for any number of reasons, and these reasons can be classified into two categories - those that are specific to the investment being considered (called firm specific risks) and those that apply across most or all investments (market risks).

The Components of Risk

When a firm makes an investment, in a new asset or a project, the return on that investment can be affected by several variables, most of which are not under the direct control of the firm. Some of the risk comes directly from the investment, a portion from competition, some from shifts in the industry, some from changes in exchange rates and some from macroeconomic factors. A portion of this risk, however, will be eliminated by the firm itself over the course of multiple investments and another portion by investors as they hold diversified portfolios.

The first source of risk is project-specific; an individual project may have higher or lower cashflows than expected, either because the firm misestimated the cashflows for that project or because of factors specific to that project. When firms take a large number of similar projects, it can be argued that much of this risk should be diversified away in the normal course of business. For instance, Disney, while considering making a new movie, exposes itself to estimation error - it may under or over estimate the cost and time of making the movie, and may also err in its estimates of revenues from both theatrical release and the sale of merchandise. Since Disney releases several movies a year, it can be argued that some or much of this risk should be diversifiable across movies produced during the course of the year.[3]

> ***Project Risk:*** This is risk that affects only the project under consideration, and may arise from factors specific to the project or estimation error.

The second source of risk is competitive risk, whereby the earnings and cashflows on a project are affected (positively or negatively) by the actions of competitors. While a good project analysis will build in the expected reactions of competitors into estimates of profit margins and growth, the actual actions taken by competitors may differ from these expectations. In most cases, this component of risk

> ***Competitive Risk:*** This is the unanticipated effect on the cashflows in a project of competitor actions - these effects can be positive or negative.

will affect more than one project, and is therefore more difficult to diversify away in the normal course of business by the firm. Disney, for instance, in its analysis of revenues from its Disney retail store division may err in its assessments of the strength and strategies of competitors like Toys'R'Us and WalMart. While Disney cannot diversify away its competitive risk, stockholders in Disney can, if they are willing to hold stock in the competitors.[4]

The third source of risk is industry-specific risk — those factors that impact the earnings and cashflows of a specific industry. There are three sources of industry-specific risk. The first is *technology risk*, which reflects the effects of technologies that change or evolve in ways different from those expected when a project was originally analyzed. The second source is *legal risk*, which reflects the effect of changing laws and regulations. The third is *commodity risk*, which reflects the effects of price changes in commodities and services that are used or produced disproportionately by a specific industry. Disney, for instance, in assessing the prospects of its broadcasting division (ABC) is likely to be exposed to all three risks; to technology risk, as the lines between television entertainment and the internet are increasing blurred by companies like Microsoft, to legal risk, as the laws governing broadcasting change and to commodity risk, as the costs of making new television programs change over time. A firm cannot diversify away its industry-specific risk without diversifying across industries, either with new projects or through acquisitions. Stockholders in the firm should be able to diversify away industry-specific risk by holding portfolios of stocks from different industries.

> ***Industry-Specific Risk:*** These are unanticipated effects on project cashflows of industry-wide shifts in technology, changes in laws or in the price of a commodity.

> ***International Risk:*** This is the additional uncertainty created in cashflows of projects by unanticipated changes in exchange rates and by political risk in foreign markets.

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3 To provide an illustration, Disney released *Treasure Pl* ... million to make and resulted in a $98 million write-... animated Disney movie made hundreds of millions of dollars and became one of the biggest hits of 2003.

4 Firms could conceivably diversify away competitive risk by acquiring their existing competitors. Doing so would expose them to attacks under the anti-trust law, however and would not eliminate the risk from as yet unannounced competitors.

The fourth source of risk is international risk. A firm faces this type of risk when it generates revenues or has costs outside its domestic market. In such cases, the earnings and cashflows will be affected by unexpected exchange rate movements or by political developments. Disney, for instance, was clearly exposed to this risk with its 33% stake in EuroDisney, the theme park it developed outside Paris. Some of this risk may be diversified away by the firm in the normal course of business by investing in projects in different countries whose currencies may not all move in the same direction. Citibank and McDonalds, for instance, operate in many different countries and are much less exposed to international risk than was Wal-Mart in 1994, when its foreign operations were restricted primarily to Mexico. Companies can also reduce their exposure to the exchange rate component of this risk by borrowing in the local currency to fund projects; for instance, by borrowing money in pesos to invest in Mexico. Investors should be able to reduce their exposure to international risk by diversifying globally.

The final source of risk is market risk**:** macroeconomic factors that affect essentially all companies and all projects, to varying degrees. For example, changes in interest rates will affect the value of projects already taken and those yet to be taken both directly, through the discount rates, and indirectly, through the cashflows. Other factors that affect all investments include the term structure (the difference between short and long term rates), the risk preferences of investors (as investors become more risk averse, more risky investments will lose value), inflation, and economic growth. While expected values of all these variables enter into project analysis, unexpected changes in these variables will affect the values of these investments. Neither investors nor firms can diversify away this risk since all risky investments bear some exposure to this risk.

> ***Market Risk:*** Market risk refers to the unanticipated changes in project cashflows created by changes in interest rates, inflation rates and the economy that affect all firms, though to differing degrees.

☞: 3.3. Risk is in the eyes of the beholder

A privately owned firm will generally end up with a higher discount rate for a project than would an otherwise similar publicly traded firm with diversified investors.

a. True

b. False

Does this provide a rationale for why a private firm may be acquired by a publicly traded firm?

Why Diversification Reduces or Eliminates Firm-Specific Risk

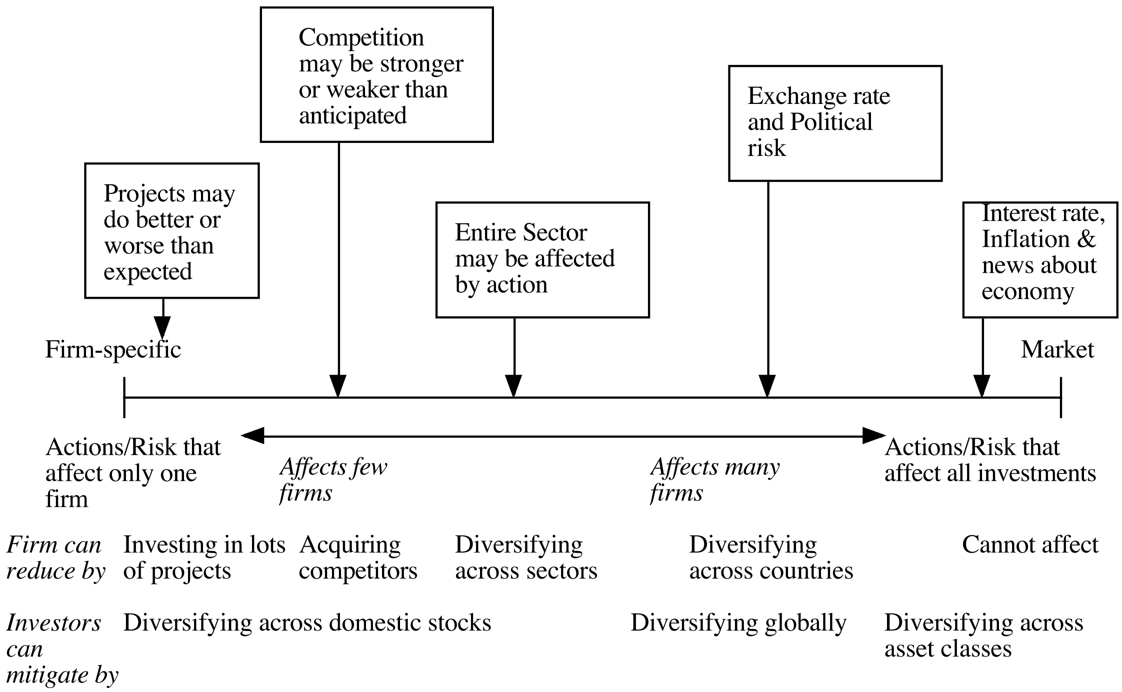
Why do we distinguish between the different types of risk? Risk that affect one of a few firms, i.e., firm specific risk, can be reduced or even eliminated by investors as they hold more diverse portfolios due to two reasons.

- The first is that each investment in a diversified portfolio is a much smaller percentage of that portfolio. Thus, any risk that increases or reduces the value of only that investment or a small group of investments will have only a small impact on the overall portfolio.
- The second is that the effects of firm-specific actions on the prices of individual assets in a portfolio can be either positive or negative for each asset for any period. Thus, in large portfolios, it can be reasonably argued that this risk will average out to be zero and thus not impact the overall value of the portfolio.

Diversification: This is the process of holding many investments in a portfolio, either across the same asset class (eg. stocks) or across asset classes (real estate, bonds etc.

In contrast, risk that affects most of all assets in the market will continue to persist even in large and diversified portfolios. For instance, other things being equal, an increase in interest rates will lower the values of most assets in a portfolio. Figure 3.5 summarizes the different components of risk and the actions that can be taken by the firm and its investors to reduce or eliminate this risk.

Figure 3.5: A Break Down of Risk



While the intuition for diversification reducing risk is simple, the benefits of diversification can also be shown statistically. In the last section, we introduced standard deviation as the measure of risk in an investment and calculated the standard deviation for an individual stock (Disney). When you combine two investments that do not move together in a portfolio, the standard deviation of that portfolio can be lower than the standard deviation of the individual stocks in the portfolio. To see how the magic of diversification works, consider a portfolio of two assets. Asset A has an expected return of μ_A and a variance in returns of σ^2_A, while asset B has an expected return of μ_B and a variance in returns of σ^2_B. The correlation in returns between the two assets, which measures how the assets move together, is ρ_{AB}.[5] The expected returns and variance of a two-asset portfolio can be written as a function of these inputs and the proportion of the portfolio going to each asset.

$$\mu_{portfolio} = w_A \, \mu_A + (1 - w_A) \, \mu_B$$

$$\sigma^2_{portfolio} = w_A^2 \, \sigma^2_A + (1 - w_A)^2 \, \sigma^2_B + 2 \, w_A \, w_B \, \rho_{AB} \, \sigma_A \, \sigma_B$$

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[5] The correlation is a number between –1 and +1. If the correlation is –1, the two stocks move in lock step but in opposite directions. If the correlation is +1, the two stocks move together in synch.

where

w_A = Proportion of the portfolio in asset A

The last term in the variance formulation is sometimes written in terms of the covariance in returns between the two assets, which is

$\sigma_{AB} = \rho_{AB}\, \sigma_A\, \sigma_B$

The savings that accrue from diversification are a function of the correlation coefficient. Other things remaining equal, the higher the correlation in returns between the two assets, the smaller are the potential benefits from diversification. The following example illustrates the savings from diversification.

Illustration 3.2: Variance of a portfolio: Disney and Aracruz

In illustration 3.1, we computed the average return and standard deviation of returns on Disney between January 1999 and December 2003. While Aracruz is a Brazilian stock, it has been listed and traded in the U.S. market over the same period. [6] Using the same 60 months of data on Aracruz, we computed the average return and standard deviation on its returns over the same period:

	Disney	*Aracruz ADR*
Average Monthly Return	- 0.07%	2.57%
Standard Deviation in Monthly Returns	9.33%	12.62%

Over the period (1999-2003), Aracruz was a much more attractive investment than Disney but it was also much more volatile. We computed the correlation between the two stocks over the 60-month period to be 0.2665. Consider now a portfolio that is invested 90% in Disney and 10% in the Aracruz ADR. The variance and the standard deviation of the portfolio can be computed as follows:

$$\text{Variance of portfolio} = w_{Dis}^2\, \sigma^2_{Dis} + (1 - w_{Dis})^2\, \sigma^2_{Ara} + 2\, w_{Dis}\, w_{Ara}\, \rho_{Dis,Ara}\, \sigma_{Dis}\, \sigma_{Ara}$$

$$= (.9)^2(.0933)^2+(.1)^2(.1262)^2+ 2\,(.9)(.1)(.2665)(.0933)(.1262)$$

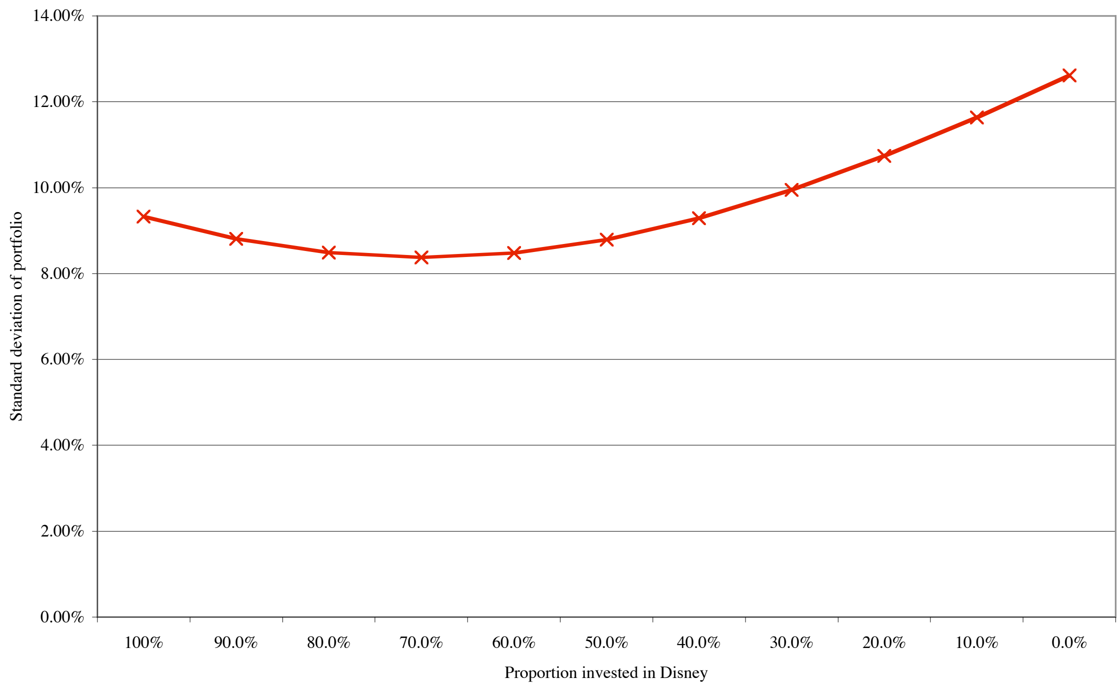
$$= .007767$$

[6] Like most foreign stocks, Aracruz has a listing for depository receipts or ADRs on the U.S. exchanges. Effectively, a bank buys shares of Aracruz in Brazil and issues dollar denominated shares in the United States to interested investors. Aracruz's ADR price tracks the price of the local listing while reflecting exchange rate changes.

Standard Deviation of Portfolio = $\sqrt{.007767}$ = .0881 or 8.81%

The portfolio is less risky than either of the two stocks that go into it. In figure 3.6, we graph the standard deviation in the portfolio as a function of the proportion of the portfolio invested in Disney:

Figure 3.6: Standard Deviation of Portfolio



As the proportion of the portfolio invested in Aracruz shifts towards 100%, the standard deviation of the portfolio converges on the standard deviation of Aracruz.

Identifying the Marginal Investor

The marginal investor in a firm is the investor who is most likely to be trading at the margin and therefore has the most influence on the pricing of its equity. In some cases, this may be a large institutional investor, but institutional investors themselves can differ in several ways. The institution may be a taxable mutual fund or a tax-exempt pension fund, may be domestically or internationally diversified, and vary on investment philosophy. In some cases, the marginal investors may be individuals, and here again there can be wide differences depending upon how diversified these individuals are, and what their investment objectives may be. In still other cases, the marginal investors may be insiders in the firm who own a significant portion of the equity of the firm and are involved in the management of the firm.

While it is difficult to identify the marginal investor in a firm, we would begin by breaking down the percent of the firm's stock held by individuals, institutions and insiders in the firm. This information, which is available widely for US stocks, can then be analyzed to yield the following conclusions:

- If the firm has relatively small institutional holdings but substantial holdings by wealthy individual investors, the marginal investor is *an individual investor with a significant equity holding* in the firm. In this case, we have to consider how diversified that individual investor's portfolio is to assess project risk. If the individual investor is not diversified, this firm may have to be treated like a private firm, and the cost of equity has to include a premium for all risk, rather than just non-diversifiable risk. If on the other hand, the individual investor is a wealthy individual with significant stakes in a large number of firms, a large portion of the risk may be diversifiable.
- If the firm has small institutional holdings and small insider holdings, its stock is held by large numbers of *individual investors with small equity holdings*. In this case, the marginal investor is an individual investor, with a portfolio that may be only partially diversified. For instance, phone and utility stocks in the United States, at least until recently, had holdings dispersed among thousands of individual investors, who held the stocks for their high dividends. This preference for dividends meant, however, that these investors diversified across only those sectors where firms paid high dividends.
- If the firm has significant institutional holdings and small insider holdings, the marginal investor is almost always a *diversified, institutional investor*. In fact, we can learn more about what kind of institutional investor holds stock by examining the top 15 or 20 largest stockholders in the firms, and then categorizing them by tax status (mutual funds versus pension funds), investment objective (growth or value) and globalization (domestic versus international).
- If the firm has significant institutional holdings and large insider holdings, the choice for marginal investor becomes a little more complicated. Often, in these

scenarios, the large insider is the founder or original owner for the firm, and often, this investor continues to be involved in the top management of firm. Microsoft and Dell are good examples, with Bill Gates and Michael Dell being the largest stockholders in the firms. In most of these cases, however, the insider owner seldom trades the stock, and his or her wealth is determined by the level of the stock price, which is determined by institutional investors trading the stock. We would argue that the institutional investor is the marginal investor in these firms as well, though *the leading stockholder will influence* the final decision.

Thus, by examining the percent of stock held by different groups, and the largest investors in a firm, we should have a sense of who the marginal investor in the firm is, and how best to assess and risk in corporate financial analysis.

Illustration 3.3: Identifying the Marginal Investor

Who are the marginal investors in Disney, Aracruz and Deutsche Bank? We begin to answer this question by examining whether iinsiders own a significant portion of the equity in the firm and are involved in the top management of the firm. Although no such investors exist at Disney and Deutsche Bank, the voting shares in Aracruz are closely held by its incumbent managers. In Table 8.4, we examine the proportion of stock held in each of the firms by individuals and institutions, with the institutional holding broken down further into mutual fund and other institutional holdings.

Table 3.1: Investors in Disney, Aracruz and Deutsche Bank

	Disney	*Deutsche Bank*	*Aracruz (non-voting)*
Mutual Funds	*31%*	*16%*	*29%*
Other Institutional Investors	*42%*	*58%*	*26%*
Individuals	*27%*	*26%*	*45%*

Source: Value Line, Morningstar

All three companies are widely held by institutional investors. To break down the institutional investment, we examined the ten largest investors in each firm at the end of 2002 in Table 8.5, with the percent of the firm's stock held by each (in brackets).

Table 3.2: Largest Stockholders in Disney, Aracruz and Deutsche Bank

Disney	*Deutsche Bank*	*Aracruz - Preferred*

Barclays Global (3.40%)	Allianz (4.81%)	Safra (10.74%)
State Street (3.10%)	La Caixa (3.85%)	BNDES (6.34%)
Fidelity (3.01%)	Capital Research (1.35%)	Scudder Kemper (1.03%)
Citigroup (3.00%)	Fidelity (0.50%)	BNP Paribas (0.56%)
Southeastern Asset (2.36%)	Frankfurt Trust (0.43%)	Barclays Global (0.29%)
State Farm Mutual (2.06%)	Aviva (0.37%)	Vanguard Group (0.18%)
Vanguard Group (1.93%)	Daxex (0.31%)	Banco Itau (0.12%)
JP Morgan Chase (1.83%)	Unifonds (0.29%)	Van Eck Associates (0.12%)
Mellon Bank (1.64%)	Fidelity (0.28%)	Pactual (0.11%)
Lord Abbet & Co(1.58%)	UBS Funds (0.21%)	Banco Bradesco (0.07%)

Source: Bloomberg

The ten largest investors in Disney are all institutional investors, suggesting that we are on safe grounds assuming that the marginal investor in Disney is likely to be both institutional and diversified. The largest single investor in Deutsche Bank is Allianz, the German insurance giant, reflecting again the cross-holding corporate governance structure favored by German corporations. However, the investors below Allianz are all institutional investors, and about half of them are non-German. Here again, we can safely assume that the marginal investor is likely to be institutional and broadly diversified across at least European equities rather than just German stocks. The common shares in Aracruz, where the voting rights reside, is held by a handful of controlling stockholders, but trading in this stock is light.[7] The two largest holders of preferred shares in Aracruz, Safra and BNDES, are also holders of common stock and do not trade on their substantial holdings. The remaining shares are held largely by institutional investors and many of them are from outside Brazil. While there is a clear danger here that the company will be run for the benefit of the voting shareholders, the price of the voting stock is closely linked to the price of the preferred shares. Self-interest alone should induce the voting shareholders to consider the investors in the preferred shares as the marginal investors in the company.

Why is the marginal investor assumed to be diversified?

The argument that investors can reduce their exposure to risk by diversifying can be easily made, but risk and return models in finance go further. They argue that the

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[7] Three stockholders, VCP, Safra and Grupo Lorentzen hold 28% each of the voting shares.

marginal investor, who sets prices for investments, is well diversified; thus, the only risk that will be priced in the risk as perceived by that investor. The justification that can be offered is a simple one. The risk in an investment will always be perceived to be higher for an undiversified investor than to a diversified one, since the latter does not consider any firm-specific risk while the former does. If both investors have the same perceptions about future earnings and cashflows on an asset, the diversified investor will be willing to pay a higher price for that asset because of his or her risk perceptions. Consequently, the asset, over time, will end up being held by diversified investors.

While this argument is a powerful one for stocks and other assets, which are traded in small units and are liquid, it is less so for investments that are large and illiquid. Real estate in most countries is still held by investors who are undiversified and have the bulk of their wealth tied up in these investments. The benefits of diversification are strong enough, however, that securities such as real estate investment trusts and mortgage-backed bonds were created to allow investors to invest in real estate and stay diversified at the same time.

Note that diversification does not require investors to give up their pursuit of higher returns. Investors can be diversified and try to beat the market at the same time, For instance, investors who believe that they can do better than the market by buying stocks trading at low PE ratios can still diversify by holding low PE stocks in a number of different sectors at the same time.

☞: 3.4. Management Quality and Risk

A well managed firm is less risky than a firm that is badly managed.

a. True

b. False

In Practice: Who should diversify? The Firm or Investors?

As we noted in the last section, the exposure to each type of risk can be mitigated by either the firm or by investors in the firm. The question of who should do it can be answered fairly easily by comparing the costs faced by each. As a general rule, a firm should embark on actions that reduce risk only if it is cheaper for it to do so than it is for its investors. With a publicly traded firm, it will usually be much cheaper for investors to diversify away risk than it is for the firm. Consider, for instance, risk that affects an entire sector. A firm can reduce its exposure to this risk by either acquiring other firms, paying large premiums over the market price, or by investing large amounts in businesses where it does not have any expertise. Investors in the firm, on the other hand, can accomplish the same by expanding their portfolios to include stocks in other sectors or even more simply by holding diversified mutual funds. Since the cost of diversifying for investors is very low, firms should try to diversify away risk only if the cost is minimal or if the risk reduction is a side benefit from an action with a different objective. One example would be project risk. Since Disney is in the business of making movies, the risk reduction that comes from making lots of movies is essentially costless.

The choice is more complicated for private businesses. The owners of these businesses often have the bulk of their wealth invested in these businesses and they can either try to take money out of the businesses and invest it elsewhere or they can diversify their businesses. In fact, many family businesses in Latin America and Asia became conglomerates as they expanded, partly because they wanted to spread their risks.

III. Measuring Market Risk

While most risk and return models in use in corporate finance agree on the first two step of this process, i.e., that risk comes from the distribution of actual returns around the expected return and that risk should be measured from the perspective of a marginal investor who is well diversified, they part ways on how to measure the non-diversifiable or market risk. In this section, we will provide a sense of how each of the four basic models - the capital asset pricing model (CAPM), the arbitrage pricing model (APM) and the multi-factor model - approaches the issue of measuring market risk.

A. The Capital Asset Pricing Model

The risk and return model that has been in use the longest and is still the standard in most real world analyses is the capital asset pricing model (CAPM). While it has come in for its fair share of criticism over the years, it provides a useful starting point for our discussion of risk and return models.

1. Assumptions

> ***Riskless Asset:*** A riskless asset is one, where the actual return is always equal to the expected return.

While diversification has its attractions in terms of reducing the exposure of investors to firm specific risk, most investors limit their diversification to holding relatively few assets. Even large mutual funds are reluctant to hold more than a few hundred stocks, and many of them hold as few as 10 to 20 stocks. There are two reasons for this reluctance. The first is that the marginal benefits of diversification become smaller as the portfolio gets more diversified - the twenty-first asset added will generally provide a much smaller reduction in firm specific risk than the fifth asset added, and may not cover the marginal costs of diversification, which include transactions and monitoring costs. The second is that many investors (and funds) believe that they can find under valued assets and thus choose not to hold those assets that they believe to be correctly or over valued.

The capital asset pricing model assumes that there are no transactions costs, all assets are traded and that investments are infinitely divisible (i.e., you can buy any fraction of a unit of the asset). It also assumes that there is no private information and that investors therefore cannot find under or over valued assets in the market place. By making these assumptions, it eliminates the factors that cause investors to stop diversifying. With these assumptions in place, the logical end limit of diversification is to hold every traded risky asset (stocks, bonds and real assets included) in your portfolio, in proportion to their market value[8]. This portfolio of every traded risky asset in the market place is called the market portfolio.

2. Implications for Investors

If every investor in the market holds the same market portfolio, how exactly do investors reflect their risk aversion in their investments? In the capital asset pricing model, investors adjust for their risk preferences in their allocation decisions, where they

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[8] If investments are not held in proportion to their market value, investors are still losing some diversification benefits. Since there is no gain from over weighting some sectors and under weighting others in a market place where the odds are random of finding under valued and over valued assets, investors will not do so.

decide how much to invest in an asset with guaranteed returns – a riskless asset - and how much in risky assets (market portfolio). Investors who are risk averse might choose to put much or even all of their wealth in the riskless asset. Investors who want to take more risk will invest the bulk or even all of their wealth in the market portfolio. Those investors who invest all their wealth in the market portfolio and are still desirous of taking on more risk, would do so by borrowing at the riskless rate and investing in the same market portfolio as everyone else.

These results are predicated on two additional assumptions. First, there exists a riskless asset. Second, investors can lend and borrow at this riskless rate to arrive at their optimal allocations. There are variations of the CAPM that allow these assumptions to be relaxed and still arrive at conclusions that are consistent with the general model.

☞: 3.5. Efficient Risk Taking

In the capital asset pricing model, the most efficient way to take a lot of risk is to

a. Buy a well-balanced portfolio of the riskiest stocks in the market
b. Buy risky stocks that are also undervalued
c. Borrow money and buy a well diversified portfolio

3. Measuring the Market Risk of an Individual Asset

The risk of any asset to an investor is the risk added on by that asset to the investor's overall portfolio. In the CAPM world, where all investors hold the market portfolio, the risk of an individual asset to an investor will be the risk that this asset adds on to the market portfolio. Intuitively, assets that move more with the market portfolio will tend to be riskier than assets that move less, since the movements that are unrelated to the market portfolio will not affect the overall value of the portfolio when an asset is added on to the portfolio. Statistically, this added risk is measured by the *covariance* of the asset with the market portfolio.

The covariance is a non-standardized measure of market risk; knowing that the covariance of Disney with the Market Portfolio is 55% does not provide a clue as to whether Disney is riskier or safer than the average asset. We therefore standardize the risk measure by dividing the covariance of each asset with the market portfolio by the variance of the market portfolio. This yields the beta of the asset:

$$\text{Beta of an asset i} = \frac{\text{Covariance of asset i with Market Portfolio}}{\text{Variance of the Market Portfolio}}$$

Since the covariance of the market portfolio with itself is its variance, the beta of the market portfolio, and by extension, the average asset in it, is one. Assets that are riskier than average (using this measure of risk) will have betas that exceed one and assets that are safer than average will have betas that are lower than one . The riskless asset will have a beta of zero.

4. Getting Expected Returns

The fact that every investor holds some combination of the riskless asset and the market portfolio leads to the next conclusion, which is that the expected return on an asset is linearly related to the beta of the asset. In particular, the expected return on an asset can be written as a function of the risk-free rate and the beta of that asset;

Beta: The beta of any investment in the CAPM is a standardized measure of the risk that it adds to the market portfolio.

Expected Return on asset i

$= R_f + \beta_i [E(R_m) - R_f]$

= Risk-free rate + Beta of asset i * (Risk premium on market portfolio)

where,

$E(R_i)$ = Expected Return on asset i

R_f = Risk-free Rate

$E(R_m)$ = Expected Return on market portfolio

β_i = Beta of asset i

To use the capital asset pricing model, we need three inputs. While we will look at the estimation process in far more detail in the next chapter, each of these inputs is estimated as follows:

- The riskless asset is defined to be an asset where the investor knows the expected return with certainty for the time horizon of the analysis. Consequently, the riskless rate used will vary depending upon whether the time period for the expected return is one year, five years or ten years.

- The risk premium is the premium demanded by investors for investing in the market portfolio, which includes all risky assets in the market, instead of investing in a riskless asset. Thus, it does not relate to any individual risky asset but to risky assets as a class.
- The beta, which we defined to be the covariance of the asset divided by the market portfolio, is the only firm-specific input in this equation. In other words, the only reason two investments have different expected returns in the capital asset pricing model is because they have different betas.

In summary, in the capital asset pricing model all of the market risk is captured in one beta, measured relative to a market portfolio, which at least in theory should include all traded assets in the market place held in proportion to their market value.

☞: 3.6. What do negative betas mean?

In the capital asset pricing model, there are assets that can have betas that are less than zero. When this occurs, which of the following statements describes your investment?

a. This investment will have an expected return less than the riskless rate
b. This investment insures your "diversified portfolio" against some type of market risk
c. Holding this asset makes sense only if you are well diversified
d. All of the above

In Practice: Index Funds and Market Portfolios

Many critics of the capital asset pricing model seize on its conclusion that all investors in the market will hold the market portfolio, which includes all assets in proportion to their market value, as evidence that it is an unrealistic model. But is it? It is true that not all assets in the world are traded and that there are transactions costs. It is also true that investors sometimes trade on inside information and often hold undiversified portfolios. However, we can create portfolios that closely resemble the market portfolio using index funds. An index fund replicates an index by buying all of the stocks in the index, in the same proportions that they form of the index. The earliest and still the largest one is the Vanguard 500 Index fund, which replicates the S&P 500 index. Today, we have access to index funds that replicate smaller companies in the United States, European stocks, Latin American markets and Asian equities as well as bond and commodity markets An investor can create a portfolio composed of a mix of index funds – the weights on each fund should be based upon market values of the underlying market - which resembles the market portfolio; the only asset class that is usually difficult to replicate is real estate.

B. The Arbitrage Pricing Model

The restrictive assumptions in the capital asset pricing model and its dependence upon the market portfolio have for long been viewed with skepticism by both academics and practitioners. In the late seventies, an alternative and more general model for measuring risk called the arbitrage pricing model was developed.[9]

1. Assumptions

Arbitrage: An investment that requires no investment, involves no risk but still delivers a sure profit.

The arbitrage pricing model is built on the simple premise that two investments with the same exposure to risk should be priced to earn the same expected returns. An alternate way of saying this is that if two portfolios have the same exposure to risk but offer different expected returns, investors can buy the portfolio that has the higher expected returns and sell the one with lower expected returns, until the expected returns converge.

Like the capital asset pricing model, the arbitrage pricing model begins by breaking risk down into two components. The first is firm specific and covers information that affects primarily the firm. The second is the market risk that affects all investment; this would include unanticipated changes in a number of economic variables, including gross national product, inflation, and interest rates. Incorporating this into the return model above

$$R = E(R) + m + \varepsilon$$

where m is the market-wide component of unanticipated risk and ε is the firm-specific component.

[9] Ross, Stephen A., 1976, *The Arbitrage Theory Of Capital Asset Pricing*, Journal of Economic Theory, v13(3), 341-360.

2. The Sources of Market-Wide Risk

While both the capital asset pricing model and the arbitrage pricing model make a distinction between firm-specific and market-wide risk, they part ways when it comes to measuring the market risk. The CAPM assumes that all of the market risk is captured in the market portfolio, whereas the arbitrage pricing model allows for multiple sources of market-wide risk, and measures the sensitivity of investments to each source with what a factor betas. In general, the market component of unanticipated returns can be decomposed into economic factors:

$$R = R + m + \varepsilon$$

$$= R + (\beta_1 F_1 + \beta_2 F_2 + ... + \beta_n F_n) + \varepsilon$$

where

$\beta_j =$ Sensitivity of investment to unanticipated changes in factor j

$F_j =$ Unanticipated changes in factor j

3. The Effects of Diversification

The benefits of diversification have been discussed extensively in our treatment of the capital asset pricing model. The primary point of that discussion was that diversification of investments into portfolios eliminate firm-specific risk. The arbitrage pricing model makes the same point and concludes that the return on a portfolio will not have a firm-specific component of unanticipated returns. The return on a portfolio can then be written as the sum of two weighted averages -that of the anticipated returns in the portfolio and that of the factor betas:

$$R_p = (w_1R_1+w_2R_2+...+w_nR_n)+ (w_1\beta_{1,1}+w_2\beta_{1,2}+...+w_n\beta_{1,n})\, F_1 +$$
$$(w_1\beta_{2,1}+w_2\beta_{2,2}+...+w_n\beta_{2,n})\, F_2 \; .....$$

where,

w_j = Portfolio weight on asset j

R_j = Expected return on asset j

$\beta_{i,j}$= Beta on factor i for asset j

Note that the firm specific component of returns (ε) in the individual firm equation disappears in the portfolio as a result of diversification.

4. Expected Returns and Betas

The fact that the beta of a portfolio is the weighted average of the betas of the assets in the portfolio, in conjunction with the absence of arbitrage, leads to the conclusion that expected returns should be linearly related to betas. To see why, assume that there is only one factor and that there are three portfolios. Portfolio A has a beta of 2.0, and an expected return on 20%; portfolio B has a beta of 1.0 and an expected return of 12%; and portfolio C has a beta of 1.5, and an expected return on 14%. Note that the investor can put half of his wealth in portfolio A and half in portfolio B and end up with a portfolio with a beta of 1.5 and an expected return of 16%. Consequently no investor will choose to hold portfolio C until the prices of assets in that portfolio drop and the expected return increases to 16%. Alternatively, an investor can buy the combination of portfolio A and B, with an expected return of 16%, and sell portfolio C with an expected return of 15%, and pure profit of 1% without taking any risk and investing any money. To prevent this "arbitrage" from occurring, the expected returns on every portfolio should be a linear function of the beta to prevent this f. This argument can be extended to multiple factors, with the same results. Therefore, the expected return on an asset can be written as

$$E(R) \quad = \quad R_f + \beta_1\ [E(R_1)\text{-}R_f] + \beta_2\ [E(R_2)\text{-}R_f]\ \ldots + \beta_n\ [E(R_n)\text{-}R_f]$$

where

R_f = Expected return on a zero-beta portfolio

$E(R_j)$ = Expected return on a portfolio with a factor beta of 1 for factor j, and zero for all other factors.

The terms in the brackets can be considered to be risk premiums for each of the factors in the model.

Note that the capital asset pricing model can be considered to be a special case of the arbitrage pricing model, where there is only one economic factor driving market-wide returns and the market portfolio is the factor.

$$E(R) \quad = \quad R_f + \beta_m\ (E(R_m)\text{-}R_f)$$

5. The APM in Practice

The arbitrage pricing model requires estimates of each of the factor betas and factor risk premiums in addtion to the riskless rate. In practice, these are usually estimated using historical data on stocks and a statistical technique called factor analysis. Intuitively, a factor analysis examines the historical data looking for common patterns that affect broad groups of stocks (rather than just one sector or a few stocks). It provides two output measures:

> ***Arbitrage:*** An investment opportunity with no risk that earns a return higher than the riskless rate.

1. It specifies the number of common factors that affected the historical data that it worked on.
2. It measures the beta of each investment relative to each of the common factors, and provides an estimate of the actual risk premium earned by each factor.

The factor analysis does not, however, identify the factors in economic terms.

In summary, in the arbitrage pricing model the market or non-diversifiable risk in an investment is measured relative to multiple unspecified macro economic factors, with the sensitivity of the investment relative to each factor being measured by a factor beta. The number of factors, the factor betas and factor risk premiums can all be estimated using a factor analysis.

C. Multi-factor Models for risk and return

The arbitrage pricing model's failure to identify specifically the factors in the model may be a strength from a statistical standpoint, but it is a clear weakness from an intuitive standpoint. The solution seems simple: Replace the unidentified statistical factors with specified economic factors, and the resultant model should be intuitive while still retaining much of the strength of the arbitrage pricing model. That is precisely what multi-factor models do.

Deriving a Multi-Factor Model

Multi-factor models generally are not based on extensive economic rationale but are determined by the data. Once the number of factors has been identified in the arbitrage pricing model, the behavior of the factors over time can be extracted from the data. These factor time series can then be compared to the time series of macroeconomic

> ***Unanticipated Inflation:*** This is the difference between actual inflation and expected inflation.

variables to see if any of the variables are correlated, over time, with the identified factors.

For instance, a study from the 1980s suggested that the following macroeconomic variables were highly correlated with the factors that come out of factor analysis: industrial production, changes in the premium paid on corporate bonds over the riskless rate, shifts in the term structure, unanticipated inflation, and changes in the real rate of return.[10] These variables can then be correlated with returns to come up with a model of expected returns, with firm-specific betas calculated relative to each variable. The equation for expected returns will take the following form:

$$E(R) = R_f + \beta_{GNP} (E(R_{GNP})-R_f) + \beta_i (E(R_i)-R_f) \ ...+ \beta_\delta (E(R_\delta)-R_f)$$

where

β_{GNP} = Beta relative to changes in industrial production

$E(R_{GNP})$ = Expected return on a portfolio with a beta of one on the industrial production factor, and zero on all other factors

β_i = Beta relative to changes in inflation

$E(R_i)$ = Expected return on a portfolio with a beta of one on the inflation factor, and zero on all other factors

The costs of going from the arbitrage pricing model to a macroeconomic multi-factor model can be traced directly to the errors that can be made in identifying the factors. The economic factors in the model can change over time, as will the risk premium associated with each one. For instance, oil price changes were a significant economic factor driving expected returns in the 1970s but are not as significant in other time periods. Using the wrong factor(s) or missing a significant factor in a multi-factor model can lead to inferior estimates of cost of equity.

In summary, multi factor models, like the arbitrage pricing model, assume that market risk can be captured best using multiple macro economic factors and estimating betas relative to each. Unlike the arbitrage pricing model, multi factor models do attempt to identify the macro economic factors that drive market risk.

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[10] Chen, N., R. Roll and S.A. Ross, 1986, *Economic Forces and the Stock Market*, Journal of Business, 1986, v59, 383-404.

D. Proxy Models

All of the models described so far begin by thinking about market risk in economic terms and then developing models that might best explain this market risk. All of them, however, extract their risk parameters by looking at historical data. There is a final class of risk and return models that start with past returns on individual stocks, and then work backwards by trying to explain differences in returns across long time periods using firm characteristics. In other words, these models try to find common characteristics shared by firms that have historically earned higher returns and identify these characteristics as proxies for market risk.

> ***Book-to-Market Ratio:*** This is the ratio of the book value of equity to the market value of equity.

Fama and French, in a highly influential study of the capital asset pricing model in the early 1990s, note that actual returns over long time periods have been highly correlated with price/book value ratios and market capitalization.[11] In particular, they note that firms with small market capitalization and low price to book ratios earned higher returns between 1963 and 1990. They suggest that these measures and similar ones developed from the data be used as proxies for risk and that the regression coefficients be used to estimate expected returns for investments. They report the following regression for monthly returns on stocks on the NYSE, using data from 1963 to 1990:

$$R_t = 1.77\% \quad - 0.11 \ln (MV) + 0.35 \ln (BV/MV)$$

where

MV = Market Value of Equity

BV/MV = Book Value of Equity / Market Value of Equity

The values for market value of equity and book-price ratios for individual firms, when plugged into this regression, should yield expected monthly returns. For instance, a firm with a market value of $ 100 million and a book to market ratio of 0.5 would have an expected monthly return of 1.02%.

$$R_t = 1.77\% \quad - 0.11 \ln (100) + 0.35 \ln (0.5) = 1.02\%$$

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[11] Fama, E.F. and K.R. French, 1992, *The Cross-Section of Expected Returns*, Journal of Finance, v47, 427-466.

As data on individual firms has becomes richer and more easily accessible in recent years, these proxy models have expanded to include additional variables. In particular, researchers have found that price momentum (the rate of increase in the stock price over recent months) also seems to help explain returns; stocks with high price momentum tend to have higher returns in following periods.

In summary, proxy models measure market risk using firm characteristics as proxies for market risk, rather than the macro economic variables used by conventional multi-factor models[12]. The firm characteristics are identified by looking at differences in returns across investments over very long time periods and correlating with identifiable characteristics of these investments.

A Comparative Analysis of Risk and Return Models

All the risk and return models developed in this chapter have common ingredients. They all assume that only market-wide risk is rewarded, and they derive the expected return as a function of measures of this risk. Figure 3.7 presents a comparison of the different models:

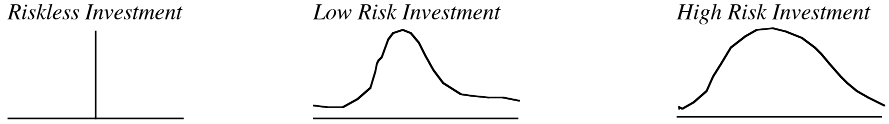
[12] Adding to the confusion, researchers in recent years have taken to describing proxy models also as multi factor models.

Figure 3.7: Competing Models for Risk and Return in Finance

Step 1: Defining Risk

The risk in an investment can be measured by the variance in actual returns around an expected return

Riskless Investment *Low Risk Investment* *High Risk Investment*



Step 2: Differentiating between Rewarded and Unrewarded Risk

Risk that is specific to investment (Firm Specific)
Can be diversified away in a diversified portfolio
1. each investment is a small proportion of portfolio
2. risk averages out across investments in portfolio

Risk that affects all investments (Market Risk)
Cannot be diversified away since most assets are affected by it.

The marginal investor is assumed to hold a "diversified" portfolio. Thus, only market risk will be rewarded and priced.

Step 3: Measuring Market Risk

The CAPM	**The APM**	**Multi-Factor Models**	**Proxy Models**
If there is 1. no private information 2. no transactions cost the optimal diversified portfolio includes every traded asset. Everyone will hold this market portfolio **Market Risk = Risk added by any investment to the market portfolio:**	If there are no arbitrage opportunities then the market risk of any asset must be captured by betas relative to factors that affect all investments. **Market Risk = Risk exposures of any asset to market factors**	Since market risk affects most or all investments, it must come from macro economic factors. **Market Risk = Risk exposures of any asset to macro economic factors.**	In an efficient market, differences in returns across long periods must be due to market risk differences. Looking for variables correlated with returns should then give us proxies for this risk. **Market Risk = Captured by the Proxy Variable(s)**
Beta of asset relative to Market portfolio (from a regression)	Betas of asset relative to unspecified market factors (from a factor analysis)	Betas of assets relative to specified macro economic factors (from a regression)	Equation relating returns to proxy variables (from a regression)

The capital asset pricing model makes the most assumptions but arrives at the simplest model, with only one risk factor requiring estimation. The arbitrage pricing model makes fewer assumptions but arrives at a more complicated model, at least in terms of the parameters that require estimation. In general, the CAPM has the advantage of being a simpler model to estimate and to use, but it will under perform the richer multi factor models when the company is sensitive to economic factors not well represented in the market index. For instance, oil companies, which derive most of their risk from oil price movements, tend to have low CAPM betas. Using a multi factor model, where one of the factors may be capturing oil and other commodity price movements, will yield a better estimate of risk and higher cost of equity for these firms[13].

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[13] Weston, J.F. and T.E. Copeland, 1992, *Managerial Finance*, Dryden Press. They used both approaches to estimate the cost of equity for oil companies in 1989 and came up with 14.4% with the CAPM and 19.1% using the arbitrage pricing model.

The biggest intuitive block in using the arbitrage pricing model is its failure to identify specifically the factors driving expected returns. While this may preserve the flexibility of the model and reduce statistical problems in testing, it does make it difficult to understand what the beta coefficients for a firm mean and how they will change as the firm changes (or restructures).

Does the CAPM work? Is beta a good proxy for risk, and is it correlated with expected returns? The answers to these questions have been debated widely in the last two decades. The first tests of the model suggested that betas and returns were positively related, though other measures of risk (such as variance) continued to explain differences in actual returns. This discrepancy was attributed to limitations in the testing techniques. In 1977, Roll, in a seminal critique of the model's tests, suggested that since the market portfolio (which should include every traded asset of the market) could never be observed, the CAPM could never be tested, and that all tests of the CAPM were therefore joint tests of both the model and the market portfolio used in the tests, i.e., all any test of the CAPM could show was that the model worked (or did not) given the proxy used for the market portfolio.[14] He argued that in any empirical test that claimed to reject the CAPM, the rejection could be of the proxy used for the market portfolio rather than of the model itself. Roll noted that there was no way to ever prove that the CAPM worked, and thus, no empirical basis for using the model.

The study by Fama and French quoted in the last section examined the relationship between the betas of stocks and annual returns between 1963 and 1990 and concluded that there was little relationship between the two. They noted that market capitalization and book-to-market value explained differences in returns across firms much better than did beta and were better proxies for risk. These results have been contested on two fronts. First, Amihud, Christensen, and Mendelson, used the same data, performed different statistical tests, and showed that betas did, in fact, explain returns during the time period.[15] Second, Chan and Lakonishok look at a much longer time series

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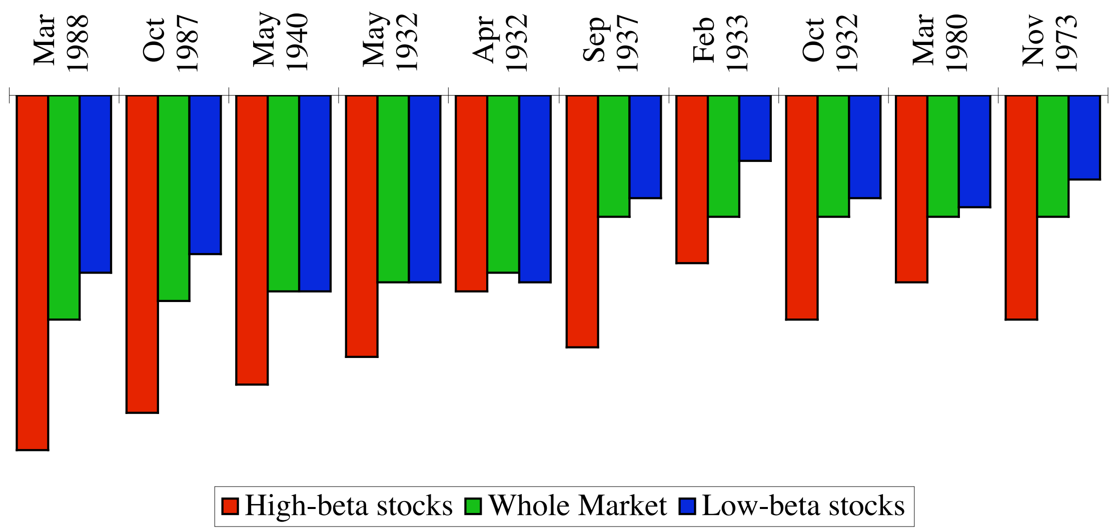
[14] Roll, R., 1977, A Critique of the Asset Pricing Theory's Tests: Part I: On Past and Potential Testability of Theory, Journal of Financial Economics, v4, 129-176.

[15] Amihud, Y., B. Christensen and H. Mendelson, 1992, *Further Evidence on the Risk-Return Relationship*, Working Paper, New York University.

of returns from 1926 to 1991 and found that the positive relationship between betas and returns broke down only in the period after 1982.[16] They attribute this breakdown to indexing, which they argue has led the larger, lower-beta stocks in the S & P 500 to outperform smaller, higher-beta stocks. They also find that betas are a useful guide to risk in extreme market conditions, with the riskiest firms (the 10% with highest betas) performing far worse than the market as a whole, in the ten worst months for the market between 1926 and 1991 (See Figure 3.8).

Figure 3.8: Returns and Betas: Ten Worst Months between 1926 and 1991



While the initial tests of the APM and the multi-factor models suggested that they might provide more promise in terms of explaining differences in returns, a distinction has to be drawn between the use of these models to explain differences in past returns and their use to get expected returns for the future. The competitors to the CAPM clearly do a much better job at explaining past returns since they do not constrain themselves to one factor, as the CAPM does. This extension to multiple factors does become more of a problem when we try to project expected returns into the future, since the betas and premiums of each of these factors now have to be estimated. As the factor premiums and

[16] Chan, L.K. and J. Lakonsihok, 1993, *Are the reports of Beta's death premature?,* Journal of Portfolio

betas are themselves volatile, the estimation error may wipe out the benefits that could be gained by moving from the CAPM to more complex models. The regression models that were offered as an alternative are even more exposed to this problem, since the variables that work best as proxies for market risk in one period (such as size) may not be the ones that work in the next period. This may explain why multi-factor models have been accepted more widely in evaluating portfolio performance evaluation than in corporate finance; the former is focused on past returns whereas the latter is concerned with future expected returns.

Ultimately, the survival of the captial asset pricing model as the default model for risk in real world application is a testament both to its intuitive appeal and the failure of more complex models to deliver significant improvement in terms of expected returns. We would argue that a judicious use of the capital asset pricing model, without an over reliance on historical data, in conjunction with the accumulated evidence[17] presented by those who have developed the alternatives to the CAPM, is still the most effective way of dealing with risk in modern corporate finance.

In Practice: Implied Costs of Equity and Capital

The controversy surrounding the assumptions made by each of the risk and return models outlined above and the errors that are associated with the estimates from each has led some analysts to use an alternate approach for companies that are publicly traded. With these companies, the market price represents the market's best estimate of the value of the company today. If you assume that the market is right and you are willing to make assumptions about expected growth in the future, you can back out a cost of equity from the current market price. For example, assume that a stock is trading at \$ 50 and that dividends next year are expected to be \$2.50. Furthermore, assume that dividends will grow 4% a year in perpetuity. The cost of equity implied in the stock price can be estimated as follows:

Management, v19, 51-62.

[17] Barra, a leading beta estimation service, adjusts betas to reflect differences in fundamentals across firms (such as size and dividend yields). It is drawing on the regression studies that have found these to be good proxies for market risk.

Stock price = \$ 50 = Expected dividends next year/ (Cost of equity – Expected growth rate)

$$\$ 50 = 2.50/(r - .04)$$

Solving for r, r = 9%. This approach can be extended to the entire firm and to compute the cost of capital.

While this approach has the obvious benefit of being model free, it has its limitations. In particular, our cost of equity will be a function of our estimates of growth and cashflows. If we use overly optimistic estimates of expected growth and cashflows, we will under estimate the cost of equity. It is also built on the presumption that the market price is right.

The Risk in Borrowing: Default Risk and the Cost of Debt

When an investor lends to an individual or a firm, there is the possibility that the borrower may default on interest and principal payments on the borrowing. This possibility of default is called the default risk. Generally speaking, borrowers with higher default risk should pay higher interest rates on their borrowing than those with lower default risk. This section examines the measurement of default risk, and the relationship of default risk to interest rates on borrowing.

In contrast to the general risk and return models for equity, which evaluate the effects of market risk on expected returns, models of default risk measure the consequences of firm-specific default risk on promised returns. While diversification can be used to explain why firm-specific risk will not be priced into expected returns for equities, the same rationale cannot be applied to securities that have limited upside potential and much greater downside potential from firm-specific events. To see what we mean by limited upside potential, consider investing in the bond issued by a company. The coupons are fixed at the time of the issue, and these coupons represent the promised cash flow on the bond. The best-case scenario for you as an investor is that you receive the promised cash flows; you are not entitled to more than these cash flows even if the company is wildly successful. All other scenarios contain only bad news, though in varying degrees, with the delivered cash flows being less than the promised cash flows.

Consequently, the expected return on a corporate bond is likely to reflect the firm-specific default risk of the firm issuing the bond.

The Determinants of Default Risk

The default risk of a firm is a function of its capacity to generate cashflows from operations and its financial obligations - including interest and principal payments.[18] It is also a function of the how liquid a firm's assets are since firms with more liquid assets should have an easier time liquidating them, in a crisis, to meet debt obligations. Consequently, the following propositions relate to default risk:

- Firms that generate high cashflows relative to their financial obligations have lower default risk than do firms that generate low cashflows relative to obligations. Thus, firms with significant current investments that generate high cashflows, will have lower default risk than will firms that do not.
- The more stable the cashflows, the lower is the default risk in the firm. Firms that operate in predictable and stable businesses will have lower default risk than will otherwise similar firms that operate in cyclical and/or volatile businesses, for the same level of indebtedness.
- The more liquid a firm's assets, for any given level of operating cashflows and financial obligations, the less default risk in the firm.

For as long as there have been borrowers, lenders have had to assess default risk. Historically, assessments of default risk have been based on financial ratios to measure the cashflow coverage (i.e., the magnitude of cashflows relative to obligations) and control for industry effects, to capture the variability in cashflows and the liquidity of assets.

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[18] Financial obligation refers to any payment that the firm has legally obligated itself to make, such as interest and principal payments. It does not include discretionary cashflows, such as dividend payments or new capital expenditures, which can be deferred or delayed, without legal consequences, though there may be economic consequences.

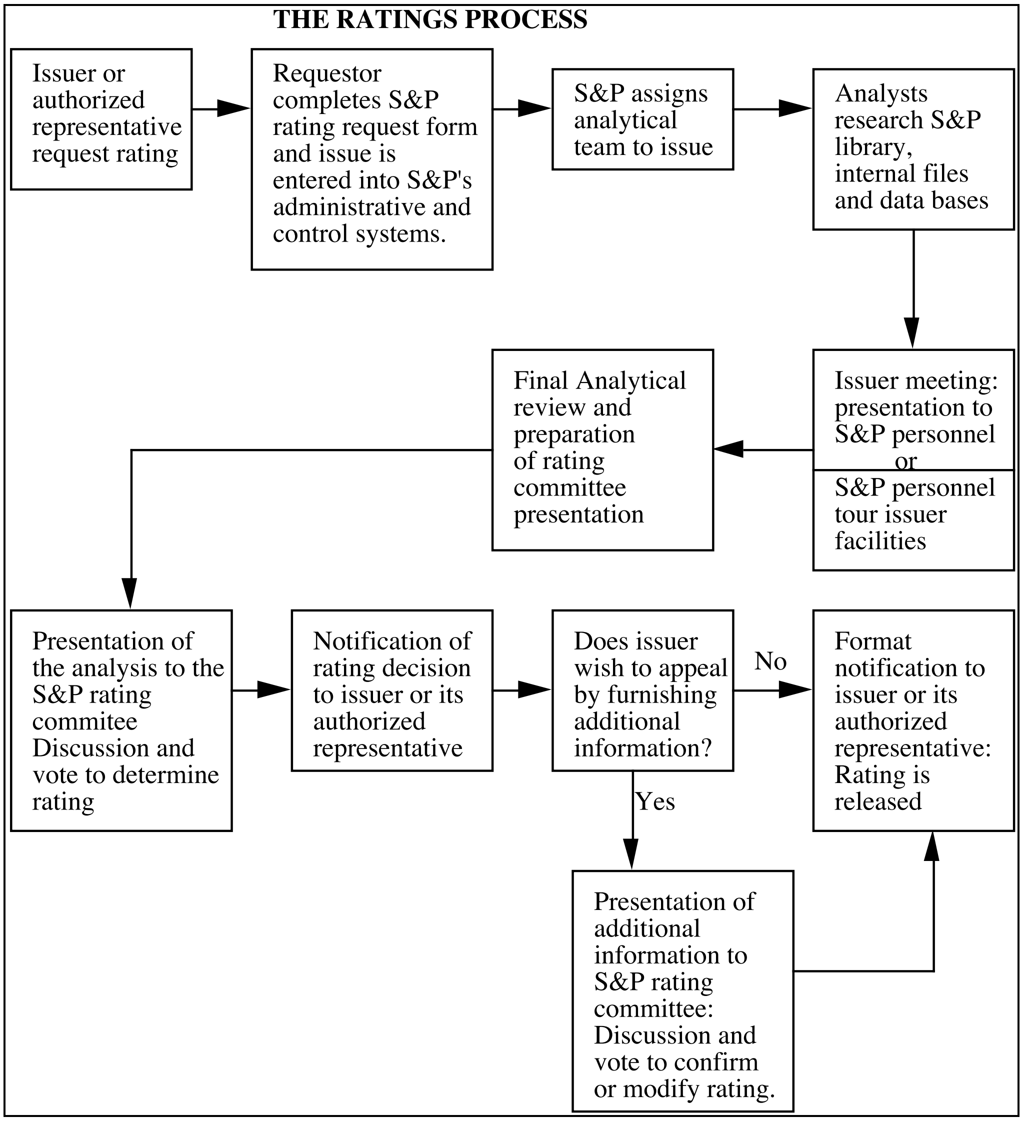
Default Risk and Interest rates

When banks did much of the lending to firms, it made sense for banks to expend the resources to make their own assessments of default risk, and they still do for most lenders. The advent of the corporate bond market created a demand for third party assessments of default risk on the part of bondholders. This demand came from the need for economies of scale, since few individual bondholders had the resources to make the assessment themselves. In the United States, this led to the growth of ratings agencies like Standard and Poor's and Moody's which made judgments of the default risk of corporations, using a mix of private and public information, converted these judgments into measures of default risk (bond rating) and made these ratings public. Investors buying corporate bonds could therefore use the bond ratings as a shorthand measure of default risk.

The Ratings Process

The process of rating a bond starts when a company requests a rating from the ratings agency. This request is usually precipitated by a desire on the part of the company to issue bonds. While ratings are not a legal pre-requisite for bond issues, it is unlikely that investors in the bond market will be willing to buy bonds issued by a company that is not well known and has shown itself to be unwilling to put itself through the rigor of a bond rating process. It is not surprising, therefore, that the largest number of rated companies are in the United States, which has the most active corporate bond markets, and that there are relatively few rated companies in Europe, where bank lending remains the norm for all but the largest companies.

The ratings agency then collects information from both publicly available sources, such as financial statements, and the company itself, and makes a decision on the rating. If it disagrees with the rating, the company is given the opportunity to present additional information. This process is presented schematically for one ratings agency, Standard and Poors (S&P), in Figure 3.9:



The ratings assigned by these agencies are letter ratings. A rating of AAA from Standard and Poor’s and Aaa from Moody’s represents the highest rating granted to firms that are viewed as having the lowest default risk. As the default risk increases, the ratings decrease toward D for firms in default (Standard and Poor’s). Table 3.1 provides a description of the bond ratings assigned by the two agencies.

Table 3.1: Index of Bond Ratings

Standard and Poor's		Moody's	
AAA	The highest debt rating assigned. The borrower's capacity to repay debt is extremely strong.	Aaa	Judged to be of the best quality with a small degree of risk.
AA	Capacity to repay is strong and differs from the highest quality	Aa	High quality but rated lower than Aaa because margin of protection

	only by a small amount.		may not be as large or because there may be other elements of long-term risk.
A	Has strong capacity to repay; Borrower is susceptible to adverse effects of changes in circumstances and economic conditions.	A	Bonds possess favorable investment attributes but may be susceptible to risk in the future.
BBB	Has adequate capacity to repay, but adverse economic conditions or circumstances are more likely to lead to risk.	Baa	Neither highly protected nor poorly secured; adequate payment capacity.
BB,B, CCC, CC	Regarded as predominantly speculative, BB being the least speculative andd CC the most.	Ba B	Judged to have some speculative risk. Generally lacking characteristics of a desirable investment; probability of payment small.
D	In default or with payments in arrears.	Caa Ca C	Poor standing and perhaps in default. Very speculative; often in default. Highly speculative; in default.

In Practice: Investment Grade and Junk Bonds

While ratings can range from AAA (safest) to D (in default), a rating at or above BBB by Standard and Poor's (Baa for Moody's) is categorized as investment grade, reflecting the view of the ratings agency that there is relatively little default risk in investing in bonds issued by these firms. Bonds rated below BBB are generally categorized as junk bonds or as high-yield bonds. While it is an arbitrary dividing line, it is an important one for two reasons. First, many investment portfolios are restricted from investing in bonds below investment grade. Thus, the market for investment grade bonds tends to be wider and deeper than that for bonds below that grade. Second, firms that are not rated investment grade have a tougher time when they try to raise new funding and they also pay much higher issuance costs when they do. In fact, until the early 1980s, firms below investment grade often could not issue new bonds. [19] The perception that

[19] In the early 1980s, Michael Milken and Drexel Burnham that created the junk bond market, allowing for original issuance of junk bonds. They did this primarily to facilitate hostile takeovers by the raiders of the era.

they are exposed to default risk also creates a host of other costs including tighter supplier credit and debt covenants.

Determinants of Bond Ratings

The bond ratings assigned by ratings agencies are primarily based upon publicly available information, though private information conveyed by the firm to the rating agency does play a role. The rating that is assigned to a company's bonds will depend in large part on financial ratios that measure the capacity of the company to meet debt payments and generate stable and predictable cashflows. While a multitude of financial ratios exist, table 3.2 summarizes some of the key ratios that are used to measure default risk:

Table 3.2: Financial Ratios used to measure Default Risk

Ratio	Description
Pretax Interest Coverage	= (Pretax Income from Continuing Operations + Interest Expense) / Gross Interest
EBITDA Interest Coverage	= EBITDA/ Gross Interest
Funds from Operations / Total Debt	=(Net Income from Continuing Operations + Depreciation) / Total Debt
Free Operating Cashflow/ Total Debt	= (Funds from Operations - Capital Expenditures - Change in Working Capital) / Total Debt
Pretax Return on Permanent Capital	= (Pretax Income from Continuing Operations + Interest Expense) / (Average of Beginning of the year and End of the year of long and short term debt, minority interest and Shareholders Equity)
Operating Income/Sales (%)	= (Sales - COGS (before depreciation) - Selling Expenses - Administrative Expenses - R&D Expenses) / Sales
Long Term Debt/ Capital	= Long Term Debt / (Long Term Debt + Equity)
Total Debt/Capitalization	= Total Debt / (Total Debt + Equity)

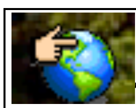
There is a strong relationship between the bond rating a company receives and its performance on these financial ratios. Table 3.3 provides a summary of the median ratios from 1998 to 2000 for different S&P ratings classes for manufacturing firms.

Table 3.3: Financial Ratios by Bond Rating: 1998- 2000

	AAA	*AA*	*A*	*BBB*	*BB*	*B*	*CCC*
EBIT interest cov. (x)	17.5	10.8	6.8	3.9	2.3	1.0	0.2
EBITDA interest cov.	21.8	14.6	9.6	6.1	3.8	2.0	1.4
Funds flow/total debt	105.8	55.8	46.1	30.5	19.2	9.4	5.8
Free oper. cash flow/total debt (%)	55.4	24.6	15.6	6.6	1.9	–4.5	-14.0
Return on capital (%)	28.2	22.9	19.9	14.0	11.7	7.2	0.5
Oper.income/sales (%)	29.2	21.3	18.3	15.3	15.4	11.2	13.6
Long-term debt/capital (%)	15.2	26.4	32.5	41.0	55.8	70.7	80.3
Total Debt/ Capital (%)	26.9	35.6	40.1	47.4	61.3	74.6	89.4
Number of firms	10	34	150	234	276	240	23

Note that the pre-tax interest coverage ratio and the EBITDA interest coverage ratio are stated in terms of times interest earned, whereas the rest of the ratios are stated in percentage terms.

Not surprisingly, firms that generate income and cashflows that are significantly higher than debt payments that are profitable and that have low debt ratios are more likely to be highly rated than are firms that do not have these characteristics. There will be individual firms whose ratings are not consistent with their financial ratios, however, because the ratings agency does bring subjective judgments into the final mix. Thus, a firm that performs poorly on financial ratios but is expected to improve its performance dramatically over the next period may receive a higher rating than that justified by its current financials. For most firms, however, the financial ratios should provide a reasonable basis for guessing at the bond rating.

There is a dataset on the web that summarizes key financial ratios by bond rating class for the United States in the most recent period for which the data is available.

Bond Ratings and Interest Rates

The interest rate on a corporate bond should be a function of its default risk. If the rating is a good measure of the default risk, higher rated bonds should be priced to yield lower interest rates than would lower rated bonds. The difference between the interest rate on a bond with default risk and a default-free government bond is called the default spread. This default spread will vary by maturity of the bond and can also change from period to period, depending on economic conditions. Table 3.4 summarizes default spreads in early 2004 for ten-year bonds in each ratings class (using S&P ratings) and the market interest rates on these bonds, based upon a treasury bond rate of 4%.

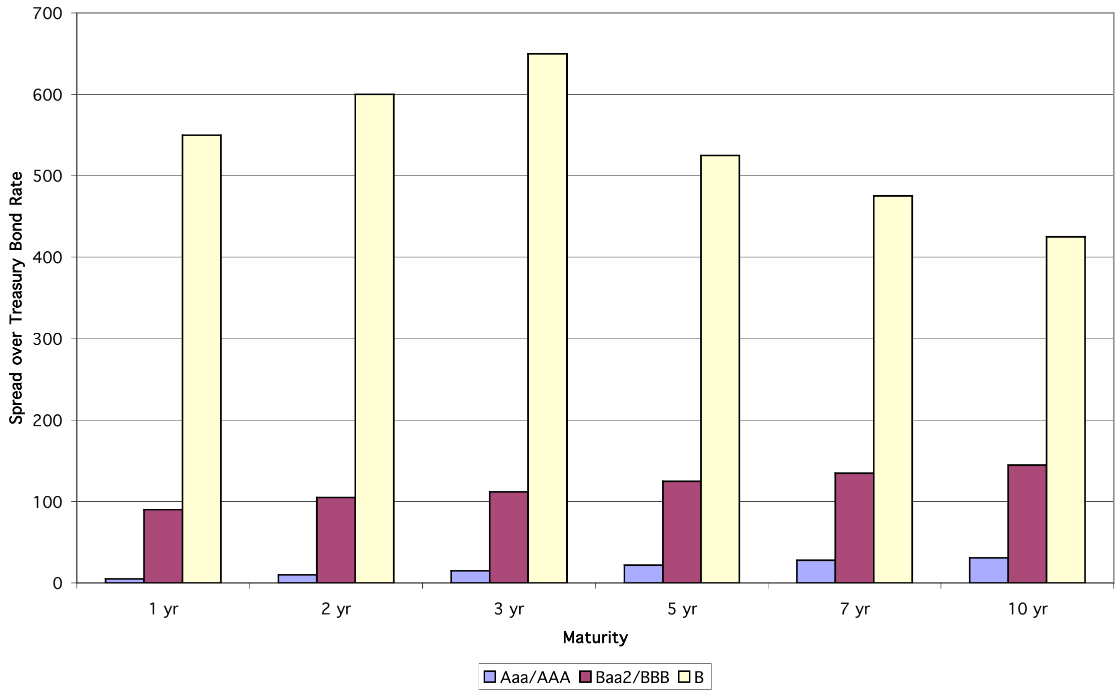
Table 3.4: Default Spreads for Ratings Classes: January 2004

Rating	*Default Spread*	*Interest rate on bond*
AAA	0.30%	4.30%
AA	0.50%	4.50%
A+	0.70%	4.70%
A	0.85%	4.85%
A-	1.00%	5.00%
BBB	1.50%	5.50%
BB	3.50%	7.50%
B+	4.25%	8.25%
B	5.00%	9.00%
B-	8.25%	12.25%
CCC	12.50%	16.50%
CC	14.00%	18.00%
C	16.00%	20.00%
D	20.00%	24.00%

Source: bondsonline.com

Table 3.4 provides default spreads at a point in time, but default spreads not only vary across time but they can vary for bonds with the same rating but different maturities. From observation, the default spread for corporate bonds of a given ratings class seems to increase with the maturity of the bond. In Figure 3.10 we present the default spreads estimated for an AAA, BBB and CCC rated bond for maturities ranging from 1 to 10 years in January 2004.

Figure 3.10: Default Spreads by Maturity



For the AAA and BBB ratings, the default spread widen for the longer maturities. For the B rated bonds, the spreads widen as we go from 1 to 3 year maturities but narrow after than. Why might this be? It is entirely possible that this reflects where we are in the economic cycle. In early 2004, there were many cyclical firms that were in trouble because of the recession of the prior 2 years. If these firms survive in the short term (say 3 years), improving earnings will reduce default risk in future years.

The default spreads presented in Table 3.4, after a good year for the stock markets and signs of an economic pickup, were significantly lower than the default spreads a year earlier. This phenomenon is not new. Historically, default spreads for every ratings class have increased during recessions and decreased during economic booms. The practical implication of this phenomenon is that default spreads for bonds have to be re-estimated at regular intervals, especially if the economy shifts from low to high growth or vice versa.

A final point worth making here is that everything that has been said about the relationship between interest rates and bond ratings could be said more generally about interest rates and default risk. The existence of ratings is a convenience that makes the assessment of default risk a little easier for us when analyzing companies. In its absence, we would still have to assess default risk on our own and come up with estimates of the default spread we would charge if we were lending to a firm.

ratings.xls: There is a dataset on the web that summarizes default spreads by bond rating class for the most recent period.

In Practice: Ratings Changes and Interest Rates

The rating assigned to a company can change at the discretion of the ratings agency. The change is usually triggered by a change in a firm's operating health, a new security issue by the firm or by new borrowing. Other things remaining equal, ratings will drop if the operating performance deteriorates or if the firm borrows substantially more and improve if it reports better earnings or if it raises new equity. In either case, though, the ratings agency is reacting to news that the rest of the market also receives. In fact, ratings agencies deliberate before making ratings changes, often putting a firm on a credit watch list before changing its ratings. Since markets can react instantaneously, it should come as no surprise that bond prices often decline before a ratings drop and increase before a ratings increase. In fact, studies indicate that much of the bond price reaction to deteriorating credit quality precedes a ratings drop.

This does not mean that there is no information in a ratings change. When ratings are changed, the market still reacts but the reactions tend to be small. The biggest service provided by ratings agencies may be in providing a measure of default risk that is comparable across hundreds of rated firms, thus allowing bond investors a simple way of categorizing their potential investments.

Conclusion

Risk, as we define it in finance, is measured based upon deviations of actual returns on an investment from its' expected returns. There are two types of risk. The first, which we call equity risk, arises in investments where there are no promised cash flows, but there are expected cash flows. The second,, default risk, arises on investments with promised cash flows.

On investments with equity risk, the risk is best measured by looking at the variance of actual returns around the expected returns, with greater variance indicating greater risk. This risk can be broken down into risk that affects one or a few investments, which we call firm specific risk, and risk that affects many investments, which we refer to as market risk. When investors diversify, they can reduce their exposure to firm specific risk. By assuming that the investors who trade at the margin are well diversified, we conclude that the risk we should be looking at with equity investments is the market risk. The different models of equity risk introduced in this chapter share this objective of measuring market risk, but they differ in the way they do it. In the capital asset pricing model, exposure to market risk is measured by a market beta, which estimates how much risk an individual investment will add to a portfolio that includes all traded assets. The arbitrage pricing model and the multi-factor model allow for multiple sources of market risk and estimate betas for an investment relative to each source. Regression or proxy models for risk look for firm characteristics, such as size, that have been correlated with high returns in the past and use these to measure market risk. In all these models, the risk measures are used to estimate the expected return on an equity investment. This expected return can be considered the cost of equity for a company.

On investments with default risk, risk is measured by the likelihood that the promised cash flows might not be delivered. Investments with higher default risk should have higher interest rates, and the premium that we demand over a riskless rate is the default premium. For most US companies, default risk is measured by rating agencies in the form of a company rating; these ratings determine, in large part, the interest rates at which these firms can borrow. Even in the absence of ratings, interest rates will include a default premium that reflects the lenders' assessments of default risk. These default-risk adjusted interest rates represent the cost of borrowing or debt for a business.

Problems and Questions

1. The following table lists the stock prices for Microsoft from 1989 to 1998. The company did not pay any dividends during the period

Year	Price
1989	$ 1.20
1990	$ 2.09
1991	$ 4.64
1992	$ 5.34
1993	$ 5.05
1994	$ 7.64
1995	$ 10.97
1996	$ 20.66
1997	$ 32.31
1998	$ 69.34

a. Estimate the average annual return you would have made on your investment

b. Estimate the standard deviation and variance in annual returns

c. If you were investing in Microsoft today, would you expect the historical standard deviations and variances to continue to hold? Why or why not?

2. Unicom is a regulated utility serving Northern Illinois. The following table lists the stock prices and dividends on Unicom from 1989 to 1998.

Year	Price	Dividends
1989	$ 36.10	$ 3.00
1990	$ 33.60	$ 3.00
1991	$ 37.80	$ 3.00
1992	$ 30.90	$ 2.30
1993	$ 26.80	$ 1.60
1994	$ 24.80	$ 1.60
1995	$ 31.60	$ 1.60
1996	$ 28.50	$ 1.60
1997	$ 24.25	$ 1.60
1998	$ 35.60	$ 1.60

a. Estimate the average annual return you would have made on your investment

b. Estimate the standard deviation and variance in annual returns

c. If you were investing in Unicom today, would you expect the historical standard deviations and variances to continue to hold? Why or why not?

3. The following table summarizes the annual returns you would have made on two companies – Scientific Atlanta, a satellite and data equipment manufacturer, and AT&T, the telecomm giant, from 1988 to 1998.

Year	*Scientific Atltanta*	*AT&T*
1989	80.95%	58.26%
1990	-47.37%	-33.79%
1991	31%	29.88%
1992	132.44%	30.35%
1993	32.02%	2.94%
1994	25.37%	-4.29%
1995	-28.57%	28.86%
1996	0.00%	-6.36%
1997	11.67%	48.64%
1998	36.19%	23.55%

a. Estimate the average and standard deviation in annual returns in each company

b. Estimate the covariance and correlation in returns between the two companies

c. Estimate the variance of a portfolio composed, in equal parts, of the two investments

4. You are in a world where there are only two assets, gold and stocks. You are interested in investing your money in one, the other or both assets. Consequently you collect the following data on the returns on the two assets over the last six years.

	Gold	Stock Market
Average return	8%	20%
Standard deviation	25%	22%
Correlation	-.4	

a. If you were constrained to pick just one, which one would you choose?

b. A friend argues that this is wrong. He says that you are ignoring the big payoffs that you can get on gold. How would you go about alleviating his concern?

c. How would a portfolio composed of equal proportions in gold and stocks do in terms of mean and variance?

d. You now learn that GPEC (a cartel of gold-producing countries) is going to vary the amount of gold it produces with stock prices in the US. (GPEC will produce less gold when stock markets are up and more when it is down.) What effect will this have on your portfolios? Explain.

5. You are interested in creating a portfolio of two stocks – Coca Cola and Texas Utilities. Over the last decade, an investment in Coca Cola stock would have earned an average annual return of 25%, with a standard deviation in returns of 36%. An investment in Texas Utilities stock would have earned an average annual return of 12%, with a standard deviation of 22%. The correlation in returns across the two stocks is 0.28.

a. Assuming that the average and standard deviation, estimated using past returns, will continue to hold in the future, estimate the average returns and standard deviation of a portfolio composed 60% of Coca Cola and 40% of Texas Utilities stock.

b. Estimate the minimum variance portfolio.

c. Now assume that Coca Cola's international diversification will reduce the correlation to 0.20, while increasing Coca Cola's standard deviation in returns to 45%. Assuming all of the other numbers remain unchanged, answer (a) and (b).

6. Assume that you have half your money invested in Times Mirror, the media company, and the other half invested in Unilever, the consumer product giant. The expected returns and standard deviations on the two investments are summarized below:

	Times Mirror	Unilever
Expected Return	14%	18%
Standard Deviation	25%	40%

Estimate the variance of the portfolio as a function of the correlation coefficient (Start with –1 and increase the correlation to +1 in 0.2 increments).

7. You have been asked to analyze the standard deviation of a portfolio composed of the following three assets:

Investment	Expected Return	Standard Deviation
Sony Corporation	11%	23%
Tesoro Petroleum	9%	27%
Storage Technology	16%	50%

You have also been provided with the correlations across these three investments:

	Sony	Tesoro	Storage Tech
Sony	1.00	-0.15	0.20
Tesoro	-0.15	1.00	-0.25

Storage Tech	0.20	-0.25	1.00

Estimate the variance of a portfolio, equally weighted across all three assets.

8. You have been asked to estimate a Markowitz portfolio across a universe of 1250 assets.
   a. How many expected returns and variances would you need to compute?
   b. How many covariances would you need to compute to obtain Markowitz portfolios?

9. Assume that the average variance of return for an individual security is 50 and that the average covariance is 10. What is the expected variance of a portfolio of 5, 10, 20, 50 and 100 securities. How many securities need to be held before the risk of a portfolio is only 10% more than the minimum?

10. Assume you have all your wealth (a million dollars) invested in the Vanguard 500 index fund, and that you expect to earn an annual return of 12%, with a standard deviation in returns of 25%. Since you have become more risk averse, you decide to shift $ 200,000 from the Vanguard 500 index fund to treasury bills. The T.bill rate is 5%. Estimate the expected return and standard deviation of your new portfolio.

11. Every investor in the capital asset pricing model owns a combination of the market portfolio and a riskless asset. Assume that the standard deviation of the market portfolio is 30%, and that the expected return on the portfolio is 15%. What proportion of the following investor's wealth would you suggest investing in the market portfolio and what proportion in the riskless asset? (The riskless asset has an expected return of 5%)
   a. an investor who desires a portfolio with no standard deviation
   b. an investor who desires a portfolio with a standard deviation of 15%
   c. an investor who desires a portfolio with a standard deviation of 30%
   d. an investor who desires a portfolio with a standard deviation of 45%
   e. an investor who desires a portfolio with an expected return of 12%

12. The following table lists returns on the market portfolio and on Scientific Atltanta, each year from 1989 to 1998.

Year	*Scientific Atltanta*	*Market Portfolio*
1989	80.95%	31.49%
1990	-47.37%	-3.17%

1991	31%	30.57%
1992	132.44%	7.58%
1993	32.02%	10.36%
1994	25.37%	2.55%
1995	-28.57%	37.57%
1996	0.00%	22.68%
1997	11.67%	33.10%
1998	36.19%	28.32%

a. Estimate the covariance in returns between Microsoft and the market portfolio

b. Estimate the variances in returns on both investments

c. Estimate the beta for Microsoft

13. United Airlines has a beta of 1.50. The standard deviation in the market portfolio is 22% and United Airlines has a standard deviation of 66%

a. Estimate the correlation between United Airlines and the market portfolio.

b. What proportion of United Airlines' risk is market risk?

14. You are using the arbitrage pricing model to estimate the expected return on Bethlehem Steel, and have derived the following estimates for the factor betas and risk premia:

Factor	Beta	Risk Premia
1	1.2	2.5%
2	0.6	1.5%
3	1.5	1.0%
4	2.2	0.8%
5	0.5	1.2%

a. Which risk factor is Bethlehem Steel most exposed to? Is there any way, within the arbitrage pricing model, to identify the risk factor?

b. If the riskfree rate is 5%, estimate the expected return on Bethlehem Steel

c. Now assume that the beta in the capital asset pricing model for Bethlehem Steel is 1.1, and that the risk premium for the market portfolio is 5%. Estimate the expected return, using the CAPM.

d. Why are the expected returns different using the two models?

15. You are using the multi-factor model to estimate the expected return on Emerson Electric, and have derived the following estimates for the factor betas and risk premia:

Macro-economic Factor	*Measure*	*Beta*	*Risk Premia* (R_{factor}-R_f)
Level of Interest rates	T.bond rate	0.5	1.8%
Term Structure	T.bond rate – T.bill rate	1.4	0.6%
Inflation rate	CPI	1.2	1.5%
Economic Growth	GNP Growth rate	1.8	4.2%

With a riskless rate of 6%, estimate the expected return on Emerson Electric.

16. The following equation is reproduced from the study by Fama and French of returns between 1963 and 1990.

$$R_t = .0177 \quad - 0.11 \ln (MV) + 0.35 \ln (BV/MV)$$

where MV is the market value of equity in hundreds of millions of dollar and BV is the book value of equity in hundreds of millions of dollars. The return is a monthly return.

a. Estimate the expected annual return on Lucent Technologies. The market value of equity is \$ 240 billion, and the book value of equity is \$ 13.5 billion.

b. Lucent Technologies has a beta of 1.55. If the riskless rate is 6%, and the risk premium for the market portfolio is 5.5%, estimate the expected return.

c. Why are the expected returns different under the two approaches?

Live Case Study
Stockholder Analysis

Objective: To find out who the average and marginal investors in the company are. This is relevant because risk and return models in finance assume that the marginal investor is well diversified.

Key Questions:

- Who is the average investor in this stock? (Individual or pension fund, taxable or tax-exempt, small or large, domestic or foreign)
- Who is the marginal investor in this stock?

Framework for Analysis

1. *Who holds stock in this company?*
    - How many stockholders does the company have?
    - What percent of the stock is held by institutional investors?
    - Does the company have listings in foreign markets? (If you can, estimate the percent of the stock held by non-domestic investors)
2. *Insider Holdings*
    - Who are the insiders in this company? (Besides the managers and directors, anyone with more than 5% is treated as an insider)
    - What role do the insiders play in running the company?
    - What percent of the stock is held by insiders in the company?
    - What percent of the stock is held by employees overall? (Include the holdings by employee pension plans)
    - Have insiders been buying or selling stock in this company in the most recent year?

Getting Information on Stockholder Composition

Information about insider and institutional ownership of firms is widely available since both groups have to file with the SEC. These SIC filings are used to develop rankings of the largest holders of stock in firms. Insider activity (buying and selling) is also recorded by the SEC, though the information is not available until a few weeks after the filing.

Online sources of information:

http://www.stern.nyu.edu/~adamodar/cfin2E/project/data.htm

Appendix on Statistics: Means, Variances, Covariances and Regressions

Large amounts of data are often compressed into more easily assimilated summaries, which provide the user with a sense of the content, without overwhelming him or her with too many numbers. There a number of ways in which data can be presented. One approach breaks the numbers down into individual values (or ranges of values) and provides probabilities for each range. This is called a "distribution". Another approach is to estimate "summary statistics" for the data. For a data series, X_1, X_2, X_3, ...X_n, where n is the number of observations in the series, the most widely used summary statistics are as follows –

- the mean (μ), which is the average of all of the observations in the data series

$$Mean = \mu_X = \frac{\sum_{j=1}^{j=n} X_j}{n}$$

- the median, which is the mid-point of the series; half the data in the series is higher than the median and half is lower
- the variance, which is a measure of the spread in the distribution around the mean, and is calculated by first summing up the squared deviations from the mean, and then dividing by either the number of observations (if the data represents the entire population) or by this number, reduced by one (if the data represents a sample)

$$\text{Variance} = \sigma_X^2 = \frac{\sum_{j=1}^{j=n} (X_j - \mu)^2}{n-1}$$

When there are two series of data, there are a number of statistical measures that can be used to capture how the two series move together over time. The two most widely used are the correlation and the covariance. For two data series, X (X_1, X_2,.) and Y(Y,Y...), the covariance provides a non-standardized measure of the degree to which they move together, and is estimated by taking the product of the deviations from the mean for each variable in each period.

$$\text{Covariance} = \sigma_{XY} = \frac{\sum_{j=1}^{j=n} (X_j - \mu_X)\ (Y_j - \mu_Y)}{n-2}$$

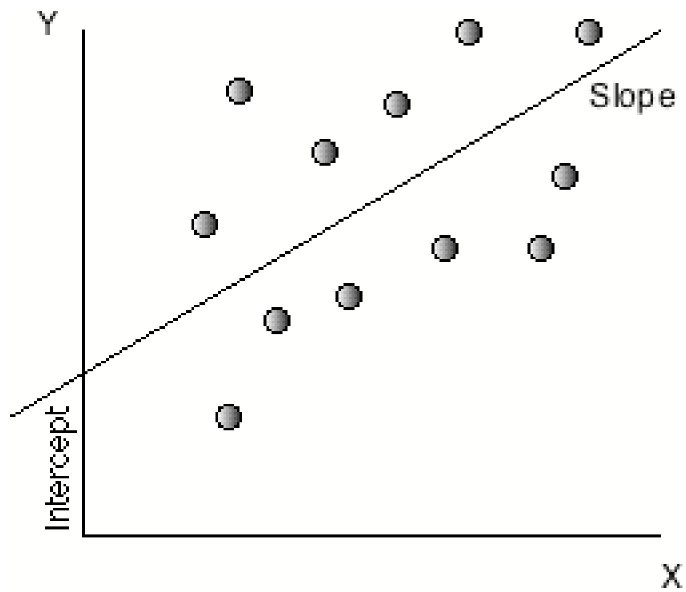
The sign on the covariance indicates the type of relationship that the two variables have. A positive sign indicates that they move together and a negative that they move in opposite directions. While the covariance increases with the strength of the relationship, it is still relatively difficult to draw judgements on the strength of the relationship between two variables by looking at the covariance, since it is not standardized.

The correlation is the standardized measure of the relationship between two variables. It can be computed from the covariance –

$$\text{Correlation} = \rho_{XY} = \sigma_{XY} / \sigma_X \sigma_Y = \frac{\sum_{j=1}^{j=n} (X_j - \mu_X)\,(Y_j - \mu_Y)}{\sqrt{\sum_{j=1}^{j=n} (X_j - \mu_X)^2}\,\sqrt{\sum_{j=1}^{j=n} (Y_j - \mu_Y)^2}}$$

The correlation can never be greater than 1 or less than minus 1. A correlation close to zero indicates that the two variables are unrelated. A positive correlation indicates that the two variables move together, and the relationship is stronger the closer the correlation gets to one. A negative correlation indicates the two variables move in opposite directions, and that relationship also gets stronger the closer the correlation gets to minus 1. Two variables that are perfectly positvely correlated (r=1) essentially move in perfect proportion in the same direction, while two assets which are perfectly negatively correlated move in perfect proporiton in opposite directions.

A simple regression is an extension of the correlation/covariance concept which goes one step further. It attempts to explain one variable, which is called the dependent variable, using the other variable, called the independent variable. Keeping with statitical tradition, let Y be the dependent variable and X be the independent variable. If the two variables are plotted against each other on a scatter plot, with Y on the vertical axis and X on the horizontal axis, the regression attempts to fit a straight line through the points in such a way as the minimize the sum of the squared deviations of the points from the line. Consequently, it is called ordinary least squares (OLS) regression. When such a line is fit, two parameters emerge – one is the point at which the line cuts through the Y axis, called the intercept of the regression, and the other is the slope of the regression line.



OLS Regression: $Y = a + b\,X$

The slope (b) of the regression measures both the direction and the magnitude of the relation. When the two variables are positively correlated, the slope will also be positive, whereas when the two variables are negatively correlated, the slope will be negative. The magnitude of the slope of the regression can be read as follows - for every unit increase in the dependent variable (X), the independent variable will change by b (slope). The close linkage between the slope of the regression and the correlation/covariance should not be surprising since the slope is estimated using the covariance –

$$\text{Slope of the Regression} = b = \frac{\text{Covariance}_{YX}}{\text{Variance of X}} = \frac{\sigma_{YX}}{\sigma_X^2}$$

The intercept (a) of the regression can be read in a number of ways. One interpretation is that it is the value that Y will have when X is zero. Another is more straightforward, and is based upon how it is calculated. It is the difference between the average value of Y, and the slope adjusted value of X.

$$\text{Intercept of the Regression} = a = \mu_Y - b * (\mu_X)$$

Regression parameters are always estimated with some noise, partly because the data is measured with error and partly because we estimate them from samples of data. This noise is captured in a couple of statistics. One is the R-squared of the regression, which measures the proportion of the variability in Y that is explained by X. It is a direct function of the correlation between the variables –

$$\text{R - squared of the Regression} = \text{Correlation}_{YX}^2 = \rho_{YX}^2 = \frac{b^2\sigma_X^2}{\sigma_Y^2}$$

An R-squared value closer to one indicates a strong relationship between the two variables, though the relationship may be either positive or negative. Another measure of noise in a regression is the standard error, which measures the "spread' around each of the two parameters estimated- the intercept and the slope. Each parameter has an associated standard error, which is calculated from the data –

$$\text{Standard Error of Intercept} = SE_a = \sqrt{\frac{\left(\sum_{j=1}^{j=n} X_j^2\right)\left[\frac{\left(\sum_{j=1}^{j=n}(Y_j - bX_j)^2\right)}{n-1}\right]}{n\sum_{j=1}^{j=n}(X_j - \mu_X)^2}}$$

$$\text{Standard Error of Slope} = SE_b = \sqrt{\frac{\left[\frac{\left(\sum_{j=1}^{j=n}(Y_j - bX_j)^2\right)}{n-1}\right]}{\sum_{j=1}^{j=n}(X_j - \mu_X)^2}}$$

If we make the additional assumption that the intercept and slope estimates are normally distributed, the parameter estimate and the standard error can be combined to get a "t statistic" that measures whether the relationship is statistically significant.

T statistic for intercept = a/SE_a

T statistic from slope = b/SE_b

For samples with more than 120 observations, a t statistic greater than 1.66 indicates that the variable is significantly different from zero with 95% certainty, while a statistic greater than 2.36 indicates the same with 99% certainty. For smaller samples, the t statistic has to be larger to have statistical significance.[20]

[20] The actual values that t statistics need to take on can be found in a table for the t distribution, which is reproduced at the end of this book as an appendix.

The regression that measures the relationship between two variables becomes a multiple regression when it is extended to include more than one independent variables (X1,X2,X3,X4..) in trying to explain the dependent variable Y. While the graphical presentation becomes more difficult, the multiple regression yields a form that is an extension of the simple regression.

$$Y = a + b\,X1 + c\,X2 + dX3 + eX4$$

The R-squared still measures the strength of the relationship, but an additional R-squared statistic called the adjusted R squared is computed to counter the bias that will induce the R-squared to keep increasing as more independent variables are added to the regression. If there are k independent variables in the regression, the adjusted R squared is computed as follows –

$$\text{R squared} = R^2 = \frac{\left(\sum_{j=1}^{j=n} (Y_j - bX_j)^2\right)}{\text{n - k - 1}}$$

$$\text{Adjusted R squared} = R^2 - \left[\frac{\text{k - 1}}{\text{n - k}}\right] R^2$$

CHAPTER 4

RISK MEASUREMENT AND HURDLE RATES

In the last chapter, we presented the argument that the expected return on an equity investment should be a function of the market or non-diversifiable embedded in that investment. In this chapter, we turn our attention to how best to estimate the parameters of market risk in each of the models described in the previous chapter - the capital asset pricing model, the arbitrage pricing model and the mutli-factor model. We will present three alternative approaches for measuring the market risk in an investment; the first is to use historical data on market prices for the firm considering the project, the second is to use the market risk parameters estimated for other firms that are in the same business as the project being analyzed and the third is to use accounting earnings or revenues to estimate the parameters.

In addition to estimating market risk, we will also discuss how best to estimate a riskless rate and a risk premium (in the CAPM) or risk premiums (in the APM and multi-factor models) to convert the risk measures into expected returns. We will present a similar argument for converting default risk into a cost of debt, and then bring the discussion to fruition by combining both the cost of equity and debt to estimate a cost of capital, which will become the minimum acceptable hurdle rate for an investment.

Cost of Equity

The cost of equity is the rate of return that investors require to make an equity investment in a firm. All of the risk and return models described in the previous chapter need a riskfree rate and a risk premium (in the CAPM) or premiums (in the APM and multi-factor models). We will begin by discussing those common inputs before we turn our attention to the estimation of risk parameters.

I. Riskfree Rate

Most risk and return models in finance start off with an asset that is defined as risk free and use the expected return on that asset as the risk free rate. The expected returns on risky investments are then measured relative to the risk free rate, with the risk creating an expected risk premium that is added on to the risk free rate.

Requirements for an asset to be riskfree

We defined a riskfree asset as one where the investor knows the expected returns with certainty. Consequently, for an investment to be riskfree, i.e., to have an actual return be equal to the expected return, two conditions have to be met –

- There has to be *no default risk*, which generally implies that the security has to be issued by a government. Note, though, that not all governments are default free and the presence of government or sovereign default risk can make it very difficult to estimate riskfree rates in some currencies.
- There can be *no uncertainty about reinvestment rates*, which implies that there are no intermediate cash flows. To illustrate this point, assume that you are trying to estimate the expected return over a five-year period and that you want a risk free rate. A six-month treasury bill rate, while default free, will not be risk free, because there is the reinvestment risk of not knowing what the treasury bill rate will be in six months. Even a 5-year treasury bond is not risk free, since the coupons on the bond will be reinvested at rates that cannot be predicted today. The risk free rate for a five-year time horizon has to be the expected return on a default-free (government) five-year zero coupon bond.

This clearly has painful implications for anyone doing corporate financial analysis, where expected returns often have to be estimated for periods ranging from multiple years. A purist's view of risk free rates would then require different risk free rates for each period and different expected returns. As a practical compromise, however, it is worth noting that the present value effect of using risk free rates that vary from year to year tends to be small for most well behaved[1] term structures. In these cases, we could use a duration matching strategy, where the duration of the default-free security used as the risk free asset is matched up to the duration[2] of the cash flows in the analysis. If, however, there

[1] By well behaved term structures, I would include a normal upwardly sloping yield curve, where long term rates are at most 2-3% higher than short term rates.

[2] In investment analysis, where we look at projects, these durations are usually between 3 and 10 years. In valuation, the durations tend to be much longer, since firms are assumed to have infinite lives. The duration

are very large differences, in either direction, between short term and long term rates, it does pay to stick with year-specific risk free rates in computing expected returns.

Cash Flows and Risk free Rates: The Consistency Principle

The risk free rate used to come up with expected returns should be measured consistently with how the cash flows are measured. If the cashflows are nominal, the riskfree rate should be in the same currency in which the cashflows are estimated. This also implies that it is not where a project or firm is domiciled that determines the choice of a risk free rate, but the currency in which the cash flows on the project or firm are estimated. Thus, Disney can analyze a proposed project in Mexico in dollars, using a dollar discount rate, or in pesos, using a peso discount rate. For the former, it would use the US treasury bond rate as the riskfree rate but for the latter, it would need a peso riskfree rate.

Under conditions of high and unstable inflation, valuation is often done in real terms. Effectively, this means that cash flows are estimated using real growth rates and without allowing for the growth that comes from price inflation. To be consistent, the discount rates used in these cases have to be real discount rates. To get a real expected rate of return, we need to start with a real risk free rate. While government bills and bonds offer returns that are risk free in nominal terms, they are not risk free in real terms, since expected inflation can be volatile. The standard approach of subtracting an expected inflation rate from the nominal interest rate to arrive at a real risk free rate provides at best an estimate of the real risk free rate. Until recently, there were few traded default-free securities that could be used to estimate real risk free rates; but the introduction of inflation-indexed treasuries has filled this void. An inflation-indexed treasury security does not offer a guaranteed nominal return to buyers, but instead provides a guaranteed real return. In early 2004, for example, the inflation indexed US 10-year treasury bond rate was only 1.6%, much lower than the nominal 10-year bond rate of 4%.

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in these cases is often well in excess of ten years and increases with the expected growth potential of the firm.

4.1. ☞: **What is the right riskfree rate?**

The correct risk free rate to use in the capital asset pricing model

a. is the short term government security rate

b. is the long term government security rate

c. can be either, depending upon whether the prediction is short term or long term.

In Practice: What if there is no default-free rate?

Our discussion, hitherto, has been predicated on the assumption that governments do not default, at least on local borrowing. There are many emerging market economies where this assumption might not be viewed as reasonable. Governments in these markets are perceived as capable of defaulting even on local borrowing. When this is coupled with the fact that many governments do not borrow long term locally, there are scenarios where obtaining a l risk free rate in the local currency, especially for the long term, becomes difficult. In these cases, there are compromises that give us reasonable estimates of the risk free rate.

- Look at the largest and safest firms in that market and use the rate that they pay on their long-term borrowings in the local currency as a base. Given that these firms, in spite of their size and stability, still have default risk, you would use a rate that is marginally lower[3] than the corporate borrowing rate.
- If there are long term dollar-denominated forward contracts on the currency, you can use interest rate parity and the treasury bond rate (or riskless rate in any other base currency) to arrive at an estimate of the local borrowing rate.[4]
- You could adjust the local currency government borrowing rate by the estimated default spread on the bond to arrive at a riskless local currency rate. The default

[3] Reducing the corporate borrowing rate by 1% (which is the typical default spread on highly rated corporate bonds in the U.S) to get a riskless rate yields reasonable estimates.

[4] For instance, if the current spot rate is 38.10 Thai Baht per US dollar, the ten-year forward rate is 61.36 Baht per dollar and the current ten-year US treasury bond rate is 5%, the ten-year Thai risk free rate (in nominal Baht) can be estimated as follows.

$$61.36 = (38.1)\left(\frac{1 + \text{Interest Rate}_{\text{Thai Baht}}}{1 + 0.05}\right)^{10}$$

Solving for the Thai interest rate yields a ten-year risk free rate of 10.12%.

spread on the government bond can be estimated using the local currency ratings[5] that are available for many countries. For instance, assume that the Brazilian government bond rate (in nominal Brazilian Reals (BR)) is 14% and that the local currency rating assigned to the Brazilian government is BB+. If the default spread for BB+ rated bonds is 5%, the riskless Brazilian real rate would be 9%.

Riskless BR rate = Brazil Government Bond rate – Default Spread = 14% -5% = 9%

II. Risk premium

The risk premium(s) is clearly a significant input in all of the asset pricing models. In the following section, we will begin by examining the fundamental determinants of risk premiums and then look at practical approaches to estimating these premiums.

What is the risk premium supposed to measure?

The risk premium in the capital asset pricing model measures the extra return that would be demanded by investors for shifting their money from a riskless investment to an average risk investment. It should be a function of two variables:

1. *Risk Aversion of Investors*: As investors become more risk averse, they should demand a larger premium for shifting from the riskless asset. While of some of this risk aversion may be inborn, some of it is also a function of economic prosperity (when the economy is doing well, investors tend to be much more willing to take risk) and recent experiences in the market (risk premiums tend to surge after large market drops).
2. *Riskiness of the Average Risk Investment*: As the riskiness of the average risk investment increases, so should the premium. This will depend upon what firms are actually traded in the market, their economic fundamentals and how good they are at managing risk. For instance, the premium should be lower in markets where only the largest and most stable firms trade in the market.

[5] Ratings agencies generally assign different ratings for local currency borrowings and dollar borrowing, with higher ratings for the former and lower ratings for the latter.

Since each investor in a market is likely to have a different assessment of an acceptable premium, the premium will be a weighted average of these individual premiums, where the weights will be based upon the wealth the investor brings to the market. Put more directly, what Warren Buffett, with his substantial wealth, thinks is an acceptable premium will be weighted in far more into market prices than what you or I might think about the same measure.

In the arbitrage pricing model and the multi-factor models, the risk premiums used for individual factors are similar wealth-weighted averages of the premiums that individual investors would demand for each factor separately.

☞ **4.2: What is your risk premium?**

Assume that stocks are the only risky assets and that you are offered two investment options:

- A riskless investment (say a Government Security), on which you can make 4%
- A mutual fund of all stocks, on which the returns are uncertain

How much of an expected return would you demand to shift your money from the riskless asset to the mutual fund?

a. Less than 4%

b. Between 4-6%

c. Between 6-8%

d. Between 8-10%

e. Between 10-12%

f. More than 12%

Your answer to this question should provide you with a measure of your risk premium. (For instance, if your answer is 6%, your premium is 2%.)

Estimating Risk Premiums

There are three ways of estimating the risk premium in the capital asset pricing model - large investors can be surveyed about their expectations for the future, the actual premiums earned over a past period can be obtained from historical data and the implied premium can be extracted from current market data. The premium can be estimated only from historical data in the arbitrage pricing model and the multi-factor models.

1. Survey Premiums

Since the premium is a weighted average of the premiums demanded by individual investors, one approach to estimating this premium is to survey investors about their expectations for the future. It is clearly impractical to survey all investors; therefore, most surveys focus on portfolio managers who carry the most weight in the process. Morningstar regularly survey individual investors about the return they expect to earn, investing in stocks. Merrill Lynch does the same with equity portfolio managers and reports the results on its web site. While numbers do emerge from these surveys, very few practitioners actually use these survey premiums. There are three reasons for this reticence:

- There are no constraints on reasonability; individual money managers could provide expected returns that are lower than the riskfree rate, for instance.
- Survey premiums are extremely volatile; the survey premiums can change dramatically, largely as a function of recent market movements.
- Survey premiums tend to be short term; even the longest surveys do not go beyond one year.

☞ **4.3: Do risk premiums change?**

In the previous question, you were asked how much of a premium you would demand for investing in a portfolio of stocks as opposed to a riskless asset. Assume that the market dropped by 20% last week, and you were asked the same question today. Would your premium

a. be higher?
b. be lower?
c. be unchanged?

2. Historical Premiums

The most common approach to estimating the risk premium(s) used in financial asset pricing models is to base it on historical data. In the arbitrage pricing model and multi- factor models, the raw data on which the premiums are based is historical data on asset prices over very long time periods. In the CAPM, the premium is defined as the difference between average returns on stocks and average returns on risk-free securities over an extended period of history.

Basics

In most cases, this approach is composed of the following steps. It begins by defining a time period for the estimation, which can range to as far back as 1871 for U.S. data. It then requires the calculation of the average returns on a stock index and average returns on a riskless security over the period. Finally, it calculates the difference between the returns on stocks and the riskless return and uses it as a risk premium looking forward. In doing so, we implicitly assume that

1. The risk aversion of investors has not changed in a systematic way across time. (The risk aversion may change from year to year, but it reverts back to historical averages.)
2. It assumes that the average riskiness of the "risky" portfolio (stock index) has not changed in a systematic way across time.

Estimation Issues

While users of risk and return models may have developed a consensus that historical premium is, in fact, the best estimate of the risk premium looking forward, there are surprisingly large differences in the actual premiums we observe being used in practice. For instance, the risk premium estimated in the US markets by different investment banks, consultants and corporations range from 4% at the lower end to 12% at the upper end. Given that we almost all use the same database of historical returns, provided by Ibbotson Associates[6], summarizing data from 1926, these differences may seem surprising. There are, however, three reasons for the divergence in risk premiums.

- <u>Time Period Used</u>: While there are many who use all the data going back to 1926, there are almost as many using data over shorter time periods, such as fifty, twenty or even ten years to come up with historical risk premiums. The rationale presented by those who use shorter periods is that the risk aversion of the average investor is likely to change over time and that using a shorter and more recent time period provides a

[6] See "Stocks, Bonds, Bills and Inflation", an annual edition that reports on the annual returns on stocks, treasury bonds and bills, as well as inflation rates from 1926 to the present. (http://www.ibbotson.com)

more updated estimate. This has to be offset against a cost associated with using shorter time periods, which is the greater noise in the risk premium estimate. In fact, given the annual standard deviation in stock prices[7] between 1928 and 2002 of 20%, the standard error[8] associated with the risk premium estimate can be estimated as follows for different estimation periods in Table 4.1.

Table 4.1: Standard Errors in Risk Premium Estimates

Estimation Period	Standard Error of Risk Premium Estimate
5 years	$\frac{20}{\sqrt{5}} = 8.94\%$
10 years	$\frac{20}{\sqrt{10}} = 6.32\%$
25 years	$\frac{20}{\sqrt{25}} = 4.00\%$
50 years	$\frac{20}{\sqrt{50}} = 2.83\%$

Note that to get reasonable standard errors, we need very long time periods of historical returns. Conversely, the standard errors from ten-year and twenty-year estimates are likely to be almost as large or larger than the actual risk premium estimated. This cost of using shorter time periods seems, in our view, to overwhelm any advantages associated with getting a more updated premium.

- Choice of Riskfree Security: The Ibbotson database reports returns on both treasury bills and treasury bonds and the risk premium for stocks can be estimated relative to each. Given that the yield curve in the United States has been upward sloping for most of the last seven decades, the risk premium is larger when estimated relative to shorter term government securities (such as treasury bills). The riskfree rate chosen in computing the premium has to be consistent with the riskfree rate used to compute expected returns. For the most part, in corporate finance and valuation, the riskfree rate will be a long term default-free (government) bond rate and not a treasury bill

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[7] For the historical data on stock returns, bond returns and bill returns, check under "updated data" in www.stern.nyu.edu/~adamodar.

[8] These estimates of the standard error are probably understated because they are based upon the assumption that annual returns are uncorrelated over time. There is substantial empirical evidence that returns are correlated over time, which would make this standard error estimate much larger.

rate. Thus, the risk premium used should be the premium earned by stocks over treasury bonds.

- Arithmetic and Geometric Averages: The final sticking point when it comes to estimating historical premiums relates to how the average returns on stocks, treasury bonds and bills are computed. The arithmetic average return measures the simple mean of the series of annual returns, whereas the geometric average looks at the compounded return[9]. Conventional wisdom argues for the use of the arithmetic average. In fact, if annual returns are uncorrelated over time and our objectives were to estimate the risk premium for the next year, the arithmetic average is the best unbiased estimate of the premium. In reality, however, there are strong arguments that can be made for the use of geometric averages. First, empirical studies seem to indicate that returns on stocks are negatively correlated[10] over time. Consequently, the arithmetic average return is likely to over state the premium. Second, while asset pricing models may be single period models, the use of these models to get expected returns over long periods (such as five or ten years) suggests that the single period may be much longer than a year. In this context, the argument for geometric average premiums becomes even stronger.

In summary, the risk premium estimates vary across users because of differences in time periods used, the choice of treasury bills or bonds as the riskfree rate and the use of arithmetic as opposed to geometric averages. The effect of these choices is summarized in table 4.2, which uses returns from 1928 to 2003. [11]

Table 4.2: Historical Risk Premia for the United States – 1928- 2003

	Stocks – Treasury Bills	*Stocks – Treasury Bonds*

[9] The compounded return is computed by taking the value of the investment at the start of the period ($Value_0$) and the value at the end ($Value_N$) and then computing the following:

$$\text{Geometric Average} = \left(\frac{\text{Value}_N}{\text{Value}_0}\right)^{1/N} - 1$$

[10] In other words, good years are more likely to be followed by poor years and vice versa. The evidence on negative serial correlation in stock returns over time is extensive and can be found in Fama and French (1988). While they find that the one-year correlations are low, the five-year serial correlations are strongly negative for all size classes.

[11] The raw data on treasury bill rates, treasury bond rates and stock returns was obtained from the Federal Reserve data archives maintained by the Fed in St. Louis.

	Arithmetic	Geometric	Arithmetic	Geometric
1928 – 2003	7.92%	5.99%	6.54%	4.82%
1962 – 2003	6.09%	4.85%	4.70%	3.82%
1992 – 2003	8.43%	6.68%	4.87%	3.57%

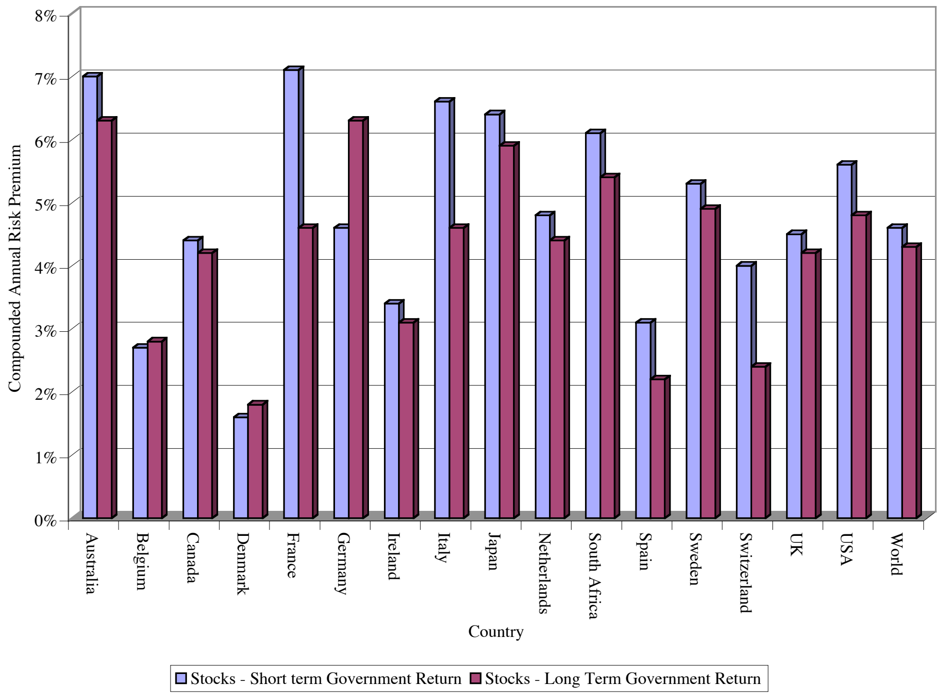
Note that the premiums can range from 3.57% to 8.43%, depending upon the choices made. In fact, these differences are exacerbated by the fact that many risk premiums that are in use today were estimated using historical data three, four or even ten years ago. If we follow the propositions about picking a long-term geometric average premium over the long term treasury bond rate, the historical risk premium that makes the most sense is 4.82%.

Historical Premiums in other markets

While historical data on stock returns is easily available and accessible in the United States, it is much more difficult to get this data for foreign markets. The most detailed look at these returns estimated the returns you would have earned on 14 equity markets between 1900 and 2001 and compared these returns with those you would have earned investing in bonds.[12] Figure 4.1 presents the risk premiums – i.e., the additional returns - earned by investing in equity over treasury bills and bonds over that period in each of the 14 markets:

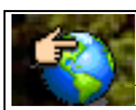
[12] Dimson, E., P. March and M. Staunton, 2002, *Triumph of the Optimists*, Princeton University Prsss.

Figure 4.1: Equity Risk Premiums - By Country



Data from Dimson et al. The differences in compounded annual returns between stocks and short term governments/ long term governments is reported for each country.

While equity returns were higher than what you would have earned investing in government bonds or bills in each of the countries examined, there are wide differences across countries. If you had invested in Spain, for instance, you would have earned only 3% over government bills and 2% over government bonds on an annual basis by investing in equities. In France, in contrast, the corresponding numbers would have been 7.1% and 4.6%. Looking at 40-year or 50-year periods, therefore, it is entirely possible that equity returns can lag bond or bill returns, at least in some equity markets. In other words, the notion that stocks always win in the long term is not only dangerous but does not make sense. If stocks always beat riskless investments in the long term, stocks should be riskless to an investor with a long time horizon.

histretSP.xls: This data set has yearly data on treasury bill rates, treasury bond rates and returns and stock returns going back to 1928.

A Modified Historical Risk Premium

In many emerging markets, there is very little historical data and the data that exists is too volatile to yield a meaningful estimate of the risk premium. To estimate the risk premium in these countries, let us start with the basic proposition that the risk premium in any equity market can be written as:

Equity Risk Premium = Base Premium for Mature Equity Market + Country Premium

The country premium could reflect the extra risk in a specific market. This boils down our estimation to answering two questions:

- What should the base premium for a mature equity market be?
- How do we estimate the additional risk premium for individual countries?

To answer the first question, we will make the argument that the US equity market is a mature market and that there is sufficient historical data in the United States to make a reasonable estimate of the risk premium. In fact, reverting back to our discussion of historical premiums in the US market, we will use the geometric average premium earned by stocks over treasury bonds of 4.82% between 1928 and 2003. We chose the long time period to reduce standard error, the treasury bond to be consistent with our choice of a riskfree rate and geometric averages to reflect our desire for a risk premium that we can use for longer term expected returns. There are three approaches that we can use to estimate the country risk premium.

1. *Country bond default spreads*: While there are several measures of country risk, one of the simplest and most easily accessible is the rating assigned to a country's debt by a ratings agency (S&P, Moody's and IBCA all rate countries). These ratings measure default risk (rather than equity risk), but they are affected by many of the factors that drive equity risk – the stability of a country's currency, its budget and trade balances and its political stability, for instance[13]. The other advantage of ratings is that they come with default spreads over the US treasury bond. For instance, Brazil was rated B2 in early 2004 by Moody's and the 10-year Brazilian C-Bond, which is a dollar denominated bond was priced to yield 10.01%, 6.01% more than the interest rate

[13] The process by which country ratings are obtained is explained on the S&P web site at http://www.ratings.standardpoor.com/criteria/index.htm.

(4%) on a 10-year treasury bond at the same time.[14] Analysts who use default spreads as measures of country risk typically add them on to both the cost of equity and debt of every company traded in that country. For instance, the cost of equity for a Brazilian company, estimated in U.S. dollars, will be 6.01% higher than the cost of equity of an otherwise similar U.S. company. If we assume that the risk premium for the United States and other mature equity markets is 4.82%, the cost of equity for a Brazilian company can be estimated as follows (with a U.S. Treasury bond rate of 4% and a beta of 1.2).

Cost of equity = Riskfree rate + Beta *(U.S. Risk premium) + Country Bond Default Spread

= 4% + 1.2 (4.82%) + 6.01% = 15.79%

In some cases, analysts add the default spread to the U.S. risk premium and multiply it by the beta. This increases the cost of equity for high beta companies and lowers them for low beta firms.

2. *Relative Standard Deviation*: There are some analysts who believe that the equity risk premiums of markets should reflect the differences in equity risk, as measured by the volatilities of these markets. A conventional measure of equity risk is the standard deviation in stock prices; higher standard deviations are generally associated with more risk. If you scale the standard deviation of one market against another, you obtain a measure of relative risk.

$$\text{Relative Standard Deviation}_{\text{Country X}} = \frac{\text{Standard Deviation}_{\text{Country X}}}{\text{Standard Deviation}_{\text{US}}}$$

This relative standard deviation when multiplied by the premium used for U.S. stocks should yield a measure of the total risk premium for any market.

$$\text{Equity risk premium}_{\text{Country X}} = \text{Risk Premum}_{\text{US}} * \text{Relative Standard Deviation}_{\text{Country X}}$$

Assume, for the moment, that you are using a mature market premium for the United States of 4.82% and that the annual standard deviation of U.S. stocks is 20%. The

[14] These yields were as of January 1, 2004. While this is a market rate and reflects current expectations, country bond spreads are extremely volatile and can shift significantly from day to day. To counter this volatility, the default spread can be normalized by averaging the spread over time or by using the average default spread for all countries with the same rating as Brazil in early 2003.

annualized standard deviation[15] in the Brazilian equity index was 36%, yielding a total risk premium for Brazil:

$$\text{Equity Risk Premium}_{\text{Brazil}} = 4.82\% * \frac{36\%}{20\%} = 8.67\%$$

The country risk premium can be isolated as follows:

$$\text{Country Risk Premium}_{\text{Brazil}} = 8.67\% - 4.82\% = 3.85\%$$

While this approach has intuitive appeal, there are problems with using standard deviations computed in markets with widely different market structures and liquidity. There are very risky emerging markets that have low standard deviations for their equity markets because the markets are illiquid. This approach will understate the equity risk premiums in those markets.

3. *Default Spreads + Relative Standard Deviations*: The country default spreads that come with country ratings provide an important first step, but still only measure the premium for default risk. Intuitively, we would expect the country equity risk premium to be larger than the country default risk spread. To address the issue of how much higher, we look at the volatility of the equity market in a country relative to the volatility of the bond market used to estimate the spread. This yields the following estimate for the country equity risk premium.

$$\text{Country Risk Premium} = \text{Country Default Spread} * \left(\frac{\sigma_{\text{Equity}}}{\sigma_{\text{Country Bond}}}\right)$$

To illustrate, consider the case of Brazil. As noted earlier, the dollar denominated bonds issued by the Brazilian government trade with a default spread of 6.01% over the US treasury bond rate. The annualized standard deviation in the Brazilian equity index over the previous year was 36%, while the annualized standard deviation in the Brazilian dollar denominated C-bond was 27%[16]. The resulting additional country equity risk premium for Brazil is as follows:

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[15] Both the US and Brazilian standard deviations were computed using weekly returns for two years from the beginning of 2002 to the end of 2003. While you could use daily standard deviations to make the same judgments, they tend to have much more noise in them.

[16] The standard deviation in C-Bond returns was computed using weekly returns over 2 years as well. Since there returns are in dollars and the returns on the Brazilian equity index are in real, there is an inconsistency

$$\text{Brazils Country Risk Premium} = 6.01\% \left(\frac{36\%}{27\%} \right) = 8.01\%$$

Note that this country risk premium will increase if the country rating drops or if the relative volatility of the equity market increases. It is also in addition to the equity risk premium for a mature market. Thus, the total equity risk premium for a Brazilian company using the approach and a 4.82% premium for the United States would b2 12.83%.

Why should equity risk premiums have any relationship to country bond spreads? A simple explanation is that an investor who can make 11% on a dollar-denominated Brazilian government bond would not settle for an expected return of 10.5% (in dollar terms) on Brazilian equity. Both this approach and the previous one use the standard deviation in equity of a market to make a judgment about country risk premium, but they measure it relative to different bases. This approach uses the country bond as a base, whereas the previous one uses the standard deviation in the U.S. market. This approach assumes that investors are more likely to choose between Brazilian government bonds and Brazilian equity, whereas the previous one approach assumes that the choice is across equity markets.

The three approaches to estimating country risk premiums will generally give you different estimates, with the bond default spread and relative equity standard deviation approaches yielding lower country risk premiums than the melded approach that uses both the country bond default spread and the equity and bond standard deviations. In the case of Brazil, for instance, the country risk premiums range from 3.85% using the relative equity standard deviation approach to 6.01% for the country bond approach to We believe that the larger country risk premiums that emerge from the last approach are the most realistic for the immediate future, but that country risk premiums may decline over time. Just as companies mature and become less risky over time, countries can mature and become less risky as well.

In Practice: Should there be a country risk premium?

here. We did estimate the standard deviation on the Brazilian equity index in dollars but it made little difference to the overall calculation since the dollar standard deviation was close to 36%.

Is there more risk in investing in a Malaysian or Brazilian stock than there is in investing in the United States? The answer, to most, seems to be obviously affirmative. That, however, does not answer the question of whether there should be an additional risk premium charged when investing in those markets. Note that the only risk that is relevant for the purpose of estimating a cost of equity is market risk or risk that cannot be diversified away. The key question then becomes whether the risk in an emerging market is diversifiable or non-diversifiable risk. If, in fact, the additional risk of investing in Malaysia or Brazil can be diversified away, then there should be no additional risk premium charged. If it cannot, then it makes sense to think about estimating a country risk premium.

For purposes of analyzing country risk, we look at the marginal investor – the investor most likely to be trading on the equity. If that marginal investor is globally diversified, there is at least the potential for global diversification. If the marginal investor does not have a global portfolio, the likelihood of diversifying away country risk declines substantially. Even if the marginal investor is globally diversified, there is a second test that has to be met for country risk to not matter. All or much of country risk should be country specific. In other words, there should be low correlation across markets. Only then will the risk be diversifiable in a globally diversified portfolio. If, on the other hand, the returns across countries have significant positive correlation, country risk has a market risk component and is not diversifiable and can command a premium. Whether returns across countries are positively correlated is an empirical question. Studies from the 1970s and 1980s suggested that the correlation was low and this was an impetus for global diversification. Partly because of the success of that sales pitch and partly because economies around the world have become increasingly intertwined over the last decade, more recent studies indicate that the correlation across markets has risen. This is borne out by the speed at which troubles in one market, say Russia, can spread to a market with which it has little or no obvious relationship, say Brazil.

So where do we stand? We believe that while the barriers to trading across markets have dropped, investors still have a home bias in their portfolios and that markets remain partially segmented. While globally diversified investors are playing an increasing role in the pricing of equities around the world, the resulting increase in correlation across markets has resulted in a portion of country risk becoming non-diversifiable or market risk..

There is a data set on the website that contains the updated ratings for countries and the risk premiums associated with each.

3. Implied Equity Premiums

There is an alternative to estimating risk premiums that does not require historical data or corrections for country risk, but does assume that the overall stock market is correctly priced. Consider, for instance, a very simple valuation model for stocks.

$$\text{Value} = \frac{\text{Expected Dividends Next Period}}{(\text{Required Return on Equity - Expected Growth Rate in Dividends})}$$

This is essentially the present value of dividends growing at a constant rate. Three of the four variables in this model can be obtained externally – the current level of the market (i.e., value), the expected dividends next period and the expected growth rate in earnings and dividends in the long term. The only "unknown" is then the required return on equity; when we solve for it, we get an implied expected return on stocks. Subtracting out the riskfree rate will yield an implied equity risk premium.

To illustrate, assume that the current level of the S&P 500 Index is 900, the expected dividend yield on the index for the next period is 2% and the expected growth rate in earnings and dividends in the long term is 7%. Solving for the required return on equity yields the following:

$$900 = \frac{900(0.02)}{r - 0.07}$$

Solving for r,

$$r - 0.07 = 0.02$$

$$r = 0.09 = 9\%$$

If the current riskfree rate is 6%, this will yield a premium of 3%.

This approach can be generalized to allow for high growth for a period and extended to cover cash flow based, rather than dividend based, models. To illustrate this, consider the S&P 500 Index on January 1, 2004. The index was at 1111.91 and the dividend yield on the index in 2003 was roughly 2.81%.[17] In addition, the consensus estimate[18] of growth in earnings for companies in the index was approximately 9.5% for the next 5 years and the 10-year treasury bond rate on that day was 4.25%. Since a growth rate of 9.5% cannot be sustained forever, we employ a two-stage valuation model, where we allow dividends to grow at 9.5% for 5 years and then lower the growth rate to the treasury bond rate of 4.25% after the 5 year period.[19] Table 4.3 summarizes the expected cash flows for the next 5 years of high growth and the first year of stable growth thereafter.

Table 4.3: Expected Cashflows on S&P 500

Year	*Cash Flow on Index*
1	34.26
2	37.52
3	41.08
4	44.98
5	49.26
6	51.35

[a]Cash flow in the first year = 2.81% of 1111.91 (1.095)

If we assume that these are reasonable estimates of the cash flows and that the index is correctly priced, then

$$\text{Index level} = 1111.91 = \frac{34.26}{(1+r)} + \frac{37.52}{(1+r)^2} + \frac{41.08}{(1+r)^3} + \frac{44.98}{(1+r)^4} + \frac{49.26}{(1+r)^5} + \frac{49.26(1.0425)}{(r-.0425)(1+r)^5}$$

Note that the last term of the equation is the terminal value of the index, based upon the stable growth rate of 4.25%, discounted back to the present. Solving for r in this equation yields us the required return on equity of 7.94%. Subtracting out the treasury bond rate of 4.25% yields an implied equity premium of 3.69%.

The advantage of this approach is that it is market-driven and current and it does not require any historical data. Thus, it can be used to estimate implied equity premiums

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[17] Stock buybacks during the year were added to the dividends to obtain a consolidated yield.

[18] We used the average of the analyst estimates for individual firms (bottom-up). Alternatively, we could have used the top-down estimate for the S&P 500 earnings.

in any market. It is, however, bounded by whether the model used for the valuation is the right one and the availability and reliability of the inputs to that model. For instance, the equity risk premium for the Brazilian market in January 2004 was estimated from the following inputs. The index (Bovespa) was at 21050 and the current dividend yield on the index was 4%. Earnings in companies in the index are expected to grow 14% (in US dollar terms) over the next 5 years and 4.5% thereafter. These inputs yield a required return on equity of 10.70%, which when compared to the treasury bond rate of 4% on that day results in an implied equity premium of 6.70%. For simplicity, we have used nominal dollar expected growth rates[20] and treasury bond rates, but this analysis could have been done entirely in the local currency.

The implied equity premiums change over time much more than historical risk premiums. In fact, the contrast between these premiums and the historical premiums is best illustrated by graphing out the implied premiums in the S&P 500 going back to 1960 in Figure 4.2.

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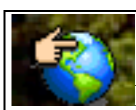
[19] The treasury bond rate is the sum of expected inflation and the expected real rate. If we assume that real growth is equal to the real rate, the long term stable growth rate should be equal to the treasury bond rate.

[20] The input that is most difficult to estimate for emerging markets is a long term expected growth rate. For Brazilian stocks, I used the average consensus estimate of growth in earnings for the largest Brazilian companies which have listed ADRs . This estimate may be biased, as a consequence.

Figure 4.2: Implied Premium for US Equity Market

In terms of mechanics, we used smoothed historical growth rates in earnings and dividends as our projected growth rates and a two-stage dividend discount model. Looking at these numbers, we would draw the following conclusions.

- The implied equity premium has seldom been as high as the historical risk premium. Even in 1978, when the implied equity premium peaked, the estimate of 6.50% is well below what many practitioners use as the risk premium in their risk and return models. In fact, the average implied equity risk premium has been between about 4% over the last 40 years.
- The implied equity premium did increase during the seventies, as inflation increased. This does have interesting implications for risk premium estimation. Instead of assuming that the risk premium is a constant and unaffected by the level of inflation and interest rates, which is what we do with historical risk premiums, it may be more realistic to increase the risk premium as expected inflation and interest rates increase.

histimpl.xls: This data set on the web shows the inputs used to calculate the premium in each year for the U.S. market.

implprem.xls: This spreadsheet allows you to estimate the implied equity premium in a market.

☞ **4.4: Implied and Historical Premiums**

Assume that the implied premium in the market is 3%, and that you are using a historical premium of 7.5%. If you valued stocks using this historical premium, you are likely

a. to find more under valued stocks than over valued ones
b. to find more over valued stocks than under valued ones
c. to find about as many undervalued as overvalued stocks

III. Risk Parameters

The final set of inputs we need to put risk and return models into practice are the risk parameters for individual assets and projects. In the CAPM, the beta of the asset has to be estimated relative to the market portfolio. In the APM and Multi-factor model, the betas of the asset relative to each factor have to be measured. There are three approaches available for estimating these parameters; one is to use historical data on market prices for individual assets; the second is to estimate the betas from fundamentals and the third is to use accounting data. We will use all three approaches in this section.

A. Historical Market Betas

This is the conventional approach for estimating betas used by most services and analysts. For firms that have been publicly traded for a length of time, it is relatively straightforward to estimate returns that a investor would have made on the assets in intervals (such as a week or a month) over that period. These returns can then be related to a proxy for the market portfolio to get a beta in the capital asset pricing model, or to multiple macro economic factors to get betas in the multi factor models, or put through a factor analysis to yield betas for the arbitrage pricing model.

Standard Procedures for Estimating CAPM Parameters - Betas and Alphas

The standard procedure for estimating betas is to regress[21] stock returns (R_j) against market returns (R_m) -

$$R_j = a + b\ R_m$$

where

a = Intercept from the regression

b = Slope of the regression = Covariance (R_j, R_m) / σ^2_m

The slope of the regression corresponds to the beta of the stock and measures the riskiness of the stock.

> ***Jensen's Alpha:*** This is the difference between the actual returns on an asset and the return you would have expected it to make during a past period, given what the market did, and the asset's beta.

The intercept of the regression provides a simple measure of performance during the period of the regression, relative to the capital asset pricing model.

$$R_j = R_f + \beta\ (R_m - R_f)$$

$$= R_f\ (1-\beta) + \beta\ R_m \quad \text{........... Capital Asset Pricing Model}$$

$$R_j = a + b\ R_m \quad \text{........... Regression Equation}$$

Thus, a comparison of the intercept (a) to R_f (1-β) should provide a measure of the stock's performance, at least relative to the capital asset pricing model.[22]

If $a > R_f\ (1-\beta)$ .... Stock did better than expected during regression period

$a = R_f\ (1-\beta)$ .... Stock did as well as expected during regression period

$a < R_f\ (1-\beta)$ .... Stock did worse than expected during regression period

The difference between a and R_f (1-β) is called Jensen's alpha, and provides a measure of whether the asset in question under or out performed the market, after adjusting for risk, during the period of the regression.

> ***R Squared:*** The R squared measures the proportion of the variability of a dependent variable that is explained by an independent variable or variables.

The third statistic that emerges from the regression is the R squared (R^2) of the regression.

[21] The appendix to this chapter provides a brief overview of ordinary least squares regressions.

[22] The regression can be run using returns in excess of the risk-free rate, for both the stock and the market. In that case, the intercept of the regression should be zero if the actual returns equal the expected returns from the CAPM, greater than zero if the stock does better than expected and less than zero if it does worse than expected.

While the statistical explanation of the R squared is that it provides a measure of the goodness of fit of the regression, the financial rationale for the R squared is that it provides an estimate of the proportion of the risk (variance) of a firm that can be attributed to market risk; the balance (1 - R^2) can then be attributed to firm-specific risk.

The final statistic worth noting is the standard error of the beta estimate. The slope of the regression, like any statistical estimate, is made with noise, and the standard error reveals just how noisy the estimate is. The standard error can also be used to arrive at confidence intervals for the "true" beta value from the slope estimate.

Estimation Issues

There are three decisions the analyst must make in setting up the regression described above. The first concerns the length of the estimation period. The trade-off is simple: A longer estimation period provides more data, but the firm itself might have changed in its risk characteristics over the time period. Disney and Deutsche Bank have changed substantially in terms of both business mix and financial leverage over the last few years and any regression that we run using historical data will be affected by these changes.

The second estimation issue relates to the return interval. Returns on stocks are available on an annual, monthly, weekly, daily and even on an intra-day basis. Using daily or intra-day returns will increase the number of observations in the regression, but it exposes the estimation process to a significant bias in beta estimates related to non-trading.[23] For instance, the betas estimated for small firms, which are more likely to suffer from non-trading, are biased downwards when daily returns are used. Using weekly or monthly returns can reduce the non-trading bias significantly.[24]

The third estimation issue relates to the choice of a market index to be used in the regression. The standard practice used by most beta estimation services is to estimate the betas of a company relative to the index of the market in which its stock trades. Thus, the betas of German stocks are estimated relative to the Frankfurt DAX, British stocks

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[23] The non-trading bias arises because the returns in non-trading periods is zero (even though the market may have moved up or down significantly in those periods). Using these non-trading period returns in the regression will reduce the correlation between stock returns and market returns and the beta of the stock.

[24] The bias can also be reduced using statistical techniques suggested by Dimson and Scholes-Williams.

relative to the FTSE, Japanese stocks relative to the Nikkei, and U.S. stocks relative to the S&P 500. While this practice may yield an estimate that is a reasonable measure of risk for the parochial investor, it may not be the best approach for an international or cross-border investor, who would be better served with a beta estimated relative to an international index.

Illustration 4.1: Estimating CAPM risk parameters for Disney

In assessing risk parameters for Disney, the returns on the stock and the market index are computed as follows –

(1) The returns to a stockholder in Dsiney are computed month by month from January 1999 to December 2003. These returns include both dividends and price appreciation and are defined as follows –

$$\text{Stock Return}_{\text{intel, j}} = (\text{Price}_{\text{Intel, j}} - \text{Price}_{\text{Intel, j-1}} + \text{Dividends}_{\text{j}}) / \text{Price}_{\text{Intel,j-1}}$$

where $\text{Stock Return}_{\text{Intel,j}}$ = Returns to a stockholder in Disney in month j

$\text{Price}_{\text{Intel, j}}$ = Price of Disney stock at the end of month j

$\text{Dividends}_{\text{j}}$ = Dividends on Disney stock in month j

Dividends are added to the returns of the month in which the stock went ex-dividend.[25] If there was a stock split[26] during the month, the returns have to take into account the split factor, since stock prices will be affected.[27]

(2) The returns on the S&P 500 market index are computed for each month of the period, using the level of the index at the end of each month, and the monthly dividend yield on stocks in the index. –

$$\text{Market Return}_{\text{intel, j}} = (\text{Index}_{\text{j}} - \text{Index}_{\text{j-1}} + \text{Dividends}_{\text{t}}) / \text{Index}_{\text{j-1}}$$

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[25] The ex-dividend day is the day by which the stock has to be bought for an investor to be entitled to the dividends on the stock.

[26] A split changes the number of shares outstanding in a company without affecting any of its fundamentals. Thus, in a three-for-two split, there will be 50% more shares outstanding after the split. Since the overall value of equity has not changed, the stock price will drop by an equivalent amount (1 - 100/150 = 33.33%)

[27] While there were no stock splits in the time period of the regression, Disney did have a 3 for 1 stock split in July 1998. The stock price dropped significantly, and if not factored in will result in very negative returns in that month. Splits can be accounted for as follows –

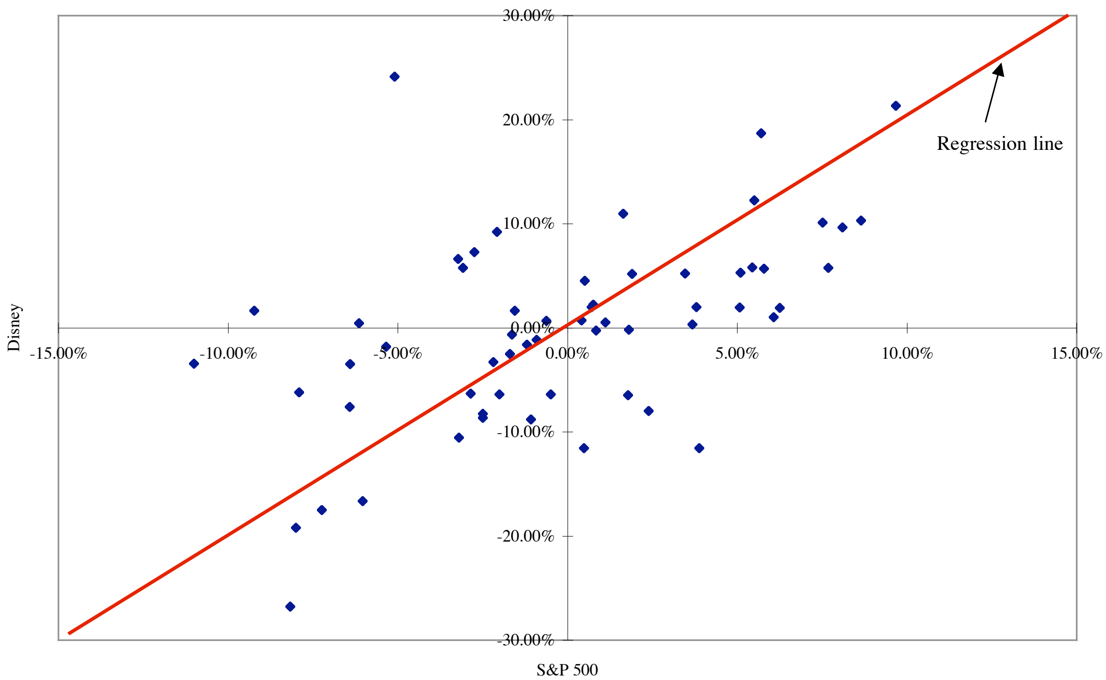
$$\text{Return}_{\text{intel, j}} = (\text{Factor}_{\text{j}} * \text{Price}_{\text{Intel, j}} - \text{Price}_{\text{Intel, j-1}} + \text{Factor} * \text{Dividends}_{\text{j}}) / \text{Price}_{\text{Intel,j-1}}$$

The factor would be set to 3 for July 1998 and the ending price would be multiplied by 3, as would the dividends per share, if they were paid after the split.

where $Index_j$ is the level of the index at the end of month j and $Dividend_j$ is the dividends paid on the index in month j. While the S&P 500 and the NYSE Composite are the most widely used indices for U.S. stocks, they are, at best, imperfect proxies for the market portfolio in the CAPM, which is supposed to include all assets.

Figure 4.3 graphs monthly returns on Disney against returns on the S&P 500 index from January 1999 to December 2003.

Figure 4.3: Disney versus S&P 500: 1999 - 2003



The regression statistics for Disney are as follows:[28]

(a) Slope of the regression = 1.01. This is Disney's beta, based on returns from 1999 to 2003. Using a different time period for the regression or different return intervals (weekly or daily) for the same period can result in a different beta.

(b) Intercept of the regression = 0.0467%. This is a measure of Disney's performance, when it is compared with R_f $(1-\beta)$.[29] The monthly risk-free rate (since the returns used in

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[28] The regression statistics are computed in the conventional way. The appendix explains the process in more detail.

[29] In practice, the intercept of the regression is often called the alpha and compared to zero. Thus, a positive intercept is viewed as a sign that the stock did better than expected and a negative intercept as a sign that the stock did worse than expected. In truth, this can be done only if the regression is run in terms of excess returns, i.e., returns over and above the riskfree rate in each month for both the stock and the market index.

the regression are monthly returns) between 1999 and 2003 averaged 0.313%, resulting in the following estimate for the performance:

R_f (1-β) = 0.313% (1-1.01) = -.0032%

Intercept - R_f (1-β) = 0.0467% - (-0.0032%) = 0.05%

This analysis suggests that Disney's stock performed 0.05% better than expected, when expectations are based on the CAPM, on a monthly basis between January 1999 and December 2003. This results in an annualized excess return of approximately 0.60%.

Annualized Excess Return = (1 + Monthly Excess Return)^{12} - 1

= (1+0.0005)^{12} -1 =.0060 or 0.60%

By this measure of performance, Disney did slightly better than expected during the period of the regression, given its beta and the market's performance over the period. Note, however, that this does not imply that Disney would be a good investment looking forward. It also does not provide a breakdown of how much of this excess return can be attributed to 'industry-wide' effects, and how much is specific to the firm. To make that breakdown, the excess returns would have to be computed over the same period for other firms in the entertainment industry and compared with Disney's excess return. The difference would be then attributable to firm-specific actions. In this case, for instance, the average annualized excess return on other entertainment firms between 1999 and 2003 was 1.33%. This would imply that Disney stock underperformed it's peer group by 0.73% between 1999 and 2003, after adjusting for risk. (Firm-specific Jensen's alpha = 0.60% - 1.33% = - 0.73%)

(c) R squared of the regression = 29%. This statistic suggests that 29% of the risk (variance) in Disney comes from market sources (interest rate risk, inflation risk etc.), and that the balance of 71% of the risk comes from firm-specific components. The latter risk should be diversifiable, and therefore unrewarded. Disney's R squared is slightly higher than the median R squared of companies listed on the New York Stock Exchange, which was approximately 21% in 2003.

(d) Standard Error of Beta Estimate = 0.20. This statistic implies that the true beta for Disney could range from 0.81 to 1.21 (subtracting adding one standard error to beta estimate of 1.01) with 67% confidence and from 0.61 to 1.41 (subtracting adding two standard error to beta estimate of 1.01) with 95% confidence. While these ranges may

seem large, they are not unusual for most U.S. companies. This suggests that we should consider regression estimates of betas from regressions with caution.

☞ **4.5: The Relevance of R-squared to an Investor**

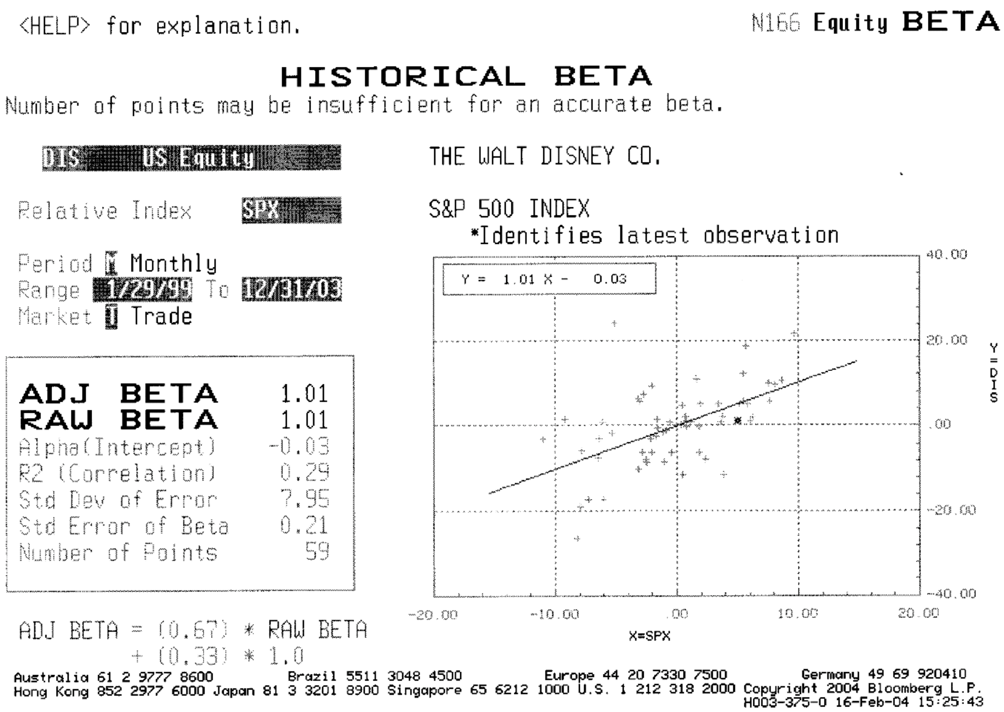
Assume that, having done the regression analysis, both Disney and Amgen, a biotechnology company, have betas of 1.01. Disney, however, has an R-squared of 31%, while Amgen has an R-squared of only 15%. If you had to pick between these investments, which one would you choose?

a. Disney, because it's higher R-squared suggests that it is less risky
b. Amgen, because it's lower R-squared suggests a greater potential for high returns
c. I would be indifferent, because they both have the same beta

Would your answer be any different if you were running a well-diversified fund?

In Practice: Using a Service beta

Most analysts who use betas obtain them from an estimation service; Merrill Lynch, Barra, Value Line, Standard and Poor's, Morningstar and Bloomberg are some of the well known services. All these services begin with regression betas and make what they feel are necessary changes to make them better estimates for the future. While most of these services do not reveal the internal details of this estimation, Bloomberg is an honorable exception. The following is the beta calculation page from Bloomberg for Disney, using the same period as our regression (January 1999 to December 2003):



While the time period used is identical to the one used in our earlier regression, there are subtle differences between this regression and the earlier one in Figure 4.1. First, Bloomberg uses price appreciation in the stock and the market index in estimating betas and ignores dividends.[30] This does not make much of a difference for a Disney, but it could make a difference for a company that either pays no dividends or pays significantly higher dividends than the market. Second, Bloomberg also computes what they call an adjusted beta, which is estimated as follows:

Adjusted Beta = Raw Beta (0.67) + 1 (0.33)

These weights do not vary across stocks, and this process pushes all estimated betas towards one. Most services employ similar procedures to adjust betas towards one. In doing so, they are drawing on empirical evidence that suggests that the betas for most companies, over time, tend to move towards the average beta, which is one. This may be explained by the fact that firms get more diversified in their product mix and client base as they get larger.

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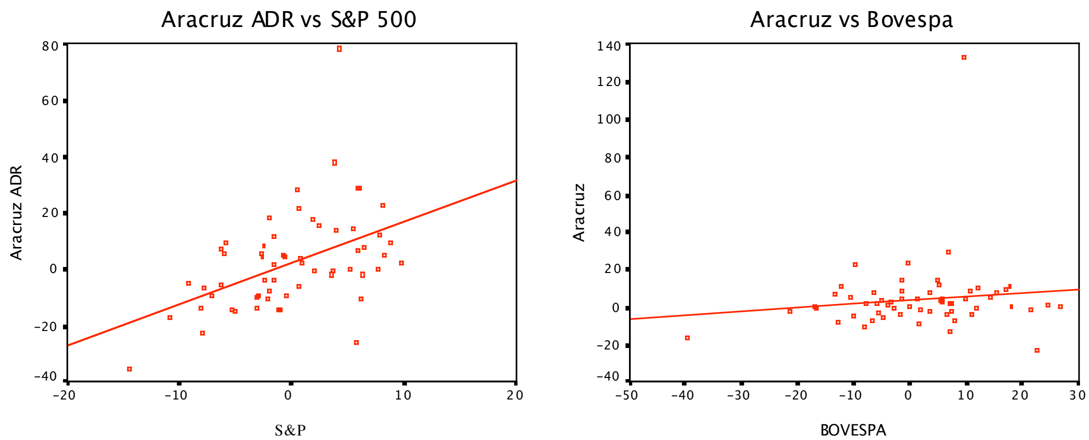
[30] This is why the intercept in the Bloomberg print out (0.03%) is slightly different from the intercept estimated earlier in the chapter (0.05%). The beta and R-squared are identical.

In general, betas reported by different services for the same firm can be very different because they use different time periods (some use 2 years and others 5 years), different return intervals (daily, weekly or monthly), different market indices and different post-regression estimates. While these beta differences may be troubling, the beta estimates delivered by each of these services comes with a standard error, and it is very likely that all of the betas reported for a firm fall within the range of the standard errors from the regressions.

Illustration 4.2: Estimating Historical Betas for Aracruz and Deutsche Bank

Aracruz is a Brazilian company and we can regress returns on the stock against a Brazilian index to obtain risk parameters. The stock also had an ADR listed on the U.S. exchanges and we can regress returns on the ADR against a U.S. index to obtain parameters. Figure 4.4 presents both graphs for the January 1999- December 2003 time period:

Figure 4.4: Estimating Aracruz's Beta: Choice of Indices



Aracruz ADR = 2.80% + 1.00 S&P *Aracruz = 2.62% + 0.22 Bovespa*

How different are the risk parameters that emerge from the two regressions? Aracruz has a beta of 1.00, when the ADR is regressed against the S&P 500, and a beta of only 0.22, when the local listing is regressed against the Bovespa.[31] Each regression has its own problems. The Bovespa is a narrow index dominated by a few liquid stocks and does not

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[31] The biggest source of the difference is one month (January 1999). In that month, Aracruz had a return of 133% in the Sao Paulo exchange while the ADR dropped by 9.67% in the same month. The disparity in returns can be attributed to a steep devaluation in the Brazilian Real in that month.

represent the broad spectrum of Brazilian equities. While the S&P 500 is a broader index, the returns on the ADR have little relevance to a large number of non-US investors who bought the local listing.

Deutsche Bank does not have an ADR listed in the United States but we can regress return on Deutsche against a multitude of indices. Table 4.4 presents comparisons of the results of the regressions of returns on Deutsche against three indices – a German equity index (DAX), an index of large European companies (FTSE Euro 300) and a global equity index (Morgan Stanley Capital Index (MSCI)).

Table 4.4: Deutsche Bank Risk Parameters: Index Effect

	DAX	*FTSE Euro 300*	*MSCI*
Intercept	1.24%	1.54%	1.37%
Beta	1.05	1.52	1.23
Std Error of Beta	0.11	0.19	0.25
R Squared	62%	52%	30%

Here again, the risk parameters estimated for Deutsche Bank are a function of the index used in the regression. The standard error is lowest (and the R squared is highest) for the regression against the DAX; this is not surprising since Deutsche is a large component of the DAX. The standard error gets larger and the R squared gets lower as the index is broadened to initially include other European stocks and then to global stocks.

In Practice: Which index should we use to estimate betas?

In most cases, analysts are faced with a mind-boggling array of choices among indices when it comes to estimating betas; there are more than 20 broad equity indices ranging from the Dow 30 to the Wilshire 5000 in the United States alone. One common practice is to use the index that is most appropriate for the investor who is looking at the stock. Thus, if the analysis is being done for a U.S. investor, the S&P 500 index is used. This is generally not appropriate. By this rationale, an investor who owns only two stocks should use an index composed of only those stocks to estimate betas.

The right index to use in analysis should be determined by the holdings of the marginal investor in the company being analyzed. Consider Aracruz and Deutsche Bank in the earlier illustration. If the marginal investors in.these companies are investors who holds only domestic stocks – just Brazilian stocks in the case of Aracruz or German stocks in the case of Deutsche – we can use the regressions against the local indices. If the marginal investor is a global investor, a more relevant measure of risk may emerge by using the global index. Over time, you would expect global investors to displace local investors as the marginal investors, because they will perceive far less of the risk as market risk and thus pay a higher price for the same security. Thus, one of the ironies of our notion of risk is that Aracruz will be less risky to an overseas investor who has a global portfolio than to a Brazilian investor with all of his or her wealth in Brazilian assets.

Standard Procedures for Estimating Risk Parameters in the Arbitrage Pricing and Multi-factor Models

Like the CAPM, the arbitrage pricing model defines risk to be non-diversifiable risk, but, unlike the CAPM, the APM allows for multiple economic factors in measuring this risk. While the process of estimation of risk parameters is different for the arbitrage pricing model, many of the issues raised relating to the determinants of risk in the CAPM continue to have relevance for the arbitrage pricing model.

The parameters of the arbitrage pricing model are estimated from a factor analysis on historical stock returns, which yields the number of common economic factors determining these returns, the risk premium for each factor and the factor-specific betas for each firm.

Factor Analysis: This is a statistical technique, where past data is analyzed with the intent of extracting common factors that might have affected the data.

Once the factor-specific betas are estimated for each firm, and the factor premia are measured, the arbitrage pricing model can be used to estimated expected returns on a stock.

$$\text{Cost of Equity} = R_f + \sum_{j=1}^{j=k} \beta_j \left(E(R_j) - R_f\right)$$

where,

R_f = Risk-free rate

β_j = Beta specific to factor j

$E(R_j) - R_f =$ Risk premium per unit of factor j risk

k = Number of factors

In a multi-factor model, the betas are estimated relative to the specified factors, using historical data for each firm.

B. Fundamental Betas

The beta for a firm may be estimated from a regression but it is determined by fundamental decisions that the firm has made on what business to be in, how much operating leverage to use in the business and the degree to which the firm uses financial leverage. In this section, we will examine an alternative way of estimating betas, where we are less reliant on historical betas and more cognizant of the intuitive underpinnings of betas.

Determinants of Betas

The beta of a firm is determined by three variables -(1) the type of business or businesses the firm is in, (2) the degree of operating leverage in the firm and (3) the firm's financial leverage. While much of the discussion in this section will be couched in terms of CAPM betas, the same analysis can be applied to the betas estimated in the APM and the multi-factor model as well.

Type of Business Since betas measure the risk of a firm relative to a market index, the more sensitive a business is to market conditions, the higher is its beta. Thus, other things remaining equal, cyclical firms can be expected to have higher betas than non-cyclical firms. Other things remaining equal, then, companies involved in housing and automobiles, two sectors of the economy which are very sensitive to economic conditions, will have higher betas than companies which are in food processing and tobacco, which are relatively insensitive to business cycles.

> ***Cyclical Firm:*** A cyclical firm has revenues and operating income that tend to move strongly with the economy - up when the economy is doing well, and down during recessions.

Building on this point, we would also argue that the degree to which a product's purchase is discretionary will affect the beta of the firm manufacturing the product. Thus, the betas of food processing firms, such as General Foods and Kellogg's, should be lower than the betas of specialty retailers, since consumers can defer the purchase of the latter's products during bad economic times.

It is true that firms have only limited control over how discretionary the product or service that they provide is to their customers. There are firms, however, that have used this limited control to maximum effect to make their products less discretionary to buyers, and by extension, lowered their business risk. One approach is to make the product or service a much more integral and necessary part of everyday life, thus making its purchase more of a requirement. A second approach is to effectively use advertising and marketing to build brand loyalty. The objective in good advertising, as we see it, is to make discretionary products or services seem like necessities to the target audience. Thus, corporate strategy, advertising and marketing acumen can, at the margin, alter the business risk and betas over time.

☞ **4.7: Betas and Business Risk**

Polo Ralph Lauren, the upscale fashion designer, went public in 1997. Assume that you were asked to estimate its beta. Based upon what you know about the firm's products, would you expect the beta to be

a. greater than one
b. about one
c. less than one

Why?

Degree of Operating Leverage The degree of operating leverage is a function of the cost structure of a firm, and is usually defined in terms of the relationship between fixed costs and total costs. A firm that has high operating leverage (i.e., high fixed costs relative to total costs) will also have higher variability in operating income than would a firm producing a similar product with low operating leverage.[32] Other

Operating Leverage: This is a measure of the proportion of the operating expenses of a company which are fixed costs.

[32] To see why, compare two firms with revenues of $ 100 million and operating income of $ 10 million, but assume that the first firm's costs are all fixed whereas only half of the second firm's costs are fixed. If revenues increase at both firms by $ 10 million, the first firm will report a doubling of operating income

things remaining equal, the higher variance in operating income will lead to a higher beta for the firm with high operating leverage.

While operating leverage affects betas, it is difficult to measure the operating leverage of a firm, at least from the outside, since fixed and variable costs are often aggregated in income statements. It is possible to get an approximate measure of the operating leverage of a firm by looking at changes in operating income as a function of changes in sales.

Degree of Operating leverage = % Change in Operating Profit / % Change in Sales

For firms with high operating leverage, operating income should change more than proportionately, when sales change.

Can firms change their operating leverage? While some of a firm's cost structure is determined by the business it is in (an energy utility has to build expensive power plants, and airlines have to lease expensive planes), firms in the United States have become increasingly inventive in lowering the fixed cost component in their total costs. Labor contracts that emphasize flexibility and allow the firm to make its labor costs more sensitive to its financial success, joint venture agreements, where the fixed costs are borne by someone else, and sub-contracting of manufacturing, which reduce the need for expensive plant and equipment, are only some of the manifestations of this phenomenon. While the arguments for such actions may be couched in terms of competitive advantage and flexibility, they do reduce the operating leverage of the firm and its exposure to "market" risk.

Illustration 4.3: Measuring Operating Leverage for Disney Corporation

In table 4.5, we estimate the degree of operating leverage for Disney from 1987 to 2003:

Table 4.5: Degree of Operating Leverage: Disney

Year	Net Sales	% Change in Sales	EBIT	% Change in EBIT
1987	2877		756	

(from \$ 10 to \$ 20 million) whereas the second firm will report a rise of 55% in its operating income (since costs will rise by \$ 4.5 million, 45% of the revenue increment).

1988	3438	19.50%	848	12.17%
1989	4594	33.62%	1177	38.80%
1990	5844	27.21%	1368	16.23%
1991	6182	5.78%	1124	-17.84%
1992	7504	21.38%	1287	14.50%
1993	8529	13.66%	1560	21.21%
1994	10055	17.89%	1804	15.64%
1995	12112	20.46%	2262	25.39%
1996	18739	54.71%	3024	33.69%
1997	22473	19.93%	3945	30.46%
1998	22976	2.24%	3843	-2.59%
1999	23435	2.00%	3580	-6.84%
2000	25418	8.46%	2525	-29.47%
2001	25172	-0.97%	2832	12.16%
2002	25329	0.62%	2384	-15.82%
2003	27061	6.84%	2713	13.80%
1987-2003		15.83%		10.09%
1996-2003		11.73%		4.42%

The degree of operating leverage changes dramatically from year to year, because of year-to-year swings in operating income. Using the average changes in sales and operating income over the period, we can compute the operating leverage at Disney:

Operating Leverage = % Change in EBIT/ % Change in Sales

= 10.09% / 15.83% = 0.64

There are two important observations that can be made about Disney over the period, though. First, the operating leverage for Disney is lower than the operating leverage for other entertainment firms, which we computed to be 1.12.[33] This would suggest that Disney has lower fixed costs than its competitors. Second, the acquisition of Capital Cities by Disney in 1996 may be affecting the operating leverage. Looking at the numbers since 1996, we get an even lower estimate of operating leverage:

$$\text{Operating Leverage}_{1996\text{-}03} = 4.42\%/11.73\% = 0.38$$

We would not read too much into these numbers because Disney has such a wide range of businesses. We would hypothesize that Disney's theme part business has higher fixed costs (and operating leverage) than it's movie business.

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33 To compute this statistic, we looked at the aggregate revenues and operating income of entertainment companies each year from 1987 to 2003.

☞ **4.8: Social Policy and Operating Leverage**

Assume that you are comparing a European automobile manufacturing firm with a U.S. automobile firm. European firms are generally much more constrained in terms of laying off employees, if they get into financial trouble. What implications does this have for betas, if they are estimated relative to a common index?

a. The European firm will have much a higher beta than the U.S. firms
b. The European firms will have a similar betas to the U.S. firm
c. The European firms will have a much lower beta than the U.S. firms

Should small or high growth firms have higher betas than larger and more mature firms?

Though the answer may seem obvious at first sight – that smaller, higher growth firms should are riskier than larger firms – it is not an easy question to answer. If the question were posed in terms of total risk, smaller and higher growth firms will tend to be riskier simply because they have more volatile earnings streams (and their market prices reflect that). When it is framed in terms of betas or market risk, smaller and higher growth firms should have higher betas only if the products and services they offer are more discretionary to their customers or if they have higher operating leverage. It is possible that smaller firms operate in niche markets and sell products which customers can delay or defer buying and that the absence of economies of scales lead to higher fixed costs for these firms. These firms should have higher betas than their larger counterparts. It is also possible that neither condition holds for a particular small firm. The answer will therefore depend both on the company in question and the industry in which it operates.

In practice, analysts often add what is called a small firm premium to the cost of equity for smaller firms. This small firm premium is usually estimated from historical data to be the difference between the average annual returns on small market cap stocks and the rest of the market – about 3 to 3.5% when we look at the 1926-2003 period. This practice can be dangerous for three reasons. The first is that the small firm premium has been volatile and disappeared for an extended period in the 1980s. The second is that the definition of a small market cap stock varies across time and that the historical small cap premium is largely attributable to the smallest (among the small cap) stocks. The third is that using a constant small stock premium adjustment removes any incentive that the analyst may have to examine the product characteristics and operating leverage of individual small market cap companies more closely.

Degree of Financial Leverage Other things remaining equal, an increase in financial leverage will increase the equity beta of a firm. Intuitively, we would expect that the fixed interest payments on debt to increase earnings per share in good times and to push it down in bad times.[34] Higher leverage increases the variance in earnings per share and makes equity investment in the firm riskier. If all of the firm's risk is borne by the stockholders (i.e., the beta of debt is zero)[35], and debt creates a tax benefit to the firm, then,

$$\beta_L = \beta_u \ (1 + (1\text{-t}) \ (D/E))$$

where

β_L = Levered Beta for equity in the firm

β_u = Unlevered beta of the firm (i.e., the beta of the firm without any debt)

t = Marginal tax rate for the firm

D/E = Debt/Equity Ratio

The marginal tax rate is the tax rate on the last dollar of income earned by the firm generally will not be equal to the effective or average rates, and it is used because interest expenses save taxes on the marginal income. Intuitively, we expect that as leverage increases (as measured by the debt to equity ratio), equity investors bear increasing amounts of market risk in the firm, leading to higher betas. The tax factor in the equation captures the benefit created by the tax deductibility of interest payments.

The unlevered beta of a firm is determined by the types of the businesses in which it operates and its operating leverage. This unlevered beta is often also referred to as the **asset beta** since its value is determined by the assets (or businesses) owned by the firm.

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34 Interest expenses always lower net income, but the fact that the firm uses debt instead of equity implies that the number of shares will also be lower. Thus, the benefit of debt shows up in earnings per share.

35 to ignore the tax effects and compute the levered beta as

$$\beta_L = \beta_u \ (1 + D/E)$$

If debt has market risk (i.e., its beta is greater than zero), the original formula can be modified to take it into account. If the beta of debt is β_D , the beta of equity can be written as:

$$\beta_L = \beta_u \ (1+(1\text{-t})(D/E)) - \beta_D \ (1\text{-t})D/E$$

Thus, the equity beta of a company is determined both by the riskiness of the business it operates in, as well as the amount of financial leverage risk it has taken on. Since financial leverage multiplies the underlying business risk, it stands to reason that firms that have high business risk should be reluctant to take on financial leverage. It also stands to reason that firms which operate in relatively stable businesses should be much more willing to take on financial leverage. Utilities, for instance, have historically had high debt ratios, but have not had high betas, mostly because their underlying businesses have been stable and fairly predictable.

Breaking risk down into business and financial leverage components also provides some insight into why companies have high betas, since they can end up with high betas in one of two ways - they can operate in a risky business, or they can use very high financial leverage in a relatively stable business.

Illustration 4.4: Effects of Financial Leverage on betas: Disney

From the regression for the period from 1999 to 2003, Disney had a beta of 1.01. To estimate the effects of leverage on Disney, we began by estimating the average debt/equity ratio between 1999 and 2003, using market values for debt and equity.

Average Market Debt/Equity Ratio between 1999 and 2003 = 27.5%

The unlevered beta is estimated using a marginal corporate tax rate of 37.3%:[36]

Unlevered Beta = Current Beta / (1 + (1 - tax rate) (Average Debt/Equity))

= 1.01 / (1 + (1 - 0.373)) (0.275) = 0.8615

The levered beta at different levels of debt can then be estimated:

Levered Beta = Unlevered Beta * [1 + (1 - tax rate) (Debt/ Equity)]

For instance, if Disney were to increase its debt equity ratio to 10%, its equity beta will be

Levered Beta (@10% D/E) = 0.8615*(1+ (1 - 0.373) (0.10)) = 0.9155

If the debt equity ratio were raised to 25%, the equity beta would be

Levered Beta (@25% D/E) = 0.8615 *(1+ (1 - 0.373) (0.25)) = 1.00

[36] The marginal corporate tax rate in the United States in 2003 was 35%. The marginal state and local tax rates, corrected for federal tax savings, is estimated by Disney in its annual report to be 2.3%. Disney did report some offsetting tax benefits that reduced their effective tax rate to 35%. We assumed that these offsetting tax benefits were temporary.

Table 4.6 summarizes the beta estimates for different levels of financial leverage ranging from 0 to 90% debt.

Table 4.6: Financial Leverage and Betas

Debt to Capital	*Debt/Equity Ratio*	*Beta*	*Effect of Leverage*
0.00%	0.00%	0.86	0.00
10.00%	11.11%	0.92	0.06
20.00%	25.00%	1.00	0.14
30.00%	42.86%	1.09	0.23
40.00%	66.67%	1.22	0.36
50.00%	100.00%	1.40	0.54
60.00%	150.00%	1.67	0.81
70.00%	233.33%	2.12	1.26
80.00%	400.00%	3.02	2.16
90.00%	900.00%	5.72	4.86

As Disney's financial leverage increases, the beta increases concurrently.

levbeta.xls: This spreadsheet allows you to estimate the unlevered beta for a firm and compute the betas as a function of the leverage of the firm.

marginaltaxrate.xls: This data set on the web has marginal tax rates for different countries.

In Practice: Dueling Tax Rates

The marginal tax rate, which is the tax rate on marginal income (or the last dollar of income) is a key input not only for the levered beta calculation but also for the after-tax cost of debt that we will be estimating later in this chapter. Estimating it can be problematic because firms seldom report it in their financials. Most firms report an effective tax rate on taxable income in their annual reports and filings with the SEC. This rate is computed by dividing the taxes paid by the net taxable income, reported in the financial statement. The effective tax rate can be different from the marginal tax rate for several reasons:

- If it is a small firm and the tax rate is higher for higher income brackets, the average tax rate across all income will be lower than the tax rate on the last dollar of income. For larger firms, where most of the income is at the highest tax bracket, this is less of an issue.
- Publicly traded firms, at least in the United States, often maintain two sets of books, one for tax purposes and one for reporting purposes. They generally use different accounting rules for the two and report lower income to tax authorities and higher income in their annual reports. Since taxes paid are based upon the tax books, the effective tax rate will usually be lower than the marginal tax rate.
- Actions that defer or delay the payment of taxes can also cause deviations between marginal and effective tax rates. In the period when taxes are deferred, the effective tax rate will lag the marginal tax rate. In the period when the deferred taxes are paid, the effective tax rate can be much higher than the marginal tax rate.

The best source of the marginal tax is the tax code of the country where the firm earns its operating income. If there are state and local taxes, they should be incorporated into the marginal tax rate as well. For companies in multiple tax locales, the marginal tax rate used should be the average of the different marginal tax rates, weighted by operating income by locale.

Bottom Up Betas

Breaking down betas into their business, operating leverage and financial leverage components provides us with an alternative way of estimating betas, where we do not need past prices on an individual firm or asset to estimate its beta.

To develop this alternative approach, we need to introduce an additional feature that betas possess that proves invaluable. The beta of two assets put together is a weighted average of the individual asset betas, with the weights based upon market value. Consequently, the beta for a firm is a weighted average of the betas of all of different businesses it is in. Thus, the bottom-up beta for a firm, asset or project can be estimated as follows.

1. Identify the business or businesses that make up the firm, whose beta we are trying to estimate. Most firms provide a breakdown of their revenues and operating income by business in their annual reports and financial filings.
2. Estimate the average unlevered betas of other publicly traded firms that are primarily or only in each of these businesses. In making this estimate, we have to consider the following estimation issues:
   - *Comparable firms*: In most businesses, there are at least a few comparable firms and in some businesses, there can be hundreds. Begin with a narrow definition of comparable firms, and widen it if the number of comparable firms is too small.
   - *Beta Estimation*: Once a list of comparable firms has been put together, we need to estimate the betas of each of these firms. Optimally, the beta for each firm will be estimated against a common index. If that proves impractical, we can use betas estimated against different indices.
   - *Unlever first or last*: We can compute an unlevered beta for each firm in the comparable firm list, using the debt to equity ratio and tax rate for that firm, or we can compute the average beta, debt to equity ratio and tax rate for the sector and unlever using the averages. Given the standard errors of the individual regression betas, we would suggest the latter approach.
   - *Averaging approach*: The average beta across the comparable firms can be either a simple average or a weighted average, with the weights based upon market capitalization. Statistically, the savings in standard error are larger if a simple averaging process is used.
   - *Adjustment for Cash*: Investments in cash and marketable securities have betas close to zero. Consequently, the unlevered beta that we obtain for a business by looking at comparable firms may be affected by the cash holdings of these firms. To obtain an unlevered beta cleansed of cash:

$$\text{Unlevered Beta corrected for Cash} = \frac{\text{Unlevered Beta}}{(1 - \text{Cash/ Firm Value})}$$

3. To calculate the unlevered beta for the firm, we take a weighted average of the unlevered betas, using the proportion of firm value derived from each business as the weights. These firm values will have to be estimated since divisions of a firm usually

do not have market values available.[37] If these values cannot be estimated, we use operating income or revenues as weights. This is also take into account the cash holdings of the firm by computing it as a percent of firm value and attaching a beta of zero if the cash is invested in riskless securities (like commercial paper or treasury bills) or a higher beta if it is invested in riskier securities (like corporate bonds). This weighted average is called the bottom-up unlevered beta.

4. Calculate the current debt to equity ratio for the firm, using market values if available. If not, use the target leverage specified by the management of the firm or industry-typical debt ratios.
5. Estimate the levered beta for the firm (and each of its businesses) using the unlevered beta from step 3 and the leverage from step 4.

Clearly, this process rests on being able to identify the unlevered betas of individual businesses.

There are three advantages associated with using bottom-up betas and they are significant:

- We can estimate betas for firms that have no price history since all we need is an identification of the business they operate in. In other words, we can estimate bottom up betas for initial public offerings, private businesses and divisions of companies.
- Since the beta for the business is obtained by averaging across a large number of regression betas, it will be more precise than any individual firm's regression beta estimate. The standard error of the average beta estimate will be a function of the number of comparable firms used in step 2 above and can be approximated as follows:

$$\sigma_{\text{Average Beta}} = \frac{\text{Average } \sigma_{\text{Beta}}}{\sqrt{\text{Number of firms}}}$$

  Thus, the standard error of the average of the betas of 100 firms, each of which has a standard error of 0.25, will be only 0.025. (0.25/√100).
- The bottom-up beta can reflect recent and even forthcoming changes to a firm's business mix and financial leverage, since we can change the mix of businesses and the weight on each business in making the estimate.

[37] The exception is when you have stock tracking each division traded separately in financial markets.

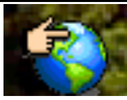This data set on the web has updated betas and unlevered betas by business sector in the United States.

Illustration 4.5: Bottom Up Beta for Disney

Disney is an entertainment firm with diverse holdings. In addition to its theme parks, it has significant investments in broadcasting and movies. To estimate Disney's beta today, we broke their business into four major components -

1. *Studio Entertainment*, which is the production and acquisition of motion pictures for distribution in theatrical, television and home video markets as well as television programming for network and syndication markets. Disney produces movies under five imprints – Walt Disney Pictures, Touchstone Pictures, Hollywood Pictures, Miramax and Dimension.
2. *Media Networks,* which includes the ABC Television and Radio networks, and reflects the acquisition made in 1995. In addition, Disney has an extensive exposure in the cable market through the Disney channel, A & E and ESPN among others.
3. *Park Resorts*, which include Disney World (in Orlando, Florida) and Disney Land (in Anaheim, California), as well as royalty holdings in Tokyo Disneyland and Disneyland Paris. The hotels and villas at each of these theme parks are considered part of the theme parks, since they derive their revenue almost exclusively from visitors to these parks.
4. *Consumer Products*, which includes a grab bag of businesses including Disney's retail outlets, its licensing revenues, software, interactive products and publishing.

This breakdown reflects Disney's reporting in its annual report. In reality, there are a number of smaller businesses that Disney is in that are embedded in these four businesses including:

- *Cruise lines*: Disney operates two ships – Disney Magic and Disney Wonder – that operate out of Florida and visit Caribbean ports.
- *Internet operations*: Disney made extensive investments in the GO network and other online operations. While much of this investment was written off by 2002, they still represent a potential source of future revenues.

- *Sports franchises*: Disney owns the National Hockey League franchise, the Mighty Ducks of Anaheim; in 2002 it sold it's stake in the Anaheim Angels, a Major League Baseball team.

Absent detailed information on the operations of these businesses, we will assume that they represent too small a portion of Disney's overall revenues to make a significant difference in the risk calculation. For the four businesses for which we have detailed information, we estimated the unlevered beta by looking at comparable firms in each business. Table 4.7 summarizes the comparables used and the unlevered beta for each of the businesses.

Table 4.7: Estimating Unlevered Betas for Disney's Business Areas

Business	*Comparable firms*	*Number of firms*	*Average levered beta*	*Median D/E*	*Unlevered beta*	*Cash/Firm Value*	*Unlevered beta corrected for cash*
Media Networks	Radia and TV broadcasting companies	24	1.22	20.45%	1.0768	0.75%	1.0850
Parks and Resorts	Theme park & Entertainment firms	9	1.58	120.76%	0.8853	2.77%	0.9105
Studio Entertainment	Movie companies	11	1.16	27.96%	0.9824	14.08%	1.1435
Consumer Products	Toy and apparel retailers; Entertainment software	77	1.06	9.18%	0.9981	12.08%	1.1353

To obtain the beta for Disney, we have to estimate the weight that each business is of Disney as a company. The value for each of the divisions was estimated by applying the typical revenue multiple at which comparable firm trade at to the revenue reported by Disney for that segment in 2003.[38] The unlevered beta for Disney as a company in 2003

[38] We first estimated the enterprise value for each firm by adding the market value of equity to the book value of debt and subtracting out cash. We divided the aggregate enterprise value by revenues for all of the comparable firms to obtain the multiples. We did not use the averages of the revenue multiples of the individual firms because a few outliers skewed the results. While Disney has about $1.2 billion in cash, it represents about 1.71% of firm value and will have a negligible impact on the beta. We have ignored it in computing the beta for Disney's equity.

is a value-weighted average of the betas of each of the different business areas. Table 4.8 summarizes this calculation.

Table 4.8: Estimating Disney's Unlevered Beta

Business	*Revenues in 2002*	*EV/Sales*	*Estimated Value*	*Firm Value Proportion*	*Unlevered beta*
Media Networks	$10,941	3.41	$37,278.62	49.25%	1.0850
Parks and Resorts	$6,412	2.37	$15,208.37	20.09%	0.9105
Studio Entertainment	$7,364	2.63	$19,390.14	25.62%	1.1435
Consumer Products	$2,344	1.63	$3,814.38	5.04%	1.1353
Disney	$27,061		$75,691.51	100.00%	1.0674

The equity beta can then be calculated using the current financial leverage for Disney as a firm. Combining the market value of equity of $ 55,101 million an estimated market value of debt of $14,668 million[39], we arrive at the current beta for Disney:

Equity Beta for Disney = 1.0674 (1+(1-.373)(14, 668/55,101) = 1.2456

This contrasts with the beta of 1.01 that we obtained from the regression, and is, in our view, a much truer reflection of the risk in Disney.

In Practice: Can't find comparable firms?

A problem faced by analysts using the bottom up approach for some firms is a paucity of comparable firms, either because the firm is unique in terms of the product it offers or because the bulk of the firms in the sector are private businesses. Rather than fall back on the regression approach, which is likely to yield a very wide range for the beta, we would suggest the following to expand the comparable firm sample:

- *Geographic expansion*: When analyzing firms from smaller markets, such as Brazil or Greece, the number of comparable firms will be small if we restrict ourselves only to firms in the market. One way to increase sample size is to consider firms in the same business that are listed and traded in other markets – European markets for Greece and Latin American markets for Brazil. With commodity companies that trade in global markets, like paper and oil companies, we can consider a global sample.

[39] The details of this calculation will be explored later in this chapter.

- *Production Chain*: Another way to expand the sample is to look for firms that either provide supplies to the firm that you are analyzing or firms that feed off your firm. For instance, when analyzing book retailers, we can consider book publishers as part of the sample since the fortunes of the two are entwined. It is unlikely that one of these groups can have a good year without the other partaking in the success
- *Customer specialization*: Using the same rationale, the betas of firms that derive the bulk of their revenues from a sector may be best estimated using firms in the sector. Thus, the beta of a law firm that derives all of its revenues from investment banks may be best estimated by looking at the betas of investment banks.

Illustration 4.6: Bottom-up Beta for Bookscape Books

We cannot estimate a regression beta for Bookscape Books, the private firm, since it does not have a history of past prices. We can, however, estimate the beta for Bookscape Books, using the bottom up approach. Since we were able to find only three publicly traded book retailers in the United States, we expanded the sample to include book publishers. We list the betas of these firms as well as debt, cash and equity values in Table 4.9:

Table 4.9: Betas and Leverage of Publicly Traded Book Retailers and Publishers

Firm	*Beta*	*Debt*	*Equity*	*Cash*
Books-A-Million	0.532	$45	$45	$5
Borders Group	0.844	$182	$1,430	$269
Barnes & Noble	0.885	$300	$1,606	$268
Courier Corp	0.815	$1	$285	$6
Info Holdings	0.883	$2	$371	$54
John Wiley &Son-A	0.636	$235	$1,662	$33
Scholastic Corp	0.744	$549	$1,063	$11
	0.7627	$1,314	$6,462	$645

While the firms in this sample are very different in terms of market capitalization, the betas are consistent. To estimate the unlevered beta for the sector, we use the average beta across the firms in conjunction with the aggregate values of debt and market value of equity (with a marginal tax rate of 35%):

Debt to Equity Ratio for industry = 1314/6462 = 20.33%

Unlevered Beta = 0.7627/(1+(1-.35)(.2033)) = 0.6737

To correct for cash, we use the aggregate cash balance across the firms:

Unlevered Beta corrected for cash = 0.6737 (1 – 645/(1314+6462)) = 0.7346

Since Bookscape has a negligible cash balance, the unlevered beta for book retailing is also the unlevered beta for the firm.

Since the debt/equity ratios used are market debt equity ratios, and the only debt equity ratio we can compute for Bookscape is a book value debt equity ratio, we have assumed that Bookscape is *close to the industry average* debt to equity ratio of 20.33%. Using a marginal tax rate of 40% (based upon personal income tax rates) for Bookscape, we get a levered beta of 0.82.

Levered beta for Bookscape = 0.7346 (1 +(1-.40) (.2033)) = 0.82

Illustration 4.7: Bottom up Beta for Aracruz

The bottom up beta for Aracruz is difficult to estimate if we remain within its home market, which is Brazil, for two reasons. First, there are only three publicly traded firms within the market that are in the same line of business as Aracruz (i.e. paper and pulp production). Second, the betas for all Brazilian firms are unreliable because the index used to estimate these betas, the Bovespa, is a narrow one, dominated by a few large companies.

There are three groups of comparable firms that we can use as comparable firms in the bottom-up beta estimate:

- *Emerging Market Paper and Pulp companies*: This is a much larger sample of firms. While the individual firm betas may skewed by the limitations of the local indices, the errors should average out over the sample.
- *U.S Paper and Pulp companies*: The advantage gained is not just in terms of the number of firms but also in terms of reliable betas. The peril in this approach is that the risk in U.S. companies can be different from the risk in Brazilian because of regulatory differences.[40]
- *Global Paper and Pulp companies*: This is the largest group and includes a diverse group of companies in both emerging and developed markets. Since betas

are measures of relative risk, we would argue that barring significant differences in regulation and monopoly power across markets, it is reasonable to compare betas across markets.

	Number of firms	*Average Beta*	*D/E*	*Unlevered Beta*	*Cash/Value*	*Unlevered Beta corrected for cash*
Emerging Markets	111	0.6895	38.33%	0.5469	6.58%	0.5855
US	34	0.7927	83.57%	0.5137	2.09%	0.5246
Global	288	0.6333	38.88%	0.5024	6.54%	0.5375

The tax rates used were 32% for emerging market companies, 35% for U.S. companies and 33% for Global companies, based upon averaging the marginal tax rates in each group. The unlevered beta of emerging market companies is slightly higher than the U.S. and global groupings. While the average beta for U.S. companies is higher than the rest of the sample, the difference is entirely due to the higher debt to equity ratios of these companies. We will use an emerging market unlevered beta of 0.59 as the beta for the paper and pulp business that Aracruz is involved in.

We can estimate the unlevered beta for Aracruz in two steps. First, we consider the asset composition for Aracruz. In addition to being in the paper business, Aracruz has a cash balance of 1,018 million BR, which is roughly 7.07% of the firm value. Since this is much larger than the typical cash balances of the companies on our comparable firm list, and the beta of cash is zero, the unlevered beta for Aracruz can be estimated as follows:

Unlevered Beta for Aracruz = (0.9293) (0.585) + (0.0707) (0) = 0.5440

Aracruz had gross debt outstanding of 4.093 million BR at the end of 2003 and a market value of equity of 9,189 million BR leading to a debt/equity ratio of 44.59%. Allowing for a tax rate of 34% (the Brazilian marginal tax rate), the levered beta for Aracruz can then be estimated as follows:

Levered Beta for Aracruz = 0.5440 (1+ (1-.34) (.4459)) = 0.7040

[40] As a counterpoint, paper and pulp companies are commodity companies and are governed by the vagaries of the price of paper and pulp. In other words, there is a reasonable argument to be made that paper and pulp companies globally are governed by the same primary risk factors.

If we wanted a levered beta for just the paper business of Aracruz, we would use the levered beta for the paper and pulp business and the gross debt to equity ratio for the firm:

Levered Beta for paper business = 0.585 (1+ (1-.34) (.4459))) = 0.7576

In Practice: Gross Debt or Net Debt

Many analysts in Europe and Latin America prefer to subtract the cash from the gross debt to arrive at a net debt figure. While there is no conceptual problem with this approach, they should remain consistent. Consider, the calculation of unlevered and levered betas in illustration 4.7. First, the computation of unlevered beta for the emerging market paper and pulp companies would have been based upon the net debt to equity ratio for firms in the sector rather than the debt to equity ratio:

Net Debt/Equity = (Gross Debt – Cash)/ Equity = 29.22%

Unlevered Beta = Levered Beta / (1 + (1- tax rate) (Net D/E))

= 0.6895/ (1 + (1-.32)(.2922)) = 0.5751

This unlevered beta is already corrected for cash and no further adjustments are needed. To make the levered beta calculation for Aracruz, we would use the net debt to equity ratio for the company. The net debt is computed by subtracting Aracruz's cash balance of 1,018 million BR from its gross debt of 4,093 million BR yielding a net debt to equity ratio of 33.47%.

Levered Beta for Aracruz = Unlevered Beta (1 + (1 – tax rate) (Net D./E))

= 0.5751 (1 + (1-.34)(.3347)) = 0.7022

Again, we can dispense with the adjustment for cash since the net debt to equity ratio captures the cash holdings.

Notice that the levered beta of 0.7040 computed for Aracruz in illustration 4.7 does not exactly match the computation using the net debt to equity ratio. The reason lies in an implicit assumption that we make when we net cash against debt. We assume that both debt and cash are riskless and that the tax benefit from debt is exactly offset by the tax paid on interest earned on cash. It is generally not a good idea to net debt if the debt is very risky or if the interest rate earned on cash is substantially lower than the interest rate paid on debt.

With a net debt to equity ratio, there is one more potential complication. Any firm that has a cash balance that exceeds its debt will have negative net debt and using this negative net D/E ratio will yield an unlevered beta that exceeds the levered beta. While this may trouble some, it makes sense because the unlevered beta reflects the beta of the business that the firm operates in. Firms that have vast cash balances that exceed their borrowing can have levered betas that are lower than the unlevered betas of the businesses they operate in.

Illustration 4.8: Bottom Up Beta for Deutsche Bank

There are a few banks in Germany that can be viewed as competitors to Deutsche Bank, though none of them are as large as it is, or have as large of a stake in investment banking. Since the rules and regulatory constraints governing banking in the United States are different from the rules governing banks in much of the Eurozone, we will look at the betas of European banks with market capitalizations exceeding $ 5 billion to estimate the beta for the commercial banking arm of Deutsche Bank. To estimate the beta of Deutsche Bank's investment banking arm, which includes Morgan Grenfell and Banker's Trust, we use the betas of investment banking firms in the United States. The results are presented below:

Comparable Firms	*Number of firms*	*Average Beta*
Large commercial Banks in Europe	58	0.7345
U.S. investment banks	9	1.5167

Note that we do not adjust for differences in leverage, since regulatory constraints and the needs of the business keep the leverage of most commercial banks at similar levels.[41] The beta for Deutsche Bank as a firm can be estimated as a weighted average of these two betas. Using estimating market value weights of 69% for the commercial banking and

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[41] Regulators often specify capital ratios, specified in terms of book values of debt and equity that banks must meet to stay in business. Most banks stay close to these ratios though some tend to be better capitalized than others.

31% for the investment banking arms (based upon the revenues that Deutsche Bank made from each in the most recent year), we arrive at a beta for Deutsche Bank's equity:[42]

Deutsche Bank's beta = 0.7345 (0.69) + 1.5167 (0.31) = 0.9767

This beta will change over time as the weights on the businesses change.

Calculating Betas after A Major Restructuring

The bottom-up process of estimating betas provides a solution when firms go through a major restructuring, where they change both their financial mix and leverage. In these cases, the regression betas are misleading because they do not reflect fully the effects of these changes. Disney's beta, estimated from the bottom up approach, is likely to provide a more precise estimate than the beta from a regression, given Disney's acquisition of Capital Cities and its increase in leverage. In fact, a firm's beta can be estimated even before the restructuring becomes effective using this approach. In the illustration that follows, for instance, we estimate Disney's beta just before and after its acquisition of Capital Cities/ABC, allowing for the changes in both the business mix and the leverage.

Illustration 4.9: Beta of a Firm After an Acquisition: Disney / Capital Cities

In 1995, Disney announced that it was acquiring Capital Cities, the owner of the ABC television and radio network, for approximately $ 120 per share, and that it would finance the acquisition partly through the issue of $ 10 billion in debt. At the time of the acquisition, Disney had a market value of equity of $31.1 billion, debt outstanding of $3.186 billion and a levered beta of 1.15. Capital Cities, based upon the $120 offering price, had a market value of equity of $18.5 billion, debt outstanding of $ 615 million and a levered beta of 0.95.

In order to evaluate the effects of the acquisition on Disney's beta, we do the analysis in two parts. First, we examine the effects of the merger on the business risk of the combined firm, by estimating the unlevered betas of the two companies, and calculating the combined firm's unlevered beta.

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[42] Deutsche Bank does not explicitly break down income into commercial banking and investment banking components. The firm reported 5,470 million in Euros in trading revenues (investment banking), $ 15,179 million in net interest revenues and fiduciary commissions (commercial banking).

Disney's unlevered beta = 1.15/(1+0.64*0.10) = 1.08

Capital Cities unlevered beta = 0.95/(1+0.64*0.03) = 0.93

The unlevered beta for the combined firm can be calculated as the weighted average of the two unlevered betas, with the weights being based upon the market values of the two firms.[43]

Value of Disney = 31,100 + 3,186 = $ 34, 286 million

Value of Capital Cities = 18,500 + 615 = $ 19, 115 million

Unlevered Beta for combined firm = 1.08 (34286/53401) + 0.93 (19115/53401)

= 1.026

Then, we examine the effects of the financing of the merger on the betas, by calculating the debt/equity ratio for the combined firm after the acquisition. Since Disney is assuming the old debt of Capital Cities, we add that debt to Disney's existing debt and add the additional $ 10 billion in debt used to fund this acquisition:[44]

Debt = Capital Cities Old Debt + Disney's Old Debt + New Debt

= $ 615 + $ 3,186 + $ 10,000 = $ 13,801 million

Equity = Disney's Old Equity + New Equity used for Acquisition

= $ 31,100 + $ 8,500 = $ 39,600 million

where New Equity = Total Cost of Acquisition - New Debt Issued

= $ 18,500 - $ 10,000 = $ 8,500 million

Notice that the equity in Capital Cities of $18,500 million disappears after the acquisition and is replaced with new debt of $ 10,000 million and new Disney equity of $ 8,500 million. The debt/equity ratio can then be computed as follows –

D/E Ratio = 13,801/39600 = 34.82%

This debt/equity ratio in conjunction with the new unlevered beta for the combined firm yields a new beta of

New Beta = 1.026 (1 + 0.64 (.3482)) = 1.25

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[43] Unlevered betas should always be weighted based upon firm values. With levered (equity) betas, the values of equity can be used as weights.

[44] If Disney had paid off Capital Cities' old debt instead of assuming it, we could have ignored it in the debt calculation. However, Disney would then have had to raise an extra $615 million in financing to fund this acquisition.

C. Accounting Betas

A third approach is to estimate the market risk parameters from accounting earnings rather than from traded prices. Thus, changes in earnings at a division or a firm, on a quarterly or annual basis, can be regressed against changes in earnings for the market, in the same periods, to arrive at an estimate of a "market beta" to use in the CAPM. While the approach has some intuitive appeal, it suffers from three potential pitfalls. First, accounting earnings tend to be smoothed out relative to the underlying value of the company, resulting in betas that are "biased down", especially for risky firms, or "biased up", for safer firms. In other words, betas are likely to be closer to one for all firms using accounting data. Second, accounting earnings can be influenced by non-operating factors, such as changes in depreciation or inventory methods, and by allocations of corporate expenses at the divisional level. Finally, accounting earnings are measured, at most, once every quarter, and often only once every year, resulting in regressions with few observations and not much power.

Illustration 4.10: Estimating Accounting Betas — Bookscape Books

Bookscape Books, even though it is a private business, has been in existence since 1980 and has accounting earnings going back to that year. Table 4.10 summarizes accounting earnings changes at Bookscape and for the S&P 500 for each year since 1980.

Table 4.10: Earnings for Bookscape versus S&P 500

Year	S&P 500	Bookscape
1980	3.01%	3.55%
1981	1.31%	4.05%
1982	-8.95%	-14.33%
1983	-3.84%	47.55%
1984	26.69%	65.00%
1985	-6.91%	5.05%
1986	-7.93%	8.50%
1987	11.10%	37.00%
1988	42.02%	45.17%
1989	5.52%	3.50%
1990	-9.58%	-10.50%
1991	-12.08%	-32.00%
1992	-5.12%	55.00%
1993	9.37%	31.00%
1994	36.45%	21.06%

1995	30.70%	11.55%
1996	1.20%	19.88%
1997	10.57%	16.55%
1998	-3.35%	7.10%
1999	18.13%	14.40%
2000	15.13%	10.50%
2001	-14.94%	-8.15%
2002	6.81%	4.05%
2003	14.63%	12.56%

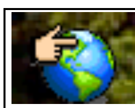
Regressing the changes in profits at Bookscape against changes in profits for the S&P 500 yields the following:

Bookscape Earnings Change = 0.1003 + 0.7329 (S & P 500 Earnings Change)

Based upon this regression, the beta for Bookscape is 0.73. In calculating this beta, we used net income to arrive at an equity beta. Using operating earnings for both the firm and the S&P 500 should yield the equivalent of an unlevered beta.

Technically, there is no reason why we cannot estimate accounting betas for Disney, Aracruz Cellulose and Deutsche Bank. In fact, for Disney, we could get net income numbers every quarter, which increases the data that we have in the regression. We could even estimate accounting betas by division, since the divisional income is reported. We do not attempt to estimate accounting betas for the following reasons:

1. To get a sufficient number of observations in our regression, we would need to go back in time at least 10 years and perhaps more. The changes that many large companies undergo over time make this a hazardous exercise.
2. Publicly traded firms smooth out accounting earnings changes even more than private firms do. This will bias the beta estimates downwards.

spearn.xls: This data set on the web has earnings changes, by year, for the S&P 500 going back to 1960.

Market, Fundamental and Accounting Betas: Which one do we use?

For most publicly traded firms, betas can be estimated using accounting data, market data or from fundamentals. Since the betas will almost never be the same, the question then becomes one of choosing between these betas. We would almost never use accounting betas, for all of the reasons specified above. We are almost as reluctant to use historical market betas for individual firms because of the standard errors in beta estimates, the failures of the local indices and the inability of these regressions to reflect the effects of major changes in the business and financial risk at the firm. Fundamental betas, in our view, provide us with the best beta estimates because they are not only more precise (because of the averaging) but also because they allow us to reflect changes in business and financial mix. In summary, we will use the fundamental estimates of equity betas of 1.25 for Disney, 0.82 for Bookscape, 0.70 for Aracruz and 0.98 for Deutsche Bank.

IV. Estimating the Cost of Equity

Having estimated the riskfree rate, the risk premium(s) and the beta(s), we can now estimate the expected return from investing in equity at any firm. In the CAPM, this expected return can be written as:

Expected Return = Riskfree Rate + Beta * Expected Risk Premium

where the riskfree rate would be the rate on a long term government bond, the beta would be either the historical, fundamental or accounting betas described above and the risk premium would be either the historical premium or an implied premium.

In the arbitrage pricing and multi-factor model, the expected return would be written as follows:

$$\text{Expected Return} = \text{Riskfree Rate} + \sum_{j-1}^{j=n} \beta_j * \text{Risk Premium}_j$$

where the riskfree rate is the long term government bond rate, β_j is the beta relative to factor j, estimated using historical data or fundamentals, and Risk Premium_j is the risk premium relative to factor j, estimated using historical data.

The expected return on an equity investment in a firm, given its risk, has key implications for both equity investors in the firm and the managers of the firm. For equity investors, it is the *rate that they need to make* to be compensated for the risk that they have taken on investing in the firm. If after analyzing an investment, they conclude that they cannot make this return, they would not buy this investment; alternatively, if they decide they can make a higher return, they would make the investment. For managers in the firm, the return that investors need to make to break even on their equity investments becomes the return that they have to try and deliver to keep these investors from becoming restive and rebellious. Thus, it becomes the rate that they have to beat in terms of returns on their equity investments in individual project. In other words, this is the *cost of equity* to the firm.

Illustration 4.11: Estimating the Cost of Equity

In illustration 4.5, we estimated a bottom-up levered beta for Disney and each of its divisions. Using the prevailing treasury bond rate of 4% and the historical risk premium of 4.82% from table 4.2, we estimate the cost of equity for Disney as a company and for each of its divisions:

Table 4.11: Levered Beta and Cost of Equity: Disney

Business	*Unlevered Beta*	*D/E Ratio*	*Levered Beta*	*Cost of Equity*
Media Networks	1.0850	26.62%	1.2661	10.10%
Parks and Resorts	0.9105	26.62%	1.0625	9.12%
Studio Entertainment	1.1435	26.62%	1.3344	10.43%
Consumer Products	1.1353	26.62%	1.3248	10.39%
Disney	1.0674	26.62%	1.2456	10.00%

Note that since none of the divisions carry their own debt, we have assumed that they are all funded using the same mix of debt and equity as Disney as a company.[45] The costs of equity vary across the remaining divisions, with studio entertainment having the highest beta and parks and resorts the lowest.[46]

To estimate the cost of equity for Deutsche Bank, we will use the same risk premium (4.82%) that we have used for the U.S, since Deutsche's business is still primarily in mature markets in Europe and the United States. Using the 10-year German Euro bond rate of 4.05% as the Euro riskfree rate[47] and Deutsche Bank's bottom up beta of 0.98, the cost of equity for Deutsche Bank is:

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[45] Disney provides no breakdown of debt by division. If it did, we could use division specific debt to equity ratios.

[46] If we consider cash as a division, the cost of equity is the riskfree rate because cash is invested in commercial paper and treasuries.

[47] There are about 8 countries that issue 10-year Euro denominated bonds. We used the German Euro bond rate as the riskfree rate, not because Deutsche Bank was a German company, but because the German Euro bond rate was the lowest of the government bond rates. The Greek and Spanish 10-year Euro bond rates

Table 4.12: Cost of Equity for Deutsche Bank

Business	*Beta*	*Cost of Equity*	*Weights*
Commercial Banking	0.7345	7.59%	69.03%
Investment Banking	1.5167	11.36%	30.97%
Deutsche Bank		8.76%	

Note that the cost of equity for investment banking is significantly higher than the cost of equity for commercial banking, reflecting the higher risks.

For Aracruz, we will add the country risk premium estimated for Brazil of 7.67%, estimated earlier in the chapter, to the mature market premium, estimated from the U.S, of 4.82% to arrive at a total risk premium of 12.49%. The cost of equity in U.S. dollars for Aracruz as a company can then be computed using the bottom up beta estimated in illustration 4.7:

Cost of Equity = Riskfree Rate in US $ + Beta * Risk Premium

= 4% + 0.7040 (12.49%) = 12.79%

As an emerging market company, Aracruz clearly faces a much higher cost of equity than its competitors in developed markets. We can also compute a cost of equity for Aracruz in real terms, by using a real riskfree rate in this calculation. Using the 10-year inflation-index U.S. treasury bond of 2% as the real riskfree rate, Aracruz's real cost of equity is:

Cost of Equity = 2% + 0.7040 (13.70%) = 10.79%

If we want to compute the cost of equity in nominal BR terms, the adjustment is more complicated and requires estimates of expected inflation rates in Brazil and the United States. If we assume that the expected inflation in BR is 8% and in U.S. dollars is 2%, the cost of equity in BR terms is:

$$\text{Cost of Equity in BR} = (1 + \text{Cost of Equity in \$}) \frac{(1 + \text{Inflation Rate}_{\text{Brazil}})}{(1 + \text{Inflation Rate}_{\text{US}})} - 1$$

$$= (1.1279) \frac{(1.08)}{(1.02)} - 1 = .1943 \text{ or } 19.43\%$$

Note that these estimates of cost of equity are affected by the cash holdings of Aracruz. We can estimate the cost of equity for the paper and pulp business of Aracruz

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were about 0.20% higher, reflecting the perception of default risk in those countries. We would continue to (independent of the cash holdings) by using the levered beta of 0.7576 for the business estimated in illustration 4.7:

Real Cost of Equity (paper business) = 2.00% + 0.7576 (12.49%) = 11.46%

US $ Cost of Equity (paper business) = 4.00% + 0.7576 (12.49%) = 13.46%

Nominal BR Cost of Equity (paper business) $1.1346 \frac{(1.08)}{(1.02)} - 1 = 20.14\%$

Finally, for Bookscape, we will use the beta of 0.82 estimated from illustration 4.6 in conjunction with the riskfree rate and risk premium for the US:

Cost of Equity = 4% + 0.82 (4.82%) = 7.73%

This cost of equity may seem incongruously low for a small, privately held business but it is legitimate if we assume that the only risk that matters is non-diversifiable risk.

In Practice: Risk, Cost of Equity and Private Firms

Implicit in the use of beta as a measure of risk is the assumption that the marginal investor in equity is a well diversified investor. While this is a defensible assumption when analyzing publicly traded firms, it becomes much more difficult to sustain for private firms. The owner of a private firm generally has the bulk of his or her wealth invested in the business. Consequently, he or she cares about the total risk in the business rather than just the market risk. Thus, for a business like Bookscape, the beta that we have estimated of 0.82 (leading to a cost of equity of 7.73%) will understate the risk perceived by the owner of Bookscape. There are two solutions to this problem:

1. Assume that the business is run with the near-term objective of sale to a large publicly traded firm. In such a case, it is reasonable to use the market beta and cost of equity that comes from it.
2. Add a premium to the cost of equity to reflect the higher risk created by the owner's inability to diversify. This may help explain the high returns that some venture capitalists demand on their equity investments in fledgling businesses.

Adjust the beta to reflect total risk rather than market risk. This adjustment is a relatively simple one, since the R squared of the regression measures the proportion of the risk that is market risk. Dividing the market beta by the square root of the R squared (which is the correlation coefficient) yields a total beta. In the Bookscape example,

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use the German Euro bond rate to value Greek and Spanish companies in Euros.

the regressions for the comparable firms against the market index have an average R squared of about 16%. The total beta for Bookscape can then be computed as follows:

$$\text{Total Beta} = \frac{\text{Market Beta}}{\sqrt{\text{R squared}}} = \frac{0.82}{\sqrt{.16}} = 2.06$$

Using this total beta would yield a much higher and more realistic estimate of the cost of equity.

$$\text{Cost of Equity} = 4\% + 2.06\ (4.82\%) = 13.93\%$$

Thus, private businesses will generally have much higher costs of equity than their publicly traded counterparts, with diversified investors. While many of them ultimately capitulate by selling to publicly traded competitors or going public, some firms choose to remain private and thrive. To do so, they have to diversify on their own (as many family run businesses in Asia and Latin America did) or accept the lower value as a price paid for maintaining total control.

From Cost of Equity to Cost of Capital

While equity is undoubtedly an important and indispensable ingredient of the financing mix for every business, it is but one ingredient. Most businesses finance some or much of their operations using debt or some hybrid of equity and debt. The costs of these sources of financing are generally very different from the cost of equity, and the minimum acceptable hurdle rate for a project will reflect their costs as well, in proportion to their use in the financing mix. Intuitively, the *cost of capital* is the weighted average of the costs of the different components of financing -- including debt, equity and hybrid securities -- used by a firm to fund its financial requirements.

☞ **4.9: Interest Rates and the Relative Costs of Debt and Equity**

It is often argued that debt becomes a more attractive mode of financing than equity as interest rates go down and a less attractive mode when interest rates go up. Is this true?

a. Yes

b. No

Why or why not?

The Costs of Non-Equity Financing

To estimate the cost of the funding that a firm raises, we have to estimate the costs of all of the non-equity components. In this section, we will consider the cost of debt first and then extend the analysis to consider hybrids such as preferred stock and convertible bonds.

The Cost of Debt

The cost of debt measures the current cost to the firm of borrowing funds to finance projects. In general terms, it is determined by the following variables:

(1) The current level of interest rates: As interest rates rise, the cost of debt for firms will also increase.

(2) The default risk of the company: As the default risk of a firm increases, the cost of borrowing money will also increase.

(3) The tax advantage associated with debt: Since interest is tax deductible, the after-tax cost of debt is a function of the tax rate. The tax benefit that accrues from paying interest makes the after-tax cost of debt lower than the pre-tax cost. Furthermore, this benefit increases as the tax rate increases.

> ***Default Risk:*** This is the risk that a firm will fail to make obligated debt payments, such as interest expenses or principal payments.

After-tax cost of debt = Pre-tax cost of debt (1 – marginal tax rate)

> ☞ **4.10: Costs of Debt and Equity**
>
> Can the cost of equity ever be lower than the cost of debt for any firm at any stage in its life cycle?
>
> a. Yes
>
> b. No

Estimating the Default Risk and Default Spread of a firm

The simplest scenario for estimating the cost of debt occurs when a firm has long-term bonds outstanding that are widely traded. The market price of the bond, in conjunction with its coupon and maturity can serve to compute a yield we use as the cost of debt. For instance, this approach works for firms that have dozens of outstanding bonds that are liquid and trade frequently.

Many firms have bonds outstanding that do not trade on a regular basis. Since these firms are usually rated, we can estimate their costs of debt by using their ratings and associated default spreads. Thus, Disney with a BBB+ rating can be expected to have a cost of debt approximately 1.25% higher than the treasury bond rate, since this is the spread typically paid by BBB+ rated firms.

Some companies choose not to get rated. Many smaller firms and most private businesses fall into this category. While ratings agencies have sprung up in many emerging markets, there are still a number of markets where companies are not rated on the basis of default risk. When there is no rating available to estimate the cost of debt, there are two alternatives:

- *Recent Borrowing History:* Many firms that are not rated still borrow money from banks and other financial institutions. By looking at the most recent borrowings made by a firm, we can get a sense of the types of default spreads being charged the firm and use these spreads to come up with a cost of debt.
- *Estimate a synthetic rating and default spread*: An alternative is to play the role of a ratings agency and assign a rating to a firm based upon its financial ratios; this rating is called a synthetic rating. To make this assessment, we begin with rated firms and examine the financial characteristics shared by firms within each ratings class. Consider a very simpler version, where the ratio of operating income to interest expense, i.e., the interest coverage ratio, is computed for each rated firm. In table 4.12, we list the range of interest coverage ratios for small manufacturing firms in each S&P ratings class[48]. We also report the typical default spreads for bonds in each ratings class.[49]

Table 4.12: Interest Coverage Ratios and Ratings

Interest Coverage Ratio	*Rating*	*Typical default spread*
> 12.5	AAA	0.35%

[48] This table was developed in early 2000, by listing out all rated firms, with market capitalization lower than $ 2 billion, and their interest coverage ratios, and then sorting firms based upon their bond ratings. The ranges were adjusted to eliminate outliers and to prevent overlapping ranges.

[49] These default spreads are obtained from an online site: http://www.bondsonline.com. You can find default spreads for industrial and financial service firms; these spreads are for industrial firms.

9.50 - 12.50	AA	0.50%
7.50 – 9.50	A+	0.70%
6.00 – 7.50	A	0.85%
4.50 – 6.00	A-	1.00%
4.00 – 4.50	BBB	1.50%
3.50 - 4.00	BB+	2.00%
3.00 – 3.50	BB	2.50%
2.50 – 3.00	B+	3.25%
2.00 - 2.50	B	4.00%
1.50 – 2.00	B-	6.00%
1.25 – 1.50	CCC	8.00%
0.80 – 1.25	CC	10.00%
0.50 – 0.80	C	12.00%
< 0.65	D	20.00%

Source: Compustat and Bondsonline.com

Now consider a private firm with $ 10 million in earnings before interest and taxes and $3 million in interest expenses; it has an interest coverage ratio of 3.33. Based on this ratio, we would assess a "synthetic rating" of BB for the firm and attach a default spread of 2.50% to the riskfree rate to come up with a pre-tax cost of debt.

By basing the synthetic rating on the interest coverage ratio alone, we run the risk of missing the information that is available in the other financial ratios used by ratings agencies. The approach described above can be extended to incorporate other ratios. The first step would be to develop a score based upon multiple ratios. For instance, the Altman Z score, which is used as a proxy for default risk, is a function of five financial ratios, which are weighted to generate a Z score. The ratios used and their relative weights are usually based upon past history on defaulted firms. The second step is to relate the level of the score to a bond rating, much as we have done in table 4.12 with interest coverage ratios. In making this extension, though, note that complexity comes at a cost. While credit or Z scores may, in fact, yield better estimates of synthetic ratings than those based only upon interest coverage ratios, changes in ratings arising from these scores are much more difficult to explain than those based upon interest coverage ratios. That is the reason we prefer the flawed but simpler ratings that we get from interest coverage ratios.

Short Term and Long Term Debt

Most publicly traded firms have multiple borrowings – short term and long term bonds and bank debt with different terms and interest rates. While there are some analysts who create separate categories for each type of debt and attach a different cost to each category, this approach is both tedious and dangerous. Using it, we can conclude that short-term debt is cheaper than long term debt and that secured debt is cheaper than unsecured debt, even though neither of these conclusions is justified.

The solution is simple. Combine all debt – short and long term, bank debt and bonds- and attach the long term cost of debt to it. In other words, add the default spread to the long term riskfree rate and use that rate as the pre-tax cost of debt. Firms will undoubtedly complain, arguing that their effective cost of debt can be lowered by using short-term debt. This is technically true, largely because short-term rates tend to be lower than long-term rates in most developed markets, but it misses the point of computing the cost of debt and capital. If this is the hurdle rate we want our long-term investments to beat, we want the rate to reflect the cost of long-term borrowing and not short-term borrowing. After all, a firm that funds long term projects with short-term debt will have to return to the market to roll over this debt.

Operating Leases and Other Fixed Commitments

The essential characteristic of debt is that it gives rise to a tax-deductible *obligation that firms have to meet in both good times and bad and the failure to meet this obligation can result in bankruptcy or loss of equity control over the firm.* If we use this definition of debt, it is quite clear that what we see reported on the balance sheet as debt may not reflect the true borrowings of the firm. In particular, a firm that leases substantial assets and categorizes them as operating leases owes substantially more than is reported in the financial statements.[50] After all, a firm that signs a lease commits to making the

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[50] In an operating lease, the lessor (or owner) transfers only the right to use the property to the lessee. At the end of the lease period, the lessee returns the property to the lessor. Since the lessee does not assume the risk of ownership, the lease expense is treated as an operating expense in the income statement and the lease does not affect the balance sheet. In a capital lease, the lessee assumes some of the risks of ownership and enjoys some of the benefits. Consequently, the lease, when signed, is recognized both as an asset and as a liability (for the lease payments) on the balance sheet. The firm gets to claim depreciation each year on the asset and also deducts the interest expense component of the lease payment each year. In general, capital leases recognize expenses sooner than equivalent operating leases.

lease payment in future periods and risks the loss of assets if it fails to make the commitment.

For corporate financial analysis, we should treat all lease payments as financial expenses and convert future lease commitments into debt by discounting them back the present, using the current pre-tax cost of borrowing for the firm as the discount rate. The resulting present value can be considered the debt value of operating leases and can be added on to the value of conventional debt to arrive at a total debt figure. To complete the adjustment, the operating income of the firm will also have to be restated:

Adjusted Operating income = Stated Operating income + Operating lease expense for the current year – Depreciation on leased asset

In fact, this process can be used to convert any set of financial commitments into debt.

Book and Market Interest Rates

When firms borrow money, they do so often at fixed rates. When they issue bonds to investors, this rate that is fixed at the time of the issue is called the coupon rate. The cost of debt is not the coupon rate on outstanding bonds nor is it the rate at which the company was able to borrow at in the past. While these factors may help determine the interest cost the company will have to pay in the current year, they do not determine the pre-tax cost of debt in the cost of capital calculations. Thus, a company that has debt that it took on when interest rates were low, on the books cannot contend that it has a low cost of debt.

To see why, consider a firm that has $ 2 billion of debt on its books and assume that the interest expense on this debt is $ 80 million. The book interest rate on the debt is 4%. Assume also that the current riskfree rate is 6%. If we use the book interest rate of 4% in our cost of capital calculations, we are requiring the projects we fund with the capital to earn more than 4% to be considered good investments. Since we can invest that money in treasury bonds and earn 6%, without taking any risk, this is clearly not a high enough hurdle. To ensure that projects earn more than what we can make on alternative investments of equivalent risk today, the cost of debt has to be based upon market interest rates today rather than book interest rates.

Assessing the Tax Advantage of Debt

Interest is tax deductible and the resulting tax savings reduce the cost of borrowing to firms. In assessing this tax advantage, we should keep in mind that:

- Interest expenses offset the marginal dollar of income and the tax advantage has to be therefore calculated using the marginal tax rate.

  After-tax cost of debt = Pre-tax cost of debt (1 – Marginal Tax Rate)

- To obtain the tax advantages of borrowing, firms have to be profitable. In other words, there is no tax advantage from interest expenses to a firm that has operating losses. It is true that firms can carry losses forward and can offset them against profits in future periods. The most prudent assessment of the tax effects of debt will therefore provide for no tax advantages in the years of operating losses and will begin adjusting for tax benefits only in future years when the firm is expected to have operating profits.

  After-tax cost of debt = Pre-tax cost of debt   If operating income < 0

  Pre-tax cost of debt (1-t)   If operating income>0

Illustration 4.12: Estimating the Costs of Debt for Disney et al.

Disney, Deutsche Bank and Aracruz are all rated companies and we will estimate their pre-tax costs of debt based upon their rating. To provide a contrast, we will also estimate synthetic ratings for Disney and Aracruz. For Bookscape, we will use the synthetic rating of BBB, estimated from the interest coverage ratio to assess the pre-tax cost of debt.

- Bond Ratings: While S&P, Moody's and Fitch rate all three companies, the ratings are consistent and we will use the S&P ratings and the associated default spreads (from table 3.4 in chapter 3) to estimate the costs of debt in table 4.13:

Table 4.13: Cost of Debt

	S&P Rating	Riskfree Rate	Default Spread	Cost of debt	Tax Rate	After-tax Cost of Debt

Disney	BBB+	4% ($)	1.25%	5.25%	37.3%	3.29%
Deutsche Bank	AA-	4.05% (Eu)[51]	1.00%	5.05%	38%	3.13%
Aracruz[52]	B+	4% ($)	3.25%	7.25%	34%	4.79%

The marginal tax rates of the US (Disney), Brazil (Aracruz) and Germany (Deutsche Bank) are used to compute the after-tax cost of debt. We will assume that all of Disney's divisions have the same cost of debt and marginal tax rate as the parent company.

- Synthetic Ratings: For Bookscape, there are no recent borrowings on the books, thus making the synthetic rating for the firm our only choice. In 2003, Bookscape had no interest expenses and reported operating income of $ 2 million after operating lease expenses of $ 600,000. If we consider the current year's operating operating lease expenses to be the equivalent of interest expenses, the resulting interest coverage ratio is 4.33, yielding a synthetic rating of A- for the firm.[53] Adding the default spread of 1.5% associated with that rating to the riskfree rate results in a pre-tax cost of debt for 5.50%. The after-tax cost of debt is computed using a 40% marginal tax rate:

After-tax cost of debt = 5.5% (1- .40) = 3.30%

Actual and Synthetic Ratings

It is usually easy to estimate the cost of debt for firms that have bond ratings available for them. There are, however, a few potential problems that sometimes arise in practice:

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[51] The default spreads for bonds issued by banks can be very different from the spreads for industrial companies. The default spread for an AA- rated financial service company was much higher at the time of this analysis than the default spread for an AA- rated manufacturing company.

[52] With Araacruz, one troublesome aspect of the pre-tax cost of debt is that it is lower than the rate at which the Brazilian government can borrow. While there are some cases where we would add the default spread of the country to that of the firm to get to a pre-tax cost of debt, Aracruz may be in a stronger position to borrow in U.S. dollars than the Brazilian government because it sells its products in a global market and gets paid in dollars.

[53] To estimate the interest coverage ratio here, we added the operating lease expense back to both the numerator and the denominator:
Interest coverage ratio = (EBIT + Operating lease expense)/ (Interest expense + Operating lease expense)
This is a conservative estimate of the rating. In reality, only a portion of the operating lease expense should be considered as interest expense. This, in turn, will increase the rating and improve the rating. In fact, the synthetic rating with this approach will be A.

- *Disagreement between ratings agencies*: While the ratings are consistent across ratings agencies for many firms, there are a few firms where the ratings agencies disagree with one agency assigning a much higher or lower rating to the firm than the others.
- *Multiple bond ratings for same firm*: Since ratings agencies rate bonds, rather than firms, the same firm can have many bond issues with different ratings depending upon how the bond is structured and secured.
- *Lags or Errors in the Rating Process*: Ratings agencies make mistakes and there is evidence that ratings changes occur after the bond market has already recognized the change in the default risk.

It is a good idea to estimate synthetic ratings even for firms that have actual ratings. If there is disagreement between ratings agencies or a firm has multiple bond ratings, the synthetic rating can operate as a tie-breaker. If there is a significant difference between actual and synthetic ratings and there is no fundamental reason that can be pinpointed for the difference, the synthetic rating may be providing an early signal of a ratings agency mistake.

We computed the synthetic ratings for Disney and Aracruz using the interest coverage ratios:

Disney: Interest coverage ratio = 2,805/758 = 3.70   Synthetic rating = A-

Aracruz: Interest coverage ratio = 888/339= 2.62   Synthetic rating = BBB

While Disney's synthetic rating is close to it's actual rating of BBB+, the synthetic rating for Aracruz is much higher than it's rating of B-. The reason for the discrepancy lies in the fact that Aracruz has two ratings – one for its local currency borrowings of BBB- and one for its dollar borrowings of B+. We used the latter to estimate the cost of debt because almost all of Aracruz's debt is dollar debt. You can also consider the difference to be a reflection of the riskiness of Brazil as a country and the penalty that Aracruz pays for being a Brazilian company. In fact, we can quantify this difference by measuring the difference in interest rates (in US dollar terms) of Aracruz with the synthetic and actual ratings:

Cost of debt with actual rating of B- : 4% + 3.25% = 7.25%

Cost of debt with synthetic rating of BBB: 4% + 1.50% = 5.50%

Country default penalty attached to Aracruz debt = 7.25% - 5.50% = 1.75%

Calculating the Cost of Preferred Stock

Preferred stock shares some of the characteristics of debt - the preferred dividend is pre-specified at the time of the issue and is paid out before common dividend -- and some of the characteristics of equity - the payments of preferred dividend are not tax deductible. If preferred stock is viewed as perpetual, the cost of preferred stock can be written as follows:

k_{ps} = Preferred Dividend per share/ Market Price per preferred share

This approach assumes that the dividend is constant in dollar terms forever and that the preferred stock has no special features (convertibility, callability etc.). If such special features exist, they will have to be valued separately to come up with a good estimate of the cost of preferred stock. In terms of risk, preferred stock is safer than common equity but riskier than debt. Consequently, it should, on a pre-tax basis, command a higher cost than debt and a lower cost than equity.

Illustration 4.13: Calculating the Cost Of Preferred Stock: Disney and Deutsche Bank

Both Disney and Deutsche Bank have preferred stock outstanding. THe preferred dividend yields on the issues are computed in March 2004 in table 4.14:

Table 4.14: Cost of Preferred Stock

Company	*Preferred Stock Price*	*Annual Dividends/share*	*Dividend Yield*
Disney	$ 26.74	$ 1.75	1.75/26.74 = 6.54%
Deutsche Bank	103.75 Euros	6.60 Euros	6.6/103.75 = 6.36%

Notice that the cost of preferred stock for Disney is higher than its pre-tax cost of debt of 5.25% and is lower than its cost of equity of 10%. For Deutsche Bank as well, the cost of preferred stock is higher than its pre-tax cost of debt (5.05%) and is lower than its cost of equity of 8.76%. For both firms, the market value of preferred stock is so small relative to the market values of debt and equity that it makes almost no impact on the overall cost of capital.

☞ **4.11: Why do companies issue preferred stock?**

Which of the following are "good" reasons for a company issuing preferred stock?

a. Preferred stock is cheaper than equity
b. Preferred stock is treated as equity by the ratings agencies and regulators
c. Preferred stock is cheaper than debt
d. Other:

Explain.

Calculating the Cost of Other Hybrid Securities

In general terms, hybrid securities share some of the characteristics of debt and some of the characteristics of equity. A good example is a convertible bond, which can be viewed as a combination of a straight bond (debt) and a conversion option (equity). Instead of trying to calculate the cost of these hybrid securities individually, they can be broken down into their debt and equity components and treated separately.

In general, it is not difficult to decompose a hybrid security that is publicly traded (and has a market price) into debt and equity components. In the case of a convertible bond, this can be accomplished in two ways:

- An option pricing model can be used to value the conversion option and the remaining value of the bond can be attributed to debt.
- The convertible bond can be valued as if it were a straight bond, using the rate at which the firm can borrow in the market, given its default risk (pre-tax cost of debt) as the interest rate on the bond. The difference between the price of the convertible bond and the value of the straight bond can be viewed as the value of the conversion option.

If the convertible security is not traded, we have to value both the straight bond and the conversion options separately.

Illustration 4.14: Breaking down a convertible bond into debt and equity components: Disney

Convertible Debt: This is debt that can be converted into stock at a specified rate, called the conversion ratio.

In March 2004, Disney had convertible bonds outstanding with 19 years left to maturity and a coupon rate of 2.125%, trading at $1,064 a bond. Holders of this bond have the right to convert the bond into 33.9444 shares of stock anytime over the bond's remaining life.[54] To break the convertible bond into straight bond and conversion option components, we will value the bond using Disney's pre-tax cost of debt of 5.25%:[55]

Straight Bond component

= Value of a 2.125% coupon bond due in 19 years with a market interest rate of 5.25%

= PV of $21.25 in coupons each year for 19 years[56] + PV of $1000 at end of year 19

$$= 21.25\left[\frac{1-(1.0525)^{-19}}{.0525}\right] + \frac{1000}{(1.0525)^{19}} = \$629.91$$

Conversion Option = Market value of convertible – Value of straight bond

= 1064 - $629.91 = $434.09

The straight bond component of $630 is treated as debt, while the conversion option of $434 is treated as equity.

☞ **4.12: Increases in Stock Prices and Convertible Bonds**

As stock prices go up, which of the following is likely to happen to the convertible bond (you can choose more than one)

a. The convertible bond will increase in value
b. The straight bond component of the convertible bond will decrease in value
c. The equity component of the convertible bond will increase as a percentage of the total value
d. The straight bond component of the convertible bond will increase as a percentage of the total value

Explain.

Calculating the Weights of Debt and Equity Components

Once we have costs for each of the different components of financing, all we need are weights on each component to arrive at a cost of capital. In this section, we will

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[54] At this conversion ratio, the price that investors would be paying for Disney shares would be $29.46, much higher than the stock price of $20.46 prevailing at the time of the analysis.

[55] This rate was based upon a 10-year treasury bond rate. If the 5-year treasury bond rate had been substantially different, we would have recomputed a pre-tax cost of debt by adding the default spread to the 5-year rate.

[56] The coupons are assumed to be annual. With semi-annual coupons, you would divide the coupon by 2 and apply a semi-annual rate to calculate the present value.

consider the choices for weighting, the argument for using market value weights and whether the weights can change over time.

Choices for Weighting

In computing weights for debt, equity and preferred stock, we have two choices. We can take the accounting estimates of the value of each funding source from the balance sheet and compute book value weights. Alternatively, we can use or estimate market values for each component and compute weights based upon relative market value. *As a general rule, the weights used in the cost of capital computation should be based upon market values*. This is because the cost of capital is a forward-looking measure and captures the cost of raising new funds to finance projects. Since new debt and equity has to be raised in the market at prevailing prices, the market value weights are more relevant.

There are some analysts who continue to use book value weights and justify them using four arguments, none of which are convincing:

- *Book value is more reliable than market value because it is not as volatile*: While it is true that book value does not change as much as market value, this is more a reflection of weakness than strength, since the true value of the firm changes over time as new information comes out about the firm and the overall economy. We would argue that market value, with its volatility, is a much better reflection of true value than is book value.[57]
- *Using book value rather than market value is a more conservative approach to estimating debt ratios*. The book value of equity in most firms in developed markets is well below the value attached by the market, whereas the book value of debt is usually close to the market value of debt. Since the cost of equity is much higher than the cost of debt, the cost of capital calculated using book value ratios

[57] There are some who argue that stock prices are much more volatile than the underlying true value. Even if this argument is justified (and it has not conclusively been shown to be so), the difference between market value and true value is likely to be much smaller than the difference between book value and true value.

will be lower than those calculated using market value ratios, making them less conservative estimates, not more so.[58]

- *Since accounting returns are computed based upon book value, consistency requires the use of book value in computing cost of capital:* While it may seem consistent to use book values for both accounting return and cost of capital calculations, it does not make economic sense. The funds invested in these projects can be invested elsewhere, earning market rates, and the costs should therefore be computed at market rates and using market value weights.

Estimating Market Values

In a world where all funding was raised in financial markets and are securities were continuously traded, the market values of debt and equity should be easy to get. In practice, there are some financing components with no market values available, even for large publicly traded firms, and none of the financing components are traded in private firms.

The Market Value of Equity

The market value of equity is generally the number of shares outstanding times the current stock price. Since it measures the cost of raising funds today, it is not good practice to use average stock prices over time or some other normalized version of the price.

- *Multiple Classes of Shares*: If there is more than one class of shares outstanding, the market values of all of these securities should be aggregated and treated as equity. Even if some of the classes of shares are not traded, market values have to be estimated for non-traded shares and added to the aggregate equity value.
- *Equity Options*: If there other equity claims in the firm - warrants and conversion options in other securities - these should also be valued and added on to the value of the equity in the firm. In the last decade, the use of options as management

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[58] To illustrate this point, assume that the market value debt ratio is 10%, while the book value debt ratio is 30%, for a firm with a cost of equity of 15% and an after-tax cost of debt of 5%. The cost of capital can be calculated as follows –

With market value debt ratios: 15% (.9) + 5% (.1) = 14%
With book value debt ratios: 15% (.7) + 5% (.3) = 12%

compensation has created complications, since the value of these options has to be estimated.

How do we estimate the value of equity for private businesses? We have two choices. One is to estimate the market value of equity by looking at the multiples of revenues and net income at which publicly traded firms trade. The other is to bypass the estimation process and use the market debt ratio of publicly traded firms as the debt ratio for private firms in the same business. This is the assumption we made for Bookscape, where we used the industry average debt to equity ratio for the book/publishing business as the debt to equity ratio for Bookscape.

The Market Value of Debt

The market value of debt is usually more difficult to obtain directly since very few firms have all of their debt in the form of bonds outstanding trading in the market. Many firms have non-traded debt, such as bank debt, which is specified in book value terms but not market value terms. To get around the problem, many analysts make the simplifying assumptions that the book value of debt is equal to its market value. While this is not a bad assumption for mature companies in developed markets, it can be a mistake when interest rates and default spreads are volatile.

A simple way to convert book value debt into market value debt is to treat the entire debt on the books as a coupon bond, with a coupon set equal to the interest expenses on all of the debt and the maturity set equal to the face-value weighted average maturity of the debt, and to then value this coupon bond at the current cost of debt for the company. Thus, the market value of \$ 1billion in debt, with interest expenses of \$ 60 million and a maturity of 6 years, when the current cost of debt is 7.5% can be estimated as follows:

$$\text{Estimated Market Value of Debt} = 60\left[\frac{(1 - \frac{1}{(1.075)^6}}{.075}\right] + \frac{1{,}000}{(1.075)^6} = \$930$$

This is an approximation and that a more accurate computation would require valuing each debt issue separately, using this process. As a final point, we should add the present value of operating lease commitments to this market value of debt to arrive at an aggregate value for debt in computing the cost of capital.

Can financing weights change over time?

Using the current market values to obtain weights will yield a cost of capital for the current year. But can the weights attached to debt and equity, and the resulting cost of capital, change from year to year? Absolutely, and especially in the following scenarios:

- *Young firms*: Young firms often are all equity funded largely because they do not have the cash flows (or earnings) to sustain debt. As they become larger, increasing earnings and cashflow usually allow for more borrowing. When analyzing firms early in the life cycle, we should allow for the fact that the debt ratio of the firm will probably increase over time towards the industry average.
- *Target Debt Ratios and Changing financing mix*: Mature firms sometimes decide to change their financing strategies, pushing towards target debt ratios that are much higher or lower than current levels. When analyzing these firms, we should consider the expected changes as the firm moves from the current to the target debt ratio.

As a general rule, we should view the cost of capital as a year-specific number, and change the inputs each year. Not only will the weights attached to debt and equity change over time, but so will the estimates of beta and the cost of debt. In fact, one of the advantages of using bottom-up betas is that the beta each year can be estimated as a function of the expected debt to equity ratio that year.

Illustration 4.15: Market value and book value debt ratios: Disney and Aracruz

Disney has a number of debt issues on its books, with varying coupon rates and maturities. Table 4.15 summarizes Disney's outstanding debt:

Table 4.15: Debt at Disney: September 2003

Debt	*Face Value*	*Stated Interest rate*	*Maturity*	*Wtd Maturity*
Commercial Paper	$0	2.00%	0.5	0.0000
Medium term paper	$8,114	6.10%	15	9.2908
Senior Convertibles	$1,323	2.13%	10	1.0099
Other U.S. dollar denominated debt	$597	4.80%	15	0.6836
Privately Placed Debt	$343	7.00%	4	0.1047
Euro medium-term debt	$1,519	3.30%	2	0.2319

Preferred Stock[59]	$485	7.40%	1	0.0370
Cap Cities Debt	$191	9.30%	9	0.1312
Other	$528	3.00%	1	0.0403
Total	$13,100	5.60%		11.5295

To convert the book value of debt to market value, we use the current pre-tax cost of debt for Disney of 5.25% as the discount rate, $13,100 as the book value of debt and the current year's interest expenses of $ 666 million as the coupon:

$$\text{Estimated MV of Disney Debt} = 666\left[\frac{(1-\frac{1}{(1.0525)^{11.53}}}{.0525}\right] + \frac{13{,}100}{(1.0525)^{11.53}} = \$12{,}915 \text{ million}$$

To this amount, we add the present value of Disney's operating lease commitments. This present value is computed by discounting the lease commitment each year at the pre-tax cost of debt for Disney (5.25%):[60]

Year	Commitment	Present Value
1	$ 271.00	$ 257.48
2	$ 242.00	$ 218.46
3	$ 221.00	$ 189.55
4	$ 208.00	$ 169.50
5	$ 275.00	$ 212.92
6 –9	$ 258.25	$ 704.93
Debt Value of leases =		$ 1,752.85

Adding the debt value of operating leases to the market value of debt of $12,915 million yields a total market value for debt of $14,668 million at Disney.

Aracruz has debt with a book value of 3,946 million BR, interest expenses of 339 million BR in the current year and an average maturity for the debt of 3.20 years. Since most of the debt is dollar debt, we used the nominal dollar pre-tax cost of debt for the firm of 7.25% (from illustration 4.12)[61]. The market value of Aracruz debt is:

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[59] Preferred stock should really not be treated as debt. In this case, though, the amount of preferred stock is small that we have included it as part of debt for Disney.

[60] Disney reports total commitments of $715 million beyond year 6. Using the average commitment from year one through five as an indicator, we assumed that this total commitment would take the form of an annuity of $178.75 million a year for four years.

[61] If the debt had been predominantly nominal BR debt, we would have used a nominal BR cost of debt.

$$\text{MV of Aracruz Debt} = 339\left[\frac{(1-\frac{1}{(1.0725)^{3.20}}}{.0725}\right] + \frac{3{,}946}{(1.0725)^{3.20}} = 4{,}094 \text{ million BR}$$

There are no lease commitments reported in Aracruz's financial statements.[62]

In table 4.16 we contrast the book values of debt and equity with the market values for Disney and Aracruz. The market value of equity is estimated using the current market price and the number of shares outstanding.

Table 4.16: Book value versus Market Value: Debt Ratios

	BV: Debt	BV: Equity	BV: D/(D+E)	MV: Debt	MV: Equity	MV: D/E
Disney	$13,100	$24,219	35.10%	$14,668	$55,101	21.02%
Aracruz	$3,946	$5,205	43.12%	$4,094	$9,189	30.82%

For Disney, the market value debt ratio of 21.02% is much lower than the book value debt ratio of 35.10%. For Aracruz, the market debt ratio is 30.82%, lower than the book debt ratio of 43.12%.

Bookscape's only debt takes the form of operating lease commitments. The bookstore has a 25 years remaining on a real estate leases, requiring the payment of $500,000 a year. The present value of these operating lease commitments, using a 5.50% pre-tax cost of borrowing, is:

Present value of operating lease commitments = 500 (PV of annuity, 5.5%, 25 years)

= $6.707 million

Bookscape does not have a market value of equity, since it is a private firm. The book value of equity for the firm at the end of 2003 was $ 5 million.

Estimating and using the cost of capital

With the estimates of the costs of the individual components – debt, equity and preferred stock (if any) – and the market value weights of each of the components, the cost of capital can be computed. Thus if E, D and PS are the market values of equity, debt and preferred stock respectively, the cost of capital can be written as follows:

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[62] While many companies outside the United States do no provide details on lease commitments in future years, Aracruz publishes financial statements that use US accounting standards for its ADR listing.

Cost of Capital = k_e (E/ (D+E+PS)) + k_d (D/ (D+E+PS)) + k_{ps} (PS/ (D+E+PS))

The cost of capital is a measure of the composite cost of raising money that a firm faces. It will generally be lower than the cost of equity, which is the cost of just equity funding.

It is a source of confusion to many analysts that both the cost of equity and the cost of capital are used as hurdle rates in investment analysis. The way to resolve this confusion is to recognize when it is appropriate to use each one.

- If we want to adopt the perspective of just the equity investors in a business or a project and measure the returns earned just by these investors on their investment, the cost of equity is the correct hurdle rate to use. In measuring the returns to equity investors then, we have to consider only the income or cashflows left over after all other claimholders needs (interest payments on debt and preferred dividends, for instance) have been met.
- If the returns that we are measuring are composite returns to all claimholders, based upon earnings before payments to debt and preferred stockholders, the comparison should be to the cost of capital.

While these principles are abstract, we will consider them in more detail in the next chapter when we look at examples of projects.

Illustration 4.16: Estimating Cost of Capital

Culminating the analysis in this chapter, we first estimate the costs of capital for each of Disney’s divisions, In making these estimates, we use the costs of equity that we obtained for the divisions in illustration 4.11 and Disney’s cost of debt from illustration 4.12. We also assume that all of the divisions are funded with the same mix of debt and equity as the parent company. Table 4.17 provides estimates of the costs of capital for the divisions:

Table 4.17: Cost of capital for Disney’s divisions

Business	*Cost of Equity*	*After-tax cost of debt*	*E/(D+E)*	*D/(D+E)*	*Cost of capital*
Media Networks	10.10%	3.29%	78.98%	21.02%	8.67%
Parks and Resorts	9.12%	3.29%	78.98%	21.02%	7.90%
Studio Entertainment	10.43%	3.29%	78.98%	21.02%	8.93%
Consumer Products	10.39%	3.29%	78.98%	21.02%	8.89%
Disney	10.00%	3.29%	78.98%	21.02%	8.59%

The cost of capital for Disney as a company is 8.59% but the costs of capitals vary across divisions with a low of 7.90% for the parks and resorts division to a high or 8.93% for studio entertainment.

To estimate the cost of capital in both real and nominal US dollar terms for Aracruz in real terms, we use the cost of equity (from illustration 4.11) and the after-tax cost of debt (from illustration 4.12) and the estimates are reported in table 4.18:

Table 4.18: Cost of Capital for Aracruz: Real and US Dollars

	Levered Beta	*Cost of Equity*	*After-tax Cost of Debt*	*D/(D+E)*	*Cost of Capital*
In Real Terms					
Paper & Pulp	0.7576	11.46%	3.47%	30.82%	9.00%
Cash	0	2.00%			2.00%
Aracruz	0.7040	10.79%	3.47%	30.82%	8.53%
In US Dollar Terms					
Paper & Pulp	0.7576	13.46%	4.79%	30.82%	10.79%
Cash	0	4.00%			4.00%
Aracruz	0.7040	12.79%	4.79%	30.82%	10.33%

The nominal dollar costs of capital can be converted into nominal BR costs of capital using the differential inflation rates in the two countries, just as the cost of equity was earlier in the chapter.

When estimating the cost of equity for Bookscape, we assumed that the company would be funded using the same market debt to equity ratio as the book/publishing industry. Staying consistent, we will use the market debt to capital ratio to compute the cost of capital for the firm. We will also present two estimates of the cost of capital – one using the market beta and the other using the total beta:

	Beta	*Cost of Equity*	*After-tax Cost of debt*	*D/(D+E)*	*Cost of Capital*
Market Beta	0.82	7.97%	3.30%	16.90%	7.18%
Total Beta	2.06	13.93%	3.30%	16.90%	12.14%

The cost of capital estimated using the total beta is a more realistic estimate, given that this is a private company, and we will use it as the cost of capital for Bookscape in the coming chapters.

Equity, Debt and Cost of Capital for Banks

Note that we did not estimate a cost of capital for Deutsche Bank even though we have estimates of the costs of equity and debt for the firm. The reason is simple and goes to the heart of how firms view debt. For non-financial service firms, debt is a source of capital and is used to fund real projects – building a factory or making a movie. For banks, debt is raw material that is used to generate profits. Boiled down to its simplest elements, it is a bank's job to borrow money (debt) at a low rate and lend it out at a higher rate. It should come as no surprise that when banks (and their regulators) talk about capital, they mean equity capital.[63]

There is also a practical problem in computing the cost of capital for a bank. If we define debt as any fixed commitment where failure to meet the commitment can lead to loss of equity control, the deposits made by customers at bank branches would qualify and the debt ratio of a bank will very quickly converge on 100%. If we define it more narrowly, we still are faced with a problem of where to draw the line. A pragmatic compromise is to view only long term bonds issued by a bank as debt, but it is an artificial one. Deutsche Bank, for instance, had long-term debt in December 2003 was 82 billion Euros, common equity with a market value of 40.96 billion Euros and preferred stock with a market value of 4.1 billion Euros. Using the cost of equity of 8.76% (from illustration 4.11), the after-tax cost of debt of 3.13% from illustration 4.12 and the cost of preferred stock (6.36%) from illustration 4.13:

Cost of capital = 3.13% (82/127.06) + 8.47% (40.96/127.06) + 6.36%(4.1/127.06)

= 5.05%

With Deutsche Bank, we will do almost all of our analyses using the cost of equity rather than the cost of capital.

Conclusion

This chapter explains the process of estimating discount rates, by relating them to the risk and return models described in the previous chapter –

- The cost of equity can be estimated using risk and return models -- the capital asset pricing model, where risk is measured relative to a single market factor, the arbitrage

[63] All of the capital ratios that govern banks are stated in terms of book value of equity, though equity is defined broadly to include preferred stock.

pricing model, where the cost of equity is determined by the sensitivity to multiple unspecified economic factors or a multiple factor model, where sensitivity to macro-economic variables is used to measure risk.

- In both these models, the key inputs are the riskfree rate, the risk premiums and the beta (in the CAPM) or betas (in the APM). The last of these inputs is usually estimated using historical data on prices; in the case of private firms, they might have to be estimated using comparable publicly traded firms.
- While the betas are estimated using historical data, they are determined by the fundamental decisions that a firm makes on its business mix, its operating and financial leverage.

- The cost of capital is a weighted average of the costs of the different components of financing, with the weights based on the market values of each component. The cost of debt is the market rate at which the firm can borrow, adjusted for any tax advantages of borrowing. The cost of preferred stock, on the other hand, is the preferred dividend.
- The cost of capital is the minimum acceptable hurdle rate that will be used to determine whether to invest in a project.

Live Case Study

Risk and Return: Analysis for the Firm

Objective: To develop a risk profile for your company, estimate its risk parameters and use these parameters to estimate costs of equity and capital for the firm.

Key Questions:

- What is the risk profile of your company? (How much overall risk is there in this firm? Where is this risk coming from (market, firm, industry or currency)? How is the risk profile changing?)
- What is the performance profile of an investment in this company? What return would you have earned investing in this company's stock? Would you have under or out performed the market? How much of the performance can be attributed to management?
- How risky is this company's equity? Why? What is its cost of equity?
- How risky is this company's debt? What is its cost of debt?
- What is this company's current cost of capital?

Framework for Analysis:

1. *Estimating Historical Risk Parameters (Top Down Betas)*

   Run a regression of returns on your firm's stock against returns on a market index, preferably using monthly data and 5 years of observations (or)

If you have access to Bloomberg, go into the beta calculation page and print of the page (after setting return intervals to monthly and using 5 years of data)

- What is the intercept of the regression? What does it tell you about the performance of this company's stock during the period of the regression?
- What is the slope of the regression?
    - What does it tell you about the risk of the stock?
    - How precise is this estimate of risk? (Provide a range for the estimate.)
- What portion of this firm's risk can be attributed to market factors? What portion to firm-specific factors? Why is this important?
- How much of the "risk" for this firm is due to business factors? How much of it is due to financial leverage?

2. *Comparing to Sector Betas (Bottom up Betas)*
    - Break down your firm by business components, and estimate a business beta for each component
    - Attach reasonable weights to each component and estimate a unlevered beta for the business.
    - Using the current leverage of the company, estimate a levered beta for each component.
3. *Choosing Between Betas*
    - Which of the betas that you have estimated for the firm (top down or bottom up) would you view as more reliable? Why?
    - Using the beta that you have chosen, estimate the expected return on an equity investment in this company to
        - a short term investor
        - a long term investor
    - As a manager in this firm, how would you use this expected return?
4. *Estimating Default Risk and Cost of Debt*
    - If your company is rated,
        - What is the most recent rating for the firm?
        - What is the default spread and interest rate associated with this rating?
        - If your company has bonds outstanding, estimate the yield to maturity on a long term bond? Why might this be different from the rate estimated in the last step?
        - What is the company's marginal tax rate?
    - If your company is not rated,
        - Does it have any recent borrowings? If yes, what interest rate did the company pay on these borrowing?
        - Can you estimate a "synthetic" rating? If yes, what interest rate would correspond to this rating?)
5. *Estimating Cost of Capital*
    - Weights for Debt and Equity
        - What is the market value of equity?

  - Estimate a market value for debt. (To do this you might have to collect information on the average maturity of the debt, the interest expenses in the most recent period and the book value of the debt)
  - What are the weights of debt and equity?
- *Cost of Capital*
  - What is the cost of capital for the firm?

Getting Information on Risk and Return

If you want to run a regression of stock returns against a market index to estimate a beta, you will need to estimate past returns for both the stock and index. Several services including Bloomberg and S&P provide access to the data. If you want a beta estimate for your firm, you can find it online or look it up in Value Line. If you want to estimate bottom-up betas, based upon comparable firms, you will first have to identify the businesses that your firm operates in (which should be available in the firm's 10-K), find comparable firms in each business and then estimate the average beta and debt to equity ratio for these firms.

You can find the rating for your company from the S&P and Moody publications that list all traded bonds and their ratings. Alternatively, you can estimate an interest coverage ratio and a synthetic rating.

Online sources of information:

http://www.stern.nyu.edu/~adamodar/cfin2E/project/data.htm

Problems and Questions

1. In December 1995, Boise Cascade's stock had a beta of 0.95. The treasury bill rate at the time was 5.8%, and the treasury bond rate was 6.4%. The firm had debt outstanding of $ 1.7 billion and a market value of equity of $ 1.5 billion; the corporate marginal tax rate was 36%.
a. Estimate the expected return on the stock for a short term investor in the company.
b. Estimate the expected return on the stock for a long term investor in the company.
c. Estimate the cost of equity for the company.

2. Boise Cascade also had debt outstanding of $ 1.7 billion and a market value of equity of $ 1.5 billion; the corporate marginal tax rate was 36%.
a. Assuming that the current beta of 0.95 for the stock is a reasonable one, estimate the unlevered beta for the company.
b. How much of the risk in the company can be attributed to business risk and how much to financial leverage risk?

3. Biogen Inc., as biotechnology firm, had a beta of 1.70 in 1995. It had no debt outstanding at the end of that year.
a. Estimate the cost of equity for Biogen, if the treasury bond rate is 6.4%.
b. What effect will an increase in long term bond rates to 7.5% have on Biogen's cost of equity?
c. How much of Biogen's risk can be attributed to business risk?

4. Genting Berhad is a Malaysian conglomerate, with holding in plantations and tourist resorts. The beta estimated for the firm, relative to the Malaysian stock exchange, is 1.15, and the long term government borrowing rate in Malaysia is 11.5%.
a. Estimate the expected return on the stock.
b. If you were an international investor, what concerns, if any, would you have about using the beta estimated relative to the Malaysian Index? If you do, how would you modify the beta?

5. You have just done a regression of monthly stock returns of HeavyTech Inc., a manufacturer of heavy machinery, on monthly market returns over the last five years and come up with the following regression:

$$R_{HeavyTech} = 0.5\% + 1.2\ R_M$$

The variance of the stock is 50% and the variance of the market is 20%. The current T.Bill rate is 3% (It was 5% one year ago). The stock is currently selling for $50, down $4 over the last year, and has paid a dividend of $2 during the last year and expects to pay a dividend of $2.50 over the next year. The NYSE composite has gone down 8% over the last year, with a dividend yield of 3%. HeavyTech Inc. has a tax rate of 40%.

a. What is the expected return on HeavyTech over the next year?

b. What would you expect HeavyTech's price to be one year from today?

c. What would you have expected HeavyTech's stock returns to be over the last year?

d. What were the actual returns on HeavyTech over the last year?

e. HeavyTech has $100 million in equity and $ 5 million in debt. It plans to issue $50 million in new equity and retire $50 million in debt. Estimate the new beta.

6. Safecorp, which owns and operates grocery stores across the United States, currently has $50 million in debt and $100 million in equity outstanding. Its stock has a beta of 1.2. It is planning a leveraged buyout , where it will increase its debt/equity ratio of 8. If the tax rate is 40%, what will the beta of the equity in the firm be after the LBO?

7. Novell, which had a market value of equity of $2 billion and a beta of 1.50, announced that it was acquiring WordPerfect, which had a market value of equity of $ 1 billion, and a beta of 1.30. Neither firm had any debt in its financial structure at the time of the acquisition, and the corporate tax rate was 40%.

a. Estimate the beta for Novell after the acquisition, assuming that the entire acquisition was financed with equity.

b. Assume that Novell had to borrow the $ 1 billion to acquire WordPerfect. Estimate the beta after the acquisition.

8. You are analyzing the beta for Hewlett Packard and have broken down the company into four broad business groups, with market values and betas for each group.

Business Group	Market Value of Equity	Beta
Mainframes	$ 2.0 billion	1.10
Personal Computers	$ 2.0 billion	1.50
Software	$ 1.0 billion	2.00
Printers	$ 3.0 billion	1.00

a. Estimate the beta for Hewlett Packard as a company. Is this beta going to be equal to the beta estimated by regressing past returns on HP stock against a market index. Why or Why not?

b. If the treasury bond rate is 7.5%, estimate the cost of equity for Hewlett Packard. Estimate the cost of equity for each division. Which cost of equity would you use to value the printer division?

c. Assume that HP divests itself of the mainframe business and pays the cash out as a dividend. Estimate the beta for HP after the divestiture. (HP had $ 1 billion in debt outstanding.)

9. The following table summarizes the percentage changes in operating income, percentage changes in revenue and betas for four pharmaceutical firms.

Firm	% Change in Revenue	% Change in Operating Income	Beta
PharmaCorp	27%	25%	1.00
SynerCorp	25%	32%	1.15
BioMed	23%	36%	1.30
Safemed	21%	40%	1.40

a. Calculate the degree of operating leverage for each of these firms.

b. Use the operating leverage to explain why these firms have different betas.

10. A prominent beta estimation service reports the beta of Comcast Corporation, a major cable TV operator, to be 1.45. The service claims to use weekly returns on the stock over the prior five years and the NYSE composite as the market index to estimate betas. You replicate the regression using weekly returns over the same period and arrive at a beta estimate of 1.60. How would you reconcile the two estimates?

11. Battle Mountain is a mining company, which mines gold, silver and copper in mines in South America, Africa and Australia. The beta for the stock is estimated to be 0.30. Given the volatility in commodity prices, how would you explain the low beta?

12. You have collected returns on AnaDone Corporation (AD Corp.), a large diversified manufacturing firm, and the NYSE index for five years:

Year	AD Corp	NYSE
1981	10%	5%
1982	5%	15%

1983	-5%	8%
1984	20%	12%
1985	-5%	-5%

a. Estimate the intercept (alpha) and slope (beta) of the regression.

b. If you bought stock in AD Corp. today how much would you expect to make as a return over the next year? [The six-month T.Bill rate is 6%]

c. Looking back over the last five years, how would you evaluate AD's performance relative to the market?

d. Assume now that you are an undiversified investor and that you have all of your money invested in AD Corporation. What would be a good measure of the risk that you are taking on? How much of this risk would you be able to eliminate if you diversify?

e. AD is planning to sell off one of its divisions. The division under consideration has assets which comprise half of the book value of AD Corporation, and 20% of the market value. Its beta is twice the average beta for AD Corp (before divestment). What will the beta of AD Corporation be after divesting this division?

13. You run a regression of monthly returns of Mapco Inc, an oil and gas producing firm, on the S&P 500 index and come up with the following output for the period 1991 to 1995.

Intercept of the regression = 0.06%

X-coefficient of the regression = 0.46

Standard error of X-coefficient = 0.20

R squared = 5%

There are 29.5 million shares outstanding, and the current market price is $ 53. The firm has $ 753 million in debt outstanding. (The firm has a tax rate of 36%)

a. What would an investor in Mapco's stock require as a return, if the T.Bond rate is 6%?

b. What proportion of this firm's risk is diversifiable?

c. Assume now that Mapco has three divisions, of equal size (in market value terms). It plans to divest itself of one of the divisions for $ 20 million in cash and acquire another for $ 50 million (It will borrow $ 30 million to complete this acquisition). The division it is divesting is in a business line where the average unlevered beta is 0.20, and the division it is acquiring is in a business line where the average unlevered beta is 0.80. What will the beta of Mapco be after this acquisition?

14. You have just run a regression of monthly returns of American Airlines (AMR) against the S&P 500 over the last five years. You have misplaced some of the output and are trying to derive it from what you have.

a. You know the R squared of the regression is 0.36, and that your stock has a variance of 67%. The market variance is 12%. What is the beta of AMR?

b. You also remember that AMR was not a very good investment during the period of the regression and that it did worse than expected (after adjusting for risk) by 0.39 % a month for the five years of the regression. During this period, the average riskfree rate was 4.84%. What was the intercept on the regression?

c. You are comparing AMR Inc. to another firm which also has an R squared of 0.48. Will the two firms have the same beta? If not, why not?

15. You have run a regression of <u>monthly</u> returns on Amgen, a large biotechnology firm, against <u>monthly</u> returns on the S&P 500 index, and come up with the following output –

$$R_{stock} = 3.28\% + 1.65\ R_{Market} \qquad\qquad R^2 = 0.20$$

The current one-year treasury bill rate is 4.8% and the current thirty-year bond rate is 6.4%. The firm has 265 million shares outstanding, selling for $ 30 per share.

i. What is the expected return on this stock over the next year?

ii. Would your expected return estimate change if the purpose was to get a discount rate to analyze a thirty-year capital budgeting project?

iii. An analyst has estimated, correctly, that the stock did 51.10% better than expected, annually, during the period of the regression. Can you estimate the annualized riskfree rate that she used for her estimate?

iv. The firm has a debt/equity ratio of 3%, and faces a tax rate of 40%. It is planning to issue $2 billion in new debt and acquire a new business for that amount, with the same risk level as the firm's existing business. What will the beta be after the acquisition?

16. You have just run a regression of monthly returns on MAD Inc., a newspaper and magazine publisher, against returns on the S&P 500, and arrived at the following result –

$$R_{MAD} = -0.05\% + 1.20\, R_{S\&P}$$

The regression has an R-squared of 22%. The current T.Bill rate is 5.5% and the current T.Bond rate is 6.5%. The riskfree rate during the period of the regression was 6%.. Answer the following questions relating to the regression –

a. Based upon the intercept, you can conclude that the stock did

A. 0.05% worse than expected on a monthly basis, during the regression.

B. 0.05% better than expected on a monthly basis during the period of the regression

C. 1.25% better than expected on a monthly basis during the period of the regression.

D. 1.25% worse than expected on a monthly basis during the period of the regression.

E. None of the above. (1 point)

b. You now realize that MAD Inc went through a major restructuring at the end of last month (which was the last month of your regression), and made the following changes –

- The firm sold off its magazine division, which had an unlevered beta of 0.6, for $ 20 million.
- It borrowed an additional $ 20 million, and bought back stock worth $ 40 million.

After the sale of the division and the share repurchase, MAD Inc. had $ 40 million in debt and $ 120 million in equity outstanding.

If the firm's tax rate is 40%, re-estimate the beta, after these changes.

17. Time Warner Inc., the entertainment conglomerate, has a beta of 1.61. Part of the reason for the high beta is the debt left over from the leveraged buyout of Time by Warner in 1989, which amounted to $10 billion in 1995. The market value of equity at Time Warner in 1995 was also $ 10 billion. The marginal tax rate was 40%.

a. Estimate the unlevered beta for Time Warner.

b. Estimate the effect of reducing the debt ratio by 10% each year for the next two years on the beta of the stock.

18. Chrysler, the automotive manufacturer, had a beta of 1.05 in 1995. It had \$ 13 billion in debt outstanding in that year, and 355 million shares trading at \$ 50 per share. The firm had a cash balance of \$ 8 billion at the end of 1995. The marginal tax rate was 36%.

a. Estimate the unlevered beta of the firm.

b. Estimate the effect of paying out a special dividend of \$ 5 billion on this unlevered beta.

c. Estimate the beta for Chrysler after the special dividend.

19. You are trying to estimate the beta of a private firm that manufactures home appliances. You have managed to obtain betas for publicly traded firms that also manufacture home appliances.

Firm	*Beta*	*Debt*	*MV of Equity*
Black & Decker	1.40	\$ 2,500	\$ 3,000
Fedders Corp.	1.20	\$ 5	\$ 200
Maytag Corp.	1.20	\$ 540	\$ 2250
National Presto	0.70	\$ 8	\$ 300
Whirlpool	1.50	\$ 2900	\$ 4000

The private firm has a debt equity ratio of 25%, and faces a tax rate of 40%. The publicly traded firms all have marginal tax rates of 40%, as well.

a. Estimate the beta for the private firm.

b. What concerns, if any, would you have about using betas of comparable firms?

20. As the result of stockholder pressure, RJR Nabisco is considering spinning off its food division. You have been asked to estimate the beta for the division, and decide to do so by obtaining the beta of comparable publicly traded firms. The average beta of comparable publicly traded firms is 0.95, and the average debt/equity ratio of these firms is 35%. The division is expected to have a debt ratio of 25%. The marginal corporate tax rate is 36%.

a. What is the beta for the division?

b. Would it make any difference if you knew that RJR Nabisco had a much higher fixed cost structure than the comparable firms used here?

21. Southwestern Bell, a phone company, is considering expanding its operations into the media business. The beta for the company at the end of 1995 was 0.90, and the debt/equity ratio was 1. The media business is expected to be 30% of the overall firm value in 1999, and the average beta

of comparable firms is 1.20; the average debt/equity ratio for these firms is 50%. The marginal corporate tax rate is 36%.

a. Estimate the beta for Southwestern Bell in 1999, assuming that it maintains its current debt/equity ratio.

b. Estimate the beta for Southwestern Bell in 1999, assuming that it decides to finance its media operations with a debt/equity ratio of 50%.

22. The chief financial officer of Adobe Systems, a growing software manufacturing firm, has approached you for some advice regarding the beta of his company. He subscribes to a service which estimates Adobe System's beta each year, and he has noticed that the beta estimates have gone down every year since 1991 - 2.35 in 1991 to 1.40 in 1995. He would like the answers to the following questions –

a. Is this decline in beta unusual for a growing firm?

b. Why would the beta decline over time?

c. Is the beta likely to keep decreasing over time?

23. You are analyzing Tiffany's, an upscale retailer, and find that the regression estimate of the firm's beta is 0.75; the standard error for the beta estimate is 0.50. You also note that the average unlevered beta of comparable specialty retailing firms is 1.15.

a. If Tiffany's has a debt/equity ratio of 20%, estimate the beta for the company based upon comparable firms. (The tax rate is 40%)

b. Estimate a range for the beta from the regression.

c. How would you reconcile the two estimates? Which one would you use in your analysis?

CHAPTER 5

MEASURING RETURN ON INVESTMENTS

In chapter 4, we developed a process for estimating costs of equity, debt and capital and presented an argument that the cost of capital is the minimum acceptable hurdle rate. We also argued that a project has to earn a return greater than this hurdle rate to create value to the owners of a business. In this chapter, we turn to the question of how best to measure the return on a project. In doing so, we will attempt to answer the following questions:

- What is a project? In particular, how general is the definition of an investment and what are the different types of investment decisions that firms have to make?
- In measuring the return on a project, should we look at the cash flows generated by the project or at the accounting earnings?
- If the returns on a project are unevenly spread over time, how do we consider (or should we not consider) differences in returns across time?

We will illustrate the basics of investment analysis using three hypothetical projects – an online book ordering service for Bookscape, a new theme park in Thailand for Disney and a plant to manufacture linerboard for Aracruz Cellulose.

What is a project?

Investment analysis concerns which projects to accept and which to reject; accordingly, the question of what comprises a "project" is central to this and the following chapters. The conventional project analyzed in capital budgeting has three criteria: (1) a large up-front cost, (2) cash flows for a specific time period, and (3) a salvage value at the end, which captures the value of the assets of the project when the project ends. While such projects undoubtedly form a significant proportion of investment decisions, especially for manufacturing firms, it would be a mistake to assume that investment decision analysis stops there. If a project is defined more broadly to include any decision that results in using the scarce resources of a business, then everything from strategic decisions and

> ***Salvage Value***: This is the estimated liquidation value of the assets invested in the projects at the end of the project life.

acquisitions to decisions about which air conditioning system to use in a building would fall within its reach.

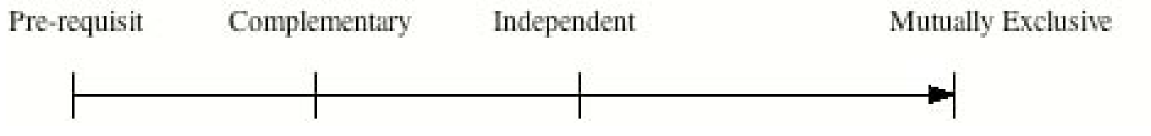
Defined broadly then, any of the following decisions would qualify as projects:

1. Major strategic decisions to enter new areas of business (such as Disney's foray into real estate or Deutsche Bank's into investment banking) or new markets (such as Disney television's expansion into Latin America)
2. Acquisitions of other firms (such as Disney's acquisition of Capital Cities or Deutsche Bank's acquisition of Morgan Grenfell)
3. Decisions on new ventures within existing businesses or markets, such as the one made by Disney to expand its Orlando theme park to include an Animal Kingdom or the decision to produce a new animated children's movie.
4. Decisions that may change the way existing ventures and projects are run, such as decisions on deciding programming schedules on the Disney channel or changing inventory policy at Bookscape.
5. Decisions on how best to deliver a service that is necessary for the business to run smoothly. A good example would be Deutsche Bank's decision on what type of financial information system to acquire to allow traders and investment bankers to do their jobs. While the information system itself might not deliver revenues and profits, it is an indispensable component for other revenue generating projects.

> ***Mutually Exclusive Projects:*** A group of projects is said to be mutually exclusive, when acceptance of one of the projects implies that the rest have to be rejected.

Investment decisions can be categorized on a number of different dimensions. The first relates to how the project affects other projects the firm is considering and analyzing. While some projects are independent of the analysis of any other projects, and thus can be analyzed separately, other projects are mutually exclusive — i.e., taking one project will mean rejecting other projects; in this case, all of the projects will have to be considered together. At the other extreme, some projects are pre-requisites for other projects down the road. In general, projects can be categorized as falling somewhere on the continuum between pre-requisites and mutually exclusive, as depicted in Figure 5.1.

Figure 5.1: The Project Continuum



The second dimension that can be used to classify is the ability of the project to generate revenues or reduce costs. The decision rules that analyze revenue generating projects attempt to evaluate whether the earnings or cash flows from the projects justify the investment needed to implement them. When it comes to cost-reduction projects, the decision rules examine whether the reduction in costs justifies the up-front investment needed for the projects.

Illustration 5.1: Project Descriptions – Disney, Aracruz and Bookscape

In this chapter and parts of the next, we will use three hypothetical projects to illustrate the basics of investment analysis.

- The first project we will look at is a proposal by Bookscape to add an *on-line book ordering and information service*. While the impetus for this proposal comes from the success of on-line book stores like Amazon, this on-line service will be more focused on helping customers research books and find the ones they need rather than on price. Thus, if Bookscape decides to add this service, it will have to hire and train two well qualified individuals to answer customer queries, in addition to investing in the computer equipment and phone lines that the service will require. This project analysis will help illustrate some of the issues that come up when private businesses look at investments and also when businesses take on projects that have a different risk profile.
- The second project we will analyze is a *proposed theme park for Disney in Bangkok*, Thailand. Bangkok Disneyworld, which will be patterned on Euro Disney in Paris and Disney World in Florida, will require a huge investment in infrastructure and take several years to complete. This project analysis will bring several issues to the forefront, including questions of how to deal with projects when the cash flows are in a foreign currency and what to do when projects have very long lives.

- The third project we will consider is a *plant in Brazil to manufacture linerboard* for Aracruz Cellulose. Linerboard is a stiffened paper product that can be transformed into cardboard boxes. This investment is a more conventional one, with an initial investment, a fixed lifetime and a salvage value at the end. We will, however, do the analysis for this project from an equity standpoint to illustrate the generality of investment analysis. In addition, in light of concerns about inflation, we will do the analysis entirely in real terms.

Hurdle rates for firms versus Hurdle rates for projects

In the last chapter, we developed a process for estimating the costs of equity and capital for firms. In this chapter, we will extend the discussion to hurdle rates in the context of new or individual investments.

Using the firm's hurdle rate for individual projects

Can we use the costs of equity and capital that we have estimated for the firms for these projects? In some cases we can, but only if all investments made by a firm are similar in terms of their risk exposure. As a firm's investments become more diverse, in terms of their risk exposure, the firm is less able to use its cost of equity and capital to evaluate these projects. Projects that are riskier have to be assessed using a higher cost of equity and capital than projects that are safer. In this chapter, we consider how to estimate project costs of equity and capital.

What would happen if a firm chose to use its cost of equity and capital to evaluate all projects? This firm would find itself over investing in risky projects and under investing in safe projects. Over time, the firm will become riskier, as its safer businesses find themselves unable to compete with riskier businesses.

Cost of Equity for Projects

In assessing the beta for a project, we will consider three possible scenarios. The first scenario is the one where all the projects considered by a firm are similar in their exposure to risk; this homogeneity makes risk assessment simple. The second scenario is one where a firm is in multiple businesses with different exposures to risk, but projects within each business have the same risk exposure. The third scenario is the most complicated one, where each project considered by a firm has a different exposure to risk.

1. Single Business; Project Risk similar within business

When a firm operates in only one business and all projects within that business share the same risk profile, the firm can use its overall cost of equity as the cost of equity for the project. Since we estimated the cost of equity using a beta for the firm in the last chapter, this would mean that we would use the same beta to estimate the cost of equity for each project that the firm analyzes. The advantage of this approach is that it does not require risk estimation prior to every project, providing managers with a fixed benchmark for their project investments. The approach is restricting, though, since it can be usefully applied only to companies that are in one line of business and take on homogeneous projects.

2. Multiple Businesses with Different Risk Profiles: Project Risk similar within each Business

When firms operate in more than one line of business, the risk profiles are likely to be different across different businesses. If we make the assumption that projects taken within each business have the same risk profile, we can estimate the cost of equity for each business separately and use that cost of equity for all projects within that business. Riskier businesses will have higher costs of equity than safer businesses, and projects taken by riskier businesses will have to cover these higher costs. Imposing the firm's cost of equity on all projects in all businesses will lead to over investing in risky businesses (since the cost of equity will be set too low) and under investing in safe businesses (since the cost of equity will be set too high).

How do we estimate the cost of equity for individual businesses? When the approach requires equity betas, we cannot fall back on the conventional regression approach (in the CAPM) or factor analysis (in the APM), since these approaches require past prices. Instead, we have to use one of the two approaches that we described in the last section as alternatives to regression betas – bottom-up betas based upon other publicly traded firms in the same business or accounting betas, estimated based upon the accounting earnings for the division.

3. Projects with Different Risk Profiles

As a purist, you could argue that each project's risk profile is, in fact, unique, and that it is inappropriate to use either the firm's cost of equity or divisional costs of equity to assess projects. While this may be true, we have to consider the trade off. Given that small differences in the cost of equity should not make a significant difference in our investment decisions, we have to consider whether the added benefits of analyzing each project individually exceed the costs of doing so.

When would it make sense to assess a project's risk individually? If a project is large in terms of investment needs, relative to the firm assessing it, and has a very different risk profile from other investments in the firm, it would make sense to assess the cost of equity for the project independently. The only practical way of estimating betas and costs of equity for individual projects is the bottom-up beta approach.

Cost of Debt for Projects

In the last chapter, we noted that the cost of debt for a firm should reflect its default risk. At the level of individual projects, the assessment of default risk becomes much more difficult, since projects seldom borrow on their own; most firms borrow money for all the projects that they undertake. There are three approaches to estimating the cost of debt for a project:

- One approach is based on the argument that since the borrowing is done by the firm rather than by individual projects, the cost of debt for a project should be the cost of debt for the firm considering the project. This approach makes the most sense when the projects being assessed are small relative to the firm taking them and thus have little or no appreciable effect on the firm's default risk.
- Look at the project's capacity to generate cash flows relative to its financing costs, and to estimate a default risk and cost of debt for the project. The most common approach used to estimate this default risk is to look at other firms that take similar projects, and use the typical default risk and cost of debt for these firms. This approach generally makes sense when the project is large in terms of its capital needs relative to the firm and has different cash flow characteristics

(both in terms of magnitude and volatility) from other investments taken by the firm.

- The third approach applies when a project actually borrows its own funds, with lenders having no recourse against the parent firm, in case the project defaults. While this is unusual, it can occur when investments have significant tangible assets of their own, and the investment is large relative to the firm considering it. In this case, the cost of debt for the project can be assessed using its capacity to generate cash flows relative to its financing obligations. In the last chapter, we used the bond rating of a firm to come up with the cost of debt for the firm. While projects may not be rated, we can still estimate a rating for a project based on financial ratios, and this rating can be used to estimate default risk and the cost of debt.

Financing Mix and Cost of Capital for Projects

To get from the costs of debt and equity to the cost of capital, we have to weight each by their relative proportions in financing. Again, the task is much easier at the firm level, where we use the current market values of debt and equity to arrive at these weights. We may borrow money to fund a project, but it is often not clear whether we are using the debt capacity of the project or the firm's debt capacity. The solution to this problem will again vary depending upon the scenario we face.

- When we are estimating the financing weights for small projects that do not affect a firm's debt capacity, the financing weights should be those of the firm.
- When assessing the financing weights of large projects, with risk profiles different from that of the firm, we have to be more cautious. Using the firm's financing mix to compute the cost of capital for these projects can be misleading, since the project being analyzed may be riskier than the firm as a whole and thus incapable of carrying the firm's debt ratio. In this case, we would argue for the use of the average debt ratio of the other firms in the business in assessing the cost of capital of the project.
- The financing weights for stand-alone projects that are large enough to issue their own debt should be based upon the actual amounts borrowed by the projects. For

firms with such projects, the financing weights can vary from project to projects, as will the cost of debt.

In summary, the cost of debt and debt ratio for a project will reflect the magnitude of the project relative to the firm, and its risk profile, again relative to the firm. Table 5.1 summarizes our analyses:

Table 5.1: Cost of Debt and Debt Ratio: Project Analyses

Project Characteristics	*Cost of Debt*	*Debt Ratio*
Project is small and has cash flow characteristics similar to the firm	Firm's cost of debt	Firm's debt ratio
Project is large and has cash flow characteristics different from the firm	Cost of debt of comparable firms	Average debt ratio of comparable firms
Stand-alone Project	Cost of debt for project (based upon actual or synthetic ratings)	Debt ratio for project

Illustration 5.2: Estimating hurdle rates for individual projects

Using the principles of estimation laid out in the last few pages, we can estimate the hurdles rates for the three projects that we are analyzing in this chapter:

- *Bookscape Online Information & Ordering Service*: Since the beta and cost of equity that we estimated for Bookscape as a company reflect its status as a book store, we will re-estimate the beta for this online project by looking at publicly traded internet retailers. The unlevered total beta[1] of internet retailers is 4.20 and we assume that this project will be funded with the same mix of debt and equity (D/E=20.33%) that Bookscape uses in the rest of the business. We will also assume that Bookscape's tax rate of 40% and pre-tax cost of debt of 5.5% apply to this project as well.

[1] The unlevered market beta for internet retailers is 2.10 and the average correlation of these stocks with the market is 0.50. The unlevered total beta is therefore 2.10/0.5 = 4.20.

Levered Beta for Online Service = 4.20 (1 + (1-.4) (.2033)) = 4.712

Cost of Equity for Online Service = 4% + 4.712 (4.82%) = 26.71%

Cost of Capital for Online Service = 26.71% (.831) + 5.5% (1-.4) (.169) = 22.76%

- *Disneyworld Bangkok*: We did estimate a cost of capital of 9.12% for the Disney theme park business in the last chapter, using a bottom-up levered beta of 1.0625 for the business. The only concern we would have with using this cost of capital for this project is that it may not adequately reflect the additional risk associated with the theme park being in an emerging market. To counter this risk, we compute the cost of equity for the theme park using a risk premium that includes a country risk premium for Thailand:[2]

  Cost of Equity in US $= 4% + 1.0625 (4.82% + 3.30%) = 12.63%

  Cost of Capital in US $ = 12.63% (.7898) + 3.29% (.2102) = 10.66%

  Note that we have assumed that Disney will maintain its overall mix of debt and equity of 21.02% and its current after-tax cost of debt in funding this project.

- *Aracruz Paper Plant*: We estimated the cost of equity and capital for Aracruz's paper business in chapter 4 in real, U.S. dollar and nominal BR terms. In this chapter, we will use the real costs of equity and capital because our cash flows will be estimated in real terms as well:

  Real Cost of Equity for Paper Business = 11.46%

  Real Cost of Capital for Paper Business = 9.00%

In Practice: Exchange Rate Risk, Political Risk and Foreign Projects

When computing the cost of capital for the Disney Bangkok project, we adjusted the cost of capital for the additional risk associated with investing in Thailand. While it may seem obvious that an Thai investment will carry more risk for Disney than an investment in the United States, the question of whether discount rates should be adjusted for country risk is not an easy one to answer. It is true that a Thai investment will carry

[2] We use the same approach we used to estimate the country risk premium for Brazil in the last chapter. The rating for Thailand is Baa1 and the default spread for the country bond is 1.50%. Multiplying this by the relative volatility of 2.2 of the equity market in Thailand (strandard deviation of equity/standard devaiation of country bond) yields a country risk premium of 3.3%.

more risk for Disney than an investment in the United States, both because of exchange rate risk (the cashflows will be in Thai Baht and not in US dollars) and because of political risk (arising from Thailand's emerging market status). However, this risk should affect the discount rate only if it cannot be diversified away by the marginal investors in Disney.

In order to analyze whether the risk in Thaliand is diversifiable to Disney, we went back to our assessment of the marginal investors in the company in chapter 3, where we noted that they were primarily diversified institutional investors. Not only does exchange rate risk affect different companies in their portfolios very differently – some may be hurt by a strengthening dollar and others may be helped – but these investors can hedge exchange rate risk, if they so desire. If the only source of risk in the project were exchange rate, we would be inclined to treat it as diversifiable risk and not adjust the cost of capital. The issue of political risk is more confounding. To the extent that political risk is not only more difficult to hedge but also more likely to carry a non-diversifiable component, especially when we are considering risky emerging markets, the cost of capital should be adjusted to reflect it.

In short, whether we adjust the cost of capital for foreign projects will depend both upon the firm that is considering the project and the country in which the project is located. If the marginal investors in the firm are diversified and the project is in a country with relatively little or no political risk, we would be inclined not to add a risk premium on to the cost of capital. If the marginal investors in the firm are diversified and the project is in a country with significant political risk, we would add a political risk premium to the cost of capital. If the marginal investors in the firm are not diversified, we would adjust the discount rate for both exchange rate and political risk.

Measuring Returns: The Choices

On all of the investment decisions described above, we have to choose between alternative approaches to measuring returns on the investment made. We will present our argument for return measurement in three steps. First, we will contrast accounting earnings and cash flows, and argue that cash flows are much better measures of true return on an investment. Second, we will note the differences between total cash flows and incremental cash flows and present the case for using incremental cash flows in measuring returns. Finally, we will argue that returns that occur earlier in a project life should be weighted more than returns that occur later in a project life, and that the return on an investment should be measured using time-weighted returns.

A. Accounting Earnings versus Cash Flows

The first and most basic choice we have to make when it comes to measuring returns is the one between the accounting measure of income on a project - measured in accounting statements, using accounting principles and standards - and the cash flow generated by a project - measured as the difference between the cash inflows in each period and the cash outflows.

Why are accounting earnings different from cashflows?

Accountants have invested substantial time and resources in coming up with ways of measuring the income made by a project. In doing so, they subscribe to some generally accepted accounting principles (GAAP). Generally accepted accounting principles require the recognition of revenues when the service for which the firm is getting paid has been performed in full or substantially, and has received in return either cash or a receivable that is both observable and measurable. For expenses that are directly linked to the production of revenues (like labor and materials), expenses are recognized in the same period in which revenues are recognized. Any expenses that are not directly linked to the production of revenues are recognized in the period in which the firm consumes the services. While the objective of distributing revenues and expenses fairly across time is a worthy one, the process of accrual accounting does create an accounting earnings number which can be very different from the cash flow generated by a project in any period. There are three significant factors that account for this difference.

1. Operating versus Capital Expenditure

Accountants draw a distinction between expenditures that yield benefits only in the immediate period or periods (such as labor and material for a manufacturing firm) and those that yield benefits over multiple periods (such as land, buildings and long-lived plant). The former are called operating expenses and are subtracted from revenues in computing the accounting income, while the latter are capital expenditures and are not subtracted from revenues in the period that they are made. Instead, the expenditure is spread over multiple periods and deducted as an expense in each period - these expenses are called depreciation (if the asset is a tangible asset like a building) or amortization (if the asset is an intangible asset like a patent or a trade mark).

While the capital expenditures made at the beginning of a project are often the largest and most prominent, many projects require capital expenditures during their lifetime. These capital expenditures will reduce the cash available in each of these periods.

> 5.1. ☞**: What are research and development expenses?**
>
> Research and development expenses are generally considered to be operating expenses by accountants. Based upon our categorization of capital and operating expenses, would you consider research and development expenses to be
>
> *a.* operating expenses
>
> *b.* capital expenses
>
> *c.* could be operating or capital expenses, depending upon the type of research being done.
>
> Why?

2. Non-Cash Charges

The distinction that accountants draw between operating and capital expenses leads to a number of accounting expenses, such as depreciation and amortization, which are not cash expenses. These non-cash expenses, while depressing accounting income, do not reduce cash flows. In fact, they can have a significant positive impact on cash flows, if they affect the tax liability of the firm. Some non-cash charges reduce the taxable income and the taxes paid by a business. The most important of such charges is depreciation, which, while reducing taxable and net income, does not cause a cash outflow. Consequently, depreciation is added back to net income to arrive at the cash flows on a project.

For projects that generate large depreciation charges, a significant portion of the cash flows can be attributed to the tax benefits of depreciation, which can be written as follows

Tax Benefit of Depreciation = Depreciation * Marginal Tax Rate

While depreciation is similar to other tax deductible expenses in terms of the tax benefit it generates, its impact is more positive because it does not generate a concurrent cash outflow.

Amortization is also a non-cash charge, but the tax effects of amortization can vary depending upon the nature of the amortization. Some amortization, such as the amortization of the price paid for a patent or a trade mark, are tax deductible and reduce both accounting income and taxes. Thus, they provide tax benefits similar to depreciation. Other amortization, such as the amortization of the premium paid on an acquisition (called goodwill), reduces accounting income but not taxable income. This amortization does not provide a tax benefit.

While there are a number of different depreciation methods used by firms, they can be classified broadly into two groups. The first is straight line depreciation, whereby equal amounts of depreciation are claimed each period for the life of the project. The second group includes accelerated depreciation methods such as double-declining balance depreciation, which result in more depreciation early in the project life and less in the later years.

3. Accrual versus Cash Revenues and Expenses

The accrual system of accounting leads to revenues being recognized when the sale is made, rather than when the customer pays for the good or service. Consequently, accrual revenues may be very different from cash revenues for three reasons. First, some customers, who bought their goods and services in prior periods, may pay in this period; second, some customers who buy their goods and services in this period (and are therefore shown as part of revenues in this period) may defer payment until future periods. Finally, some customers who buy goods and services may never pay (bad debts). In some cases, customers may even pay in advance for products or services that will not be delivered until future periods.

A similar argument can be made on the expense side. Accrual expenses, relating to payments to third parties, will be different from cash expenses, because of payments made for material and services acquired in prior periods and because some materials and services acquired in current periods will not be paid for until future periods. Accrual taxes will be different from cash taxes for exactly the same reasons.

When material is used to produce a product or deliver a service, there is an added consideration. Some of the material that is used may have been acquired in previous periods and was brought in as inventory into this period, and some of the material that is acquired in this period may be taken into the next period as inventory.

Accountants define net working capital as the difference between current assets (such as inventory and accounts receivable) and current liabilities (such as accounts payable and taxes payable). Differences between accrual earnings and cash earnings, in the absence of non-cash charges, can be captured by changes in the net working capital.

In Practice: The Payoff to Managing Working Capital

Firms that are more efficient in managing their working capital will see a direct payoff in terms of cash flows. Efficiency in working capital management implies that the firm has reduced its net working capital needs without adversely affecting its expected growth in revenues and earnings. Broadly defined, there are four ways in which net working capital can be reduced:

1. While firms need to maintain an inventory to both produce goods and meet customer demand, minimizing this inventory while meeting these objectives can produce a lower net working capital. In fact, recent advances in technology which allow for just-in-time production have helped U.S. firms reduce their inventory needs significantly.
2. Firms that sell goods and services on credit can reduce their net working capital needs by inducing customers to pay their bills faster, and by improving their collection procedures.
3. Firms can also look for suppliers who offer more generous credit terms since accounts payable can be used to finance inventory and accounts receivable.
4. Firms that need cash for operational reasons can reduce their net working capital by keeping this cash balance to its minimum.

From Accounting Earnings to Cashflows

The three factors outlined above can cause accounting earnings to deviate significantly from the cash flows. To get from after-tax operating earnings, which measures the earnings to the firm, to cash flows to all investors in the firm, we have to

- *Add back all non-cash charges*, such as depreciation and amortization, to the operating earnings
- *Subtract out* all cash outflows that represent *capital expenditures*
- *Net out the effect of changes in non-cash working capital*, i.e. changes in accounts receivable, inventory and accounts payable. If non-cash working capital increased, the cash flows will be reduced by the change, whereas if it decreased, there is a cash inflow.

The first two adjustments adjust operating earnings to account for the distinction drawn by accountants between operating and capital expenditures, whereas the last adjustment converts accrual revenues and expenses into cash revenues and expenses.

Cash Flow to Firm = Earnings before interest and taxes (1-t) + Depreciation & Amortization - Change in Non-cash Working Capital - Capital Expenditures

The cash flow to the firm is a pre-debt, after-tax cash flow that measures the cash generated by a project for all claim holders in the firm, after reinvestment needs have been met.

To get from net income, which measures the earnings of equity investors in the firm, to cash flows to equity investors requires the additional step of considering the net cash flow created by repaying old debt and taking on new debt. The difference between new debt issues and debt repayments is called the net debt, and it has to be added back to arrive at cash flows to equity. In addition, other cash flows to non-equity claim holders in the firm, such as preferred dividends, have to be netted from cash flows.

Cash Flow to Equity = Net Income + Depreciation & Amortization - Change in Non-cash Working Capital - Capital Expenditures + (New Debt Issues – Debt Repayments) – Preferred Dividends

The cash flow to equity measures the cash flows generated by a project for equity investors in the firm, after taxes, debt payments and reinvestment needs.

5.2. ☞: **Earnings and Cash Flows**

If the earnings for a firm are positive, the cash flows will also be positive.

a. True

b. False

Why or why not?

In Practice: Managing Earnings

Companies, which have seen the effect on their stock prices of not meeting analyst expectations on earnings, have learned over the last decade to manage their earnings. Accounting standards, strict as they are for U.S. companies, still allow some leeway for firms to move earnings across periods by delaying revenues or expenses, or choosing a different accounting method. Companies like Microsoft not only work at holding down expectations on the part of analysts following them, but also use their growth and flexibility to move earnings across time to beat expectations. In January 1997, Microsoft reported earnings per share of 57 cents for the quarter, beating consensus estimates of 51 cents per quarter, the 41st quarter out of 42 that Microsoft had beaten expectations.

The phenomenon of managing earnings has profound implications for a number of actions that firms may take, from how they sell their products and services, to what kinds of projects they take or firms they acquire and how they account for such investments. While Microsoft has not been guilty of accounting manipulation and has worked strictly within the rules of the game, other companies which have tried to replicate its success have had to resort to far more questionable methods to report earnings that beat expectations.

The Case for Cash Flows

When earnings and cash flows are different, as they are for many projects, we must examine which one provides a more reliable measure of performance. We would argue that accounting earnings, especially at the equity level (net income), can be manipulated at least for individual periods, through the use of creative accounting techniques and strategic allocations. In a book, entitled Accounting for Growth which won national headlines in the United Kingdom and cost the author his job, Terry Smith, an analyst at UBS Phillips & Drew, examined 12 legal accounting techniques commonly used to mislead investors about the profitability of individual firms. To show how creative accounting techniques can increase reported profits, Smith highlighted such companies as Maxwell Communications and Polly Peck, both of which eventually succumbed to bankruptcy.

The second reason for using cash flow is a much more direct one. No business that we know off accepts earnings as payment for goods and services delivered; all of them require cash. Thus, a project with positive earnings and negative cash flows will drain cash from the business undertaking it. Conversely, a project with negative earnings and positive cash flows might make the accounting bottom line look worse, but will generate cash for the business undertaking it.

B. Total versus Incremental Cash Flows

The objective when analyzing a project is to answer the question: Will taking this project make the entire firm or business more valuable? Consequently, the cash flows we should look at in investment analysis are the cash flows the project creates for the firm or business considering it. We will call these cash flows incremental cash flows.

Differences between Incremental and Total Cashflows

The total and the incremental cash flows on a project will generally be different for two reasons. The first is that some of the cash flows on an investment may have occurred already and therefore are unaffected by whether we take the investment or not. Such cash flows are titled sunk costs and should be removed from the analysis. The second is that some of the projected cash flows on any investment will be generated by the firm, whether this investment is accepted or rejected. Allocations of fixed expenses, such as general and administrative costs, usually fall into this category. These cash flows are not incremental and the analysis needs to be cleansed of their impact.

1. Sunk Costs

There are some expenses, related to a project that might be incurred before the project analysis is done. One example would be expenses associated with a test market done to assess the potential market for a product prior to conducting a full-blown investment analysis. Such expenses are called *sunk costs*. Since they will not be recovered if the project is rejected, sunk costs are not incremental and therefore should not be considered as part of the investment analysis. This contrasts with their treatment in accounting statements, that do not distinguish between expenses that have already been incurred and expenses which are still to be incurred.

One category of expenses that consistently falls into the sunk cost column in project analysis is research and development, which occurs well before a product is even considered for introduction. Firms that spend large amounts on research and development, such as Merck and Intel, have struggled to come to terms with the fact that the analysis of these expenses generally occur after the fact, when little can be done about them.

In Practice: Who Will Pay The Sunk Costs?

While sunk costs should not be treated as part of investment analysis, a firm does need to cover its sunk costs over time or it will cease to exist. Consider, for example, a firm like McDonald's, which expends considerable resources in test marketing products before introducing them. Assume, on the ill-fated McLean Deluxe (the low-fat hamburger introduced in 1990), that the test market expenses amounted to $30 million and that the net present value of the project, analyzed after the test market, amounted to $ 20 million. The project should be taken. If this is the pattern for every project McDonald's takes on, however, it will collapse under the weight of its test marketing expenses. To be successful, the cumulated net present value of its successful projects will have to exceed the cumulated test marketing expenses on both its successful and unsuccessful products.

2. Allocated Costs

An accounting device created to ensure that every part of a business bears its fair share of costs is allocation, whereby costs that are not directly traceable to revenues generated by individual products or divisions are allocated across these units, based upon revenues, profits, or assets. While the purposes of such allocations may be rational, their effect on investment analyses have to be viewed in terms of whether they create "incremental" cash flows. An allocated cost that will exist with or without the project being analyzed does not belong in the investment analysis.

Any increase in administrative or staff costs that can be traced to the project is an incremental cost and belongs in the analysis. One way to estimate the incremental component of these costs is to break them down on the basis of whether they are fixed or variable, and, if they are variable, what they are a function of. Thus, a portion of administrative costs may be related to revenue, and the revenue projections of a new project can be used to estimate the administrative costs to be assigned to it.

Illustration 5.3: Dealing with Allocated Costs

Case 1: Assume that you are analyzing a project for a retail firm with general and administrative (G&A) costs currently of $600,000 a year. The firm currently has five stores, and the new project will create a sixth division. The G & A Costs are allocated evenly across the stores; with five stores, the allocation to each store will be $120,000. The firm is considering opening a new store; with six stores, the allocation of G & A expenses to each store will be $100,000.

In this case, assigning a cost of $100,000 for general and administrative costs to the new store in the investment analysis would be a mistake, since it is not an incremental cost — the total G& A cost will be $600,000, whether the project is taken or not.

Case 2: In the analysis above, assume that all the facts remain unchanged except for one. The total general and administrative costs are expected to increase from $600,000 to $660,000 as a consequence of the new store. Each store is still allocated an equal amount; the new store will be allocated one-sixth of the total costs, or $110,000.

In this case, the allocated cost of $110,000 should not be considered in the investment analysis for the new store. The incremental cost of $ 60,000 [$660,000-$600,000], however, should be considered as part of the analysis.

In Practice: Who Will Pay For Headquarters?

As in the case of sunk costs, the right thing to do in project analysis (i.e., considering only direct incremental costs) may not add up to create a firm that is financially healthy. Thus, if a company like Disney does not require individual movies that it analyzes to cover the allocated costs of general administrative expenses of the movie division, it is difficult to see how these costs will be covered at the level of the firm.

In 2003, Disney's corporate shared costs amounted to $443 million. Assuming that these general administrative costs serve a purpose, which otherwise would have to be borne by each of Disney's business, and that there is a positive relationship between the magnitude of these costs and revenues, it seems reasonable to argue that the firm should estimate a fixed charge for these costs that every new investment has to cover, even though this cost may not occur immediately or as a direct consequence of the new investment.

The Argument for Incremental Cash Flows

When analyzing investments it is easy to get tunnel vision and focus on the project or investment at hand, and to act as if the objective of the exercise is to maximize the value of the individual investment. There is also the tendency, with perfect hindsight, to require projects to cover all costs that they have generated for the firm, even if such costs will not be recovered by rejecting the project. The objective in investment analysis is to maximize the value of the business or firm taking the investment. Consequently, it is the cash flows that an investment will add on in the future to the business, i.e, the incremental cash flows, that we should focus on.

Illustration 5.4: Estimating Cash Flows for an On-line Book Ordering Service: Bookscape

As described in illustration 5.1, Bookscape is considering an on-line book ordering and information service, which will be staffed by two full-time employees. The following estimates relate to the costs of starting the service and the subsequent revenues from it:

1. The initial investment needed to start the service, including the installation of additional phone lines and computer equipment, will be $ 1 million. These investments are expected to have a life of 4 years, at which point they will have no salvage value. The investments will be depreciated straight line over the 4-year life.
2. The revenues in the first year are expected to be $ 1.5 million, growing 20% in year 2, and 10% in the two years following.

3. The salaries and other benefits for the employees is estimated to be $150,000 in year 1, and grow 10% a year for the following 3 years.
4. The cost of the books is assumed to be 60% of the revenues in each of the 4 years.
5. The working capital, which includes the inventory of books needed for the service and the accounts receivable (associated with selling books on credit) is expected to amount to 10% of the revenues; the investments in working capital have to be made at the beginning of each year. At the end of year 4, the entire working capital is assumed to be salvaged.
6. The tax rate on income is expected to be 40%, which is also the marginal tax rate for Bookscape.

Based upon this information, we estimate the operating income for Bookscape Online in table 5.2:

Table 5.2: Expected Operating Income on Bookscape Online

	1	*2*	*3*	*4*
Revenues	$1,500,000	$1,800,000	$1,980,000	$2,178,000
Operating Expenses				
Labor	$150,000	$165,000	$181,500	$199,650
Materials	$900,000	$1,080,000	$1,188,000	$1,306,800
Depreciation	$250,000	$250,000	$250,000	$250,000
Operating Income	*$200,000*	*$305,000*	*$360,500*	*$421,550*
Taxes	$80,000	$122,000	$144,200	$168,620
After-tax Operating Income	$120,000	$183,000	$216,300	$252,930

To get from operating income to cash flows, we add back the depreciation charges and subtract out the working capital requirements (which are the changes in working capital from year to year). We also show the initial investment of $ 1 million as a cash outflow right now (year 0) and the salvage value of the entire working capital investment in year 4.

Table 5.3: From Operating Income to After-tax Cashflows

	0 (Now)	*1*	*2*	*3*	*4*
After-tax Operating Income		$120,000	$183,000	$216,300	$252,930
+ Depreciation		$250,000	$250,000	$250,000	$250,000
- Change in Working Capital	$150,000	$30,000	$18,000	$19,800	$ 0
+ Salvage Value					$217,800

After-tax Cashflows	-$1,150,000	$340,000	$415,000	$446,500	$720,730

Note that there is an initial investment in working capital, which is 10% of the first year's revenues, invested at the beginning of the year. Each subsequent year has a change in working capital that represents 10% of the revenue change from that year to the next.

5.4. ☞: **The Effects of Working Capital**

In the analysis above, we assumed that Bookscape would have to maintain additional inventory for its on-line book service. If, instead, we had assumed that Bookscape could use its existing inventory (i.e.. from its regular bookstore), the cash flows on this project

a. will increase

b. will decrease

c. will remain unchanged

Explain.

Illustration 5.5: Estimating Incremental Cash Flows: Disney Theme Park

The theme parks to be built near Bangkok, modeled on Euro Disney in Paris, will include a "Magic Kingdom" to be constructed, beginning immediately, and becoming operational at the beginning of the second year, and a second theme park modeled on Epcot Center at Orlando to be constructed in the second and third year and becoming operational at the beginning of the fifth year. The following is the set of assumptions that underlie the investment analysis:

1. The cash flows will be estimated in nominal dollars, even thought he actual cashflows will be in Thai baht.
2. The cost of constructing Magic Kingdom will be $3 billion, with $ 2 billion to be spent right now, and $1 Billion to be spent one year from now. Disney has already spent $0.5 Billion researching the proposal and getting the necessary licenses for the park; none of this investment can be recovered if the park is not built.
3. The cost of constructing Epcot II will be $ 1.5 billion, with $ 1 billion to be spent at the end of the second year and $0.5 billion at the end of the third year.
4. The revenues at the two parks and the resort properties at the parks are assumed to be the following, based upon projected attendance figures until the tenth year and an

expected inflation rate of 2% (in US dollars). Starting in year 10, the revenues are expected to grow at the inflation rate. Table 5.4 summarizes the revenue projections:

Table 5.4: Revenue Projections: Disney Bangkok

Year	*Magic Kingdom*	*Epcot II*	*Resort Properties*	*Total*
1	$0	$0	$0	$0
2	$1,000	$0	$250	$1,250
3	$1,400	$0	$350	$3,000
4	$1,700	$300	$500	$4,250
5	$2,000	$500	$625	$5,625
6	$2,200	$550	$688	$6,563
7	$2,420	$605	$756	$7,219
8	$2,662	$666	$832	$7,941
9	$2,928	$732	$915	$8,735
10	$2,987	$747	$933	$9,242
Beyond	Revenues grow 2% a year forever			

Note that the revenues at the resort properties are set at 25% of the revenues at the theme parks.

5. The operating expenses are assumed to be 60% of the revenues at the parks, and 75% of revenues at the resort properties.
6. The depreciation will be calculated as a percent of the remaining book value of the fixed assets at the end of each year. In addition, the parks will require capital maintenance investments each year, specified as a percent of the depreciation that year. Table 5.5 lists both these statistics by year:[3]

Table 5.5: Depreciation and Capital Maintenance Percentages

Year	*Depreciation as % of book value*	*Capital Maintenance as % of /Depreciation*
1	0.00%	0.00%
2	12.70%	50.00%
3	11.21%	60.00%
4	9.77%	70.00%
5	8.29%	80.00%
6	8.31%	90.00%
7	8.34%	100.00%
8	8.38%	105.00%

[3] Capital maintenance expenditures are capital expenditures to replace fixed assets that break or become obsolete. An example would be the replacement of a ride at Magic Kingdom.

9	8.42%	110.00%
10	8.42%	110.00%

The capital maintenance expenditures are low in the early years, when the parks are still new but increase as the parks age. After year 10, both depreciation and capital expenditures are assumed to grow at the inflation rate (2%).

7. Disney will also allocate corporate general and administrative costs to this project, based upon revenues; the G&A allocation will be 15% of the revenues each year. It is worth noting that a recent analysis of these expenses found that only one-third of these expenses are variable (and a function of total revenue) and that two-thirds are fixed. After year 10, these expenses are also assumed to grow at the inflation rate of 2%.
8. Disney will have to maintain non-cash working capital (primarily consisting of inventory at the theme parks and the resort properties, netted against accounts payable) of 5% of revenues, with the investments being made at the *end of each year*.
9. The income from the investment will be taxed at Disney's marginal tax rate of 37.6%.

The projected operating earnings at the theme parks, starting in the first year of operation (which is the second year) are summarized in Exhibit 5.1. Note that the project has no income or expenses until year 2 when the first park becomes operational and that the project is expected to have an operating loss of $262 million in that year. We have assumed that the firm will have enough income in its other businesses to claim the tax benefits from these losses (37.3% of the loss) in the same year. If this had been a stand-alone project, we would have had to carry the losses forward into future years and reduce taxes in those years.

These operating earnings can be contrasted with the after-tax cash flows in exhibit 5.2, with the projected capital expenditures shown as part of the cash flows. In estimating these cash flows, we have made the following adjustments:

- Added back the depreciation and amortization each year, since it is a non-cash charge
- Subtracted out the maintenance capital expenditures in addition to the primary capital expenditures since these are cash outflows
- Added back the after-tax portion of the allocated general and administrative costs that are fixed and therefore not an incremental effect of the project.

After-tax Fixed Allocated G&A = (2/3) (Allocated G&A Expense) (1 – tax rate)

- Subtracted out the working capital requirements each year, which represent the change in working capital from the prior year. In this case, we have assumed that the working capital investments are made at the end of each year.

The investment of $3 billion in Bangkok Magic Kingdom is shown at time 0 (as $ 2 billion) and in year 1 (as $ 1 billion). The investment of $0.5 billion that will not be recovered because it has already been spent is not considered because it is a sunk cost.

5.5. ☞: **Different Depreciation Methods for Tax Purposes and for Reporting**

The depreciation that we used for the project above is assumed to be the same for both tax and reporting purposes. Assume now that Disney uses more accelerated depreciation methods for tax purposes and straight-line depreciation for reporting purposes. In estimating cash flows, we should use

a. the depreciation numbers from the tax books

b. the depreciation numbers from the reporting books

Explain.

This spreadsheet allows you to estimate the cash flows to the firm on a project

Exhibit 5.1: Operating Earnings at Disney Theme Parks in Bangkok

	Now (0)	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Magic Kingdom		$0	$1,000	$1,400	$1,700	$2,000	$2,200	$2,420	$2,662	$2,928	$2,987
Second Theme Park		$0	$0	$0	$300	$500	$550	$605	$666	$732	$747
Resort & Properties		$0	$250	$350	$500	$625	$688	$756	$832	$915	$933
Total Revenues			*$1,250*	*$1,750*	*$2,500*	*$3,125*	*$3,438*	*$3,781*	*$4,159*	*$4,575*	*$4,667*
Magic Kingdom: Operating Expenses		$0	$600	$840	$1,020	$1,200	$1,320	$1,452	$1,597	$1,757	$1,792
Epcot II: Operating Expenses		$0	$0	$0	$180	$300	$330	$363	$399	$439	$448
Resort & Property: Operating Expenses		$0	$188	$263	$375	$469	$516	$567	$624	$686	$700
Depreciation & Amortization		$0	$537	$508	$430	$359	$357	$358	$361	$366	$369
Allocated G&A Costs		$0	$188	$263	$375	$469	$516	$567	$624	$686	$700
Operating Income		*$0*	*-$262*	*-$123*	*$120*	*$329*	*$399*	*$473*	*$554*	*$641*	*$657*
Taxes		$0	-$98	-$46	$45	$123	$149	$177	$206	$239	$245
Operating Income after Taxes			-$164	-$77	$75	$206	$250	$297	$347	$402	$412
Depreciation Calculations											
Pre-project investment	$500										
New Investment – Magic Kingdom	$2,000	$1,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
New Investment - Epcot II	$0	$0	$1,000	$500	$0	$0	$0	$0	$0	$0	$0
Capital Maintenance		$0	$268	$305	$301	$287	$321	$358	$380	$403	$406
Depreciation as % of book value			12.5%	11%	9.5%	8%	8%	8%	8%	8%	8%
Depreciation		$0	$537	$508	$430	$359	$357	$358	$361	$366	$369
Book Value of Fixed Assets[a]	$2,500	$3,500	$4,232	$4,529	$4,400	$4,328	$4,292	$4,292	$4,310	$4,347	$4,384

[a] Book value of fixed assets in year t = Book value of fixed assets in year t –1 + New Cap Ex + Capital Maintenance - Depreciation

Exhibit 5.2: Operating Cash Flows at Disney Them Parks in Bangkok

	Now (0)	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Operating Income after Taxes			-$165	-$77	$75	$206	$251	$297	$347	$402	$412
+ Depreciation & Amortization			$537	$508	$430	$359	$357	$358	$361	$366	$369
- Capital Expenditures	$2,000	$1,000	$1,269	$805	$301	$287	$321	$358	$379	$403	$406
- Change in Working Capital	$0	$0	$63	$25	$38	$31	$16	$17	$19	$21	$5
+ Non-incremental Allocated Expense (1-t)		$0	$78	$110	$157	$196	$216	$237	$261	$287	$293
Cashflow to Firm	-$2,000	-$1,000	-$880	-$289	$324	$443	$486	$517	$571	$631	$663

Illustration 5.6: Estimating Cash Flows to Equity for a New Plant: Aracruz

Aracruz Cellulose is considering a plan to build a state-of-the-art plant to manufacture linerboard. The plant is expected to have a capacity of 750,000 tons and will have the following characteristics:

1. It will require an initial investment of 250 Million BR. At the end of the fifth year, an additional investment of 50 Million BR will be needed to update the plant.
2. Aracruz plans to borrow 100 Million BR, at a real interest rate of 5.25%, using a 10-year term loan (where the loan will be paid off in equal annual increments).
3. The plant will have a life of 10 years. During that period, the plant (and the additional investment in year 5) will be depreciated using double declining balance depreciation, with a life of 10 years.[4] At the end of the tenth year, the plant is expected to be sold for its remaining book value.
4. The plant will be partly in commission in a couple of months, but will have a capacity of only 650,000 tons in the first year, 700,000 tons in the second year before getting to its full capacity of 750,000 tons in the third year.
5. The capacity utilization rate will be 90% for the first 3 years, and rise to 95% after that.
6. The price per ton of linerboard is currently $400, and is expected to keep pace with inflation for the life of the plant.
7. The variable cost of production, primarily labor and material, is expected to be 55% of total revenues; there is a fixed cost of 50 Million BR, which will grow at the inflation rate.
8. The working capital requirements are estimated to be 15% of total revenues, and the investments have to be made at the beginning of each year. At the end of the tenth year, it is anticipated that the entire working capital will be salvaged.

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[4] With double declining balance depreciation, we double the straight line rate (which would be 10% a year in this case with a 10-year life) and apply that rate to the remaining book value. We apply this rate to the investment in year 5 as well.

Before we estimate the net income on this project, we have to consider the debt payments each year and break them down into interest and principal payments. Table 5.6 summarizes the results:

Table 5.6: Debt Payments – Aracruz Paper Plant

Year	*Beginning Debt*	*Interest expense*	*Principal Repaid*	*Total Payment*	*Ending Debt*
1	R$ 100,000	R$ 5,250	R$ 7,858	R$ 13,108	R$ 92,142
2	R$ 92,142	R$ 4,837	R$ 8,271	R$ 13,108	R$ 83,871
3	R$ 83,871	R$ 4,403	R$ 8,705	R$ 13,108	R$ 75,166
4	R$ 75,166	R$ 3,946	R$ 9,162	R$ 13,108	R$ 66,004
5	R$ 66,004	R$ 3,465	R$ 9,643	R$ 13,108	R$ 56,361
6	R$ 56,361	R$ 2,959	R$ 10,149	R$ 13,108	R$ 46,212
7	R$ 46,212	R$ 2,426	R$ 10,682	R$ 13,108	R$ 35,530
8	R$ 35,530	R$ 1,865	R$ 11,243	R$ 13,108	R$ 24,287
9	R$ 24,287	R$ 1,275	R$ 11,833	R$ 13,108	R$ 12,454
10	R$ 12,454	R$ 654	R$ 12,454	R$ 13,108	R$ 0

Note that while the total payment remains unchanged, the break down into interest and principal payments changes from year to year.

Exhibit 5.3 summarizes the net income from plant investment to Aracruz each year for the next 10 years. Note that all of the projections are in real cashflows. Consequently, the price of paper (which grows at the same rate as inflation) is kept constant in real terms, as is any other item having this characteristic.

In Exhibit 5.4 we estimate the cash flows to equity from the plant to Aracruz. To arrive at these cash flows, we do the following:

- Subtract out the portion of the initial capital expenditures that comes from equity; of the initial investment of 250,000 BR, only 150,000 BR comes from equity. In year 5, there is an additional investment of 50,000 BR.
- Add back depreciation and amortization, since they are non-cash charges.
- Subtract the changes in working capital; since investments in working capital are made at the beginning of each period, the initial investment in working capital of 35.1 million BR is made at time 0 and is 15% of revenues in year 1. The changes in working capital in the years that follow are 15% of the changes in revenue in those years. At the end of year 10, the entire investment in working capital is recovered as salvage.

- Subtract the principal payments that are made to the bank in each period, since these are cash outflows to the non-equity claimholders in the firm.
- Add the salvage value of the plant in year 10 to the total cash flows, since this is a cash inflow to equity investors.

The cash flows to equity measure the cash flows that equity investors at Aracruz can expect to receive from investing in the plant.

5.6. ☞**: The Effects of Debt Financing on Cashflows to Equity**

In the analysis above, we assumed an additional capital expenditure of 50 Million BR in year 5, financed entirely with funds from equity; the cash flow to equity in year 5 (from exhibit 5.4) is –5,411 Million BR. If, instead, we had assumed the 50 Million BR had come from new borrowing, the cash flow to equity in year 5

a. will increase by 50 Million BR

b. will decrease by 50 Million BR

c. will remain unchanged

Explain.

This spreadsheet allows you to estimate the cash flows to equity on a project

Exhibit 5.3: Estimated Net Income from Paper Plant Investment: Aracruz Cellulose

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Capacity (in '000s)	650	700	750	750	750	750	750	750	750	750
Utilization Rate	90%	90%	90%	95%	95%	95%	95%	95%	95%	95%
Production	585	630	675	713	713	713	713	713	713	713
Price per ton	400	400	400	400	400	400	400	400	400	400
Revenues	*234,000*	*252,000*	*270,000*	*285,000*	*285,000*	*285,000*	*285,000*	*285,000*	*285,000*	*285,000*
Operating Expenses	178,700	188,600	198,500	206,750	206,750	206,750	206,750	206,750	206,750	206,750
Depreciation	35,000	28,000	22,400	17,920	14,336	21,469	21,469	21,469	21,469	21,469
Operating Income	20,300	35,400	49,100	60,330	63,914	56,781	56,781	56,781	56,781	56,781
- Interest	5,250	4,837	4,403	3,946	3,465	2,959	2,426	1,865	1,275	654
Taxable Income	15,050	30,563	44,697	56,384	60,449	53,822	54,355	54,916	55,506	56,127
- Taxes	5,117	10,391	15,197	19,170	20,553	18,300	18,481	18,671	18,872	19,083
Net Income	9,933	20,171	29,500	37,213	39,896	35,523	35,874	36,244	36,634	37,044
Beg. Book Value	250,000	215,000	187,000	164,600	146,680	182,344	160,875	139,406	117,938	96,469
- Depreciation[a]	35,000	28,000	22,400	17,920	14,336	21,469	21,469	21,469	21,469	21,469
End Book Value	215,000	187,000	164,600	146,680	182,344	160,875	139,406	117,938	96,469	75,000

[a]Depreciation is 20% of depreciable value (Remaining book value – Salvage) until year 6. In year 6, we switch to straight line for the remaining depreciable value over the remaining life because it yields a higher depreciation ($11,469). We also depreciate the second investment in year 5 straight line over 5 years.

Exhibit 5.4: Cash Flows to Equity from Paper Plant: Aracruz Cellulose

	0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Net Income		9,933	20,171	29,500	37,213	39,896	35,523	35,874	36,244 BR	36,634 BR	37,044 BR
+ Depreciation & Amortization		35,000	28,000	22,400	17,920	14,336	21,469	21,469	21,469	21,469	21,469
- Capital Expenditures	150,000	0	0	0	0	50,000	0	0	0	0	0
- Change in Working Capital	35,100	2,700	2,700	2,250	0	0	0	0	0	0	
- Principal Repayments		7,858	8,271	8,705	9,162	9,643	10,149	10,682	11,243	11,833	12,454
+ Salvage Value of Assets[b]											117,750
Cashflow to Equity	(185,100)	34,375	37,201	40,945	45,971	(5,411)	46,842	46,661	46,470	46,270	163,809

[b]Salvage Value of Assets = Salvage value of Plant and Equipment (75,000) + Salvage value of working capital (42,750)

In Practice: Estimating Expected Revenues and Cash flows

How do we estimate a project's expected revenues and expenses? The key word in this question is "estimate". No one, no matter what his or her skill at forecasting and degree of preparation, can forecast with certainty how a project will do. There are generally three ways in which we can make these forecasts:

a. *Experience and History*: The process of estimating project revenues and expenses is simplest for firms that consider the same kind of projects repeatedly. These firms can use their experience from similar projects that are already in operation to estimate expected values for new projects. Disney, for instance, can use its experiences with its theme parks in the United States, Tokyo Disney and Euro Disney in making its estimates for Disney Bangkok.

b. *Market Testing*: If the project being assessed is different from the firm's existing business, we may need a preliminary assessment of the market before actually investing in the project. In a market survey, potential customers are asked about the product or service being considered, to gauge the interest they would have in acquiring it. The results usually are qualitative and indicate whether the interest is strong or weak, allowing the firm to then decide whether to use optimistic forecasts for revenues (if the interest is strong) or pessimistic forecasts (if the interest is weak). Companies that need more information will often test market the concept on smaller markets, before introducing it on a larger scale. Test marketing not only allows firms to test out the product or service directly, but also yields far more detailed information about the potential size of the market.

c. *Scenario Analysis*: There are cases in which a firm is considering introducing a product to a market it knows well, but there is considerable uncertainty introduced by external factors that the firm cannot control. In such cases, a firm may decide to consider different scenarios, and the revenues and expenses on the project under each scenario. While the concept is a simple one, it has four critical components. The first is the determination of which factors the scenarios will be built around. The second component is determining the number of scenarios to analyze for each factor. While more scenarios may be more realistic than fewer, it becomes more difficult to collect information and differentiate between the scenarios in terms of project revenues. The third component is the estimation of project revenues and expenses under each scenario. The final component is the assignment of probabilities to each scenario.

While we have laid out three ways of estimating revenues and expenses for projects, none of these approaches yields perfect estimates. While some project risk may come from estimation error, a large portion of risk comes from real uncertainty about the future. Improving estimation techniques, using more market testing and doing scenario analysis may reduce estimation error but cannot eliminate real uncertainty. This is why we incorporate a risk premium into the discount rate.

C. Time-Weighted versus Nominal Cash Flows

Very few projects with long lifetimes generate earnings or cash flows evenly over their life. In sectors with huge investments in infra structure, such as telecommunications, the earnings and cash flows might be negative for an extended period (say ten to twenty years) before they turn positive. In other sectors, the earnings may occur earlier in time. Whatever the reason for the unevenness of cash flows, a basic question that has to be addressed when measuring returns is whether they should reflect the timing of the earnings or cash flows. We will argue that they should, with earlier earnings and cash flows being weighted more than earnings and cash flows later in a project life.

Why cash flows across time are not comparable

There are three reasons why cash flows across time are not comparable, and a cash flow in the future is worth less than a similar cash flow today:

(1) Individuals prefer present consumption to future consumption. People would have to be offered more in the future to give up present consumption - this is called the real rate of return. The greater the real rate of return, the greater will be the difference in value between a cash flow today and an equal cash flow in the future.

(2) When there is monetary inflation, the value of currency decreases over time. The greater the inflation, the greater the difference in value between a cash flow today and a cash flow in the future.

(3) Any uncertainty (risk) associated with the cash flow in the future reduces the value of the cashflow. The greater the uncertainty associated with the cash flow, the greater will

be the difference between receiving the cash flow today and receiving an equal amount in the future.

The process by which future cash flows are adjusted to reflect these factors is called discounting, and the magnitude of these factors is reflected in the discount rate. Thus the present value of a cash flow (CF_t) at a point in time 't' in the future, when the discount rate is r, can be written as follows:

$$\text{Present Value of Cash Flow} = CF_t \left(\frac{1}{(1+r)^t} \right)$$

Note that the second term in the brackets $\left(\frac{1}{(1+r)^t} \right)$ is called the discount factor and effectively weights the cash flow by when it occurs. The differences in weights across time will depend entirely upon the level of the discount rate. Consequently, when discount rates are high, which could be due to high real rates, high inflation and/or high uncertainty, returns that occur further in the future will be weighted less. Appendix 1 includes a more complete discussion of the mechanics of present value.

The Case for Time-weighted Returns

If we accept the arguments that cash flows measure returns more accurately than earnings, and that the incremental cash flows more precisely estimate returns than total cash flows, we should logically follow up by using discounted cash flows (i.e., time-weighted returns) rather than nominal cash flows for two reasons.

1. Nominal cash flows at different points in time are not comparable, and cannot be aggregated to arrive at returns. Discounted cash flows, on the other hand, convert all cash flows on a project to today's terms and allow us to compute returns more consistently.
2. If the objective in investment analysis is to maximize the value of the business taking the investments, we should be weighting cash flows that occur early more than cash flow that occur later, because investors in the business will also do so.

5.7. ☞**: Time Horizons and Time Weighting**

Calculating present values for cash flows leads to a greater weighting for cash flows that occur sooner and a lower weighting for cash flows that occur later. Does it necessarily follow that using present value (as opposed to nominal value) makes managers more likely to take short-term projects over long term projects?

a. Yes

b. No

Why or why not?

Investment Decision Rules

Having estimated the accounting earnings, cashflows and time-weighted cashflows on an investment, we are still faced with the crucial decision of whether we should take the investment or not. In this section, we will consider a series of investment decision rules and put them to the test.

What is an investment decision rule?

When faced with new investments and projects, firms have to decide whether to invest in them or not. While we have been leading up to this decision over the last few chapters, investment decision rules allow us to formalize the process and specify what condition or conditions need to be met for a project to be acceptable. While we will be looking at a variety of investment decision rules in this section, it is worth keeping in mind what characteristics we would like a good investment decision rule to have.

- First, a good investment decision rule has to maintain a fair balance between allowing a manager analyzing a project to bring in his or her *subjective assessments* into the decision, and ensuring that different projects are judged *consistently*. Thus, an investment decision rule that is too mechanical (by not allowing for subjective inputs) or too malleable (where managers can bend the rule to match their biases) is not a good rule.
- Second, a good investment decision rule will allow the firm to further our stated objective in corporate finance, which is to *maximize the value of the firm*. Projects that are acceptable, using the decision rule, should increase the value of the firm accepting them, while projects that do not meet the requirements would destroy value if the firm invested in them.
- Third, a good investment decision rule should *work across a variety of investments*. Investments can be revenue-generating investments (such as the Home Depot opening

a new store) or they can be cost saving investments (as would be the case if Boeing adopted a new system to manage inventory). Some projects have large up-front costs (as is the case with the Boeing Super Jumbo), while other projects may have costs spread out across time. A good investment rule will provide an answer on all of these different kinds of investments.

Does there have to be only one investment decision rule? While many firms analyze projects using a number of different investment decision rules, one rule has to dominate. In other words, when the investment decision rules lead to different conclusions on whether the project should be accepted or rejected, one decision rule has to be the tie-breaker and can be viewed as the primary rule.

Accounting Income Based Decision Rules

Many of the oldest and most established investment decision rules have been drawn from the accounting statements and, in particular, from accounting measures of income. Some of these rules are based on income to equity investors (i.e., net income) while others are based on pre-debt operating income.

Return on Capital

The return on capital on a project measures the returns earned by the firm on it is total investment in the project. Consequently, it is a return to all claimholders in the firm on their collective investment in a project. Defined generally,

$$\text{Return on Capital (Pre-tax)} = \frac{\text{Earnings before interest and taxes}}{\text{Average Book Value of Total Investment in Project}}$$

$$\text{Return on Capital (After-tax)} = \frac{\text{Earnings before interest and taxes (1- tax rate)}}{\text{Average Book Value of Total Investment in Project}}$$

To illustrate, consider a 1-year project, with an initial investment of \$ 1 million, and earnings before interest and taxes of \$300,000. Assume that the project has a salvage value at the end of the year of \$800,000, and that the tax rate is 40%. In terms of a time line, the project has the following parameters:

Earnings before interest & taxes = $ 300,000

Book Value = $ 1,000,000 Salvage Value = $ 800,000

Average Book Value of Assets = $(1,000,000+$800,000)/2 = $ 900,000

The pre-tax and after-tax returns on capital can be estimated as follows:

$$\text{Return on Capital (Pre-tax)} = \frac{\$\ 300{,}000}{\$\ 900{,}000} = 33.33\%$$

$$\text{Return on Capital (After-tax)} = \frac{\$\ 300{,}000\ (1 - 0.40)}{\$\ 900{,}000} = 20\%$$

While this calculation is rather straightforward for a 1-year project, it becomes more involved for multi-year projects, where both the operating income and the book value of the investment change over time. In these cases, the return on capital can either be estimated each year and then averaged over time or the average operating income over the life of the project can be used in conjunction with the average investment during the period to estimate the average return on capital.

The after-tax return on capital on a project has to be compared to a hurdle rate that is defined consistently. The return on capital is estimated using the earnings before debt payments and the total capital invested in a project. Consequently, it can be viewed as return to the firm, rather than just to equity investors. Consequently, the cost of capital should be used as the hurdle rate.

If the after-tax return on capital > Cost of Capital -> Accept the project

If the after-tax return on capital < Cost of Capital -> Reject the project

For instance, if Disney in the example, above, had a cost of capital of 10%, it would view the investment in the new software as a good one.

Illustration 5.7: Estimating and Using Return on Capital in Decision Making: Disney and Bookscape

In illustration 5.4 and 5.5, we estimated the operating income from two projects - an investment by Bookscape in an on-line book ordering service and an investment in a theme park in Bangkok by Disney. We will estimate the return on capital on each of these investments using these estimates of operating income. Table 5.7 summarizes the estimates of operating income and the book value of capital at Bookscape.

Table 5.7: Return on Capital on Bookscape On-line

	1	*2*	*3*	*4*	*Average*
After-tax Operating Income	$120,000	$183,000	$216,300	$252,930	$193,058
BV of Capital: Beginning	$1,150,000	$930,000	$698,000	$467,800	
BV of Capital: Ending	$930,000	$698,000	$467,800	$0	
Average BV of Capital	$1,040,000	$814,000	$582,900	$233,900	$667,700
Return on Capital	11.54%	22.48%	37.11%	108.14%	28.91%

The book value of capital each year includes the investment in fixed assets and the non-cash working capital. If we average the year-specific returns on capital, the average return on capital is 44.82% but this number is pushed up by the extremely high return in year 4. A better estimate of the return on capital is obtained by dividing the average after-tax operating income over the four years by the average capital invested over the four years, which yields a return on capital of 28.91%. Since this exceeds the cost of capital that we estimated in illustration 5.2 for this project of 22.76%, the return on capital approach would suggest that this is a good project.

In table 5.8, we estimate operating income, book value of capital and return on capital for Disney's theme park investment in Thailand. The operating income estimates are from exhibit 5.1:

Table 5.8: Return on Capital for Disney Theme Park Investment

Year	After-tax Operating Income	BV of Capital: Beginning	BV of Capital: Ending	Average BV of Capital	ROC
1	$0	$2,500	$3,500	$3,000	NA
2	-$165	$3,500	$4,294	$3,897	-4.22%
3	-$77	$4,294	$4,616	$4,455	-1.73%
4	$75	$4,616	$4,524	$4,570	1.65%
5	$206	$4,524	$4,484	$4,504	4.58%
6	$251	$4,484	$4,464	$4,474	5.60%
7	$297	$4,464	$4,481	$4,472	6.64%
8	$347	$4,481	$4,518	$4,499	7.72%
9	$402	$4,518	$4,575	$4,547	8.83%
10	$412	$4,575	$4,617	$4,596	8.97%
	$175			$4,301	4.23%

The book value of capital includes the investment in fixed assets (capital expenditures), net of depreciation, and the investment in working capital that year and the return on capital each year is computed based upon the average book value of capital invested during the year. The average after-tax return on capital over the 10-year period is 4.21%. Here, the return on capital is lower than the cost of capital that we estimated in illustration 5.2 to be 10.66% and this suggests that Disney should not make this investment.

Return on Equity

The return on equity looks at the return to equity investors, using the accounting net income as a measure of this return. Again, defined generally,

$$\text{Return on Equity} = \frac{\text{Net Income}}{\text{Average Book Value of Equity Investment in Project}}$$

To illustrate, consider a 4-year project with an initial equity investment of $ 800, and the following estimates of net income in each of the 4 years:

Net Income		$ 140	$ 170	$ 210	$ 250
BV of Equity	$ 800	$ 700	$ 600	$ 500	$ 400
Return on Equity		18.67%	26.15%	38.18%	55.56%

Like the return on capital, the return on equity tends to increase over the life of the project, as the book value of equity in the project is depreciated.

Just as the appropriate comparison for the return on capital is the cost of capital, the appropriate comparison for the return on equity is the cost of equity, which is the rate of return equity investors demand.

Decision Rule for ROE Measure for Independent Projects		
If the Return on Equity > Cost of Equity	->	Accept the project
If the Return on Equity < Cost of Equity	->	Reject the project

The cost of equity should reflect the riskiness of the project being considered and the financial leverage taken on by the firm. When choosing between mutually exclusive projects of similar risk, the project with the higher return on equity will be viewed as the better project.

Illustration 5.8: Estimating Return on Equity - Aracruz Cellulose

Consider again the analysis of the paper plant for Aracruz Cellulose that we started in illustration 5.6. Table 5.9 summarizes the book value of equity and the estimated net income (from exhibit 5.3) for each of the next ten years in thousands of real BR.

Table 5.9: Return on Equity: Aracruz Paper Plant

Year	*Net Income*	*Beg. BV: Assets*	*Depreciation*	*Capital Exp.*	*Ending BV: Assets*	*BV of Working Capital*	*Debt*	*BV: Equity*	*Average BV: Equity*	*ROE*
0		0	0	250,000	250,000	35,100	100,000	185,100		
1	9,933	250,000	35,000	0	215,000	37,800	92,142	160,658	172,879	5.75%
2	20,171	215,000	28,000	0	187,000	40,500	83,871	143,629	152,144	13.26%
3	29,500	187,000	22,400	0	164,600	42,750	75,166	132,184	137,906	21.39%
4	37,213	164,600	17,920	0	146,680	42,750	66,004	123,426	127,805	29.12%
5	39,896	146,680	14,336	50,000	182,344	42,750	56,361	168,733	146,079	27.31%
6	35,523	182,344	21,469	0	160,875	42,750	46,212	157,413	163,073	21.78%
7	35,874	160,875	21,469	0	139,406	42,750	35,530	146,626	152,020	23.60%
8	36,244	139,406	21,469	0	117,938	42,750	24,287	136,400	141,513	25.61%
9	36,634	117,938	21,469	0	96,469	42,750	12,454	126,764	131,582	27.84%
10	37,044	96,469	21,469	0	75,000	0	0	75,000	100,882	36.72%
										23.24%

To compute the book value of equity in each year, we first compute the book value of the fixed assets (plant and equipment), add to it the book value of the working capital in that year and subtract out the outstanding debt. The return on equity each year is obtained by dividing the net income in that year by the average book value of equity invested in the plant in that year. The increase in the return on equity over time occurs because the net income rises, while the book value of equity decreases. The average real return on equity of 22.91% on the paper plant project is compared to the real cost of equity for this plant, which is 11.40%, suggesting that this is a good investment.

Assessing Accounting Return Approaches

How well do accounting returns measure up to the three criteria that we listed for a good investment decision rule? In terms of maintaining balance between allowing managers to bring into the analysis their judgments about the project and ensuring consistency between analysis, the accounting returns approach falls short. It fails because it is significantly affected by accounting choices. For instance, changing from straight line to accelerated depreciation affects both the earnings and the book value over time, thus altering returns. Unless these decisions are taken out of the hands of individual managers assessing projects, there will be no consistency in the way returns are measured on different projects.

Does investing in projects that earn accounting returns exceeding their hurdle rates lead to an increase in firm value? The value of a firm is the present value of expected cash flows on the firm over its lifetime. Since accounting returns are based upon earnings, rather than cash flows, and ignore the time value of money, investing in projects that earn a return greater than the hurdle rates will not necessarily increase firm value. Conversely, some projects that are rejected because their accounting returns fall short of the hurdle rate may have increased firm value. This problem is compounded by the fact that the returns are based upon the book value of investments, rather than the cash invested in the assets.

Finally, the accounting return works better for projects that have a large up-front investment and generate income over time. For projects that do not require a significant initial investment, the return on capital and equity has less meaning. For instance, a retail firm that leases store space for a new store will not have a significant initial investment, and may have a very high return on capital as a consequence.

Note that all of the limitations of the accounting return measures are visible in the last two illustrations. First, the Disney example does not differentiate between money already spent and money still to be spent; rather, the sunk cost of $ 0.5 billion is shown in the initial investment of $3.5 billion. Second, in both the Bookscape and Aracruz analyses, as the book value of the assets decreases over time, largely as a consequence of depreciation, the operating income rises, leading to an increase in the return on capital. With the Disney analysis, there is one final and very important concern. The return on capital was estimated over 10 years but the project life is likely to be much longer. After all, Disney's existing theme parks in the United States are more than three decades old and generate substantial cashflows for the firm still. Extending the project life will push up the return on capital and may make this project viable.

Notwithstanding these concerns, accounting measures of return endure in investment analysis. While this fact can be partly attributed to the unwillingness of financial managers to abandon familiar measures, it also reflects the simplicity and intuitive appeal of these measures. More importantly, as long as accounting measures of return are used by investors and equity research analysts to assess to overall performance of firms, these same measures of return will be used in project analysis.

capbudg.xls: This spreadsheet allows you to estimate the average return on capital on a project

Returns on Capital and Equity for Entire Firms

The discussion of returns on equity and capital has so far revolved around individual projects. It is possible, however, to calculate the return on equity or capital for an entire firm, based upon its current earnings and book value. The computation parallels the estimation for individual projects but uses the values for the entire firm:

$$\text{Return on Capital (ROC or ROIC)} = \frac{\text{EBIT}(1-\text{t})}{(\text{Book Value of Debt } + \text{ Book Value of Equity})}$$

$$\text{Return on Equity} = \frac{\text{Net Income}}{\text{Book Value of Equity}}$$

We use book value rather than market value because it represents the investment (at least as measured by investments) in existing investments. This return can be used as an approximate measure of the returns that the firm is making on its existing investments or assets, as long as the following assumptions hold:

1. The income used (operating or net) is income derived from existing projects and is not skewed by expenditures designed to provide future growth (such as R&D expenses) or one-time gains or losses.

2. More importantly, the book value of the assets used measures the actual investment that the firm has in these assets. Here again, stock buybacks and goodwill amortization can create serious distortions in the book value.[5]
3. The depreciation and other non-cash charges that usually depress income are used to make capital expenditures that maintain the existing asset's income earning potential.

If these assumptions hold, the return on capital becomes a reasonable proxy for what the firm is making on its existing investments or projects, and the return on equity becomes a proxy for what the equity investors are making on their share of these investments.

With this reasoning, a firm that earns a return on capital that exceeds it cost of capital can be viewed as having, on average, good projects on its books. Conversely, a firm that earns a return on capital that is less than the cost of capital can be viewed as having, on average, bad projects on its books. From the equity standpoint, a firm that earns a return on equity that exceeds its cost of equity can be viewed as earnings "surplus returns" for its stockholders, while a firm that does not accomplish this is taking on projects that destroy stockholder value.

Illustration 5.9: Evaluating Current Investments

In table 5.10, we have summarized the current returns on capital and costs of capital for Disney, Aracruz and Bookscape. The book values of debt and equity at the beginning of the year (2003) were added together to compute the book value of capital invested, and the operating income for the most recent financial year (2003) is used to compute the return on capital.[6] Considering the issues associated with measuring debt and cost of capital for financial services firms, we have not computed the values for Deutsche Bank:

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[5] Stock buybacks and large write offs will push down book capital and result in overstated accounting returns. Acquisitions that create large amounts of goodwill will push up book capital and result in understated returns on capital.

[6] Some analysts use average capital invested over the year, obtained by averaging the book value of capital at the beginning and end of the year. By using the capital invested at the beginning of the year, we have assumed that capital invested during the course of year is unlikely to generate operating income during that year.

Table 5.10: Return on Capital and Cost of Capital Comparison

Company	*EBIT (1-t)*	*BV of Debt*	*BV of Equity*	*BV of Capital*	*Return on Capital*	*Cost of Capital*	*ROC - Cost of Capital*
Disney	$1701	14130	23879	38009	4.48%	8.59%	-4.12%
Aracruz	BR 586	2862	6385	9248	6.34%	9.00%	-2.66%
Bookscape	$ 1200	0	4500	4500	26.67%	12.14%	14.53%

The marginal tax rates used in chapter 4 are used here as well. While this analysis suggests that only Bookscape is earning excess returns, the following factors should be considered:

1. The book value of capital is affected fairly dramatically by accounting decisions. In particular, Disney's capital invested increased by almost $20 billion from 1995 to 1996 as a result of the acquisition of Capital Cities, and Disney's decision to use purchase accounting. If they had chosen pooling instead, they would have reported a return on capital that exceeded their cost of capital by a healthy amount.
2. We have used the operating income from the most recent year, notwithstanding the volatility in the income. To smooth out the volatility, we can compute the average operating income over the last 3 years and use it in computing the return on capital; this approach generates a "normalized" return on capital of 4.36% for Disney and 3.40% for Aracruz. Both are still below the cost of capital.
3. We did not adjust the operating income or the book value of capital to include operating leases that were outstanding at the end of the prior year. If we had made the adjustment for Disney and Bookscape, the returns on capital would have changed to 4.42% and 12.78% respectively.[7]
4. For Aracruz, we are assuming that since the book values are adjusted for inflation, the return on capital is a real return on capital and can be compared to the real cost of capital.[8]

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[7] To adjust the operating income, we add back the operating lease expense from the most recent year and subtract out the depreciation on the operating lease asset. To adjust the book value of capital, we add the present value of operating leases at the end of the previous year to debt.

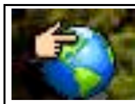
[8] Brazilian accounting standards allow for the adjustment of book value for inflation.

The analysis can also be done in purely equity terms. To do this, we would first compute the return on equity for each company by dividing the net income for the most recent year by the book value of equity at the beginning of the year and compare it to the cost of equity. Table 5.11 summarizes these results:

Table 5.11: Return on Equity and Cost of Equity Comparisons

Company	*Net Income*	*BV of Equity*	*ROE*	*Cost of Equity*	*ROE - Cost of Equity*
Disney	1267	23879	5.31%	10.00%	-4.70%
Aracruz	428	6385	6.70%	10.79%	-4.09%
Bookscape	1320	4500	29.33%	13.93%	15.40%
Deutsche Bank	1365	29991	4.55%	8.76%	-4.21%

The conclusions are similar, with Bookscape earning excess returns, whereas the other companies all have returns that lag the cost of equity.

There is a dataset on the web that summarizes, by sector, returns on equity and capital as well as costs of equity and capital.

In Practice: Economic Value Added (EVA)

Economic value added is a value enhancement concept that has caught the attention of both firms interested in increasing their value and portfolio managers, looking for good investments. EVA is a measure of dollar surplus value created by a firm or project and is measured by doing the following:

Economic Value Added (EVA) = (Return on Capital - Cost of Capital) (Capital Invested)

The return on capital is measured using “adjusted” operating income, where the adjustments[9] eliminate items that are unrelated to existing investments, and the capital investment is based upon the book value of capital, but is designed to measure the capital invested in existing assets. Firms that have positive EVA are firms that are creating surplus value, and firms with negative EVA are destroying value.

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[9] Stern Stewart, which is the primary proponent of the EVA approach, claims to make as many as 168 adjustments to operating income to arrive at the true return on capital.

While EVA is usually calculated using total capital, it can be easily modified to be an equity measure:

Equity EVA = (Return on Equity - Cost of Equity) (Equity Invested in Project or Firm)

Again, a firm that earns a positive equity EVA is creating value for its stockholders while a firm with a negative equity EVA is destroying value for its stockholders.

The measures of excess returns that we computed in the tables in the last illustration can be easily modified to become measures of EVA:

Company	*ROC - Cost of Capital*	*BV of Capital*	*EVA*	*ROE - Cost of Equity*	*BV of Equity*	*Equity EVA*
Disney	-4.12%	38009	-1565	-4.70%	23879	-1122
Aracruz	-2.66%	9248	-246	-4.09%	6385	-261
Bookscape	14.53%	4500	654	15.40%	4500	693
Deutsche Bank	NMF	NMF	NMF	-4.21%	29991	-1262

Note that EVA converts the percentage excess returns in these tables to absolute excess returns, but it is affected by the same issues of earnings and book value measurement.

5.8. ☞**: Stock Buybacks, Return on Capital and EVA**

When companies buy back stock, they are allowed to reduce the book value of their equity by the market value of the stocks bought back. When the market value of equity is well in excess of book value of equity, buying back stock will generally

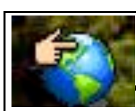
a. increase the return on capital but not affect the EVA

b. increase the return on capital and increase the EVA

c. not affect the return on capital but increase the EVA

d. none of the above

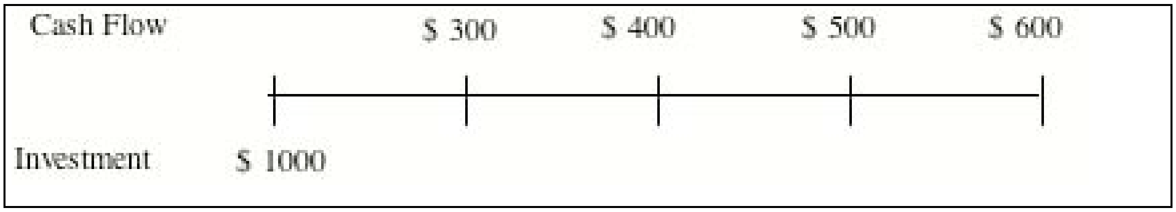
Why or why not?

There is a dataset on the web that summarizes, by sector, the economic value added and the equity economic value added in each.

Cash Flow Based Decision Rules

Payback

The payback on a project is a measure of how quickly the cash flows generated by the project cover the initial investment. Consider a project that has the following cash flows:



The payback on this project is between 2 and 3 years and can be approximated, based upon the cash flows to be 2.6 years.[10]

> ***Payback:*** The payback for a project is the length of time it will take for nominal cash flows from the project to cover the initial investment.

As with the other measures, the payback can be estimated either for all investors in the project or just for the equity investors. To estimate the payback for the entire firm, the free cash flows to the firm are cumulated until they cover the total initial investment. To estimate payback just for the equity investors, the free cash flows to equity are cumulated until they cover the initial equity investment in the project.

Illustration 5.10: Estimating Payback for the Bookscape Online Service

The following example estimates the payback from the viewpoint of the firm, using the Bookscape On-line Service cash flows estimated in illustration 5.4. Table 5.12 summarizes the annual cashflows and the cumulated value of the cashflows.

Table 5.12: Payback for Bookscape Online

Year	*Cashflow in year*	*Cumulated Cashflow*
0	-1150000	
1	340000	-810000
2	415000	-395000
3	446500	51500

4	720730	772230

The initial investment of $1.15 million is made sometime in the third year, leading to a payback of between two and three years. If we assume that cashflows occur uniformly over the course of the year:

Payback for Project = 2 + (395000/446500) = 2.88 years

Using Payback in Decision Making

While it is uncommon for firms to make investment decisions based solely on the payback, surveys suggest that some businesses do in fact use payback as their primary decision mechanism. In those situations where payback is used as the primary criterion for accepting or rejecting projects, a “maximum” acceptable payback period is typically set. Projects that pay back their initial investment sooner than this maximum are accepted, while projects that do not are rejected.

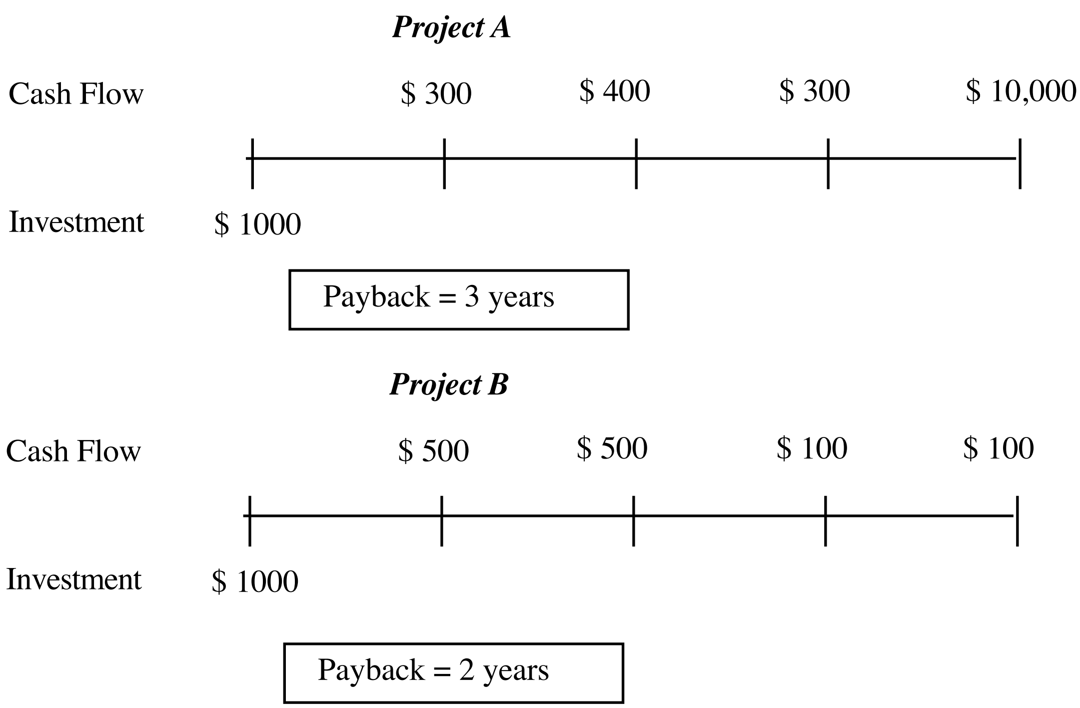
Firms are much more likely to employ payback as a secondary investment decision rule and use it either as a constraint in decision making (e.g.: Accept projects that earn a return on capital of at least 15%, as long as the payback is less than 10 years) or to choose between projects that score equally well on the primary decision rule (e.g.: when two mutually exclusive projects have similar returns on equity, choose the one with the lower payback.)

Biases, Limitations, and Caveats

The payback rule is a simple and intuitively appealing decision rule, but it does not use a significant proportion of the information that is available on a project.

- By restricting itself to answering the question “When will this project make its initial investment?” it ignores what happens after the initial investment is recouped. This is a significant shortcoming when deciding between mutually exclusive projects. To provide a sense of the absurdities this can lead to, assume that you are picking between two mutually exclusive projects with the cash flows shown in Figure 5.2:

Figure 5.2: Using Payback for Mutually Exclusive Projects



On the basis of the payback alone, project B is preferable to project A, since it has a shorter payback period. Most decision makers would pick project A as the better project, however, because of the high cash flows that result after the initial investment is paid back.

- The payback rule is designed to cover the conventional project that involves a large up-front investment followed by positive operating cash flows. It breaks down, however, when the investment is spread over time or when there is no initial investment.
- The payback rule uses nominal cash flows and counts cash flows in the early years the same as cash flows in the later years. Since money has time value, however, recouping the nominal initial investment does not make the business whole again, since that amount could have been invested elsewhere and earned a significant return.

Discounted Cash Flow Measures

Investment decision rules based on discounted cash flows not only replace accounting income with cash flows, but explicitly factor in the time value of money. The two most widely used discounted cash flows rules are *net present value* and the *internal rate of return*.

Net Present Value (NPV)

The net present value of a project is the sum of the present values of each of the cash flows — positive as well as negative — that occurs over the life of the project. The general formulation of the NPV rule is as follows

$$\boxed{\text{NPV of Project} = \sum_{t=1}^{t=N} \frac{CF_t}{(1+r)^t} - \text{Initial Investment}}$$

where

CF_t = Cash flow in period t

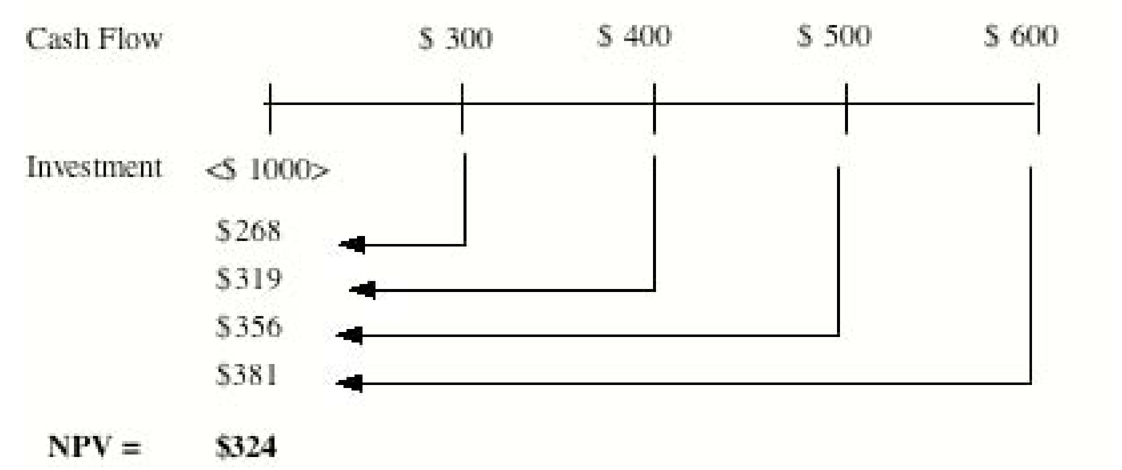
r = Discount rate

N = Life of the project

> ***Net Present Value (NPV):*** The net present value of a project is the sum of the present values of the expected cash flows on the project, net of the initial investment.

Thus, the net present value of a project with the cash flows depicted in Figure 5.3 and a discount rate of 12% can be written as:

Figure 5.3: NPV of a Project



Once the net present value is computed, the decision rule is extremely simple since the hurdle rate is already factored in the present value.

Decision Rule for NPV for Independent Projects

If the NPV > 0 -> Accept the project

If the NPV < 0 -> Reject the project

Note that a net present value that is greater than zero implies that the project makes a return greater than the hurdle rate. The following examples illustrate the two approaches.

This spreadsheet allows you to estimate the NPV from cash flows to the firm on a project

5.9. ☞: **The Significance of a positive Net Present Value**

Assume that you have analyzed a $100 million project, using a cost of capital of 15%, and come up with a net present value of $ 1 million. The manager who has to decide on the project argues that this is too small of a NPV for a project of this size, and that this indicates a "poor" project. Is this true?

a. Yes. The NPV is only 1% of the initial investment

b. No. A positive NPV indicates a good project

Explain your answer.

Illustration 5.11: NPV From The Firm's Standpoint - Bookscape On-line

Table 5.13 calculates the present value of the cash flows to Bookscape, as a firm, from the proposed on-line book ordering service, using the cost of capital of 22.76% as the discount rate on the cash flows. (The cash flows are estimated in illustration 5.4 and the cost of capital is estimated in illustration 5.2)

Table 5.13: FCFF on Bookscape On-line

Year	Annual Cashflow	PV of Cashflow
0	($1,150,000)	$ (1,150,000)
1	$ 340,000	$ 276,969
2	$ 415,000	$ 275,392
3	$ 446,500	$ 241,366
4	$ 720,730	$ 317,380
NPV		$ (38,893)

This project has a net present value of -$38,893, suggesting that it is a project that should not be accepted, based on the projected cash flows and the cost of capital of 22.76%.

Illustration 5.12: NPV From The Firm's Standpoint - Disney's Theme Park in Bangkok

In estimating the cash flows to discount for Disney's theme park in Thailand, the first point to note when computing the net present value of the proposed theme park in Thailand is the fact that it has a life far longer than the ten years shown in exhibit 5.2. To bring in the cash flows that occur after year 10, when cash flows start growing at 2%, the inflation rate forever, we draw on a present value formula for a growing perpetuity (See appendix 1):

Present Value of Cash Flows after year 10 $= FCFF_{11}/(WACC - g)$

$= \$ 663$ million/(.1066-.02)

= \$7,810 million

The cost of capital of 10.66% is the cost of capital for Bangkok theme park that we estimated in illustration 5.2. This present value is called the *terminal value* and occurs at the end of year 10.

Table 5.14 presents the net present value of the proposed theme parks in Thailand are estimated using the cash flows in nominal dollars, from exhibit 5.2, and Disney's cost of capital, in dollar terms, of 10.66%.

Table 5.14: Net Present Value of Disney Bangkok Theme Park

Year	*Annual Cashflow*	*Terminal Value*	*Present Value*
0	-\$2,000		-\$2,000
1	-\$1,000		-\$904
2	-\$880		-\$719
3	-\$289		-\$213
4	\$324		\$216
5	\$443		\$267
6	\$486		\$265
7	\$517		\$254
8	\$571		\$254
9	\$631		\$254
10	\$663	\$7,810	\$3,076
			\$749

The net present value of this project is positive. This suggests that it is a good project that will earn surplus value for Disney.

NPV and Currency Choices

When analyzing a project, the cashflows and discount rates can often be estimated in one of several currencies. For a project like the Disney theme park, the obvious choices are the project's local currency (Thai Baht) and the company's domicile currency (U.S. dollars) but we can in fact use any currency to evaluate the project. When switching from one currency to another, we have to go through the following steps:

1. *Estimate the expected exchange rate for each period of the analysis:* For some currencies (Euro, Yen or British pound), we can estimates of expected exchange rates from the financial markets in the form of forward rates. For other currencies, we weill have to estimate the exchange rate and the safest way to do so is to use the expected inflation rates in the two currencies in question. For instance, we can estimate the expected Baht/$ exchange rate in n years:

$$\text{Expected Rate (Bt/\$)} = \text{Bt/\$ (Today)} \;*\; \left[\frac{(1+\text{ Expected Inflation}_{\text{Thailand}})}{(1+\text{ Expected Inflation}_{\text{US}})}\right]^{n}$$

   We are assuming that purchasing power ultimately drives exchange rates – this is called purchasing power parity.

2. *Convert the expected cashflows from one currency to another in future periods, using these exchange rates:* Multiplying the expected cashflows in one currency to another will accomplish this.

3. *Convert the discount rate from one currency to another:* We cannot discount cashflows in one currency using discount rates estimated in another. To convert a discount rate from one currency to another, we will again use expected inflation rates in the two currencies. A dollar cost of capital can be converted into a Thai Baht cost of capital as follows:

$$\text{Cost of Capital(Bt)} = (1 + \text{Cost of Capital (\$)}) \;*\; \frac{(1+\text{Exp Inflation}_{\text{Thailand}})}{(1+\text{Exp Inflation}_{\text{US}})} - 1$$

a. Compute the net present value by discounting the converted cashflows (from step 2) at the converted discount rate (from step 3): The net present value should be identical in both currencies but only because the expected inflation rate was used to estimate the exchange rates. If the forecasted exchange rates diverge from purchasing power parity, we can get different net present values but our currency views are then contaminating our project analysis.

Illustration 5.13: NPV In Thai Baht - Disney's Theme Park in Bangkok

In illustration 5.12, we computed the net present value for the Disney Theme park in dollar terms to be $2,317 million. The entire analysis could have been done in Thai Baht terms. To do this, the cash flows would have to be converted from dollars to Thai Baht and the discount rate would then have been a Thai Baht discount rate. To estimate the expected exchange rate, we will assume that the expected inflation rate to be 10% in Thailand and 2% in the United States and the current exchange rate is 42.09 Bt per dollar, the projected exchange rate in one year will be:

Expected Exchange Rate in year 1 = 42.09 Bt * (1.10/1.02) = 45.39 Bt/$

Similar analysis will yield exchange rates for each of the next 10 years.

The dollar cost of capital of 10.35%, estimated in illustration 5.1, is converted to a Baht cost of capital using the expected inflation rates:

$$\text{Cost of Capital (Bt)} = (1 + \text{Cost of Capital (\$)}) * \frac{(1+\text{Exp Inflation}_{\text{Thailand}})}{(1+\text{Exp Inflation}_{\text{US}})} - 1$$

$$= (1.1066)\ (1.10/1.02) - 1 = 19.34\%$$

Table 5.15 summarizes exchange rates, cash flows and the present value for the proposed Disney theme parks, with the analysis done entirely in Thai Baht.

Table 5.15: Expected Cashflows from Disney Theme Park in Thai Bt

Year	*Cashflow ($)*	*Bt/$*	*Cashflow (Bt)*	*Present Value*
0	-2000	42.09	-84180	-84180
1	-1000	45.39	-45391	-38034
2	-880	48.95	-43075	-30243
3	-289	52.79	-15262	-8979
4	324	56.93	18420	9080
5	443	61.40	27172	11223
6	486	66.21	32187	11140
7	517	71.40	36920	10707
8	571	77.01	43979	10687
9	631	83.04	52412	10671
10	8474	89.56	758886	129470
NPV of Disney Theme Park =				31,542

Note that the net present value of 31,542 million Bt is exactly equal to the dollar net present value computed in illustration 5.12, converted at the current exchange rate of 42.09 Bt per dollar.

NPV in dollars = NPV in Bt/ Current exchange rate = 31,542/42.09 = $749 million

Terminal Value, Salvage Value and Net Present Value

When estimating cashflows for an individual project, practicality constrains us to estimate cashflows for a finite period – 3,5 or 10 years, for instance. At the end of that finite period, we can make one of three assumptions.

- The most conservative one is that the project ceases to exist and that its assets are worthless. In that case, the final year of operation will reflect only the operating cashflows from that year.
- We can assume that the project will end at the end of the analysis period and that the assets will be sold for salvage. While we can try to estimate salvage value directly, a common assumption that is made is that salvage value is equal to the book value of the assets. For fixed assets, this will be the undepreciated portion of the initial investment whereas for working capital, it will be the aggregate value of the investments made in working capital over the course of the project life.
- We can also assume that the project will not end at the end of the analysis period and try to estimate the value of the project on an ongoing basis – this is the terminal value. In the Disney theme park analysis, for instance, we assumed that the cashflows will continue forever and grow at the inflation rate each year. If that seems too optimistic, we can assume that the cashflows will continue wth no growth or even that they will drop by a constant rate each year.

The right approach to use will depend upon the project being analyzed. For projects that are not expected to last for long periods, we can use either of the first two approaches; a zero salvage value should be used if the project assets are likely to become obsolete by the end of the project life (example: computer hardware) and salvage can be set to book value if the assets are likely to retain significant value (example: buildings).

For projects with long lives, the terminal value approach is likely to yield more reasonable results but with one caveat. The investment and maintenance assumptions made in the analysis should reflect its long life. In particular, capital maintenance expenditures will be much higher for projects with terminal value since the assets have to retain their earning power. In the Disney theme park, the capital maintenance expenditures climb over time and become larger than depreciation as we approach the terminal year.

5.10. ☞: **Currency Choices and NPV**

A company in a high inflation economy has asked for your advice regarding which currency to use for investment analysis. The company believes that using the local currency to estimate the NPV will yield too low a value, because domestic interest rates are very high - this, in turn, would push up the discount rate. Is this true?

a. Yes. A higher discount rate will lead to lower NPV

b. No.

Explain your answer.

NPV: Firm versus Equity Analysis

In the analysis above, the cashflows that we discounted were prior to interest and principal payments and the discount rate we used was the weighted average cost of capital. In NPV parlance, we were discounting cashflows to the entire firm (rather than just its equity investors) at a discount rate that reflected the costs to different claimholders in the firm to arrive at a net present value. There is an alternative. We could have discounted the cashflows left over after debt payments for equity investors at the cost of equity and arrived at a net present value to equity investors.

Will the two approaches yield the same net present value? As a general rule, they will but only if the following assumptions hold:

- The debt is correctly priced and the market interest rate to compute the cost of capital is the right one, given the default risk of the firm. If not, it is possible that equity investors can gain (if interest rates are set too low) or lose (if interest rates are set too high) to bondholders. This, in turn, can result in the net present value to equity being different from the net present value to the firm.

- The same assumptions are made about the financing mix used in both calculations. Note that the financing mix assumption affects the discount rate (cost of capital) in the firm approach and the cashflows (through the interest and principal payments) in the equity approach.

Given that the two approaches yield the same net present value, which one should we choose to use? Many practitioners prefer discounting cashflows to the firm at the cost of capital, because it is easier to do, since the cashflows are before debt payments and we do not therefore have to estimate interest and principal payments explicitly. Cashflows to equity are more intuitive, though, since most of us think of cashflows left over after interest and principal payments as residual cashflows.

Illustration 5.14: NPV from the Equity Investors' Standpoint- Paper Plant for Aracruz

The net present value is computed from the equity investors' standpoint for the proposed linerboard plant, for Aracruz, using real cash flows to equity, estimated in exhibit 5.4 and a real cost of equity of 11.40 %. Table 5.16 summarizes the cashflows and the present values.

Table 5.16: FCFE on Linerboard Plant (in '000s)

Year	*FCFE*	*PV of FCFE*
0	(185,100 BR)	(185,100 BR)
1	34,375 BR	30,840 BR
2	37,201 BR	29,943 BR
3	40,945 BR	29,568 BR
4	45,971 BR	29,784 BR
5	(5,411 BR)	(3,145 BR)
6	46,842 BR	24,427 BR
7	46,661 BR	21,830 BR
8	46,470 BR	19,505 BR
9	46,270 BR	17,424 BR
10	163,809 BR	55,342 BR
NPV		70,418 BR

The net present value of 70.418 million BR suggests that this is a good project for Aracruz to take on.

The analysis was done entirely in real terms, but using nominal cashflows and discount rate would have had no impact on the net present value. The cashflows will be higher because of expected inflation but the discount rate will increase by exactly the same magnitude, thus resulting in an identical net present value. The choice between nominal and real cash flows therefore boils down to one of convenience. When inflation rates are low, it is better to do the analysis in nominal terms since taxes are based upon nominal income. When inflation rates are high and volatile, it is easier to do the analysis in real terms or in a different currency with a lower expected inflation rate.

5.11. ☞**: Equity, Debt and Net Present Value**

In the project described above, assume that Aracruz had used all equity to finance the project, instead of its mix of debt and equity. Which of the following is likely to occur to the NPV?

a. The NPV will go up, because the cash flows to equity will be much higher; there will be no interest and principal payments to make each year.

b. The NPV will go down, because the initial investment in the project will much higher

c. The NPV will remain unchanged, because the financing mix should not affect the NPV

d. The NPV might go up or down, depending upon .....

Explain your answer.

Properties of the NPV Rule

The net present value has several important properties that make it an attractive decision rule.

1. Net present values are additive

> ***Assets in Place:*** These are the assets already owned by a firm, or projects that it has already taken.

The net present values of individual projects can be aggregated to arrive at a cumulative net present value for a business or a division. No other investment decision rule has this property. The property itself raises a number of implications.

- The value of a firm can be written in terms of the net present values of the projects it has already taken on as well as the net present values of prospective future projects

$$\boxed{\text{Value of a Firm} = \sum \text{Present Value of Projects in Place} + \sum \text{NPV of expected future projects}}$$

The first term in this equation captures the value of *assets in place*, while the second term measures the value of *expected future growth*. Note that the present value of projects in place is based on anticipated future cash flows on these projects.

- When a firm terminates an existing project that has a negative present value based on anticipated future cash flows, the value of the firm will increase by that amount. Similarly, when a firm takes on a new project, with a negative net present value, the value of the firm will decrease by that amount.
- When a firm divests itself of an existing asset, the price received for that asset will affect the value of the firm. If the price received exceeds the present value of the anticipated cash flows on that project to the firm, the value of the firm will increase with the divestiture; otherwise, it will decrease.
- When a firm invests in a new project with a positive net present value, the value of the firm will be affected depending upon whether the NPV meets expectations. For example, a firm like Microsoft is expected to take on high positive NPV projects and this expectation is built into value. Even if the new projects taken on by Microsoft have positive NPV, there may be a drop in value if the NPV does not meet the high expectations of financial markets.
- When a firm makes an acquisition, and pays a price that exceeds the present value of the expected cash flows from the firm being acquired, it is the equivalent of taking on a negative net present value project and will lead to a drop in value.

2. Intermediate Cash Flows are invested at the hurdle rate

Implicit in all present value calculations are assumptions about the rate at which intermediate cash flows get reinvested. The net present value rule assumes that intermediate cash flows on a projects —, i.e., cash flows that occur between the initiation and the end of the project — get reinvested at the hurdle rate, which is the cost of capital if the cash flows are to the firm and the cost of equity if the cash flows are to equity investors. Given that both the cost of equity and capital are based upon the returns that can be made on alternative investments of equivalent risk, this assumption should be a reasonable one.

> ***Hurdle Rate:*** This is the minimum acceptable rate of return that a firm will accept for taking a given project.

3. NPV Calculations allow for expected term structure and interest rate shifts

In all the examples throughout in this chapter, we have assumed that the discount rate remains unchanged over time. This is not always the case, however; the net present value can be computed using time-varying discount rates. The general formulation for the NPV rule is as follows

$$\text{NPV of Project} = \sum_{t=1}^{t=N} \frac{CF_t}{\prod_{j=1}^{j=t} (1 + r_t)} - \text{Initial Investment}$$

where

CF_t = Cash flow in period t

r_t = One-period Discount rate that applies to period t

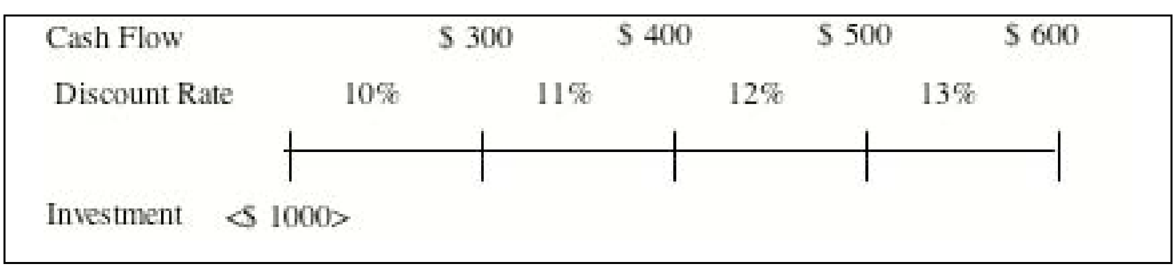
N = Life of the project

The discount rates may change for three reasons:

- The level of interest rates may change over time and the term structure may provide some insight on expected rates in the future.
- The risk characteristics of the project may be expected to change in a predictable way over time, resulting in changes in the discount rate.
- The financing mix on the project may change over time, resulting in changes in both the cost of equity and the cost of capital.

Illustration 5.15: NPV Calculation With Time-Varying Discount Rates

Assume that you are analyzing a 4-year project, investing in computer software development. Further, assume that the technological uncertainty associated with the software industry leads to higher discount rates in future years.



The present value of each of the cash flows can be computed as follows –

PV of Cash Flow in year 1 = $ 300 / 1.10 = $ 272.72

PV of Cash Flow in year 2 = \$ 400/ (1.10 * 1.11) = \$ 327.60

PV of Cash Flow in year 3 = \$ 500/ (1.10 * 1.11 * 1.12) = \$ 365.63

PV of Cash Flow in year 4 = \$ 600/ (1.10 * 1.11 * 1.12 * 1.13) = \$ 388.27

NPV of Project = \$ 272.72+ \$ 327.60+ \$ 365.63+ \$ 388.27 - \$ 1000.00 = \$354.23

5.12. ☞: **Changing Discount Rates and NPV**

In the above analysis, assume that you had been asked to use one discount rate for all of the cash flows. Is there a discount rate that would yield the same NPV as the one above?

a. Yes

b. No

If yes, how would you interpret this discount rate?

Biases, Limitations, and Caveats

In spite of its advantages and its linkage to the objective of value maximization, the net present value rule continues to have its detractors, who point out several limitations

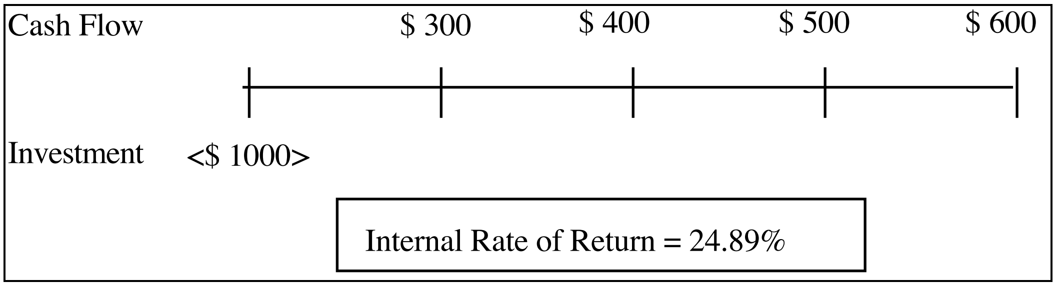
- The net present value is stated in absolute rather than relative terms and does not, therefore, factor in the scale of the projects. Thus, project A may have a net present value of \$200, while project B has a net present value of \$100, but project A may require an initial investment that is ten or 100 times larger than project B. Proponents of the NPV rule argue that it is surplus value, over and above the hurdle rate, no matter what the investment.
- The net present value rule does not control for the life of the project. Consequently, when comparing mutually exclusive projects with different lifetimes, the NPV rule is biased towards accepting longer term projects.

Internal Rate of Return

The internal rate of return is based on discounted cash flows. Unlike the net present value rule, however, it takes into account the project's scale. It is the discounted cash flow analog to the accounting rates of return. Again, in general terms, the internal rate of return is that discount rate that makes the net

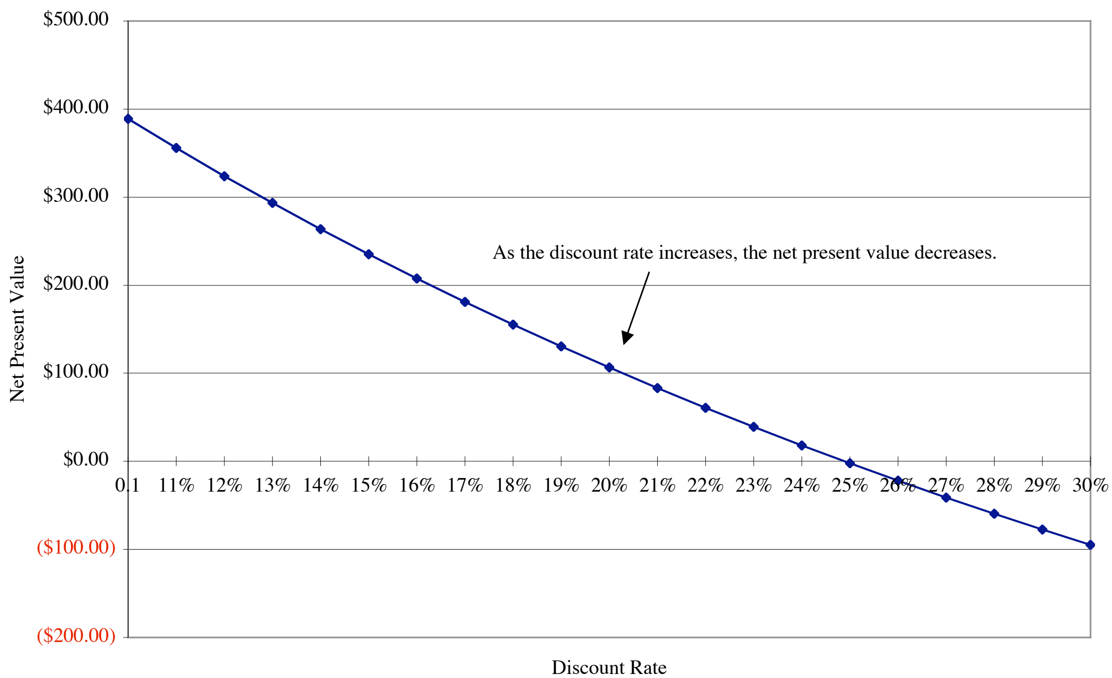
Internal Rate of Return (IRR): The IRR of a project measures the rate of return earned by the project based upon cash flows, allowing for the time value of money.

present value of a project equal to zero. To illustrate, consider again the project described at the beginning of the net present value discussion.



At the internal rate of return, the net present value of this project is zero. The linkage between the net present value and the internal rate of return is most visible when the net present value is graphed as a function of the discount rate in a _net present value profile_. A net present value profile for the project described is illustrated in Figure 5.4.

Figure 5.4: NPV Profile



The net present value profile provides several insights on the project's viability. First, the internal rate of return is clear from the graph – it is the point at which the profile crosses the X axis. Second, it provides a measure of how sensitive the NPV — and, by extension, the project decision — is to changes in the

> ***NPV Profile:*** This measures the sensitivity of the net present value to changes in the discount rate.

discount rate. The slope of the NPV profile is a measure of the discount rate sensitivity of the project. Third, when mutually exclusive projects are being analyzed, graphing both NPV profiles together provides a measure of the break-even discount rate - the rate at which the decision maker will be indifferent between the two projects.

5.13. ☞: **Discount Rates and NPV**

In the project described above, the NPV decreased as the discount rate was increased. Is this always the case?

a. Yes.

b. No

If no, when might the NPV go up as the discount rate is increased?

Using the Internal Rate of Return

One advantage of the internal rate of return is that it can be used even in cases where the discount rate is unknown. While this is true for the calculation of the IRR, it is not true when the decision maker has to use the IRR to decide whether to take a project or not. At that stage in the process, the internal rate of return has to be compared to the discount rate - if the IRR is greater than the discount rate, the project is a good one; alternatively, the project should be rejected.

Like the net present value, the internal rate of return can be computed in one of two ways:

- The IRR can be calculated based upon the free cash flows to the firm and the total investment in the project. In doing so, the IRR has to be compared to the cost of capital.
- The IRR can be calculated based upon the free cash flows to equity and the equity investment in the project. If it is estimated with these cash flows, it has to be compared to the cost of equity, which should reflect the riskiness of the project.

Decision Rule for IRR for Independent Projects

A. IRR is computed on cash flows to the firm

If the IRR > Cost of Capital	->	Accept the project
If the IRR < Cost of Capital	->	Reject the project

B. IRR is computed on cash flows to equity
If the IRR > Cost of Equity -> Accept the project
If the IRR < Cost of Equity -> Reject the project

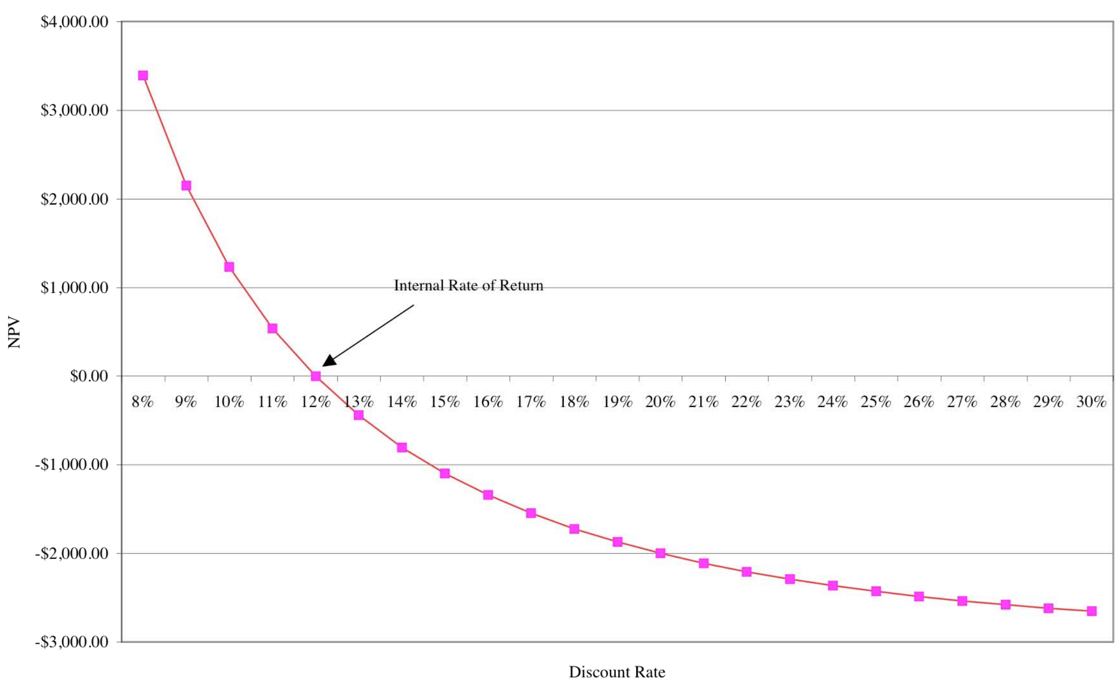
When choosing between projects of equivalent risk, the project with the higher IRR is viewed as the better project.

This spreadsheet allows you to estimate the IRR based upon cash flows to the firm on a project

Illustration 5.16: Estimating the IRR based on FCFF - Disney Theme Park in Thailand

The cash flows to the firm from the proposed theme park in Thailand, are used to arrive at a NPV profile for the project in Figure 5.5.

Figure 5.5: NPV Profile for Disney Theme Park

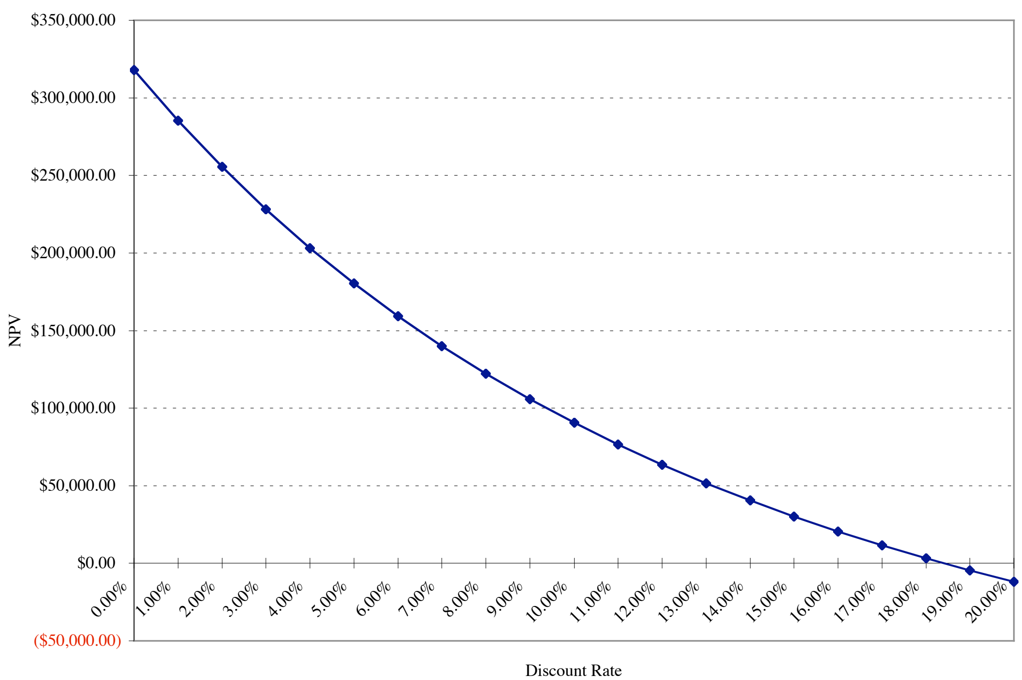


The internal rate of return in dollar terms on this project is 11.97%, which is higher than the cost of capital of 10.66%. These results are consistent with the findings from the NPV rule, which also recommended investing in the theme parks. [11]

Illustration 5.17: Estimating IRR Based Upon FCFE - Aracruz Cellulose

The net present value profile depicted in Figure 5.6 is based upon the equity investment and the free cash flows to equity estimated for the paper plant for Aracruz.

Figure 5.6: NPV Profile on Equity Investment in Paper Plant: Aracruz



The internal rate of return (in real terms) on this project is 18.06%, which is higher than the real cost of equity of 11.40%. Again, these results are consistent with the findings from the NPV rule, which also recommended accepting this investment.

Biases, Limitations, and Caveats

The internal rate of return is the most widely used discounted cash flow rule in investment analysis, but it does have some serious limitations.

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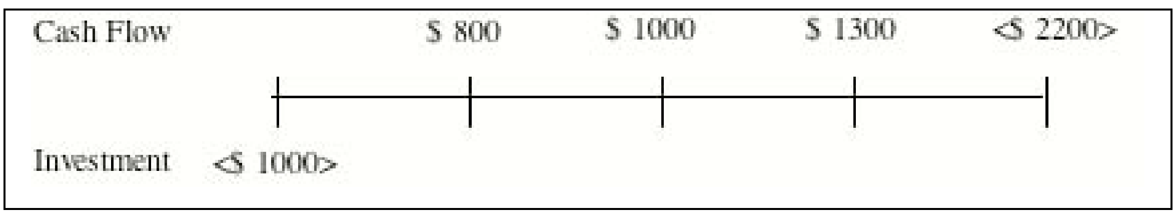
[11] The terminal value of the project itself is a function of the discount rate used. That is why the IRR function in excel will not yield the right answer. Instead, the net present value has to be recomputed at every discount rate and the IRR is the point at which the NPV=0.

- Since the IRR is a scaled measure, it tends to bias decision makers towards smaller projects, which are much more likely to yield high percentage returns, over larger ones.
- There are a number of scenarios where the internal rate of return cannot be computed or is not meaningful as a decision tool. The first is when there is no or only a very small initial investment and the investment is spread over time. In such cases, the IRR cannot be computed, or, if computed, is likely to be meaningless. The second is when there is more than one internal rate of return for a project, and it is not clear which one the decision maker should use.

Illustration 5.18: Multiple IRR Projects

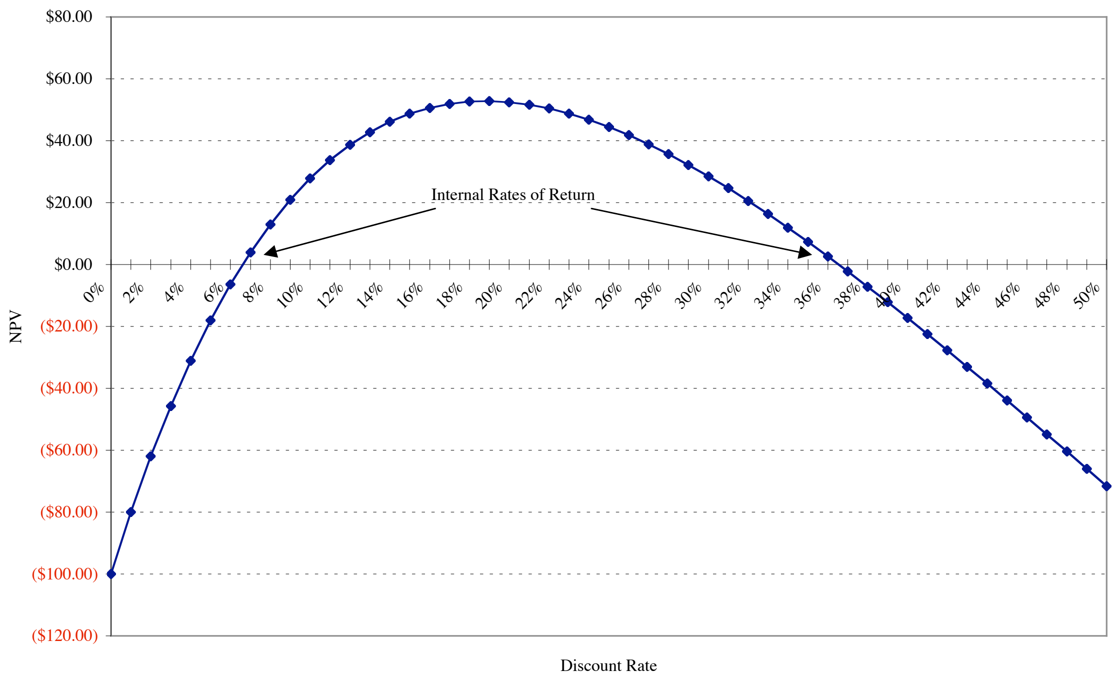
Consider a project to manufacture and sell a consumer product, with a hurdle rate of 12%, that has a 4-year life and the following cash flows over those 4 years. The project, which requires the licensing of a trademark, requires a large negative payment at the end of the fourth year. Figure 5.7 shows the cashflows:

Figure 5.7: Cashflows on Investment



The net present value profile for this project, shown in figure 5.8, reflects the problems that arise with the IRR measure.

Figure 5.8: NPV Profile for Multiple IRR Project



As you can see, this project has two internal rates of return - 6.60% and 36.55%. Since the hurdle rate falls between these two IRRs, the decision on whether to take the project or not will change depending upon which IRR is used. In order to make the right decision in this case, the decision maker would have to look at the NPV profile. If, as in this case, the net present value is positive at the hurdle rate, the project should be accepted. If the net present value is negative at the hurdle rate, the project should be rejected.

Multiple IRRs: Why They Exist And What To Do About Them.

The internal rate of return can be viewed mathematically as a root to the present value equation for cash flows. In the conventional project, where there is an initial investment and positive cash flows thereafter, there is only one sign change in the cash flows, and one root - that is, there is a unique IRR. When there is more than one sign change in the cash flows, there will be more than one internal rate of return.[12] In Figure

[12] While the number of internal rates of return will be equal to the number of sign changes, some internal rates of return may be so far out of the realm of the ordinary (eg. 10,000%) that they may not create the kinds of problems described here.

5.6, for example, the cash flow changes sign from negative to positive in year 1, and from positive to negative in year 4, leading to internal rates of return.

Lest this be viewed as some strange artifact that is unlikely to happen in the real world, note that many long term projects require substantial reinvestment at intermediate points in the project and that these reinvestments may cause the cash flows in those years to become negative. When this happens, the IRR approach may run into trouble.

There are a number of solutions suggested to the multiple IRR problems. One is to use the hurdle rate to bring the negative cash flows from intermediate periods back to the present. Another is to construct a NPV profile. In either case, it is probably much simpler to estimate and use the net present value.

Comparing NPV and IRR

While the net present value and the internal rate of return are viewed as competing investment decision rules, they generally yield similar conclusions in most cases. The differences between the two rules are most visible when decision makers are choosing between mutually exclusive projects.

Differences in Scale

The net present value of a project is stated in dollar terms and does not factor in the scale of the project. The internal rate of return, by contrast, is a percentage rate of return, which is standardized for the scale of the project. When choosing between mutually exclusive projects with very different scales, this can lead to very different results.

Illustration 5.19: NPV and IRR for projects of different scale

Assume that you are a small bank and that you are comparing two mutually exclusive projects. The first project, which is hire 4 extra tellers at the branches that you operate, requires an initial investment of $1 million and produces the cash flow revenues shown below in Figure 5.7. The second project requires investment of $10 million in an Automated Teller Machine, and is likely to produce the much higher cash flows shown in Figure 5.9, as well. The hurdle rate is 15% for both projects.

Figure 5.9: NPV and IRR - Different Scale Projects

Additional Bank Tellers

Cash Flow $ 350,000 $ 450,000 $ 600,000 $ 750,000

Investment $ 1,000,000

NPV = $467,937
IRR= 33.66%

Automated Teller Machines

Cash Flow $ 3,000,000 $ 3,500,000 $ 4,500,000 $ 5,500,000

Investment $ 10,000,000

NPV = $1,358,664
IRR=20.88%

The two decision rules yield different results. The net present value rule suggests that project B is the better project, while the internal rate of return rule leans towards project A. This is not surprising, given the differences in scale.

Capital Rationing: This refers to the scenario where the firm does not have sufficient funds - either on hand or in terms of access to markets - to take on all of the good projects it might have.

Which rule yields the better decision? The answer depends on the capital rationing constraints faced by the business making the decision. When there are no capital rationing constraints (i.e., the firm has the capacity to raise as much capital as it needs to take prospective projects), the net present value rule provides the right answer - Project B should be picked over Project A. If there are capital rationing constraints, however, then taking Project B may lead to the rejection of good projects later on. In those cases, the internal rate of return rule may

Profitability Index (PI): The profitability index is the net present value of a project divided by the initial investment in the project – it is a scaled version of NPV.

provide the better solution. The capital rationing question is dealt with in more detail in Chapter 6.

Another approach to scaling NPV: The Profitability Index

Another way of scaling the net present value is to divide it by the initial investment in the project. Doing so provides the profitability index which is another measure of project return.

$$\text{Profitability Index} = \frac{\text{Net Present Value}}{\text{Initial Investment}}$$

In Illustration 5.17, for instance, the profitability index can be computed as follows for each project:

Profitability Index for Project A = $467,937/$1,000,000 = 46.79%

Profitability Index for Project B = $ 1,358,664/ $10,000,000 = 13.59%

Based on the profitability index, project A is the better project, after scaling for size.

In most cases, the profitability index and the internal rate of return will yield similar results. As we will see in the next section, the differences between these approaches can be traced to differences in reinvestment assumptions.

Differences in Reinvestment Rate Assumption

While the differences between the NPV rule and the IRR rules due to scale are fairly obvious, there is a subtler, and much more significant difference between the two rules, relating to the reinvestment of intermediate cash flows. As pointed out earlier, the net present value rule assumes that intermediate cash flows are reinvested at the discount rate, whereas the IRR rule assumes that intermediate cash flows are reinvested at the IRR. As a consequence, the two rules can yield different conclusions, even for projects with the same scale, as illustrated in Figure 5.10.

Figure 5.10: NPV and IRR - Reinvestment Assumption

Automated Teller Machine 1

Cash Flow		\$ 5,000,000	\$ 4,000,000	\$ 3,200,000	\$ 3,000,000
Investment	\$ 10,000,000				

NPV = \$1,191,712
IRR=21.41%

Automated Teller Machine 2

Cash Flow		\$ 3,000,000	\$ 3,500,000	\$ 4,500,000	\$ 5,500,000
Investment	\$ 10,000,000				

NPV = \$1,358,664
IRR=20.88%

In this case, the net present value rule ranks the second investment higher, while the IRR rule ranks first investment as the better project. The differences arise because the NPV rule assumes that intermediate cash flows get invested at the hurdle rate, which is 15%. The IRR rule assumes that intermediate cash flows get reinvested at the IRR of that project. While both projects are impacted by this assumption, it has a much greater effect for project A, which has higher cash flows earlier on. The reinvestment assumption is made clearer if the expected end balance is estimated under each rule.

End Balance for ATM1 with IRR of 21.41% = $\$10{,}000{,}000 * 1.2141^4 = \$21{,}730{,}887$

End Balance for ATM2 with IRR of 20.88% = $\$10{,}000{,}000 * 1.2088^4 = \$21{,}353{,}673$

To arrive at these end balances, however, the cash flows in years 1, 2, and 3 will have to be reinvested at the IRR. If they are reinvested at a lower rate, the end balance on these projects will be lower than the values stated above, and the actual return earned will be lower than the IRR even though the cash flows on the project came in as anticipated.

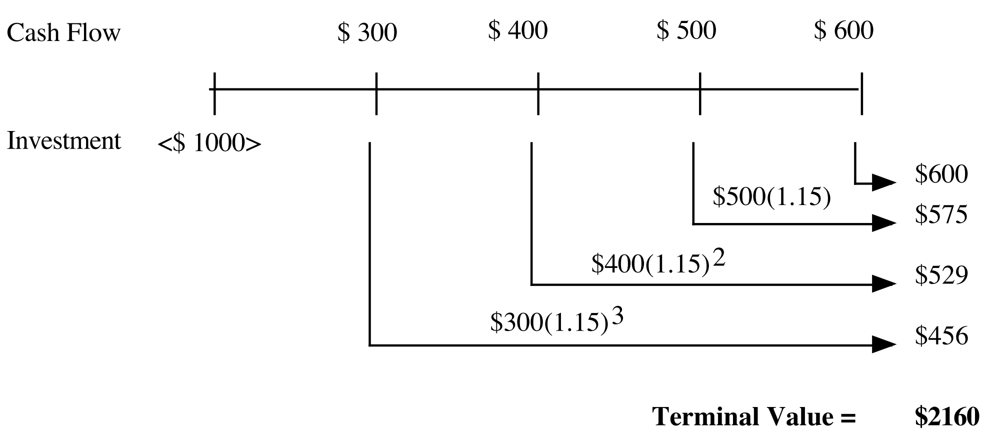
Modified Internal Rate of Return (MIRR): This is the internal rate of return, computed on the assumption that intermediate cashflows are reinvested at the hurdle rate.

The reinvestment rate assumption made by the IRR rule creates more serious consequences the longer the term of the project and the higher the IRR, since it implicitly assumes that the firm has and will continue to have, a fountain of projects yielding returns similar to that earned by the project under consideration.

A Solution to the Reinvestment Rate Problem: The Modified Internal Rate of Return

One solution that has been suggested for the reinvestment rate assumption is to assume that intermediate cash flows get reinvested at the hurdle rate - the cost of equity if the cash flows are to equity investors and the cost of capital if they are to the firm - and to calculate the internal rate of return from the initial investment and the terminal value. This approach yields what is called the modified internal rate of return (MIRR), as illustrated in Figure 5.11.

Figure 5.11: IRR versus Modified Internal Rate of Return



Internal Rate of Return = 24.89%
Modified Internal Rate of Return = 21.23%

$$\text{Modified Internal Rate of Return} = (\$2160/\$1000)^{1/4} - 1 = 21.23\%$$

The modified internal rate of return is lower than the internal rate of return because the intermediate cash flows are invested at the hurdle rate of 15% instead of the IRR of 24.89%.

There are many who believe that the MIRR is neither fish nor fowl, since it is a mix of the NPV rule and the IRR rule. From a practical standpoint, the MIRR becomes a weighted average of the returns on individual projects and the hurdle rates the firm uses, with the weights on each depending on the magnitude and timing of the cash flows - the larger and earlier the cash flows on the project, the greater the weight attached to the hurdle rate. Furthermore, the MIRR approach will yield the same choices as the NPV approach for projects of the same scale and lives.

Where Do Good Projects Come From?

In the process of analyzing new investments in the preceding chapters, we have contended that good projects have a positive net present value and earn an internal rate of return greater than the hurdle rate. While these criteria are certainly valid from a measurement standpoint, they do not address the deeper questions about good projects including the economic conditions that make for a "good" project and why it is that some firms have a more ready supply of "good" projects than others.

Implicit in the definition of a good project — one that earns a return that is greater than that earned on investments of equivalent risk — is the existence of super-normal returns to the business considering the project. In a competitive market for real investments, the existence of these excess returns should act as a magnet, attracting competitors to take on similar investments. In the process, the excess returns should dissipate over time; how quickly they dissipate will depend on the ease with which competition can enter the market and provide close substitutes and on the magnitude of any differential advantages that the business with the good projects might possess. Take an extreme scenario, whereby the business with the good projects has no differential advantage in cost or product quality over its competitors, and new competitors can enter the market easily and at low cost to provide substitutes. In this case the super-normal returns on these projects should disappear very quickly.

An integral basis for the existence of a "good" project is the creation and maintenance of barriers to new or existing competitors taking on equivalent or similar projects. These barriers can take different forms, including

a. Economies of scale: Some projects might earn high returns only if they are done on a "large" scale, thus restricting competition from smaller companies. In such cases, large companies in this line of business may be able to continue to earn super-normal returns on their projects because smaller competitors will not be able to replicate them.

b. Cost Advantages: A business might work at establishing a cost advantage over its competitors, either by being more efficient or by taking advantage of arrangements that its competitors cannot use. For example, in the late 1980s, Southwest Airlines was able to establish a cost advantage over its larger competitors, such as American and United Airlines by using non-union employees, the company exploited this cost advantage to earn much higher returns.

c. Capital Requirements: Entry into some businesses might require such large investments that it discourages competitors from entering, even though projects in those businesses may earn above-market returns. For example, assume that Boeing is faced with a large number of high-return projects in the aerospace business. While this scenario would normally attract competitors, the huge initial investment needed to enter this business would enable Boeing to continue to earn these high returns.

d. Product Differentiation: Some businesses continue to earn excess returns by differentiating their products from those of their competitors, leading to either higher profit margins or higher sales. This differentiation can be created in a number of ways - through effective advertising and promotion (Coca Cola), technical expertise (Sony), better service (Nordstrom) and responsiveness to customer needs.

e. Access to Distribution Channels: Those firms that have much better access to the distribution channels for their products than their competitors are better able to earn excess returns. In some cases, the restricted access to outsiders is due to tradition or loyalty to existing competitors. In other cases, the firm may actually own the distribution channel, and competitors may not be able to develop their own distribution channels because the costs are prohibitive.

f. Legal and Government Barriers: In some cases, a firm may be able to exploit investment opportunities without worrying about competition because of restrictions on competitors from product patents the firm may own to government restrictions on competitive entry. These arise, for instance, when companies are allowed to patent products or services, and gain the exclusive right to provide them over the patent life.

Quality of Management and Project Quality

In the preceding section we examined some of the factors that determine the attractiveness of the projects a firm will face. While some factors, such as government restrictions on entry, may largely be out of the control of incumbent management, there are other factors that can clearly be influenced by management.[13] may largely be out of the control of incumbent management, there are other factors that can clearly be influenced by management. Considering each of the factors discussed above, for instance, we would argue that a good management team can increase both the number of and the returns on available projects by

- taking projects that exploit any economies of scale that the firm may possess; in addition, management can look for ways it can create economies of scale in the firm's existing operations.
- establishing and nurturing cost advantages over its competitors; some cost advantages may arise from labor negotiations, while others may result from long-term strategic decisions made by the firm. For instance, by owning and developing SABRE, the airline reservation system, American Airlines has been able to gain a cost advantage over its competitors.
- taking actions that increase the initial cost for new entrants into the business; one of the primary reasons Microsoft's was able to dominate the computer software market in the early 1990s was its ability to increase the investment needed to develop and market software programs.
- increasing brand name recognition and value through advertising and by delivering superior products to customers; a good example is the success that Snapple experienced in the early 1990s in promoting and selling its iced tea beverages.
- nurturing markets in which the company's differential advantage is greatest, in terms of either cost of delivery or brand name value. In some cases, this will involve expanding into foreign markets, as both Levi Strauss and McDonalds did in the 1980s in order to exploit their higher brand name recognition in those markets. In other

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[13] When government policy is influenced by lobbying by firms, it can be argued that even these factors may be affected by the management of a firm.

cases, this may require concentrating on segments of an existing market as The Gap did, when it opened its Banana Republic division, which sells upscale outdoor clothing.

- improving the firm's reputation for customer service and product delivery; this will enable the firm to increase both profits and returns. One of the primary factors behind Chrysler's financial recovery in the 1980s was the company's ability to establish a reputation for producing quality cars and minivans.
- developing distribution channels that are unique and cannot be easily accessed by competitors. Avon, for instance, emplyed large sales force to go door-to-door to reach consumers who could not be reached by other distribution channels.
- getting patents on products or technologies that keep out the competition and earn high returns; doing so may require large investments in research and development over time. It can be argued that Intel's success in the market for semiconductors can be traced to the strength of its research and development efforts and the patents it consequently obtained on advanced chips, such as the Pentium.[14]

While the quality of management is typically related to the quality of projects a firm possesses, a good management team does not guarantee the existence of good projects. In fact, there is a rather large element of chance involved in the process; even the best laid plans of the management team to create project opportunities may come to naught if circumstances conspire against them – a recession may upend a retailer, or an oil price shock may cause an airline to lose money.

The Role of Acquisitions

As firms mature and increase in size, they are often confronted with a quandary. Instead of being cash poor and project rich, they find that their existing projects generate far more in cash than they have available projects in which to invest. This can be attributed partly to size and partly to competition. As they face up to their new status as cash-rich companies, with limited investment opportunities, acquiring other firms with a ready supply of high-return projects looks like an attractive option, but there is a catch. If these firms are publicly traded, the market price already reflects the expected higher

[14] It is estimated that Intel spent between $3 billion and $5 billion developing the Pentium chip.

returns not only on existing projects but also on expected future projects. In terms of present value, the value of a firm can be written as

Value of Firm = Present Value of Cash Flows from Existing Projects

+ Net Present Value of Cash Flows from Expected Future Projects

Thus, firms that are earning super-normal returns on their existing projects and are expected to maintain this status in the future will sell at prices that reflects these expectations. Accordingly, even if the cash-rich firm pays a "fair" price to acquire one of these firms, it has to earn more than the expected super normal returns to be able to claim any premium from the acquisition. To put all this in perspective, assume that you are considering the acquisition of a firm that is earning 25% on its projects, when the hurdle rate on these projects is 12%, and that it is expected to maintain these high returns for the foreseeable future. A fair price attached to this acquisition will reflect this expectation. All this implies that an acquisition will earn super-normal returns for the acquirer if, and only if, one of the following conditions holds:

> ***Super Normal Returns:*** These are returns which are greater than the returns that would normally be earned for an investment of equivalent risk.

- The acquisition is done at a price below the fair price (i.e., the company is significantly undervalued).
- The acquisition is done at a price that reflects the expectation that the firm will earn 25% but the acquirer manages to earn an even higher return, say 30%, on future projects.
- The acquisition enables the firm to take on projects that it would not have taken on as an independent firm; the net present value of these additional projects will then be a bonus that is earned by the acquiring firm. This is the essence of synergy.
- The acquisition lowers the discount rate on projects, leading to an increase in net present value, even though the returns may come in as expected.

> ***Synergy:*** This is the increase in the value that results from combining two firms.

Overall, it is clear that internally generated projects have better odds of success than do acquisitions since no premium is paid for market expectations up front.

5.14. ☞: **Firm Value and Overpayment on Acquisitions**

Megatech Corporation, a large software firm with a market value for its equity of $ 100 million, announces that it will be acquiring FastMail Corporation, a smaller software firm, for $ 15 million. On the announcement, Megatech's stock price drops by 3%. Based upon these facts, estimate the amount the market thinks Megatech should have paid for FastMail Corporation.

a. $ 15 million

b. $ 3 million

c. $ 12 million

How does NPV additivity enter into your answer?

Corporate Strategy and Project Quality

At the lofty level of corporate strategy, there may be seem to be little use for the mechanics of corporate finance. Consequently, corporate strategic decisions are often made with little or no corporate financial analysis to back them up. One way in which corporate strategy <u>can be</u> linked to corporate finance, however, is through investment policy. An objective of any corporate strategy should be to enable the firm to develop a long-term capacity to differentiate itself and earn higher returns than its competitors. Alternatively, the efficacy of a corporate strategic choice can be measured through its effect on the firm's capacity to earn excess returns on its projects. Many of the concepts that are popular in corporate strategy can be linked to the discussion in the previous section.

Conclusion

Investment analysis is arguably the most important part of corporate financial analysis. In this chapter, we have defined the scope of investment analysis, and examined a range of investment analysis techniques, ranging from accounting rate of return measures, such as return of equity and return on assets, to discounted cash flow techniques, such as net present value and internal rate of return. In general, it can be argued that:

- Any decision that requires the use of resources is an investment decision; thus, investment decisions cover everything from broad strategic decisions at one extreme to decisions on how much inventory to carry at the other.
- There are two basic approaches to investment analysis; in the equity approach, the returns to equity investors from a project are measured against the cost of equity to decide on whether to take a project; in the firm approach, the returns to all investors in the firm are measured against the cost of capital to arrive at the same judgment.
- Accounting rate of return measures, such as return on equity or return on capital, generally work better for projects that have large initial investments, earnings that are roughly equal to the cash flows, and level earnings over time. For most projects, accounting returns will increase over time, as the book value of the assets is depreciated.
- Payback, which looks at how quickly a project returns its initial investment in nominal cash flow terms, is a useful secondary measure of project performance or a measure of risk, but it is not a very effective primary technique because it does not consider cash flows after the initial investment is recouped.
- Discounted cash flow methods provide the best measures of true returns on projects because they are based upon cashflows and consider the time value of money.
- Among discounted cash flow methods, net present value provides an un-scaled measure while internal rate of return provides a scaled measure of project performance. Both methods require the same information, and, for the most part, they agree when used to analyze independent projects. The internal rate of return does tend to overstate the return on good projects because it assumes that intermediate cash flows get reinvested at the internal rate of return. When analyzing mutually exclusive projects, the internal rate of return is biased towards smaller projects and may be the more appropriate decision rule for firms that have capital constraints.
- Firms seem much more inclined to use internal rate of return than net present value as a investment analysis tool; this can be partly attributed to fact that IRR is a scaled measure of return, and partly to capital rationing constraints firms may face.

Live Case Study

Analyzing A Firm's Existing Investments

Objective: To analyze a firm's existing investments, and to identify differential advantages that explain excess returns on existing investments.

Key Questions:

1. How good or bad is the firm's existing project portfolio?
2. What are the firm's competitive strengths and differential advantages, if any?
3. Does this firm earn excess returns on its existing projects? If yes, can it maintain the competitive strengths that allowed it to earn these excess returns? If not, what can it do to start earning excess returns on its projects?
4. Does the firm have poor investments? If so, what might be the reasons for the poor returns?

Framework for Analysis:

1. *Analyzing Existing Investments*

   1.1. What is the accounting return that the firm earns on its existing investments? How does this compare with the cost of equity and capital?

   1.2. What was the firm's economic value added in the most recent financial year? How does it compare with the previous year?

   1.3. What, if anything, do the accounting returns and economic value added tell you about the quality of the firm's existing investments?

2. *Assessing Competitive Strengths*

   2.1. Who are the primary competitors to this firm and how does the firm compare to them in terms of both quantitative (size, profitability, risk) and qualitative measures (quality of management, service)?

   2.2. Does the firm have any special strength that no other firm in the sector possesses?

   2.3. Does the firm lag other firms in the sector on any of the measures?

3. *Evaluating Sustainability of Competitive Strengths*

3.1. Are the firm's competitors catching up with the firm on its strengths?

3.2. Are there new competitors either in the market or on the horizon who could compete with the firm on its strengths?

4. *Poor Investments*

   3.1. If the firm has investments that earn less than the hurdle rate, what is the most likely reason for the poor returns?

   3.2. What alternatives does the firm have with these poor investments? In particular, can it sell these investments to a third party or will it have to liquidate these investments?

Getting Information on Competitive Strengths and Excess Returns

This is primarily a qualitative assessment. Reading articles on the firm and the sector in which it operates is a good starting point. Looking at the differences across firms in the sector on size, margins, working capital ratios and risk can also provide a basis for the competitive analysis. A useful comparison would be between the excess return (return on capital – cost of capital) earned by your firm and the average excess return earned by the sector.

Online sources of information:

http://www.stern.nyu.edu/~adamodar/cfin2E/project/data.htm

Questions and Exercises

1. You have been given the following information on a project:

- It has a 5-year lifetime
- The initial investment in the project will be $25 million, and the investment will be depreciated straight line, down to a salvage value of $10 million at the end of the fifth year.
- The revenues are expected to be $20 million next year and to grow 10% a year after that for the remaining 4 years.
- The cost of goods sold, excluding depreciation, is expected to be 50% of revenues.
- The tax rate is 40%.

a. Estimate the pre-tax return on capital, by year and on average, for the project.

b. Estimate the after-tax return on capital, by year and on average, for the project.

c. If the firm faced a cost of capital of 12%, should it take this project.

2. Now assume that the facts in problem 1 remain unchanged except for the depreciation method, which is switched to an accelerated method with the following depreciation schedule:

Year	% of Depreciable Asset
1	40%
2	24%
3	14.4%
4	13.3%
5	13.3%

Depreciable Asset = Initial Investment - Salvage Value

a. Estimate the pre-tax return on capital, by year and on average, for the project.

b. Estimate the after-tax return on capital, by year and on average, for the project.

c. If the firm faced a cost of capital of 12%, should it take this project?

3. Consider again the project described in problem 1 (assume that the depreciation reverts to straight line). Assume that 40% of the initial investment for the project will be financed with debt, with an annual interest rate of 10% and a balloon payment of the principal at the end of the fifth year.

a. Estimate the return on equity, by year and on average, for this project.

b. If the cost of equity is 15%, should the firm take this project?

4. Answer true or false to the following statements:

a. The return on equity for a project will always be higher than the return on capital on the same project.

b. If the return on capital is less than the cost of equity, the project should be rejected.

c. Projects with high financial leverage will have higher interest expenses and lower net income than projects with low financial leverage and thus end up with a lower return on equity.

d. Increasing the depreciation on an asset will increase the estimated return on capital and equity on the project.

e. The average return on equity on a project over its lifetime will increase if we switch from straight line to double declining balance depreciation.

5. Under what conditions will the return on equity on a project be equal to the internal rate of return, estimated from cashflows to equity investors, on the same project?

6. You are provided with the projected income statements for a project:

Year	1	2	3	4
Revenues	$ 10,000	$ 11,000	$12,000	$13,000
- Cost of Goods Sold	$ 4,000	$ 4,400	$ 4,800	$ 5,200
- Depreciation	$ 4,000	$ 3,000	$ 2,000	$ 1,000
= EBIT	$ 2,000	$ 3,600	$ 5,200	$ 6,800

- The tax rate is 40%.
- The project required an initial investment of $15,000 and an additional investment of $2,000 at the end of year 2.
- The working capital is anticipated to be 10% of revenues, and the working capital investment has to be made at the beginning of each period.

a. Estimate the free cash flow to the firm for each of the 4 years.

b. Estimate the payback period for investors in the firm.

c. Estimate the net present value to investors in the firm, if the cost of capital is 12%. Would you accept the project?

d. Estimate the internal rate of return to investors in the firm. Would you accept the project?

7. Consider the project described in problem 6. Assume that the firm plans to finance 40% of its net capital expenditure and working capital needs with debt.

a. Estimate the free cash flow to equity for each of the 4 years.

b. Estimate the payback period for equity investors in the firm.

c. Estimate the net present value to equity investors if the cost of equity is 16%. Would you accept the project?

d. Estimate the internal rate of return to equity investors in the firm. Would you accept the project?

8. You are provided with the following cash flows on a project:

Year	Cash Flow to Firm
0	- 10,000,000
1	$ 4,000,000
2	$ 5,000,000
3	$ 6,000,000

Plot the net present value profile for this project. What is the internal rate of return? If this firm had a cost of capital of 10% and a cost of equity of 15%, would you accept this project?

9. You have estimated the following cash flows on a project:

Year	Cashflow to Equity
0	-$ 5,000,000
1	$4,000,000
2	$ 4,000,000
3	- $3,000,000

Plot the net present value profile for this project. What is the internal rate of return? If the cost of equity is 16%, would you accept this project?

10. Estimate the modified internal rate of return for the project described in problem 8. Does it change your decision on accepting this project?

11. You are analyzing two mutually exclusive projects with the following cash flows:

Year	A	B
0	-$4,000,000	-$4,000,000
1	$2,000,000	$1,000,000
2	$1,500,000	$1,500,000
3	$ 1,250,000	$1,700,000
4	$1,000,000	$2,400,000

a. Estimate the net present value of each project, assuming a cost of capital of 10%. Which is the better project?

b. Estimate the internal rate of return for each project. Which is the better project?

c. What reinvestment rate assumptions are made by each of these rules? Can you show the effect on future cash flows of these assumptions?

d. What is the modified internal rate of return on each of these projects?

12. You have a project that does not require an initial investment but has its expenses spread over the life of the project. Can the IRR be estimated for this project? Why or why not?

13. Businesses with severe capital rationing constraints should use IRR more than NPV. Do you agree? Explain.

14. You have to pick between three mutually exclusive projects with the following cash flows to the firm:

Year	Project A	Project B	Project C
0	-$10,000	$ 5,000	-$15,000
1	$ 8,000	$ 5,000	$ 10,000
2	$ 7,000	-$8,000	$10,000

The cost of capital is 12%.

a. Which project would you pick using the net present value rule?

b. Which project would you pick using the internal rate of return rule?

c. How would you explain the differences between the two rules? Which one would you rely on to make your choice?

15. You are analyzing an investment decision, in which you will have to make an initial investment of $10 million and you will be generating annual cash flows to the firm of $2 million every year, growing at 5% a year, forever.

a. Estimate the NPV of this project, if the cost of capital is 10%.

b. Estimate the IRR of this project.

16. You are analyzing a project with a 30-year lifetime, with the following characteristics:

- The project will require an initial investment of $20 million and additional investments of $ 5 million in year 10 and $ 5 million in year 20.
- The project will generate earnings before interest and taxes of $3 million each year. (The tax rate is 40%.)
- The depreciation will amount to $500,000 each year, and the salvage value of the equipment will be equal to the remaining book value at the end of year 30.
- The cost of capital is 12.5%.

a. Estimate the net present value of this project.

b. Estimate the internal rate of return on this project. What might be some of the problems in estimating the IRR for this project?

17. You are trying to estimate the NPV of a 3-year project, where the discount rate is expected to change over time.

Year	Cash Flow to Firm	Discount Rate
0	-$15,000	9.5%
1	$5,000	10.5%
2	$ 5,000	11.5%
3	$ 10,000	12.5%

a. Estimate the NPV of this project. Would you take this project?

b. Estimate the IRR of this project. How would you use the IRR to decide whether to take this project or not?

18. Barring the case of multiple internal rates of return, is it possible for the net present value of a project to be positive, while the internal rate of return is less than the discount rate. Explain.

19. You are helping a manufacturing firm decide whether it should invest in a new plant. The initial investment is expected to be \$ 50 million, and the plant is expected to generate after-tax cashflows of \$ 5 million a year for the next 20 years. There will be an additional investment of \$ 20 million needed to upgrade the plant in 10 years. If the discount rate is 10%,

a. Estimate the Net Present Value of the project.

b. Prepare a Net Present Value Profile for this project.

c. Estimate the Internal Rate of Return for this project. Is there any aspect of the cashflows that may prove to be a problem for calculating IRR?

20. You have been asked to analyze a project, where the analyst has estimated the return on capital to be 37% over the ten-year lifetime of the project. While the cost of capital is only 12%, you have concerns about using the return on capital as an investment decision rule. Would it make a difference if you knew that the project was employing an accelerated depreciation method to compute depreciation? Why?

21. Accounting rates of return are based upon accounting income and book value of investment, whereas internal rates of return are based upon cashflows and take into account the time value of money. Under what conditions will the two approaches give you similar estimates?

CHAPTER 6

PROJECT INTERACTIONS, SIDE COSTS AND SIDE BENEFITS

In much of our discussion so far, we have assessed projects independently of other projects that the firm already has or might have in the future. Disney, for instance, was able to look at the theme park investment and analyze whether it was a good or bad investment. In reality, projects at most firms have interdependencies with and consequences for other projects. Disney may be able to increase both movie and merchandise revenues because of the new theme park in Bangkok and may face higher advertising expenditures because of its Asia expansion.

In this chapter, we examine a number of scenarios in which the consideration of one project affects other projects. We start with the most extreme case, where investing in one project leads to the rejection of one or more other projects; this is the case when firms have to choose between mutually exclusive investments. We then consider a less extreme scenario, where a firm with constraints on how much capital it can raise considers a new project. Accepting this project reduces the capital available for other projects that the firm considers later in the period and thus can affect their acceptance; this is the case of capital rationing.

Projects can create costs for existing investments by using shared resources or excess capacity, and we consider these side costs next. Projects sometimes generate benefits for other projects, and we analyze how to bring these benefits into the analysis. In the final part of the chapter, we introduce the notion that projects often have options embedded in them, and that ignoring these options can result in poor project decisions.

Mutually Exclusive Projects

Projects are mutually exclusive when only one of the set of projects can be accepted by a firm. Projects may be mutually exclusive for different reasons. They may each provide a way of getting a needed service, but any one of them is sufficient for the service. The owner of a commercial building may be choosing among a number of different air-conditioning or heating systems for a building. Or, projects may provide alternative approaches to the future of a firm; a firm that has to choose between a “high-margin, low volume" strategy and a "low-margin, high-volume" strategy for a product can choose only one of the two.

In choosing among mutually exclusive projects, we continue to use the same rules we developed for analyzing independent projects. The firm should choose the project that adds the most to its value. While this concept is relatively straightforward when the projects are expected to generate cash flows for the same number of periods (have the same project life), as you will see, it can become more complicated when the projects have different lives.

Projects with Equal Lives

When comparing projects with the same lives, a business can make its decision in one of two ways. It can compute the net present value of each project and choose the one with the highest positive net present value (if the projects generate revenue) or the one with the lowest negative net present value (if the projects minimize costs). Alternatively, it can compute the differential cash flow between two projects and base its decision on the net present value or the internal rate of return of the differential cash flow.

Comparing Net Present Values

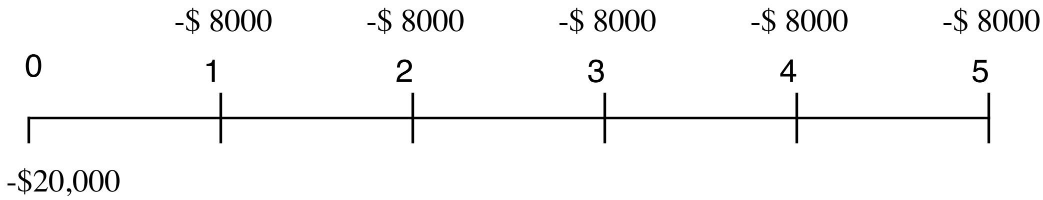
The simplest way of choosing among mutually exclusive projects with equal lives is to compute the net present values of the projects and choose the one with the highest net present value. This decision rule is consistent with firm value maximization.

Illustration 6.1: Mutually Exclusive Cost Minimizing Projects with equal lives

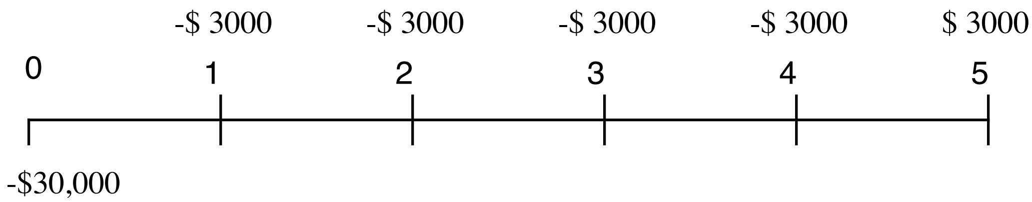
Bookscape is choosing between alternative vendors who are offering phone systems. Both systems have 5-year lives, and the appropriate cost of capital is 10% for both projects. Figure 6.1 summarizes the expected cash outflows on the two investments:

Figure 6.1: Cash Flows on Phone Systems

Vendor 1: Less Expensive System



Vendor 2: More Expensive System



The more expensive system is also more efficient, resulting in lower annual costs. The net present values of these two systems can be estimated as follows –

Net Present Value of Less Expensive System = - $20,000 - $8,000 [PV(A,10%,5 years)]
= - $50,326

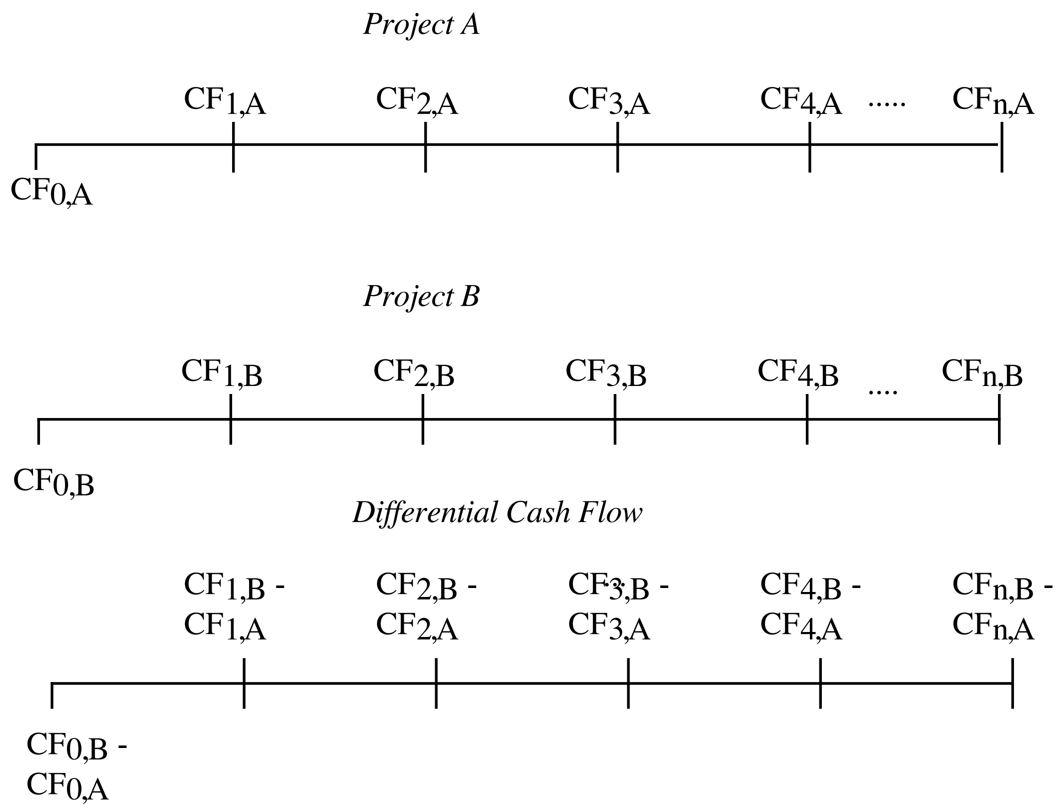
Net Present Value of More Expensive System = - $30,000 - $3,000 [PV(A,10%,5 years)]
= - $41,372

The net present value of all costs is much lower with the second system making it the better choice.

Differential Cash Flows

An alternative approach for choosing between two mutually exclusive projects is to compute the difference in cash flows each period between the two investments being compared. Thus, if A and B are mutually exclusive projects with estimated cash flows over the same life time (n), the differential cash flows can be computed as shown in Figure 6.2.

Figure 6.2: Estimating Differential Cash Flows



In computing the differential cash flows, the project with the larger initial investment becomes the project against which the comparison is made. In practical terms, this means that the Cash Flow$_{B-A}$ is computed if B has a higher initial investment than A, and the Cash Flow$_{A-B}$ is computed if A has a higher initial investment than B. If we compare more than two projects, we still compare one pair at a time, and the less attractive project is dropped at each stage.

The differential cash flows can be used to compute the net present value and the decision rule can be summarized as follows:

If $NPV_{B-A} > 0$: Project B is better than project A

$NPV_{B-A} < 0$: Project A is better than project B

Notice two points about the differential net present value. The first is that it provides the same result as would have been obtained if the business had computed net present values of the individual projects and then taken the difference between them.

$$NPV_{B-A} = NPV_B - NPV_A$$

The second is that this approach works only when the two projects being compared have the same risk level and discount rates, since only one discount rate can be used on the differential cash flows. By contrast, computing project-specific net present allows for the use of different discount rates on each project.

The differential cash flows can also be used to compute an internal rate of return, which can guide us to select the better project.

If IRR_{B-A} > Discount Rate : Project B is better than project A

IRR_{B-A} < Discount Rate : Project A is better than project B

Again, this approach works only if the projects are of equivalent risk.

6.1. ☞: **Mutually exclusive projects with different risk levels**

When comparing mutually exclusive projects with different risk levels and discount rates, what discount rate should we use to discount the differential cash flows?

a. The higher of the two discount rates
b. The lower of the two discount rates
c. An average of the two discount rates
d. None of the above

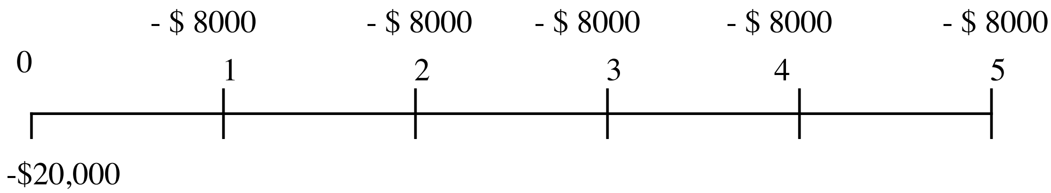
Explain your answer.

Illustration 6.2: Differential Cash Flows – NPV and IRR

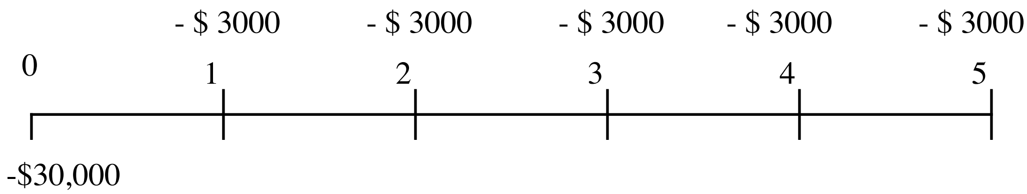
Consider again the phone systems analyzed in illustration 6.1. The differential cash flows can be estimated as shown in Figure 6.3:

Figure 6.3: Cash Flows on Phone Systems

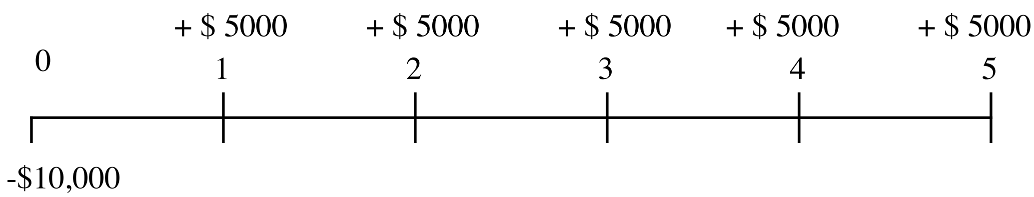
Vendor 1: Less Expensive System



Vendor 2: More Expensive System



Differential Cash Flows: More Expensive - Less Expensive System



The more expensive system costs $10,000 more to install but saves Bookscape $5,000 a year. Using the 10% discount rate, we estimate the net present value of the differential cash flows as follows:

Net Present Value of Differential Cash Flows = - $10,000 + $5,000 [PV(A,10%,5 years)]

= + $8,954

This net present value is equal to the difference between the net present values of the individual projects, and it indicates that the system that costs more up front is also the better system from the viewpoint of net present value. The internal rate of return of the differential cash flows is 41.04%, which is higher than the discount rate of 10%, once again suggesting that the more expensive system is the better one, from a financial standpoint.

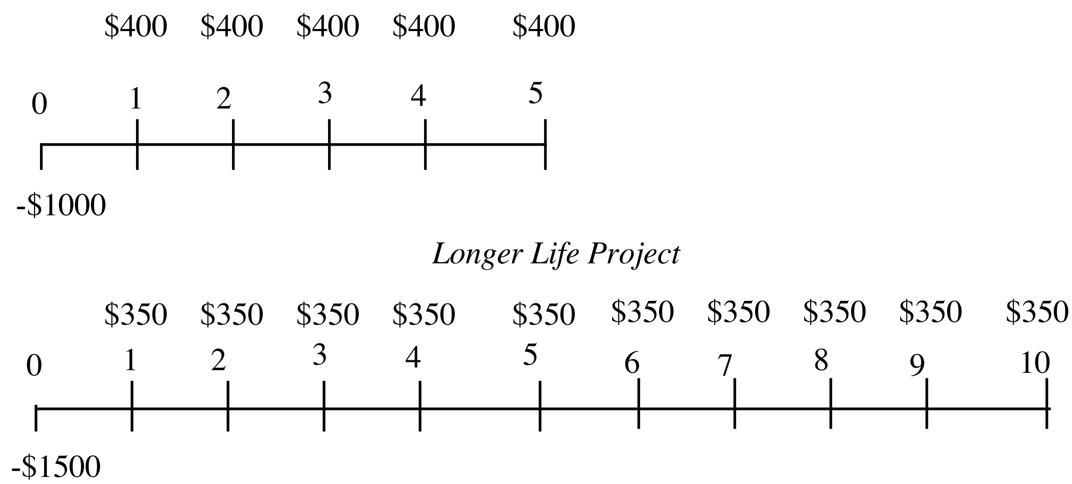
Projects with Different Lives

In many cases, firms have to choose among projects with different lives[1]. In doing so, they can no longer rely solely on the net present value. This is so because, as a dollar figure, the NPV is likely to be higher for longer term projects; the net present value of a project with only 2 years of cash flows is likely to be lower than one with 30 years of cash flows.

Assume that you are choosing between a 5-year and a 10-year project, with the cash flows shown in Figure 6.4. A discount rate of 12% applies for each.

Figure 6.4: Cash Flows on Projects with Unequal Lives

Shorter Life Project



The net present value of the first project is $442, while the net present value of the second project is $478. On the basis on net present value alone, the second project is better, but this analysis fails to factor in the additional net present value that could be made by the firm from years 6 to 10 in the project with a 5-year life.

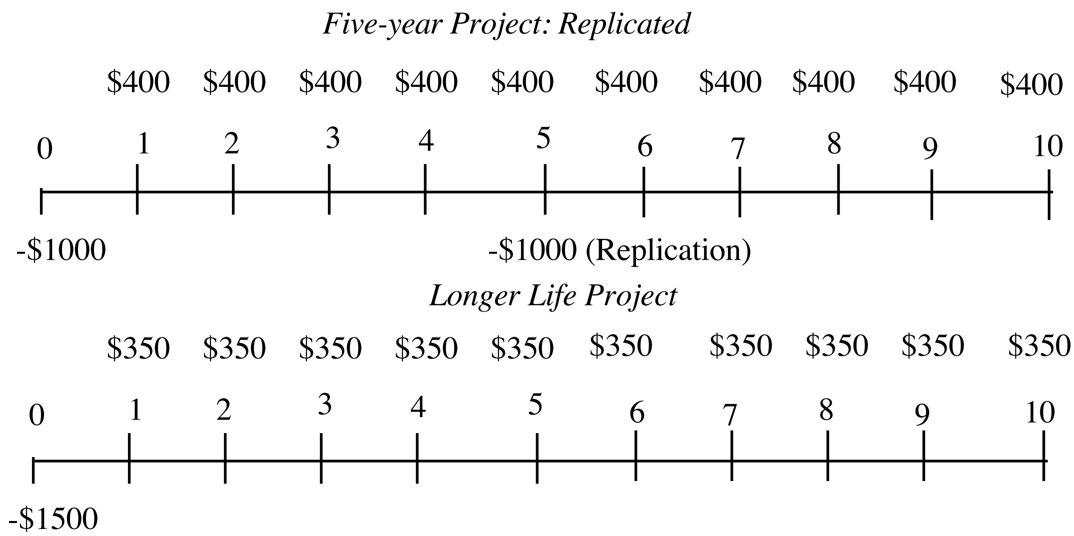
In comparing a project with a shorter life to one with a longer life, the firm must consider that it will be able to invest again with the shorter term project. Two conventional approaches - project replication and equivalent annuities — assume that when the current project ends, the firm will be able to invest in the same project or a very similar one.

Project Replication

[1] See Emery (1982).

One way of tackling the problem of different lives is to assume that projects can be replicated until they have the same lives. Thus, instead of comparing a 5-year to a 10-year project, we can find the net present value of investing in the 5-year project twice and comparing it to the net present value of the 10-year project. Figure 6.5 presents the resulting cashflows:

Figure 6.5: Cash Flows on Projects with Unequal Lives: Replicated with poorer project



The net present value of investing in the 5-year project twice is $693, while the net present value of the 10-year project remains at $478. These net present values now can be compared since they correspond to two investment choices that have the same life.

This approach has its limitations. On a practical level, it can become tedious to use when the number of projects increases and the lives do not fit neatly into multiples of each other. For example, an analyst using this approach to compare a 7-year, a 9-year and a 13-year project would have to replicate these projects to 819 years to arrive at an equivalent life for all three. Theoretically, it is also difficult to argue that a firm's project choice will essentially remain unchanged over time, especially if the projects being compared are very attractive in terms of net present value.

Illustration 6.3: Project Replication to compare projects with different lives

Suppose you are deciding whether to buy a used car, which is inexpensive but does not give very good mileage, or a new car, which costs more but gets better mileage. The two options are listed in Table 6.1.

Table 6.1: Expected Cash Flows on New versus Used Car

	Used Car	New Car
Initial cost	$ 3000	$ 8000
Maintenance costs/year	$ 1500	$ 1000
Fuel costs/mile	$ 0.20/ mile	$ 0.05/mile
Lifetime	4 years	5 years

Assume that you drive 5000 miles a year and that you have an opportunity cost of 15%. This choice can be analyzed with replication:

Step 1: Replicate the projects until they have the same lifetime; in this case, that would mean buying used cars five consecutive times and new cars four consecutive times.

A. Buy a used car every 4 years for 20 years.

Year:	0	4	8	12	16	20
Investment	-$3000	-$3000	-$3000	-$3000	-$3000	

Maintenance costs: $ 1500 every year for 20 years

Fuel costs: $ 1000 every year for 20 years (5000 miles at 20 cents a mile).

B. Buy a new car every 5 years for 20 years

Year:	0	5	10	15	20
Investment:	-$8000	-$8000	-$8000	-$8000	

Maintenance costs: $1000 every year for 20 years

Fuel costs: $ 250 every year for 20 years (5000 miles at 5 cents a mile)

Step 2: Compute the NPV of each stream.

NPV of replicating used cars for 20 years = -22225.61

NPV of replicating new cars for 20 years = -22762.21

The net present value of the costs incurred by buying a used car every 4 years is less negative than the net present value of the costs incurred by buying a new car every 5 years, given that the cars will be driven 5000 miles every year. As the mileage driven increases, however, the relative benefits of owning and driving the more efficient new car will also increase.

Equivalent Annuities

We can compare projects with different lives by converting their net present values into **equivalent annuities**. In this method, we convert the net present values into annuities. Since the NPV is annualized, it can be compared legitimately across projects with different lives. The net present value of any project can be converted into an annuity using the following calculation.

Equivalent Annuity = Net Present Value * [A(PV,r,n)]

where

r = Project discount rate,

n = Project lifetime

A(PV,r,n) = annuity factor, with a discount rate of r and an annuity of n years

Note that the net present value of each project is converted into an annuity using that project's life and discount rate. Thus, this approach is flexible enough to use on projects with different discount rates and life times. Consider again the example of the 5-year and 10-year projects given in the previous section. The net present values of these projects can be converted into annuities as follows:

Equivalent Annuity for 5-year project = $442 * PV(A,12%,5 years) = $ 122.62

Equivalent Annuity for 10-year project = $478 * PV(A,12%,10 years) = $ 84.60

The net present value of the 5-year project is lower than the net present value of the 10-year project, but using equivalent annuities, the 5-year project yields $37.98 more per year than the 10-year project.

While this approach does not explicitly make an assumption of project replication, it does so implicitly. Consequently, it will always lead to the same decision rules as the replication method. The advantage is that the equivalent annuity method is less tedious and will continue to work even in the presence of projects with infinite lives.

eqann.xls: This spreadsheet allows you to compare projects with different lives, using the equivalent annuity approach.

Illustration 6.4: Equivalent Annuities To Choose Between Projects With Different Lives

Consider again the choice between a new car and a used car described in illustration 12.4. The equivalent annuities can be estimated for the two options as follows:

Step 1: Compute the net present value of each project individually (without replication)

Net present value of buying a used car	= - $3,000 - $ 2,500 * PV(A,15%,4 years)
	= - $10,137
Net present value of buying a new car	= - $8,000 - $ 1,250 * PV(A,15%,5 years)
	= - $12,190

Step 2: Convert the net present values into equivalent annuities

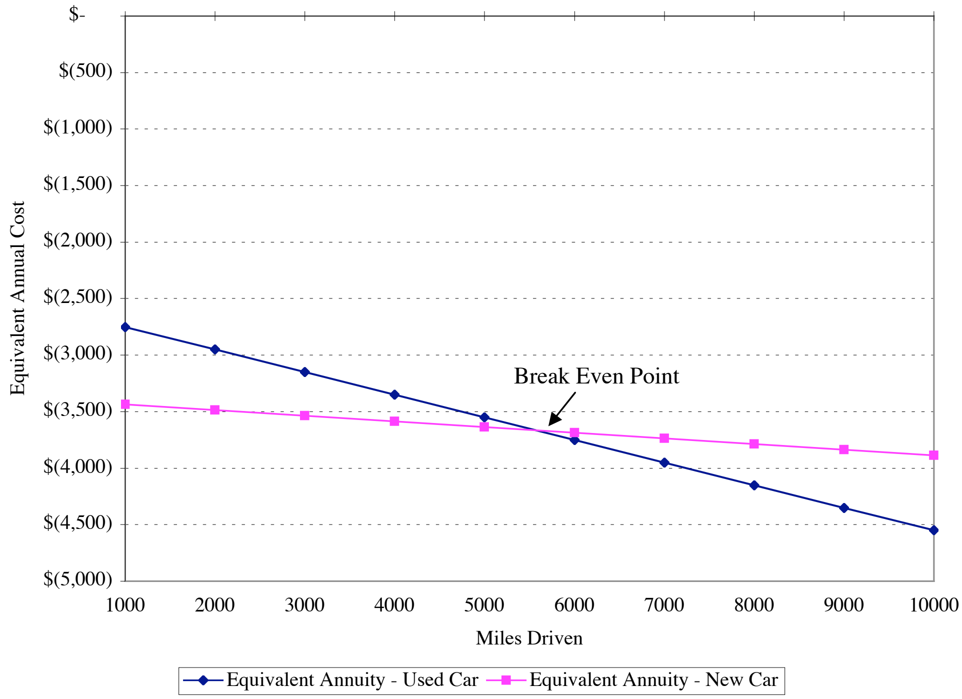
Equivalent annuity of buying a used car	= -$10,137 * (A(PV,15%, 4 years))
	= -$3,551
Equivalent annuity of buying a new car	= -12,190 * (A(PV,15%, 5 years))
	= -$3,637

Based on the equivalent annuities of the two options, buying a used car is more economical than buying a new car.

Calculating Break-even

When an investment that costs more initially but is more efficient and economical on an annual basis is compared with a less expensive and less efficient investment, the choice between the two will depend on how much the investments get used. For instance, in illustration 6.4, the less expensive used car is the more economical choice if the mileage driven is less than 5000 miles. The more efficient new car will be the better choice if the car is driven more than 5000 miles. The *break-even* is the number of miles at which the two alternatives provide the same equivalent annual cost, as is illustrated in Figure 6.6.

Figure 6.6: Equivalent Annual Costs as a function of Miles Driven



The break-even occurs at roughly 5500 miles; if there is a reasonable chance that the mileage driven will exceed this break-even, the new car becomes the better option.

Illustration 6.5: Using Equivalent Annuities as a General Approach for Multiple Projects

The equivalent annuity approach can be used to compare multiple projects with different lifetimes. For instance, assume that Disney is considering three storage alternatives for its retailing division:

Alternative	*Initial Investment*	*Annual Cost*	*Project Life*
Build own storage system	$ 10 million	$ 0.5 million	Infinite
Rent storage system	$ 2 million	$ 1.5 million	12 years
Use third-party storage	-----	$ 2.0 million	1 year

These projects have different lives; the equivalent annual costs have to be computed for the comparison. If the correct cost of capital for the retail business is 12.5%, the equivalent annual costs can be computed as follows:

Alternative	*Net Present Value*	*Equivalent Annual Cost*
Build own storage system	$ 14.00 million	$ 1.75 million
Rent storage system	$ 11.08 million	$ 1.83 million

Use third-party storage	\$ 2.00 million	\$ 2.00 million

Based on the equivalent annual costs, Disney should build its own storage system, even though the initial costs are the highest for this option.

6.2. ☞: **Mutually exclusive projects with different risk levels**

Assume that the cost of the third-party storage option will increase 2.5% a year forever. What would the equivalent annuity for this option be?

a. \$2.05 million

b. \$2.50 million

c. \$ 2 million

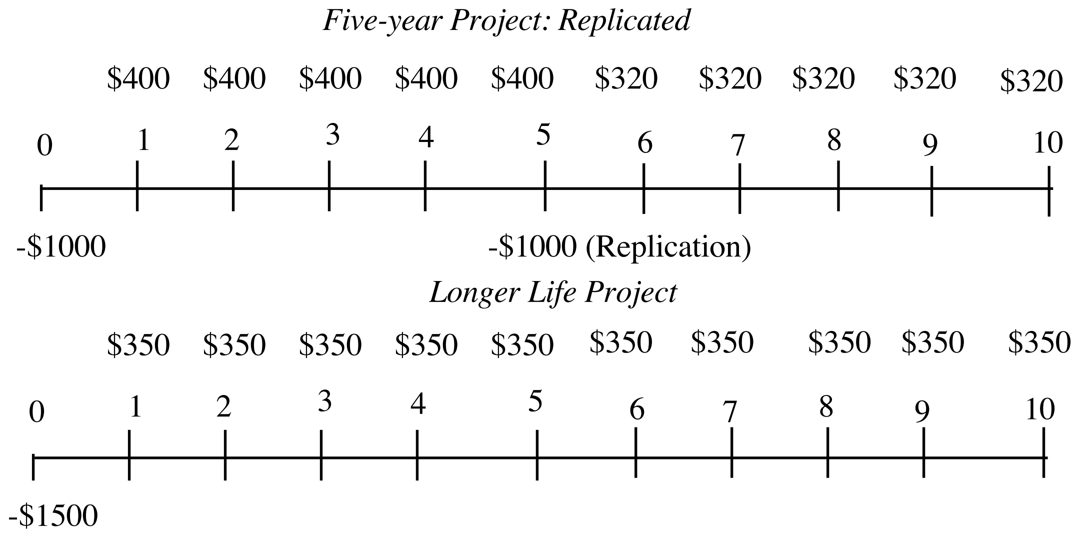
d. None of the above

Explain your answer.

Project Comparison Generalized

To compare projects with different lives, we can make specific assumptions about the types of projects that will be available when the shorter term projects end. To illustrate, we can assume that the firm will have no positive net present value projects when its current projects end; this will lead to a decision rule whereby the net present values of projects can be compared, even if they have different lives. Alternatively, we can make specific assumptions about the availability and the attractiveness of projects in the future, leading to cash flow estimates and present value computations. Again, going back to the 5-year and 10-year projects described in figure 6.4, assume that future projects will not be as attractive as current projects. More specifically, assume that the annual cash flows on the second 5-year project that will be taken when the first 5-year project ends will be \$320 instead of \$400. The net present values of these two investment streams can be computed as shown in Figure 6.7.

Figure 6.7: Cash Flows on Projects with Unequal Lives: Replicated with poorer project



The net present value of the first project, replicated to have a life of 10 years, is $ 529. This is still higher than the net present value of $478 of the longer life project. The firm will still pick the shorter-life project, though the margin in terms of net present value has shrunk.

This problem is not avoided by using internal rates of return. When the internal rate of return of a short-term project is compared to the internal rate of return of a long term project, there is an implicit assumption that future projects will continue to have similar internal rates of return.

The Replacement Decision: A Special Case of Mutually Exclusive Projects

In a *replacement decision*, we evaluate the replacement of an existing investment with a new one, generally because the existing investment has aged and become less efficient. In a typical replacement decision,

- the replacement of old equipment with new equipment will require an initial cash outflow, because the money spent on the new equipment will exceed any proceeds obtained from the sale of the old equipment.
- there will be cash inflows during the life of the new machine as a consequence of either the lower costs of operation arising from the newer equipment or the higher revenues flowing from the investment. These cash inflows will be augmented by the tax benefits accruing from the greater depreciation that will arise from the new investment.

- the salvage value at the end of the life of the new equipment will be the differential salvage value — i.e., the excess of the salvage value on the new equipment over the salvage value that would have been obtained if the old equipment had been kept for the entire period and had not been replaced.

This approach has to be modified if the old equipment has a remaining life that is much shorter than the life of the new equipment replacing it.

replace.xls: This spreadsheet allows you to analyze a replacement decision.

Illustration 6.6: Analyzing a Replacement Decision

Bookscape would like to replace an antiquated packaging system with a new one. The old system has a book value of $50,000 and a remaining life of 10 years and could be sold for $15,000, net of capital gains taxes, right now. It would be replaced with a new machine that costs $150,000 and has a depreciable life of 10 years, and annual operating costs are $40,000 lower than with the old machine. Assuming straight line depreciation for both the old and the new system, a 40% tax rate, and no salvage value on either machine in 10 years, the replacement decision cash flows can be estimated as follows:

Net Initial Investment in New Machine = - $150,000 + $ 15,000 = $ 135,000

Depreciation on the old system = $ 5,000

Depreciation on the new system = $ 15,000

Annual Tax Savings from Additional Depreciation on New Machine = (Depreciation on old machine – Depreciation on new machine) (Tax rate) = ($15,000-$5,000)*0.4 = $ 4000

Annual After-tax Savings in Operating Costs = $40,000 (1-0.4) = $ 24,000

The cost of capital for the company is 12%, resulting in a net present value from the replacement decision of

Net Present Value of Replacement Decision = - $135,000 + $ 28,000 * PV(A,12%,10 years) = $23,206

This result would suggest that replacing the old packaging machine with a new one will increase the firm's net present value by $23,206 and would be a wise move to make.

Capital Rationing

In evaluating capital investments, we have implicitly assumed that investing capital in a good project has no effect on subsequent projects that the firm may consider. Implicitly, we are assuming that firms with good projects can raise capital from financial markets, at a fair price, and without paying transactions costs. In reality, however, it is possible that the capital required to finance a project can cause managers to reject other good projects because the firm has access to limited capital. **Capital rationing** occurs when a firm is unable to invest in projects that earn returns greater than the hurdle rates[2]. Firms may face capital rationing constraints because they do not have either the capital on hand or the capacity to raise the capital needed to finance these projects. This implies that the firm does not have — and cannot raise — the capital to accept the positive net present value projects that are available to it. A firm that has many projects and limited resources on hand does not necessarily face capital rationing. It might still have the capacity to raise the resources from financial markets to finance all these projects.

Reasons for Capital Rationing Constraints

In theory, there will be no capital rationing constraint as long as a firm can follow this series of steps in locating and financing investments:

1. The firm identifies an attractive investment opportunity.
2. The firm goes to financial markets with a description of the project to seek financing.
3. Financial markets believe the firm's description of the project.
4. The firm issues securities — i.e., stocks and bonds — to raise the capital needed to finance the project at fair market prices. Implicit here is the assumption that markets are efficient and that expectations of future earnings and growth are built into these prices.
5. The cost associated with issuing these securities is minimal.

If this were the case for every firm, then every worthwhile project would be financed and no good project would ever be rejected for lack of funds; in other words, there would be no capital rationing constraint.

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[2] For discussions of the effect of capital rationing on the investment decision, see Lorie and Savage (1955) and Weingartner (1977).

The sequence described above depends on a several assumptions, some of which are clearly unrealistic, at least for some firms. Let's consider each step even more closely.

1. Project Discovery: The implicit assumption that firms know when they have good projects on hand underestimates the uncertainty and the errors associated with project analysis. In very few cases can firms say with complete certainty that a prospective project will be a good one.

2. Firm Announcements and Credibility: Financial markets tend to be skeptical about announcements made by firms, especially when such announcements contain good news about future projects. Since is easy for any firm to announce that its future projects are good, regardless of whether this is true or not, financial markets often require more substantial proof of the viability of projects.

3. Market Efficiency: If the securities issued by a firm are under priced by markets, firms may be reluctant to issue stocks and bonds at these low prices to finance even good projects. In particular, the gains from investing in a project for existing stockholders may be overwhelmed by the loss from having to sell securities at or below their estimated true value. To illustrate, assume that a firm is considering a project that requires an initial investment of $ 100 million and has a net present value of $ 10 million. Also assume that the stock of this company, which management believes should be trading for $100 per share, is actually trading at $ 80 per share. If the company issues $100 million of new stock to take on the new project, its existing stockholders will gain their share of the net present value of $10 million but they will lose $20 million ($100 million - $ 80 million) to new investors in the company. There is an interesting converse to this problem. When securities are overpriced, there may be a temptation to over invest, since existing stockholders gain from the very process of issuing equities to new investors.

5. Flotation Costs: The costs associated with raising funds in financial markets, and can be substantial. If these costs are larger than the net present value of the projects being considered, it would not make sense to raise these funds and finance the projects.

Sources of Capital Rationing

What are the sources of capital rationing? Going through the process described in the last section in Table 6.2, we can see the possible reasons for capital rationing at each step:

Table 6.2: Capital Rationing: Theory vs. Practice

	In theory	*In practice*	*Source of Rationing*
1. Project Discovery	A business uncovers a good investment opportunity.	A business believes, given the underlying uncertainty, that it has a good project.	Uncertainty about true value of projects may cause capital rationing.
2. Information Revelation	The business conveys information about the project to financial markets.	The business attempts to convey information to financial markets.	Difficulty in conveying information to markets may cause rationing.
3. Market Response	Financial markets believe the firm; i.e.,the information is conveyed credibly.	Financial markets may not believe the announcement.	The greater the “credibility gap”, the greater the rationing problem.
4. Market Efficiency	The securities issued by the business (stocks and bonds) are fairly priced.	The securities issued by the business may not be correctly priced.	With underpriced securities, firms will be unwilling to raise funds for projects.
5. Flotation Costs	There are no costs associated with raising funds for projects.	There are significant costs associated with raising funds for projects.	The greater the flotation costs, the larger will be the capital rationing problem.

The three primary sources of capital rationing constraints, therefore, are lack of credibility, under pricing of securities and flotation costs.

Researchers have collected data on firms to determine whether the firms face capital rationing constraints, and if so, to identify the sources of such constraints. One such survey was conducted by Scott and Martin and is summarized in Table 6.3.

Table 6.3: The Causes of Capital Rationing

Cause	*# firms*	*%*
Debt limit imposed by outside agreement	10	10.7
Debt limit placed by management external to firm	3	3.2
Limit placed on borrowing by internal management	65	69.1
Restrictive policy imposed on retained earnings	2	2.1
Maintenance of target EPS or PE ratio	14	14.9

Source: Martin and Scott (1976)

This survey suggests that although some firms face capital rationing constraints as a result of external factors largely beyond their control, such as issuance costs and credibility problems, most firms face self-imposed constraints, such as restrictive policies to avoid over-extending themselves by investing too much in any period.

Project Selection with Capital Rationing

Whatever the reason, many firms have capital rationing constraints, limiting the funds available for investment. Consequently, the investment analysis techniques developed in Chapter 5, such as net present value, may prove inadequate because they are based on the premise that all good projects will be accepted. In this section, we examine some of the measures to incorporate the capital rationing constraint into project evaluations.

Internal Rate of Return

As we noted in chapter 5, one reason many firms continue to use internal rate of return rather than net present value in their investment decisions is because they perceive themselves to be subject to capital rationing. Since the internal rate of return is a percentage measure of return, it measures the return to a dollar of invested capital and provides a way of directing capital to those investments where this return is highest. The limitations of the IRR approach were also examined in chapter 5, especially with its reinvestment rate assumptions and the potential for multiple and misleading internal rates of return.

Profitability Index

The profitability index is the simplest method of including capital rationing in investment analysis. It is particularly useful for firms that have a constraint for the current period only, and relatively few projects. A scaled version of the net present value, the profitability index is computed by dividing the net present value of the project by the initial investment in the project.[3]

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[3] There is another version of the profitability index, whereby the present value of all cash inflows is divided by the present value of cash outflows. The resulting ranking will be the same as with the profitability index, as defined in this chapter.

Profitability Index = Net Present Value / Initial Investment

The profitability index provides a rough measure of the net present value the firm gets for each dollar it invests. To use it in investment analysis, we first it for each investment the firm is considering, and then pick projects based on the profitability index, starting with the highest values and working down until we reach the capital constraint. When capital is limited and a firm cannot accept every positive net present value, the profitability index identifies the highest cumulative net present value from the funds available for capital investment.

Although the profitability index is intuitively appealing, it has several limitations. First, it assumes that the capital rationing constraint applies to the current period only and does not include investment requirements in future periods. Thus, a firm may choose projects with a total initial investment that is less than the current period's capital constraint, but it may expose itself to capital rationing problems in future periods if these projects have outlays in those periods. A related problem is the classification of cash flows into an initial investment that occurs now and operating cash inflows that occur in future periods. If projects have investments spread over multiple periods and operating cash outflows, the profitability index may measure the project's contribution to value incorrectly. Finally, the profitability index does not guarantee that the total investment will add up to the capital rationing constraint. If it does not, we have to consider other combinations of projects, which may yield a higher net present value. Although this is feasible for firms with relatively few projects, it becomes increasing unwieldy as the number of projects increases.

Illustration 6.7: Using the Profitability Index to select projects

Assume that Bookscape, as a private firm, has limited access to capital, has a capital budget of $100,000 in the current period. The projects available to the firm are listed in Table 6.4.

Table 6.4: Available Projects

Project	Initial Investment (in 000s)	NPV (000s)
A	$ 25	$10
B	$ 40	$ 20
C	$ 5	$ 5
D	$ 100	$ 25

E	$ 50	$ 15
F	$ 70	$ 20
G	$ 35	$ 20

Note that all the projects have positive net present values and would have been accepted by a firm not subject to a capital rationing constraint.

In order to choose among these projects, we compute the profitability index of each project in Table 6.5.

Table 6.5: Profitability Index for Projects

Project	*Initial Investment*	*NPV*	*Profitability Index*	*Ranking*
A	$25	$10	0.40	4
B	$60	$30	0.50	3
C	$5	$5	1.00	1
D	$100	$25	0.25	7
E	$50	$15	0.30	5
F	$70	$20	0.29	6
G	$35	$20	0.57	2

The profitability index of 0.40 for project A means that the project earns a net present value of 40 cents for every dollar of initial investment. Based on the profitability index, we should accept projects B, C and G. This combination of projects would exhaust the capital budget of $100,000 while maximizing the net present value of the projects accepted.

Note that this analysis is based on the assumption that the capital constraint is for the current period only and that the initial investments on all these projects will occur in the current period[4]. It also highlights the cost of the capital rationing constraint for this firm; the net present value of the projects rejected as a consequence of the constraint is $70 million.

Building in Capital Rationing Constraints into Analysis

We recommend that firms separate the capital rationing constraint from traditional investment analysis so they can observe how much these constraints cost. In the simplest terms, the cost of a capital rationing constraint is the total net present value of the good projects that could not be taken for lack of funds. There are two reasons why this

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[4] When capital rationing constraints occur over multiple periods, and there are dozens of projects, mathematical programming has been suggested as a solution by Baumol and Quandt (1965).

knowledge is useful. First, if the firm is faced with the opportunity to relax these constraints, knowing how much these constraints are costing the firm will be useful. For instance, the firm may be able to enter into a strategic partnership with a larger firm with excess funds and use the cash to take the good projects that would otherwise have been rejected, sharing the net present value of these projects. Second, if the capital rationing is self-imposed, managers in the firm are forced to confront the cost of the constraint. In some cases, the sheer magnitude of this cost may be sufficient for them to drop or relax the constraint.

6.3. ☞: **Mutually exclusive projects with different risk levels**

Assume, in illustration 6.7, that the initial investment required for project B were $40,000. Which of the following would be your best combination of projects given your capital rationing constraint of $100,000?

a. B, C and G
b. A,B, C and G
c. A, B and G
d. Other

In Practice: Using A Higher Hurdle Rate

Some firms choose what seems to be a more convenient way of selecting projects, when they face capital rationing — they raise the hurdle rate to reflect the severity of the constraint. If the definition of capital rationing is that a firm cannot take all the positive net present value projects it faces, raising the hurdle rate sufficiently will ensure that the problem is resolved or at least is hidden. For instance, assume that a firm has a true cost of capital of 12%,[5] a capital rationing constraint of $100 million, and positive net present value projects requiring an initial investment of $250 million. At a higher cost of capital, fewer projects will have positive net present values. At some cost of capital, say 18%, the

[5] By true cost of capital, we mean a cost of capital that reflects the riskiness of the firm and its financing mix.

positive net present value projects remaining will require an initial investment of $100 million or less.

There are problems which may result from building the capital rationing constraint into the cost of capital. First, once the adjustment has been made, the firm may fail to correct it for shifts in the severity of the constraint. Thus, a small firm may adjust its cost of capital from 12% to 18% to reflect a severe capital rationing constraint. As the firm gets larger, the constraint will generally become less restrictive, but the firm may not decrease its cost of capital accordingly. Second, increasing the discount rate will yield net present values that do not convey the same information as those computed using the correct discount rates. The net present value of a project, estimated using the right discount rate, is the value added to the firm by investing in that project; the adjusted present value estimated using an adjusted discount rate cannot be read the same way. Finally, adjusting the discount rate penalizes all projects equally, whether they are capital intensive or not.

Side Costs from Projects

In much of the project analyses that we have presented in this chapter, we have assumed that the resources needed for a project are newly acquired; this includes not only the building and the equipment, but also the personnel needed to get the project going. For most businesses considering new projects, this is an unrealistic assumption, however, since many of the resources used on these projects are already part of the business and will just be transferred to the new project. When a business uses such resources, there is the potential for an opportunity cost — the cost created for the rest of the business as a consequence of this project. This opportunity cost may be a significant portion of the total investment needed on a project.

Opportunity Cost: This is the cost assigned to a project resource that is already owned by the firm. It is based upon the next best alternative use.

1. Opportunity Costs

In much of the project analyses that we have presented in this chapter, we have assumed that the resources needed for a project are newly acquired; this includes not only building and equipment, but also the personnel needed to get the project going. For most businesses considering new projects, this is an unrealistic assumption, however, since many of the resources used on these projects are already part of the business and will just be transferred to the new project. When a business uses such resources, there is the potential for an opportunity cost — the cost created for the rest of the business as a consequence of using existing resources in this project instead of elsewhere. This opportunity cost may be a significant portion of the total investment needed on a project.

The opportunity cost for a resource is simplest to estimate when there is a current alternative use for the resource, and we can estimate the cash flows lost by using the resource on the project. It becomes more complicated when the resource has not a current use but potential future uses. In that case, we have to estimate the cash flows foregone on those future uses to estimate the opportunity costs.

Resource with a current alternative use

The general framework for analyzing opportunity costs begins by asking the question " Is there any other use for this resource right now?" For many resources, there will be an alternative use if the project being analyzed is not taken.

- The resource might be rented out, in which case the rental revenue is the opportunity lost by taking this project. For example, if the project is considering the use of a vacant building owned by the business already, the potential revenue from renting out this building to an outsider will be the opportunity cost.
- The resource could be sold, in which case the sales price, net of any tax liability and lost depreciation tax benefits, would be the opportunity cost from taking this project.
- The resource might be used elsewhere in the firm in which case the cost of replacing the resource is considered the opportunity cost. Thus, the transfer of experienced employees from established divisions to a new project creates a cost to these divisions, which has to be factored into the decision making.

Sometimes, decision makers have to decide whether the opportunity cost will be estimated based on the lost rental revenue, the foregone sales price or the cost of replacing the resource. When such a choice has to be made, it is the highest of the costs – – that is, the best alternative foregone — that should be considered as an opportunity cost.

6.4. ☞: **Sunk Costs and Opportunity Costs**

A colleague argues that resources that a firm owns already should not be considered in investment analysis, because the cost is a sunk cost. Do you agree?

a. Yes

b. No

How would you reconcile the competing arguments of sunk and opportunity costs?

Illustration 6.8: Estimating the Opportunity Cost for a Resource with a Current Alternative Use

Working again with the Bookscape Online example, assume that the following additional information is provided:

- While Bookscape Online will employ only two full-time employees, it is estimated that the additional business associated with on-line ordering, and the administration of the service itself will add approximately 40 hours of work for the current general manager of the bookstore. As a consequence, the salary of the general manager will be increased from \$ 100,000 to \$ 120,000 next year; it is expected to grow 5% a year after that..
- It is also estimated that Bookscape Online will utilize an office that is currently used to store financial records. The records will be moved to a bank vault, which will cost \$ 1000 a year to rent.

The opportunity cost of the addition to the general manager's workload lies in the additional salary expenditure that will be incurred as a consequence. Taking the present value of the after-tax costs (using a 40% tax rate) over the next 5 years, using the cost of capital of 22.76% estimated in illustration 5.2, yields the estimates in Table 6.6:

Table 6.6: Present Value of Additional Salary Expenses

	1	2	3	4
Increase in Salary	\$20,000	\$21,000	\$22,050	\$23,153
After-tax expense	\$12,000	\$12,600	\$13,230	\$13,892
Present Value	\$9,775	\$8,361	\$7,152	\$6,117

The cumulated present value of the costs is \$31,046.

Turning to the second resource — the storage space originally used for the financial record — if this project is taken, the opportunity cost is the cost of the bank vault.

Additional Storage Expenses per year = $1,000

After-tax Additional Storage Expenditure per year = $1,000 (1 - 0.40) = $ 600

PV of After-tax Storage Expenditures for 4 years = $ 600 * PV (A, 22.76%,4 years)

= $ 1,475.48

The opportunity costs estimated for the general manager's added workload ($ 31,046) and the storage space ($1,475) are in present value terms and can be added on to <$38,893> that we computed as the net present value of Bookscape Online in illustration 5.11.The net present value becomes more negative.

Net present value with opportunity costs = NPV without opportunity costs + Present value of opportunity costs = -$38.893 - $31,046 - $1,475= - $71,774

The cash flows associated with the opportunity costs could alternatively have been reflected in the years in which they occur. Thus, the additional salary and storage expenses could have been added to the operating expenses of the store in each of the 4 years. As table 6.7 indicates, this approach would yield the same net present value and would have clearly been the appropriate approach if the internal rate of return were to be calculated.

Table 6.7: Net Present Value with Opportunity Costs – Alternate Approach

Year	Cashflow with opportunity costs	Present Value
0	-$1,150,000	-$1,150,000
1	$327,400	$266,705
2	$401,800	$266,633
3	$432,670	$233,890
4	$706,238	$310,998
	Net Present Value =	-$71,774

Note that this net present value confirms our earlier finding —this project should not be taken.

Opportunity Costs of Resources with no Current Alternative Use

In some cases, a resource that is being considered for use in a project will have no current alternative use but the business will have to forego alternative uses in the future.

One example would be excess capacity on a machine or a computer. Most firms cannot lease or sell excess capacity, but using that capacity now for a new product may cause the businesses to run out of capacity much earlier than otherwise, leading to one of two costs:

- They assume that excess capacity is free, since it is not being used currently and cannot be sold off or rented, in most cases.
- They allocate a portion of the book value of the plant or resource to the project. Thus, if the plant has a book value of $ 100 million and the new project uses 40% of it, $ 40 million will be allocated to the project.

We will argue that neither of these approaches considers the opportunity cost of using excess capacity, since the opportunity cost comes usually comes from costs that the firm will face in the future as a consequence of using up excess capacity today. By using up excess capacity on a new project, the firm will run out of capacity sooner than it would if it did not take the project. When it does run out of capacity, it has to take one of two paths:

- New capacity will have to be bought or built when capacity runs out, in which case the opportunity cost will be the higher cost in present value terms of doing this earlier rather than later.
- Production will have to be cut back on one of the product lines, leading to a loss in cash flows that would have been generated by the lost sales.

Again, this choice is not random, since the logical action to take is the one that leads to the lower cost, in present value terms, for the firm. Thus, if it cheaper to lose sales rather than build new capacity, the opportunity cost for the project being considered should be based on the lost sales.

A general framework for pricing excess capacity for purposes of investment analysis asks three questions:

(1) If the new project is not taken, when will the firm run out of capacity on the equipment or space that is being evaluated?

(2) If the new project is taken, when will the firm run out of capacity on the equipment or space that is being evaluated? Presumably, with the new project using up some of the excess capacity, the firm will run out of capacity sooner than it would have otherwise.

(3) What will the firm do when it does run out of capacity? The firm has two choices:

It can cut back on production of the less profitable product line and make less profits than it would have without a capacity constraint. In this case, the opportunity cost is the present value of the cash flows lost as a consequence.

It can buy or build new capacity, in which case the opportunity cost is the difference in present value between investing earlier rather than later.

2. Product Cannibalization

Product cannibalization refers to the phenomenon whereby a new product introduced by a firm competes with and reduces sales of the firm's existing products. On one level, it can be argued that this is a negative incremental effect of the new product, and the lost cash flows or profits from the existing products should be treated as costs in analyzing whether or not to introduce the product. Doing so introduces the possibility that of the new product will be rejected, however. If this happens, and a competitor now exploits the opening to introduce a product that fills the niche that the new product would have and consequently erodes the sales of the firm's existing products, the worst of all scenarios is created – the firm loses sales to a competitor rather than to itself.

Product Cannibalization: These are sales generated by one product, which come at the expense of other products manufactured by the same firm.

Thus, the decision whether or not to build in the lost sales created by product cannibalization will depend on the potential for a competitor to introduce a close substitute to the new product being considered. Two extreme possibilities exist: the first is that close substitutes will be offered almost instantaneously by competitors; the second is that substitutes cannot be offered.

- If the business in which the firm operates is extremely competitive and there are no barriers to entry, it can be assumed that the product cannibalization will occur anyway, and the costs associated with it have no place in an incremental cash flow analysis. For example, in considering whether to introduce a new brand of cereal, a company like Kellogg's can reasonably ignore the expected product cannibalization that will occur because of the competitive nature of the cereal business and the ease with which Post or General Food could introduce a close substitute. Similarly, it would not make sense for Compaq to consider the product cannibalization that will occur as a consequence of introducing a Pentium notebook PC since it can be reasonably assumed that a competitor, say IBM or Dell, would create the lost sales anyway with their versions of the same product if Compaq does not introduce the product.

- If a competitor cannot introduce a substitute, because of legal restrictions such as patents, for example, the cash flows lost as a consequence of product cannibalization belong in the investment analysis, at least for the period of the patent protection. For example, Glaxo, which owns the rights to Zantac, the top selling ulcer drug, should consider the potential lost sales from introducing a new and maybe even better ulcer drug in deciding whether and when to introduce it to the market.

In most cases, there will be some barriers to entry, ensuring that a competitor will either introduce an imperfect substitute, leading to much smaller erosion in existing product sales, or that a competitor will not introduce a substitute for some period of time, leading to a much later erosion in existing product sales. In this case, an intermediate solution, whereby some of the product cannibalization costs are considered, may be appropriate. Note that brand name loyalty is one potential barrier to entry. Firms with stronger brand name loyalty should therefore factor into their investment analysis more of the cost of lost sales from existing products as a consequence of a new product introduction.

6.5. ☞: **Product Cannibalization at Disney**

In coming up with revenues on its proposed theme parks in Thailand, Disney estimates that 15% of the revenues at these parks will be generated from people who would have gone to Disneyland in California, if these parks did not exist. When analyzing the project in Thailand, would you use

a. the total revenues expected at the park?
b. only 85% of the revenues, since 15% of the revenues would have come to Disney anyway?
c. a compromise estimated that lies between the first two numbers?

Explain.

Project Synergy: This is the increase in cash flows that accrue to other projects, as a consequence of the project under consideration.

Project Synergy

When a project under consideration creates positive benefits (in the form of cash flows) for other projects that a firm may have, there are project synergies. For instance, assume that you are a clothing retailer considering whether to open an upscale clothing store for children in the same shopping center where you already own a store which caters to an adult audience. In addition to generating revenues and cash flows on its own, the children's store might increase the traffic into the adult store and increase profits at that store. That additional profit, and its ensuing cash flow, has to be factored into the analysis of the new store.

Sometimes the project synergies are not with existing projects but with other projects that are being considered contemporaneously. In such cases, the best way to analyze the projects is jointly, since examining each separately will lead to a much lower net present value. Thus, a proposal to open a children's clothing store and an adult clothing store in the same shopping center will have to be treated as a joint investment analysis, and the net present value will have calculated for both stores together. A positive net present value would suggest opening both stores, whereas a negative net present value would indicate that neither should be opened.

Illustration 6.9: Cash Flow Synergies with Existing Projects

Assume that the Bookscape is considering adding a cafe to its bookstore. The cafe, it is hoped, will make the bookstore a more attractive destination for would-be shopper. The following information relates to the proposed cafe:

- The initial cost of remodeling a portion of the store to make it a cafe, and of buying equipment is expected to be $150,000. This investment is expected to have a life of 5 years, during which period it will be depreciated using straight line depreciation. None of the cost is expected to be recoverable at the end of the five years.
- The revenues in the first year are expected to be $ 60,000, growing at 10% a year for the next four years.
- There will be one employee, and the total cost for this employee in year 1 is expected to be $30,000 growing at 5% a year for the next 4 years.

- The cost of the material (food, drinks ..) needed to run the cafe is expected to be 40% of revenues in each of the 5 years.
- An inventory amounting to 5% of the revenues has to be maintained; investments in the inventory are made at the beginning of each year.
- The tax rate for Bookscape as a business is 40%.

Based upon this information, the estimated cash flows on the cafe are shown in Table 6.8.

Table 6.8: Estimating Cash Flows from Opening Bookscape Cafe

	0	*1*	*2*	*3*	*4*	*5*
Investment	- $ 150,000					
Revenues		$60,000	$66,000	$72,600	$79,860	$87,846
Labor		$30,000	$31,500	$33,075	$34,729	$36,465
Materials		$24,000	$26,400	$29,040	$31,944	$35,138
Depreciation		$30,000	$30,000	$30,000	$30,000	$30,000
Operating Income		-$24,000	-$21,900	-$19,515	-$16,813	-$13,758
Taxes		-$9,600	-$8,760	-$7,806	-$6,725	-$5,503
AT Operating Income		-$14,400	-$13,140	-$11,709	-$10,088	-$8,255
+ Depreciation		$30,000	$30,000	$30,000	$30,000	$30,000
- Δ Working Capital	$3,000	$300	$330	$363	$399	-$4,392
Cash Flow to Firm	-$153,000	$15,300	$16,530	$17,928	$19,513	$26,138
PV at 12.14%	-$153,000	$13,644	$13,146	$12,714	$12,341	$14,742
Working Capital		$ 3,000	$ 3,300	$ 3,630	$ 3,993	$ 4,392

Note that the working capital is fully salvaged at the end of year 5, resulting in a cash inflow of $4,392.

To compute the net present value, we will use Bookscape's cost of capital of 12.14% (from chapter 4). In doing so, we recognize that this is the cost of capital for a bookstore, and that this is an investment in a cafe. It is, however, a cafe whose good fortunes rest with how well the bookstore in doing, and whose risk is therefore, the risk associated with the bookstore. The present value of the cash inflows is less than the initial investment of $150,00, resulting in a NPV of -$86,413. This suggests that this is not a good investment, based on the cash flows it would generate.

Note though, that this analysis is based upon looking at the cafe as a stand-alone entity, and that one of the benefits of the cafe is that is that it might attract more customers to the store, and get those customers who come to buy more books. For purposes of our analysis, assume that the cafe will increase revenues at the store by $500,000 in year 1, growing at 10% a year for the following 4 years. In addition, assume that the pre-tax operating margin on these sales is 10%. The incremental cash flows from the "synergy" are shown in Table 6.9.

Table 6.9: Incremental Cash Flows from Synergy

	1	*2*	*3*	*4*	*5*
Increased Revenues	$500,000	$550,000	$605,000	$665,500	$732,050
Operating Margin	10.00%	10.00%	10.00%	10.00%	10.00%
Operating Income	$50,000	$55,000	$60,500	$66,550	$73,205
Operating Income after Taxes	$29,000	$31,900	$35,090	$38,599	$42,459
PV of Cash Flows @ 12.14%	$25,861	$25,369	$24,886	$24,412	$23,947

The present value of the incremental cash flows generated for the bookstore as a consequence of the cafe is $124,474. Incorporating this into the present value analysis yields the following:

Net Present Value of Cafe = - $86,413 + $ 124,474 = $38,061

Incorporating the cash flows from the synergy into the analysis, the cafe is a good investment for Bookscape.

6.6. ☞: **Synergy benefits**

In the analysis above, the cost of capital for both the cafe and the bookstore were identical at 12.14%. Assume that the cost of capital for the cafe had been 15%, while the cost of capital for the bookstore had stayed at 12.14%. Which discount rate would you use for estimating the present value of synergy benefits?

❒ 15%

❒ 12.14%

❒ An average of the two discount rates

❒ Could be 12.14% or 15% depending upon ....

Explain.

In Practice: The Value of Synergy: Disney's Animated Movies

Disney has a well-deserved reputation for finding synergy in its movie operations, especially its animated movies. Consider, for instance, some of the spin offs from its recent movies:

1. Plastic action figures and stuffed toys are produced and sold at the time the movies are released, producing profits for Disney both from its own stores and from royalties from sales of the merchandise at other stores.
2. Joint promotions of the movies with fast-food chains such as McDonalds and Burger King, where the chains give away movie merchandise with their kid's meals, and reduce Disney's own advertising costs for the movie by promoting it.
3. With its acquisition of Capital Cities, Disney now has a broadcasting outlet for cartoons based upon successful movies (Aladdin, Little Mermaid, 101 Dalmatians), which produce production and advertising revenues for Disney.
4. Disney has also made a successful Broadway musical of its hit movie "Beauty and the Beast", and plans to use the theater that it now owns on Broadway to produce more such shows.
5. Disney's theme parks all over the world benefit indirectly since the characters from the latest animated movies and shows based upon these movies attract more people to the parks.
6. Disney produces computer software and video games based upon it's animated movie characters.
7. Finally, Disney has been extremely successful in promoting the video releases of its movies as must-have items for video collections.

In fact, on its best-known classics, such as Snow White, Disney released the movie in theaters dozens of times between the original release in 1937 and the eventual video release in 1985, making substantial profits each time.

Synergy in Acquisitions

Synergy is often a motive in acquisitions, but it is used as a way of justifying huge premiums and seldom analyzed objectively. The framework that we developed for valuing synergy in projects can be applied to valuing synergy in acquisitions. The key to the existence of synergy is that the target firm controls a specialized resource that becomes more valuable when combined with the bidding firm's resources. The specialized resource will vary depending upon the merger. Horizontal mergers occur when two firms in the same line of business merge. In that case, the synergy must come from some form of economies of scale, which reduce costs, or from increased market power, which increases profit margins and sales. Vertical integration occurs when a firm acquires a supplier of inputs into its production process or a distributor or retailer for the product it produces. The primary source of synergy in this case comes from more complete control of the chain of production. This benefit has to be weighed against the loss of efficiency from having a captive supplier, who does not have any incentive to keep costs low and compete with other suppliers.

When a firm with strengths in one functional area acquires another firm with strengths in a different functional area (functional integration), synergy may be gained by exploiting the strengths in these areas. Thus, when a firm with a good distribution network acquires a firm with a promising product line, value is gained by combining these two strengths. The argument is that both firms will be better off after the merger.

Most reasonable observers agree that there is a potential for operating synergy, in one form or the other, in many takeovers. Some disagreement exists, however, over whether synergy can be valued and, if so, how much that value should be. One school of thought argues that synergy is too nebulous to be valued and that any systematic attempt to do so requires so many assumptions that it is pointless. While this philosophy is debatable, it implies that a firm should not be willing to pay large premiums for synergy if it cannot attach a value to it.

While it is true that valuing synergy requires assumptions about future cash flows and growth, the lack of precision in the process does not mean that an unbiased estimate of value cannot be made. Thus we maintain that synergy can be valued by answering two fundamental questions:

(1) <u>What form is the synergy expected to take?</u> Will it reduce costs as a percentage of sales and increase profit margins (e.g., when there are economies of scale)? Will it increase future growth (e.g., when there is increased market power)?

(2) When can the synergy be expected to start affecting cash flows — instantaneously or over time?

Once these questions are answered, the value of synergy can be estimated using an extension of discounted cash flow techniques. First, the firms involved in the merger are valued independently, by discounting expected cash flows to each firm at the weighted average cost of capital for that firm. Second, the value of the combined firm, with no synergy, is obtained by adding the values obtained for each firm in the first step. Third, the effects of synergy are built into expected growth rates and cash flows, and the combined firm is re-valued with synergy. The difference between the value of the combined firm with synergy and the value of the combined firm without synergy provides a value for synergy.

Options Embedded in Projects

In chapter 5, we examined the process for analyzing a project, and deciding whether or not to accept the project. In particular, we noted that a project should be accepted only if the returns on the project exceed the hurdle rate; in the context of cash flows and discount rates, this translates into projects with positive net present values. The limitation with traditional investment analysis, which analyzes projects on the basis of expected cash flows and discount rates, is that it fails to consider fully the myriad options that are usually associated with many projects.

In this section, we will analyze three options that are embedded in capital budgeting projects. The first is the option to delay a project, especially when the firm has exclusive rights to the project. The second is the option to expand a project to cover new products or markets some time in the future. The third is the option to abandon a project if the cash flows do not measure up to expectations.

Real Option: A real option is an option on a non-traded asset, such as a investment project or a gold mine.

The Option to Delay a Project

Projects are typically analyzed based upon their expected cash flows and discount rates at the time of the analysis; the net present value computed on that basis is a measure of its value and acceptability at that time. Expected cash flows and discount rates change over time, however, and so does the net present value. Thus, a project that has a negative net present value now may have a positive net present value in the future. In a competitive environment, in which individual firms have no special advantages over their competitors in taking projects, this may not seem significant. In an environment in which a project can be taken by only one firm (because of legal restrictions or other barriers to entry to competitors), however, the changes in the project's value over time give it the characteristics of a call option.

In the abstract, assume that a project requires an initial investment of X (in real dollars) and that the present value of expected cash inflows computed right now is PV. The net present value of this project is the difference between the two:

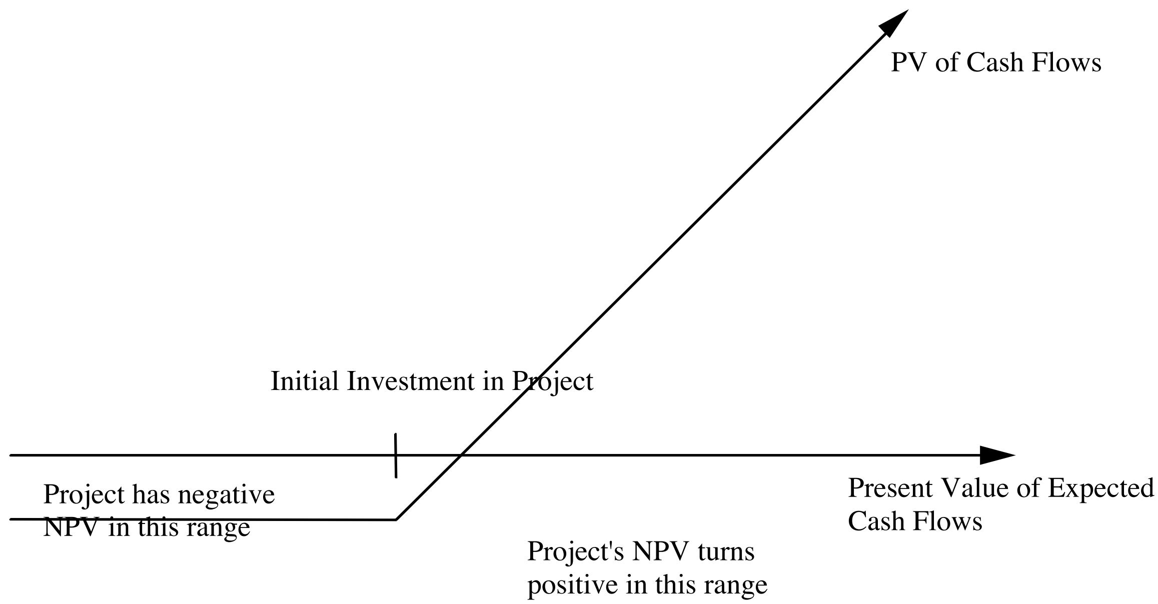
$$NPV = PV - X$$

Now assume that the firm has exclusive rights to this project for the next n years, and that the present value of the cash inflows may change over that time, because of changes in either the cash flows or the discount rate. Thus, the project may have a negative net present value right now, but it may still be a good project if the firm waits. Defining V as the present value of the cash flows, the firm's decision rule on this project can be summarized as follows:

If	$V > X$	Project has positive net present value
	$V < X$	Project has negative net present value

This relationship can be presented in a payoff diagram of cash flows on this project, as shown in Figure 6.8, assuming that the firm holds out until the end of the period for which it has exclusive rights to the project:

Figure 6.8: The Option to Delay a Project



Note that this payoff diagram is that of a call option — the underlying asset is the project, the strike price of the option is the investment needed to take the project; and the life of the option is the period for which the firm has rights to the project. The present value of the cash flows on this project and the expected variance in this present value represent the value and variance of the underlying asset.

Obtaining The Inputs For Option Valuation

On the surface, the inputs needed to apply option pricing theory to valuing the option to delay are the same as those needed for any application: the value of the underlying asset; the variance in the value; the time to expiration on the option; the strike price; the riskless rate and the equivalent of the dividend yield. Actually estimating these inputs for product patent valuation can be difficult, however.

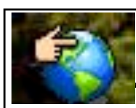
Value Of The Underlying Asset

In the case of product options, the underlying asset is the project itself. The current value of this asset is the present value of expected cash flows fro initiating the project now, which can be obtained by doing a standard capital budgeting analysis. There is likely to be a substantial amount of noise in the cash flow estimates and the present value, however. Rather than being viewed as a problem, this uncertainty should be viewed as the reason for why the project delay option has value. If the expected cash flows on the project were known with certainty and were not expected to change, there would be no need to adopt an option pricing framework, since there would be no value to the option.

Variance In The Value Of The Asset

As noted in the prior section, there is likely to be considerable uncertainty associated with the cash flow estimates and the present value that measures the value of the asset now, partly because the potential market size for the product may be unknown, and partly because technological shifts can change the cost structure and profitability of the product. The variance in the present value of cash flows from the project can be estimated in one of three ways. First, if similar projects have been introduced in the past, the variance in the cash flows from those projects can be used as an estimate. Second, probabilities can be assigned to various market scenarios, cash flows estimated under each scenario and the variance estimated across present values. Finally, the average variance in firm value of publicly traded companies which are in the business that the project will be in can be used. Thus, the average variance in firm value of bio-technology companies can be used as the variance for the option to delay a bio-technology project.

The value of the option is largely derived from the variance in cash flows - the higher the variance, the higher the value of the project delay option. Thus, the value of a option to do a project in a stable business will be less than the value of one in an environment where technology, competition and markets are all changing rapidly.

There is a data set on the web that summarizes, by sector, the variances in firm value and stock prices.

Exercise Price On Option

A project delay option is exercised when the firm owning the rights to the project decides to invest in it. The cost of making this investment is equivalent to the exercise price of the option. The underlying assumption is that this cost remains constant (in present value dollars) and that any uncertainty associated with the product is reflected in the present value of cash flows on the product.

Expiration Of The Option And The Riskless Rate

The project delay option expires when the rights to the project lapse; investments made after the project rights expire are assumed to deliver a net present value of zero as competition drives returns down to the required rate. The riskless rate to use in pricing the option should be the rate that corresponds to the expiration of the option.

Dividend Yield

There is a cost to delaying taking a project, once the net present value turns positive. Since the project rights expire after a fixed period, and excess profits (which are the source of positive present value) are assumed to disappear after that time as new competitors emerge, each year of delay translates into one less year of value-creating cash flows.[6] If the cash flows are evenly distributed over time, and the life of the patent is n years, the cost of delay can be written as:

$$\text{Annual cost of delay} = \frac{1}{n}$$

Thus, if the project rights are for 20 years, the annual cost of delay works out to 5% a year.

6.7. ☞**: Cost of Delay and Early Exercise**
For typical listed options on financial assets, it is argued that early exercise is almost never optimal. Is this true for real options as well?
a. Yes
b. No
Explain.

Illustration 6.10: Valuing a patent

Assume that a pharmaceutical company has been approached by an entrepreneur who has patented a new drug to treat ulcers. The entrepreneur has obtained FDA approval and has the patent rights for the next 17 years. While the drug shows promise, it is still

[6] A value-creating cashflow is one that adds to the net present value because it is in excess of the required return for investments of equivalent risk.

very expensive to manufacture and has a relatively small market. Assume that the initial investment to produce the drug is \$ 500 million and the present value of the cash flows from introducing the drug now is only \$ 350 million. The technology and the market is volatile, and the annualized standard deviation in the present value, estimated from a simulation is 25%.[7]

While the net present value of introducing the drug is negative, the rights to this drug may still be valuable because of the variance in the present value of the cash flow. In other words, it is entirely possible that this drug may not only be viable but extremely profitable a year or two from now. To value this right, we first define the inputs to the option pricing model:

Value of the Underlying Asset (S) = PV of Cash Flows from Project if introduced now

= \$ 350 million

Strike Price (K) = Initial Investment needed to introduce the product = \$ 500 million

Variance in Underlying Asset's Value = $(0.25)^2 = 0.0625$

Time to expiration = Life of the patent = 17 years

Dividend Yield = 1/Life of the patent = 1/17 = 5.88%

Assume that the 17-year riskless rate is 4%. The value of the option can be estimated as follows:

Call Value= 350 $\exp^{(-0.0588)(17)}$ (0.5285) -500 ($\exp^{(-0.04)(17)}$ (0.1219)= \$ 37.12 million

Thus, this ulcer drug, which has a negative net present value if introduced now, is still valuable to its owner.

6.8. ☞: **How much would you pay for this option?**

Assume that you are negotiating for a pharmaceutical company that is trying to buy this patent. What would you pay?

a. \$ 37.12 million
b. More than \$ 37.12 million
c. Less than \$ 37.12 million

---

[7] This simulation would yield an expected value for the project of \$350 million and the standard deviation in that value of 25%.

Explain.

Practical Considerations

While it is quite clear that the option to delay is embedded in many projects, there are several problems associated with the use of option pricing models to value these options. First, the underlying asset in this option, which is the project, is not traded, making it difficult to estimate its value and variance. We would argue that the value can be estimated from the expected cash flows and the discount rate for the project, albeit with error. The variance is more difficult to estimate, however, since we are attempting the estimate a variance in project value over time. One way of doing this is to run a series of simulations capturing as many scenarios for the future as possible and then calculating the variance in the present values derived from these simulations. An alternative is to use the variances in stock prices of firms involved in the same business; thus, the stock price variance of publicly traded biotechnology firms may be used as a proxy for the variance of a biotechnology project's cash flows.

Second, the *behavior of prices over time may not conform to the price path assumed by the option pricing models*. In particular, the assumption that value follows a diffusion process, and that the variance in value remains unchanged over time, may be difficult to justify in the context of a project. For instance, a sudden technological change may dramatically change the value of a project, either positively or negatively.

Third, *there may be no specific period for which the firm has rights to the project*. Unlike the example above, in which the firm had exclusive rights to the project for 20 years, often the firm's rights may be less clearly defined, both in terms of exclusivity and time. For instance, a firm may have significant advantages over its competitors, which may, in turn, provide it with the virtually exclusive rights to a project for a period of time. The rights are not legal restrictions, however, and could erode faster than expected. In such cases, the expected life of the project itself is uncertain and only an estimate.

6.9. ☞**: Exclusive Rights and the Option Feature**

A firm in an extremely competitive sector is faced with a project that has a negative net present value currently and wants to know how much the option to delay the project is worth. Which of the following would you think is the right response?

a. It should be the value from the option pricing model
b. It should be zero
c. Neither
Explain.

Implications Of Viewing The Right To Delay A Project As An Option

Several interesting implications emerge from the analysis of the option to delay a project as an option. First, a project may have a negative net present value based upon expected cash flows currently, but it may still be a "valuable" project because of the option characteristics. Thus, while a negative net present value should encourage a firm to reject a project, it should not lead it to conclude that the rights to this project are worthless. Second, a project may have a positive net present value but still not be accepted right away because the firm may gain by waiting and accepting the project in a future period, for the same reasons that investors do not always exercise an option just because it is in the money. This is more likely to happen if the firm has the rights to the project for a long time, and the variance in project inflows is high. To illustrate, assume that a firm has the patent rights to produce a new type of disk drive for computer systems and that building a new plant will yield a positive net present value right now. If the technology for manufacturing the disk drive is in flux, however, the firm may delay taking the project in the hopes that the improved technology will increase the expected cash flows and consequently the value of the project.

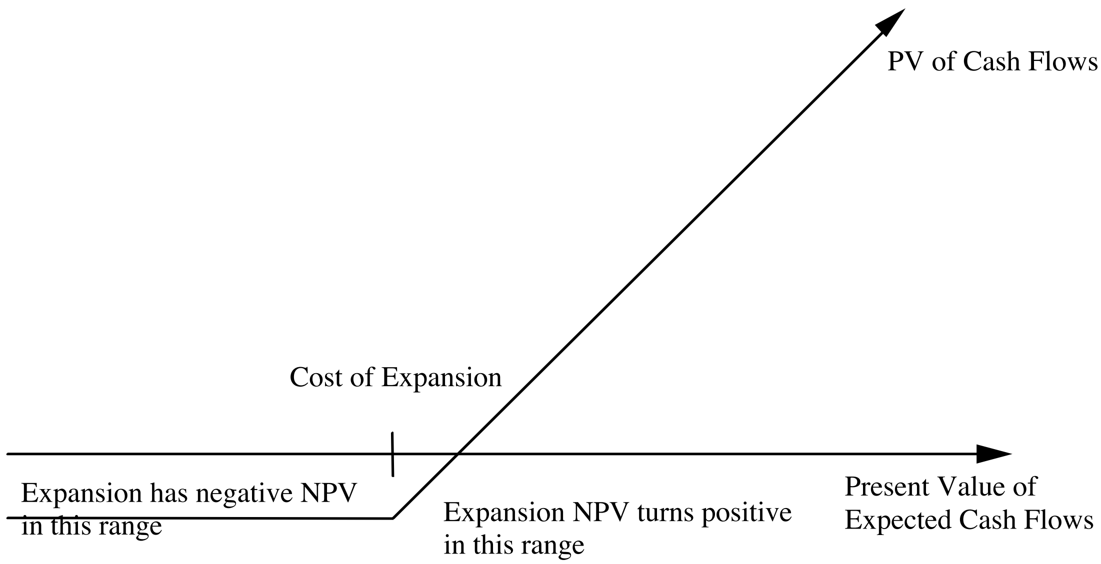
The Option to Expand a Project

In some cases, firms take projects because doing so allows them either to take on other projects or to enter other markets in the future. In such cases, it can be argued that the initial projects are options allowing the firm to take other projects, and the firm should therefore be willing to pay a price for such options. A firm may accept a negative net present value on the initial project because of the possibility of high positive net present values on future projects.

The Payoffs to the Option to Expand

To examine this option using the same framework developed earlier, assume that the present value of the expected cash flows from entering the new market or taking the new project is V, and the total investment needed to enter this market or take this project is X. Further, assume that the firm has a fixed time horizon, at the end of which it has to make the final decision on whether or not to take advantage of this opportunity. Finally, assume that the firm cannot move forward on this opportunity if it does not take the initial project. This scenario implies the option payoffs shown in Figure 6.9.

Figure 6.9: The Option to Expand a Project



As you can see, at the expiration of the fixed time horizon, the firm will enter the new market or take the new project if the present value of the expected cash flows at that point in time exceeds the cost of entering the market.

Illustration 6.11: Valuing an Option to Expand: Disney Entertainment

Assume that Disney is considering investing $ 100 million to create a Spanish version of the Disney channel to serve the growing Mexican market. Assume, also, that a financial analysis of the cash flows from this investment suggests that the present value of the cash flows from this investment to Disney will be only $ 80 million. Thus, by itself, the new channel has a negative NPV of $ 20 million.

One factor that does have to be considered in this analysis is that if the market in Mexico turns out to be more lucrative than currently anticipated, Disney could expand its reach to all of Latin America with an additional investment of $ 150 million any time over the next 10 years. While the current expectation is that the cash flows from having a

Disney channel in Latin America is only $ 100 million, there is considerable uncertainty about both the potential for such an channel and the shape of the market itself, leading to significant variance in this estimate.

The value of the option to expand can now be estimated, by defining the inputs to the option pricing model as follows:

Value of the Underlying Asset (S) = PV of Cash Flows from Expansion to Latin America, if done now =$ 100 Million

Strike Price (K) = Cost of Expansion into Latin American = $ 150 Million

We estimate the standard deviation in the estimate of the project value by using the annualized standard deviation in firm value of publicly traded entertainment firms in the Latin American markets, which is approximately 30%.

Variance in Underlying Asset's Value = $0.30^2 = 0.09$

Time to expiration = Period for which expansion option applies = 10 years

There is no cost of delay.

Assume that the ten-year riskless rate is 4%. The value of the option can be estimated as follows:

Call Value= 100 (0.6803) -150 (exp$^{(-0.04)(10)}$ (0.3156)= $ 36.30 Million

This value can be added on to the net present value of the original investment in Mexico, which has a negative NPV of $ 20 Million.

NPV of Disney Channel in Mexico = $ 80 Million - $ 100 Million = - $ 20 Million

Value of Option to Expand = $ 36.30 Million

NPV of Project with option to expand = - $ 20 million + $ 36.3 million
= $ 16.3 million

Disney should invest in the Mexican project because the option to expand into the Latin American market more than compensates for the negative net present value of the Mexican project.

Tests for Expansion Option to have Value

Not all investments have options embedded in them, and not all options, even if they do exist, have value. To assess whether an investment creates valuable options that need to be analyzed and valued, we need to understand three key questions.

1. *Is the first investment a pre-requisite for the later investment/expansion? If not, how necessary is the first investment for the later investment/expansion?* Consider our earlier analysis of the value of a patent or the value of an undeveloped oil reserve as options. A firm cannot generate patents without investing in research or paying another firm for the patents, and it cannot get rights to an undeveloped oil reserve without bidding on it at a government auction or buying it from another oil company. Clearly, the initial investment here (spending on R&D, bidding at the auction) is required for the firm to have the second investment. Now consider the Disney investment in a Spanish channel, without which presumably it is unwilling to expand into the larger Latin American market. Unlike the patent and undeveloped reserves examples, the initial investment is not a pre-requisite for the second, though management might view it as such. The connection gets even weaker, and the option value lower, when we look at one firm acquiring another to have the option to be able to enter a large market. Acquiring an internet service provider to have a foothold in the internet retailing market or buying a Chinese brewery to preserve the option to enter the Chinese beer market would be examples of less valuable options.
2. *Does the firm have an exclusive right to the later investment/expansion? If not, does the initial investment provide the firm with significant competitive advantages on subsequent investments?* The value of the option ultimately derives not from the cash flows generated by the second and subsequent investments, but from the excess returns generated by these cash flows. The greater the potential for excess returns on the second investment, the greater the value of the expansion option in the first investment. The potential for excess returns is closely tied to how much of a competitive advantage the first investment provides the firm when it takes subsequent investments. At one extreme, again, consider investing in research and development to acquire a patent. The patent gives the firm that owns it the exclusive rights to produce that product, and if the market potential is large, the right to the excess returns from the project. At the other extreme, the firm might get no competitive advantages on subsequent investments, in which case, it is questionable as to whether there can be any excess returns on these investments. In reality, most investments will

fall in the continuum between these two extremes, with greater competitive advantages being associated with higher excess returns and larger option values.

3. *How sustainable are the competitive advantages?* In a competitive market place, excess returns attract competitors, and competition drives out excess returns. The more sustainable the competitive advantages possessed by a firm, the greater will be the value of the options embedded in the initial investment. The sustainability of competitive advantages is a function of two forces. The first is the nature of the competition; other things remaining equal, competitive advantages fade much more quickly in sectors where there are aggressive competitors. The second is the nature of the competitive advantage. If the resource controlled by the firm is finite and scarce (as is the case with natural resource reserves and vacant land), the competitive advantage is likely to be sustainable for longer periods. Alternatively, if the competitive advantage comes from being the first mover in a market or from having technological expertise, it will come under assault far sooner. The most direct way of reflecting this competitive advantage in the value of the option is its life; the life of the option can be set to the period of competitive advantage and only the excess returns earned over this period counts towards the value of the option.

If the answer is yes to all three questions, then the option to expand can be valuable.

Practical Considerations

The practical considerations associated with estimating the value of the option to expand are similar to those associated with valuing the option to delay. In most cases, firms with options to expand have no specific time horizon by which they have to make an expansion decision, making these open-ended options, or, at best, options with arbitrary lives. Even in those cases where a life can be estimated for the option, neither the size nor the potential market for the product may be known, and estimating either can be problematic. To illustrate, consider the Home Depot example discussed above. While we adopted a period of five years, at the end of which the Home Depot has to decide one way or another on its future expansion in France, it is entirely possible that this time frame is not specified at the time the store is opened. Furthermore, we have assumed that both the cost and the present value of expansion are known initially. In reality, the firm may not have good estimates for either before opening the first store, since it does not have much information on the underlying market.

Implications of the Expansion Option

The option to expand is implicitly used by firms to rationalize taking projects that may have negative net present value, but provide significant opportunities to tap into new markets or sell new products. While the option pricing approach adds rigor to this argument by estimating the value of this option, it also provides insight into those occasions when it is most valuable. In general, the option to expand is clearly more valuable for more volatile businesses with higher returns on projects (such as biotechnology or computer software), than in stable businesses with lower returns (such as housing, utilities or automobile production).

It can also be argued that research and development (R&D) provides one immediate application for this methodology. Firms that expend large resources on research and development argue that they do so because it provides them with new products for the future. In recent years, however, more firms have stopped accepting this explanation at face value as a rationale for spending more money on R&D, and have started demanding better returns from their investments.

Research, Development and Test Market Expenses

Firms that spend considerable amounts of money on research and development or test marketing are often stymied when they try to evaluate these expenses, since the payoffs are often in terms of future projects. At the same time, there is the very real possibility that after the money has been spent, the products or projects may turn out not to be viable; consequently, the expenditure is treated as a sunk cost. In fact, it can be argued that R & D has the characteristics of a call option —the amount spent on the R&D is the cost of the call option, and the projects or products that might emerge from the research provide the options. If these products are viable (i.e., the present value of the cash inflows exceeds the needed investment), the payoff is the difference between the two; if not, the project will not be accepted, and the payoff is zero.

Several logical implications emerge from this view of R & D. First, research expenditures should provide much higher value for firms that are in volatile technologies or businesses, since the variance in product or project cash flows is positively correlated with the value of the call option. Thus, Minnesota Mining and Manufacturing (3M), which expends a substantial amount on R&D on basic office products, such as the Post-it pad, generally receives less value for its research than does Intel, whose research primarily concerns semi-conductor chips. Second, the value of research and the optimal amount to be spent on research will change over time as businesses mature. The best example is the pharmaceutical industry - pharmaceutical companies spent most of the 1980s investing substantial amounts in research and earning high returns on new products, as the health care business expanded. In the 1990s, however, as health care costs started leveling off and the business matured, many of these companies found that they were not getting the same payoffs on research and started cutting back.

6.10. ☞: **R & D Expenditures and Option Pricing**

If we perceive research and development expenses as the price of acquiring options (product patents), research and development expenditure will have most value if directed to

a. areas where the technology is stable and the likelihood of success is high
b. areas where the technology is volatile, though the likelihood of success is low
c. Neither

Explain.

In Practice: Are strategic considerations really options?

Many firms, faced with projects that do not meet their financial benchmarks, use the argument that these projects should be taken anyway because of "strategic considerations". In other words, it is argued that these projects will accomplish other goals for the firm or allow the firm to enter into other markets. While we are leery of how this argument is used to justify poor projects, there are cases where these strategic considerations are really referring to options embedded in projects - options to produce new products or expand into new markets.

Take the example of the Disney Channel project described above. The project, based upon conventional capital budgeting, has a negative net present value, but it should be taken nevertheless, because it gives Disney the option to enter a potentially lucrative market. Disney might well use the "strategic considerations" argument to take the project anyway.

The differences between using option pricing and the "strategic considerations" argument are the following:

1. Option pricing assigns value to only some of the "strategic considerations" that firms may have. For instance, the option to enter the Latin American market has value because of the variance in the estimates of the value of entering the market, and the fact that Disney has to take the smaller project (the Mexican venture) first in order to get the option. However, strategic considerations that are not clearly defined or include generic terms such as "corporate image" or "growth potential" may not have any value from an option pricing standpoint.
2. Option pricing attempts to put a dollar value on the "strategic consideration" being valued. As a consequence, the existence of strategic considerations does not guarantee that the project will be taken. In the Disney example, the Mexican venture should not be taken if the value of the option to enter the Latin American market is less than $ 20 million.

The Option to Abandon a Project

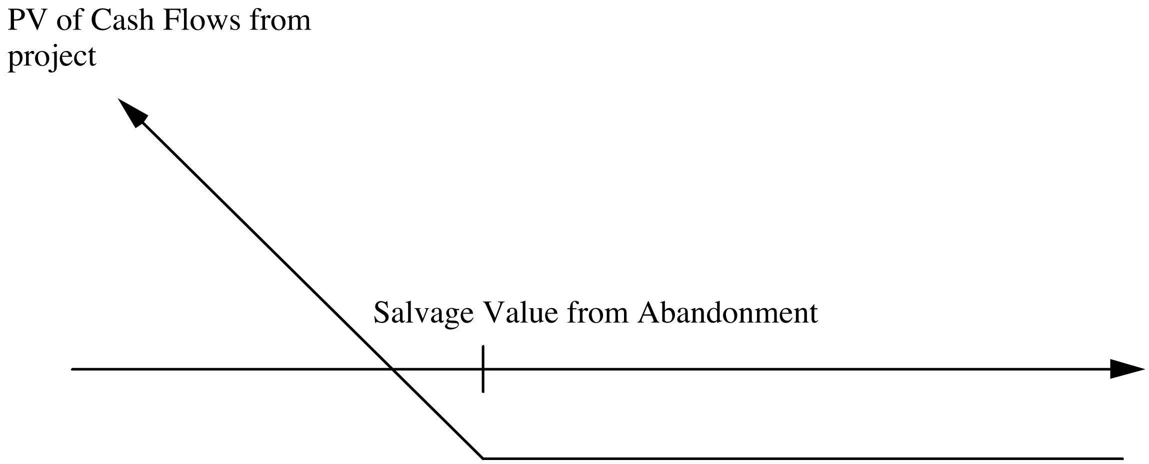
The final option to consider here is the option to abandon a project when its cash flows do not measure up to expectations. Generally, the option to abandon will generally increase the value of a project and make it more acceptable. To illustrate, assume that V is the remaining value on a project if it continues to the end of its life, and L is the liquidation or abandonment value for the same project at the same point in time. If the project has a life of n years, the value of continuing the project can be compared to the liquidation (abandonment) value — if it is higher, the project should be continued; if it is lower, the holder of the abandonment option could consider abandoning the project –

Payoff from owning an abandonment option $= 0$ if $V > L$

$= L$ if $V \leq L$

These payoffs are graphed in Figure 6.10, as a function of the expected stock price.

Figure 6.10: The Option to Abandon a Projectt



Unlike the prior two cases, the option to abandon takes on the characteristics of a put option.

Illustration 6.12: Valuing Disney's option to abandon: A Real Estate Investment

Assume that Disney is considering taking a 25-year project which requires an initial investment of \$ 250 million in a real estate partnership to develop time-share properties with a South Florida real estate developer, and where the present value of expected cash flows is \$ 254 million. While the net present value of \$ 4 million is small, assume that Disney has the option to abandon this project anytime by selling its share back to the developer in the next 5 years for \$ 150 million. A simulation of the cash flows on this time-share investment yields a standard deviation in the present value of the cash flows from being in the partnership of 20%.

The value of the abandonment option can be estimated by determining the characteristics of the put option:

Value of the Underlying Asset (S) = PV of Cash Flows from Project

= \$ 254 million

Strike Price (K) = Salvage Value from Abandonment = \$ 150 million

Variance in Underlying Asset's Value = $0.20^2 = 0.04$

Time to expiration = Life of the Project =5 years

Dividend Yield = 1/Life of the Project = 1/25 = 0.04 (We are assuming that the project's present value will drop by roughly 1/n each year into the project)

Assume that the five-year riskless rate is 4%. The value of the put option can be estimated as follows:

$$\text{Call Value} = 254\ \exp^{(0.04)(5)}\ (0.9194) - 150\ (\exp^{(-0.04)(5)}\ (0.8300) = \$\ 89.27 \text{ million}$$

$$\text{Put Value} = \$\ 89.27 - 254\ \exp^{(0.04)(5)} + 150\ (\exp^{(-0.04)(5)} = \$\ 4.13 \text{ million}$$

The value of this abandonment option has to be added on to the net present value of the project of \$ 4 million, yielding a total net present value with the abandonment option of \$ 8.13 million.

6.11. ☞**: Abandonment Value and Project Life**

Consider the project described above. Assume that three years into the project, the cash flows are coming in 20% below expectations. What will happen to the value of the option to abandon?

a. It will increase
b. It will decrease
c. It may increase or decrease, depending upon ..

Explain.

Practical Considerations

In the above analysis, we assumed, rather unrealistically, that the abandonment value was clearly specified up front and that it did not change during the life of the project. This may be true in some very specific cases, in which an abandonment option is built into the contract. More often, however, the firm has the option to abandon, and the salvage value from doing so can be estimated with noise up front. Further, the abandonment value may change over the life of the project, making it difficult to apply traditional option pricing techniques. Finally, it is entirely possible that abandoning a project may not bring in a liquidation value, but may create costs instead; a manufacturing firm may have to pay severance to its workers, for instance. In such cases, it would not make sense to abandon, unless the cash flows on the project are even more negative.

Implications

The fact that the option to abandon has value provides a rationale for firms to build the flexibility to scale back or terminate projects if they do not measure up to expectations. Firms can do this in a number of ways. The first, and most direct way, is to build in the option contractually with those parties that are involved in the project. Thus, contracts with suppliers may be written on an annual basis, rather than long term, and employees may be hired on a temporary basis, rather than permanently. The physical plant used for a project may be leased on a short term basis, rather than bought, and the financial investment may be made in stages rather than as an initial lump sum. While there is a cost to building in this flexibility, the gains may be much larger, especially in volatile businesses.

Conclusions

Projects often create side costs and benefits that are not captured in the initial estimates of cash flows used to estimate returns. In this chapter, we examined some of these indirect costs and benefits:

- Investing in one project may prevent us from taking alternative investments if these are mutually exclusive. If projects have equal lives and there are no capital rationing constraints, we can pick the investment with the higher net present value. If this is not the case, we have to find ways of controlling for differences in project lives (by computing an equivalent annuity) and for differences in scale (by computing profitability indices).
- Opportunity costs measure the costs of resources that the company already owns that might be used for a new project. While the business might not spend new money acquiring these resources, there are consequences in terms of the cash flows which have to be reflected in the returns.
- Projects may also provide synergistic benefits for other projects that a firm might have. These benefits, which also take the form of cash flows, should be reflected in the returns.
- Projects may also create options that are valuable - options to expand into new markets and to produce new products.

In summary, the project returns have to reflect all of the side costs and benefits.

Problems

1. A small manufacturing firm, which has limited access to capital, has a capital rationing constraint of $ 150 million and is faced with the following investment projects:

Project	Initial Investment	NPV
A	$25	$10
B	$30	$25
C	$40	$20
D	$10	$10
E	$15	$10
F	$60	$20
G	$20	$10
H	$25	$20
I	$35	$10
J	$15	$5

a. Which of these projects would you accept? Why?

b. What is the cost of the capital rationing constraint?

2. A closely held, publicly traded firm faces self-imposed capital rationing constraints of $ 100 million in this period and $75 million in the next period. It has to choose among the following projects:

	Investment Outlay		
Project	Current Period	Next Period	NPV
A	$20	$10	$20
B	$25	$15	$20
C	$30	$30	$15
D	$15	$15	$20
E	$40	$25	$30

F	\$10	\$10	\$10
G	\$20	\$15	\$20
H	\$30	\$25	\$35
I	\$35	\$25	\$25
J	\$25	\$15	\$10

Set up the linear programming problem, assuming that fractions and multiples of projects cannot be taken.

3. You own a rental building in the city and are interested in replacing the heating system. You are faced with the following alternatives:

a. A solar heating system, which will cost \$ 12,000 to install and \$ 500 a year to run and will last forever (assume that your building will too).

b. A gas-heating system, which will cost \$ 5,000 to install and \$ 1000 a year to run and will last 20 years.

c. An oil-heating system, which will cost \$ 3,500 to install and \$ 1200 a year to run and will last 15 years.

If your opportunity cost is 10%, which of these three options is best for you?

4. You are trying to choose a new siding for your house. A salesman offers you two choices:

a. Wooden siding, which will last 10 years and cost \$5000 to install and \$1000/year to maintain

b. Aluminium siding, which will last forever, cost \$15,000 to install, and will have a lower maintentance cost per year

If your discount rate is 10%, how low would your maintenance costs have to be for you to choose the aluminium siding?

5. You have just been approached by a magazine with an offer for re-subsription. You can renew for 1 year at \$20, 2 years for \$36, or 3 years at \$45. Assuming that you have an opportunity cost of 20% and the cost of a subscription will not change over time, which of these three options should you choose?

6. You have been hired as a capital budgeting analyst by a sporting goods firm that manufactures athletic shoes and has captured 10% of the overall shoe market (the total market is worth $100 million a year). The fixed costs associated with manufacturing these shoes is $2 million a year, and variable costs are 40% of revenues. The company's tax rate is 40%. The firm believes that it can increase its market share to 20% by investing $10 million in a new distribution system (which can be depreciated over the system's life of 10 years to a salvage value of zero) and spending $1 million a year in additional advertising. The company proposes to continue to maintain working capital at 10% of annual revenues. The discount rate to be used for this project is 8%.

a. What is the initial investment for this project?
b. What is the annual operating cash flow from this project?
c. What is the NPV of this project?
d. How much would the firm's market share have to increase for you to be indifferent to taking or rejecting this project?

7. You are considering the possibility of replacing an existing machine that has a book value of $500,000, a remaining depreciable life of 5 years and a salvage value of $ 300,000. The replacement machine will cost $ 2 million and have a 10-year life. Assuming that you use straight line depreciation and that neither machine will have any salvage value at the end of the next 10 years, how much would you need to save each year to make the change (the tax rate is 40%)?

8. You are helping a book store decide whether it should open a coffee shop on the premises. The details of the investment are as follows:

- The coffee shop will cost $ 50,000 to open; it will have a 5-year life and be depreciated straight line over the period to a salvage value of $10,000.
- The sales at the shop are expected to be $15,000 in the first year and grow 5% a year for the following 5 years.
- The operating expenses will be 50% of revenues.
- The tax rate is 40%.

- The coffee shop is expected to generate additional sales of $20,000 next year for the book shop, and the pre-tax operating margin is 40%. These sales will grow 10% a year for the following 4 years.

a. Estimate the net present value of the coffee shop without the additional book sales.

b. Estimate the present value of the cash flows accruing from the additional book sales.

c. Would you open the coffee shop?

9. The lining of a plating tank must be replaced every 3 years at the cost of approximately $2000. A new lining material has been developed that is more resistant to the corrosive effects of the plating liquid and will cost approximately $4000. If the required rate of return is 20% and annual property taxes and insurance amount to about 4% of the initial investment, how long must the new lining last to be more economical than the present one?

10. You are a small business owner considering two alternatives for your phone system.

	Plan A	*Plan B*
Initial cost	$50,000	$120,000
Annual maintenance cost	$ 9,000	$ 6,000
Salvage value	$ 10,000	$ 20,000
Life	20 years	40 years

The discount rate is 8%. Which alternatve would you pick?

11. You have been asked to compare three alternative investments and make a recommendation.

- Project A has an initial investment of $5 million and after-tax cashflows of $ 2.5 million a year for the next 5 years.
- Project B has no initial investment, after-tax cash flows of $ 1 million a year for the next 10 years, and a salvage value of $2 million (from working capital).
- Project C has an initial investment of $10 million, another investment of $5 million in 10 years, and after-tax cashflows of $ 2.5 million a year forever.

The discount rate is 10% for all three projects. Which of the three projects would you pick? Why?

12. You are the manager of a pharmaceutical company and are considering what type of laptops to buy for your salespeople to take with them on their calls.

- You can buy fairly inexpensive (and less powerful) older machines for about $ 2,000 each. These machines will be obsolete in three years and are expected to have an annual maintentance cost of $ 150.
- You can buy newer and more powerful laptops for about $ 4,000 each. These machines will last five years and are expected to have an annual maintenance cost of $ 50.

If your cost of capital is 12%, which option would you pick and why?

13. You are the supervisor of a town where the roads are in need of repair. You have a limited budget and are considering two options –

- You can patch up the roads for $100,000, but you will have to repeat this expenditure every year to keep the roads in reasonable shape.
- You can spend $ 400,000 to re-pave and repair the roads, in which case your annual expenditures on maintenance will drop.

If your discount rate is 10%, how much would the annual expenditures have to drop in the second option for you to consider it?

14. You are the manager of a specialty retailing firm which is considering two strategies for getting into the Malaysian retail market. Under the first strategy, the firm will make a small initial investment of $ 10 million and can expect to capture about 5% of the overall market share. Under the second strategy, the firm will make a much larger commitment of $ 40 million for advertising and promotion and can expect to capture about 10% of the market share. If the overall size of the market is $ 200 million, the firm's cost of capital is 12% and the typical life of a project in the firm is 15 years, what would the operating margin have to be for the firm to consider the second strategy? [You can assume that the firm leases its stores and has no depreciation or capital expenditures.]

15. You work for a firm that has limited access to capital markets. As a consequence, it has only $ 20 million available for new investments this year. The firm does have a ready supply of good projects, and you have listed all the projects.

Project	Initial Investment	NPV	IRR
I	$ 10 million	$ 3 million	21%
II	$ 5 million	$ 2.5 million	28%
III	$ 15 million	$ 4 million	19%
IV	$ 10 million	$ 4 million	24%
V	$ 5 million	$ 2 million	20%

a. Based upon the profitability index, which of these projects would you take?

b. Based upon the IRR, which of these projects would you take?

c. Why might the two approaches give you different answers?

16. You are the owner of a small hardware store and you are considering opening a gardening store in a vacant area in the back of the store. You estimate that it will cost you $ 50,000 to set up the store, and that you will generate $ 10,000 in after-tax cash flows from the store for the life of the store (which is expected to be 10 years). The one concern you have is that you have limited parking; by opening the gardening store you run the risk of not having enough parking for customers who shop at your hardware store. You estimate that the lost sales from such occurrence would amount to $ 3,000 a year, and that your after-tax operating margin on sales at the hardware store is 40%. If your discount rate is 14%, would you open the gardening store?

17. You are the manager of a grocery store and you are considering offering baby-sitting services to your customers. You estimate that the licensing and set up costs will amount to $150,000 initially and that you will be spending about $ 60,000 annually to provide the service. As a result of the service, you expect sales at the store which is $ 5 million currently to increase by 20%; your after-tax operating margin is 10%. If your cost of capital is 12%, and you expect the store to remain open for 10 years, would you offer the service?

18. You run a financial service firm where you replace your employee’s computers every three years. You have 500 employees, and each computer costs $ 2,500 currently — the old computers can be sold for $ 500 each. The new computers are generally depreciated straight line over their 3-year lives to a salvage value of $ 500. A computer-service firm

offers to lease you the computers and replace them for you at no cost, if you will pay a leasing fee of $ 5 million a year (which is tax deductible). If your tax rate is 40%, would you accept the offer?

19. You are examining the viability of a capital investment that your firm is interested in. The project will require an initial investment of $500,000 and the projected revenues are $400,000 a year for 5 years. The projected cost-of-goods-sold is 40% of revenues and the tax rate is 40%. The initial investment is primarily in plant and equipment and can be depreciated straight-line over 5 years (the salvage value is zero). The project makes use of other resources that your firm already owns:

(a) Two employees of the firm, each with a salary of $40,000 a year, who are currently employed by another division will be transferred to this project. The other division has no alternative use for them, but they are covered by a union contract which will prevent them from being fired for 3 years (during which they would be paid their current salary).

(b) The project will use excess capacity in the current packaging plant. While this excess capacity has no alternative use now, it is estimated that the firm will have to invest $ 250,000 in a new packaging plant in year 4 as a consequence of this project using up excess capacity (instead of year 8 as originally planned).

(c) The project will use a van currently owned by the firm. While the van is not currently being used, it can be rented out for $ 3000 a year for 5 years. The book value of the van is $10,000 and it is being depreciated straight line (with 5 years remaining for depreciation).

The discount rate to be used for this project is 10%.

a. What (if any) is the opportunity cost associated with using the two employees from another division?

b. What, if any, is the opportunity cost associated with the use of excess capacity of the packaging plant?

c. What, if any, is the opportunity cost associated with the use of the van ?

d. What is the after-tax operating cashflow each year on this project?

e. What is the net present value of this project?

20. Your company is considering producing a new product. You have a production facility that is currently used to only 50% of capacity, and you plan to use some of the excess capacity for the new product. The production facility cost $50 million 5 years ago when it was built and is being depreciated straight line over 25 years (in real dollars, assume that this cost will stay constant over time).

Product line	Capacity used currently	Growth rate/year	Revenues currently	Fixed Cost/Yr	Variable Cost/Yr
Old product	50%	5%/year	100 mil	25 mil	50 mil/yr
New product	30%	10%/year	80 mil	20 mil	44 mil/yr

The new product has a life of 10 years, the tax rate is 40%, and the appropriate discount rate (real) is 10%.

a. If you take on this project, when would you run out of capacity?

b. When you run out of capacity, what would you lose if you chose to cut back production (in present value after-tax dollars)? (You have to decide which product you are going to cut back production on.)

c. What would the opportunity cost to be assigned to this new product be if you chose to build a new facility when you run out of capacity instead of cutting back on production?

21. You are an analyst for a sporting goods corporation that is considering a new project that will take advantage of excess capacity in an existing plant. The plant has a capacity to produce 50000 tennis racquets, but only 25,000 are being produced currently though sales of the rackets are increasing 10% a year. You want to use some of the remaining capacity to manufacture 20,000 squash rackets each year for the next 10 years (which will use up 40% of the total capacity), and this market is assumed to be stable (no growth). An average tennis racquet sells for $100 and costs $40 to make. The tax rate for the corporation is 40%, and the discount rate is 10%. Is there an opportunity cost involved? If so, how much is it?

CHAPTER 7

CAPITAL STRUCTURE: OVERVIEW OF THE FINANCING DECISION

In the last few chapters, we have examined the investment principle, and argued that projects that earn a return greater than the minimum acceptable hurdle rate are good projects. In coming up with the cost of capital, which we defined to be the minimum acceptable hurdle rate, however, we used the existing mix of debt and equity used by the firm.

- In this chapter, we examine the choices that a firm has in terms of both debt and equity and how these choices change over a firm's life cycle. In particular, we look at how the choices change as a firm goes from being a small, private business to a large publicly traded corporation. We then evaluate the basic tradeoff between using debt and equity by weighing the benefits of borrowing against its costs. We close the chapter by examining when the costs of borrowing exactly offset its benefits, i.e, debt becomes irrelevant, and the implications for corporate finance.

The Choices: Types of Financing

There are only two ways in which any business can raise money - debt or equity. This may seem simplistic, given the array of choices firms have in terms of financing vehicles. We will begin this section with a discussion of the characteristics of debt and equity and then look at a range of financing vehicles available within each of these categories. We will then examine of a range of securities that share some characteristics with debt and some with equity and are therefore called hybrid securities.

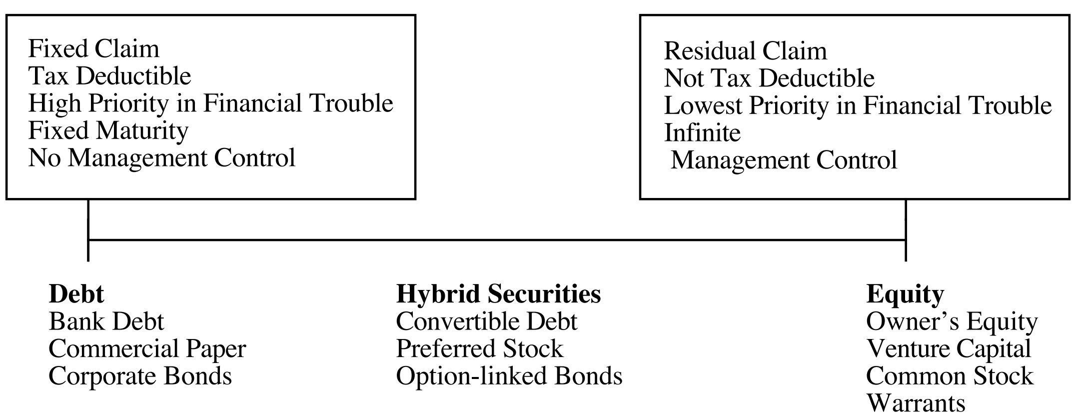
Hybrid Security: This refers to any security that shares some of the characteristics of debt and some characteristics of equity.

The Continuum between Debt and Equity

While the distinction between debt and equity is often made in terms of bonds and stocks, its roots lie in the nature of the cash flow claims of each type of financing. The first distinction is that a debt claim entitles the holder to a contracted set of cash flows (usually interest and principal payments), whereas an equity claim entitles the holder to any residual cash flows left over after meeting all other promised claims. While this remains the fundamental difference, other distinctions have arisen, partly as a result of the tax code and partly as a consequence of legal developments.

The second distinction, which is a logical outgrowth of the nature of cash flow claims (contractual versus residual), is that debt has a prior claim on both cash flows on a period-to-period basis (for interest and principal payments) and on the assets of the firm (in the case of liquidation). Thirdly, the tax laws have generally treated interest expenses, which accrue to debt holders, very differently and often much more advantageously than dividends or other cash flows that accrue to equity. In the United States, for instance, interest expenses are tax deductible, and thus create tax savings, whereas dividend payments have to be made out of after-tax cash flows. Fourth, debt usually has a fixed maturity date, at which point the principal is due, while equity generally has an infinite life. Finally, equity investors, by virtue of their claim on the residual cash flows of the firm, are generally given the bulk of or all of the control of the management of the firm. Debt investors, on the other hand, play a much more passive role in management, exercising, at most, veto power[1] over significant financial decisions. These differences are summarized in figure 7.1.

Figure 7.1: Debt versus Equity



To summarize, debt is defined as any financing vehicle that is a contractual claim on the firm (and not a function of its operating performance), creates tax-deductible payments, has a fixed life, and has a priority claim on cashflows in both operating periods and in bankruptcy. Conversely, equity is defined as any financing vehicle that is a residual claim on the firm, does not create a tax advantage from its payments, has an infinite life, does not have priority in bankruptcy, and provides management control to the owner. Any security that shares characteristics with both is a hybrid security.

In Practice: A Financing Checklist for Classifying Securities

Some new securities, at first sight, are difficult to categorize as either debt or equity. To check where on the spectrum between straight debt and straight equity these securities fall, answer the following questions:

1. Are the payments on the securities contractual or residual?

- If contractual, it is closer to debt
- If residual, it is closer to equity

2. Are the payments tax deductible?

- If yes, it is closer to debt
- If no, if is closer to equity

3. Do the cash flows on the security have a high priority or a low priority if the firm is in financial trouble?

- If it has high priority, it is closer to debt.
- If it has low priority, it is closer to equity.

4. Does the security have a fixed life?

- If yes, it is closer to debt
- If no, it is closer to equity

5. Does the owner of the security get a share of the control of management of the firm?

- If no, it is closer to debt.
- If yes, if is closer to equity

7.1. ☞**: Is this debt or is it equity?**

You have been asked to classify a security as debt or equity, and have been provided the following characteristics for the security - it requires fixed monthly payments that are tax deductible and it has an infinite life. Its claims on the cash flows of the firm, during

[1] The veto power is usually exercised through covenants in bond agreements.

operation, and on the assets, if the firm goes bankrupt, come after all debt holders' claims (including unsecured debt) are met.

a. It is debt
b. It is equity
c. It is a hybrid security

A. Equity

While most people think of equity in terms of common stock, the equity claim can take a variety of forms, depending partly upon whether the firm is privately owned or publicly traded, and partly upon the firm's growth and risk characteristics. Private firms have fewer choices available than do publicly traded firms, since they cannot issue securities to raise equity. Consequently, they have to depend either upon the owner or a private entity, usually a venture capitalist, to bring in the equity needed to keep the business operating and expanding. Publicly traded firms have access to capital markets, giving them a wider array of choices.

1. Owner's Equity

Most businesses, including the most successful companies of our time, such as Microsoft and Wal-Mart, started off as small businesses with one or a few individuals providing the seed money and plowing back the earnings of the firm into the businesses. These funds, brought in by the owners of the company, are referred to as the owner's equity, and provide the basis for the growth and eventual success of the business.

2. Venture Capital and Private Equity

As small businesses succeed and grow, they typically run into is a funding constraint, where the funds that they have access to are insufficient to cover their investment and growth needs. A venture capitalist or private equity investor provides equity financing to small and often risky businesses in return for a share of the ownership of the firm.

Venture Capital: This is usually equity capital provided to a private firm by an investor or investors, in exchange for a share of the ownership of the firm.

Generally speaking, the capacity to raise funds from alternative sources and/or to go public will increase with the size of the firm and decrease with the uncertainty about its future prospects. Thus, smaller and riskier businesses are more likely to seek venture capital and are also more likely to be asked to give up a greater share of the value of the firm when receiving the venture capital.

7.2. ☞: **The Effects of Diversification on Venture Capitalist**

You are comparing the required returns of two venture capitalists, who are interested in investing in the same software firm. One venture capitalist has all of his capital invested in only software firms, whereas the other venture capitalist has invested her capital in small companies in a variety of businesses. Which of these two will have the higher required rate of return?

a. The venture capitalist who is invested only in software companies
b. The venture capitalist who is invested in a variety of businesses
c. Cannot answer without more information

If both venture capitalists described above had the same expected cash flow estimates for the business, which one would demand a larger share of the ownership for the same capital investment?

a. The venture capitalist with the higher required rate of return
b. The venture capitalist with the lower required rate of return

3. Common Stock

The conventional way for a publicly traded firm to raise equity is to issue common stock at a price the market is willing to pay. For a newly listed company, this price is estimated by the issuing entity (such as an investment banker) and is called the offering price. For an existing publicly traded company, the price at which additional equity is issued is uaully based upon the current market price. In some cases, the common stock issued by a company is uniform; that is, each share receives a proportional share of both the cash flows (such as dividends) and the voting rights. In other cases, different classes of common stock will provide different dividends and voting rights.

Common stock is a simple security, and it is relatively easy to understand and value. In fact, it can be argued that common stock makes feasible all other security choices for a publicly traded firm, since a firm without equity cannot issue debt or hybrid securities. The accounting treatment of common stock follows well-established precedent, and can be presented easily within the conventional format of financial statements.

4. Warrants

In recent years, firms have started looking at equity alternatives to common stock. One alternative used successfully by the Japanese companies in the late 1980s involved warrants, where the holders received the right to buy shares in the company at a fixed price in return for paying for the warrants up front. Since their value is derived from the price of the underlying common stock, warrants have to be treated as another form of equity.

> ***Warrants:*** A warrant is a security issued by a company that provides the holder with the right to buy a share of stock in the company at a fixed price during the life of the warrant.

Why might a firm use warrants rather than common stock to raise equity? We can think of several reasons. First, warrants are priced based upon the implied volatility assigned to the underlying stock; the greater the volatility, the greater the value. To the degree that the market overestimates how risky a firm is, the firm may gain by using warrants and option-like securities. Second, warrants, by themselves, create no financial obligations at the time of the issue. Consequently, issuing warrants is a good way for a high growth firm to raise funds, especially when current cash flows are low or negative. Third, for financial officers who are sensitive to the dilution created by issuing common stock, warrants seem to provide the best of both worlds — they do not create any new additional shares currently, while they raise equity investment funds for current use.

> 7.3. ☞**: Stock Price Variance and the use of Warrants**
>
> Companies with high variance in their stock prices should use warrants more than companies with low variance in their stock prices, because warrant prices increase with variance.

a. True

b. False

Explain.

In Practice: Valuing Warrants

Warrants are long term call options, but standard option pricing models are based upon the assumption that exercising an option does not affect the value of the underlying asset. This may be true for listed options on stocks, but it is not true for warrants, since their exercise increases the number of shares outstanding and brings in fresh cash into the firm, both of which will affect the stock price. The expected negative impact (dilution) of exercise will make warrants less valuable than otherwise similar call options. The adjustment for dilution in the Black-Scholes to the stock price involves three steps:

Step 1: The stock price is adjusted for the expected dilution from warrant exercise.

Dilution-adjusted $S = (S\ n_S + W\ n_W) / (n_S + n_w)$

where,

S = Current value of the stock n_W = Number of warrants outstanding

W = Market value of warrants outstanding n_S = Number of shares outstanding

When the warrants are exercised, the number of shares outstanding will increase, reducing the stock price. The numerator reflects the market value of equity, including both stocks and warrants outstanding. Making this adjustment will lower the stock price used in the model and hence the value of the warrant.

Step 2: The variance used in the option pricing formula is the variance in the value of the equity in the company (i.e., the value of stocks plus warrants, not just the stocks).

5. Contingent Value Rights

Contingent value rights provide investors with the right to sell stocks for a fixed price, and thus derive their value from the volatility of the stock and the desire on the part of investors to hedge away their losses. Put options, which are traded on the option exchanges, give their holders a similar right to sell the underlying stock at a fixed price. There are two primary differences between contingent value rights and puts. First, the proceeds from the contingent value rights sales go to the firm, whereas those from the sale of listed puts go to private parties. Second, contingent value rights tend to be much more long term than typical listed puts.

> ***Contingent Value Rights:*** A contingent value right (CVR) provides the holder with the right to sell a share of stock in the underlying company at a fixed price during the life of the right.

There are several reasons why a firm may choose to issue contingent value rights. The most obvious is that the firm believes it is significantly undervalued by the market. In such a scenario, the firm may offer contingent value rights to take advantage of its belief and to provide a signal to the market of the undervaluation. Contingent value rights are also useful if the market is overestimating volatility and the put price reflects this misestimated volatility. Finally, the presence of contingent value rights as insurance may attract new investors to the market for the common stock.

B. Debt

The clear alternative to using equity, which is a residual claim, is to borrow money. This option both creates a fixed obligation to make cash flow payments and provides the lender with prior claims if the firm is in financial trouble.

1. Bank Debt

Historically, the primary source of borrowed money for all private firms and many publicly traded firms has been the local bank, with the interest rates on the debt based upon the perceived risk of the borrower. Bank debt provides the borrower with several advantages. First, it can be used for borrowing relatively small amounts of money; in contrast, bond issues thrive on economies of scale, with larger issues having lower costs. Second, if the company is neither well known nor widely followed, bank debt provides a convenient mechanism to convey information to the lender that will help in both pricing and evaluating the loan. The presence of hundreds of investors in bond issues makes this both costly and infeasible if bonds are issued as the primary vehicle for debt. Finally, in order to issue bonds, firms have to submit to being rated by ratings agencies and provide them with sufficient information to make this rating Dealing with a rating agency might be much more difficult for many firms, especially smaller firms, than dealing with a lending bank.

Besides being a source of both long term and short term borrowing for firms, banks also often offer them a flexible option to meet unanticipated or seasonal financing needs. This option is a **line of credit**, which the firm can draw on only if it needs financing. In most cases, a line of credit specifies an amount the firm can borrow and links the interest rate on the borrowing to a market rate, such as the prime rate or treasury rates. The advantage of having a line of credit is that it provides the firm with access to the funds without having to pay interest costs if the funds remain unused. Thus, it is a useful type of financing for firms with volatile working capital needs. In many cases, however, the firm is required to maintain a compensating balance on which it earns either no interest or below-market rates. For instance, a firm that wants a $ 20 million line of credit from a bank might need to maintain a compensating balance of $ 2 million, on which it earns no interest. The opportunity cost of having this compensating balance must be weighed against the higher interest costs that will be incurred by taking on a more conventional loan to cover working capital needs.

7.5. ☞**: Corporate Bonds and Bank Debt**

If a company can issue corporate bonds, it should not use bank debt.

a. True

b. False

Explain.

2. Bonds

For larger publicly traded firms, an alternative to bank debt is to issue bonds. Generally speaking, bond issues have several advantages. The first is that bonds usually carry more favorable financing terms than equivalent bank debt, largely because risk is shared by a larger number of financial market investors. The second is that bond issues might provide a chance for the issuer to add on special features that could not be added on to bank debt. For instance, bonds can be convertible into common stock or be tied to commodity prices (commodity bonds). In borrowing money, firms have to make a variety of choices including the maturity of the borrowing (short term or long term), whether the debtd should have fixed interest payments or an interest rate tied to market rates (fixed and floating rates), the nature of the security offered to those buying the bonds (secured versus unsecured) and how the debt will be repaid over time. In chapter 9, we will examine how best to make these choices.

3. Leases

A firm often borrows money to finance the acquisition of an asset needed for its operations. An alternative approach that might accomplish the same goal is to lease the asset. In a lease, the firm commits to making fixed payments to the owner of the asset for the rights to use the asset. These fixed payments are either fully or partially tax deductible, depending upon how the lease is categorized for accounting purposes. Failure to make lease payments initially results in the loss of the leased asset, but can result in bankruptcy, though the claims of the lessors (owners of the leased assets) may sometimes be subordinated to the claims of other lenders to the firm.

A lease agreement is usually categorized as either an operating lease or a capital lease. For **operating leases**, the term of the lease agreement is shorter than the life of the asset, and the present value of lease payments is generally much lower than the actual price of the asset. At the end of the life of the lease, the asset reverts back to the lessor, who will either offer to sell it to the lessee or lease it to somebody else. The lessee usually has the right to cancel the lease and return the asset to the lessor. Thus, the ownership of the asset in an operating lease clearly resides with the lessor, with the lessee bearing little or no risk if the asset becomes obsolete. Operating leases cover be the store spaces leased out by specialty retailing firms like the Gap and Ann Taylor, for instance.A **capital lease** generally lasts for the life of the asset, with the present value of lease payments covering the price of the asset. A capital lease generally cannot be canceled, and the lease can be renewed at the end of its life at a reduced rate or the asset acquired by the lessee at a favorable price. In many cases, the lessor is not obligated to pay insurance and taxes on the asset, leaving these obligations up to the lessee; the lessee consequently reduces the lease payments, leading to what are called **net leases**. A capital lease places substantial risk on the shoulders of the lessee, if the asset loses value or becomes obsolete. While the differences between operating and financial leases are obvious, some lease arrangements do not fit neatly into one or another of these extremes;

rather, they share some features of both types of leases. These leases are called **combination leases**.

7.6. ☞: **Debt Maturity and Interest Rates**

Assume that long-term interest rates are much higher than short term rates (a steeply upward sloping term structure), and that your investment banker advises you to issue short term debt because it is cheaper than long term debt. Is this true?

a. Yes

b. False

Why or why not?

***In Practice:* Leasing versus Borrowing**

If borrowing money to buy an asset and leasing the asset are both variations on debt, why might a firm choose one over the other? We can think of several factors that may sway firms in this choice:

1. *Service Reasons*: In some cases, the lessor of an asset will bundle service agreements with the lease agreement and offer to provide the lessee with service support during the life of the lease. If this service is unique, either because of the lessor's reputation or because the lessor is also the manufacturer of the asset, and if the cost of obtaining this service separately is high, the firm may choose to lease rather than buy the asset. IBM, for instance, has traditionally leased computers to users, with an offer to service them when needed.

2. *Flexibility*: Some lease agreements provide the lessee with the option to exchange the asset for a different or upgraded version during the life of the lease. This flexibility is particularly valuable when the firm is unsure of its needs and when technology changes rapidly. Flexibility is also useful when the asset is required for a period much shorter than the life of the asset, since buying the asset and selling it again is expensive in terms of transactions time and cost.

3. *Tax Reasons*: The classic reason provided for leasing is that different entities face different tax rates. An entity with a high tax rate buys an asset and leases it to one with no

or a low tax rate. By doing so, the lessor obtains the tax benefits, which are greater because of its higher tax rate. The lessee, in turn, gets the use of the asset and also gains by sharing in some of the tax benefits.

In addition, if a lease qualifies as an operating lease, it essentially operates as off-balance sheet debt and may make firms that use it look safer to the careless analyst. If firms consider leasing as an alternative to borrowing, the choice becomes primarily a financial one. Operating leases create lease obligations to the firm and these obligations are tax deductible. The present value of these after-tax lease obligations has to be weighed against the present value of the after-tax cash flows that would have been generated if the firm had borrowed the money and bought the asset instead. The after-tax cash flows from borrowing and buying the asset have to include not only the interest and principal payments on the debt, but also the tax benefits accruing from depreciation from owning the asset and the expected value of the asset at the end of operations.

C. Hybrid Securities

Summarizing our analysis thus far, equity represents a residual claim on the cash flows and assets of the firm and is generally associated with management control. Debt, on the other hand, represents a fixed claim on the cash flows and assets of the firm and is usually not associated with management control. There are a number of securities that do not fall neatly into either of these two categories; rather, they share some characteristics with equity and some with debt. These securities are called hybrid securities.

1. Convertible Debt

A convertible bond is a bond that can be converted into a pre-determined number of shares, at the discretion of the bond holder. While it generally does not pay to convert at the time of the bond issue, conversion becomes a more attractive option as stock prices increase. Firms generally add conversions options to bonds to lower the interest rate paid on the bonds.

Convertible Debt: This is debt that can be converted into equity at a rate that is specified as part of the debt agreement (conversion rate).

In a typical convertible bond, the bond holder is given the option to convert the bond into a specified number of shares of stock. The conversion ratio measures the number of shares of stock for which each bond may be exchanged. Stated differently, the market conversion value is the current value of the shares for which the bonds can be exchanged. The conversion premium is the excess of the bond value over the conversion value of the bond.

Thus, a convertible bond with a par value of $1,000, which is convertible into 50 shares of stock, has a conversion ratio of 50. The conversion ratio can also be used to compute a conversion price - the par value divided by the conversion ratio — yielding a conversion price of $20. If the current stock price is $25, the market conversion value is $1,250 (50 * $25). If the convertible bond is trading at $1,300, the conversion premium is $50.

In Practice: A Simple Approach to Decomposing Debt and Equity

The value of a convertible debt can be decomposed into straight debt and equity components using a simple approach. Since the price of a convertible bond is the sum of the straight debt and the call option components, the value of the straight bond component in conjunction with the market price should be sufficient to estimate the call option component, which is also the equity component:

Value of Equity Component = Price of Convertible Bond - Value of Straight Bond Component

The value of the straight bond component can be estimated using the coupon payments on the convertible bond, the maturity of the bond and the market interest rate the company would have to pay on a straight debt issue. This last input can be estimated directly if the company also trades straight bonds in the market place, or it can be based upon the bond rating, if any, assigned to the company.

For instance, assume that you have a 10-year convertible bond, with a 5% coupon rate trading at $ 1,050, and that the company has a debt rating of BBB (with a market interest rate of 8%). The value of the straight bond and equity components can be estimated as follows:

Straight Bond Component = $ 50 (PVA, 10 years,8%) + $1000/1.08^{10}$ = $798.69

Equity Component = $ 1,050 - $ 799 = $ 251

7.7. ☞: **Convertible Debt and Yields**

The yields on convertible bonds are much lower than the yields on straight bonds issued by a company. Therefore, convertible debt is cheaper than straight debt.

a. Yes

b. False

Why or why not?

2. Preferred Stock

Preferred stock is another security that shares some characteristics with debt and some with equity. Like debt, preferred stock has a fixed dollar dividend; if the firm does not have the cash to pay the dividend, it is cumulated and paid in a period when there are sufficient earnings. Like debt, preferred stockholders do not have a share of control in the firm, and their voting privileges are strictly restricted to issues that might affect their claims on the firm's cash flows or assets. Like equity, payments to preferred stockholders are not tax deductible and come out of after tax cash. Also like equity, preferred stock does not have a maturity date when the face value is due. In terms of priority, in the case of bankruptcy, preferred stockholders have to wait until the debt holders' claims have been met before receiving any portion of the assets of the firm.

Preferred Stock: This is a hybrid security. Like debt, it has a promised payment (the preferred dividend) in each period. Like equity, its cash flows are not tax deductible and it has an infinite life.

While accountants and ratings agencies continue to treat preferred stock as equity, it can be argued that the fixed commitments that preferred stock create are like debt obligations and have to be dealt with likewise. The obligations created by preferred stock are generally less onerous than those created by debt; however, since they are generally cumulated, cannot cause default, and do not have priority over debt claims in the case of bankruptcy.

Unlike convertible debt, which can be decomposed into equity and debt components, preferred stock cannot really be treated as debt because preferred dividends are not tax deductible and certainly cannot be viewed as the equivalent of equity because of the differences in cash flow claims and control. Consequently, preferred stock is treated as a third component of capital, in addition to debt and equity, for purposes of capital structure analysis and for estimating the cost of capital.

7.8. ☞: **Preferred Stock and Equity**

Many ratings agencies and regulators treat preferred stock as equity in computing debt ratios, because it does not have a finite maturity and firms cannot be forced into bankruptcy if they fail to pay preferred dividends. Do you agree with this categorization?

a. Yes

b. False

Why or why not?

3. Option-linked Bonds

Commodity Bonds: Commodity bonds are bonds where the interest and/or the principal payments are linked to the price of the commodity. In most cases, the payments will increase with the price of the commodity and decrease if it drops.

In recent years, firms have recognized the value of combining options with straight bonds to create bonds that more closely match the firm's specific needs. Consider two examples. In the first, commodity companies issued bonds linking the principal and even interest payments to the price of the commodity. Thus interest payments would rise if the price of the commodity increased, and vice versa. The benefit for the company was that it tailored the cash flows on the bond to the cash flows of the firm and reduced the likelihood of default. These commodity linked bonds can be viewed as a combination of a straight security and a call option on the underlying commodity. In the second example, consider insurance companies that have recently issued bonds whereby the principal on the bond is reduced in the case of a specified catastrophe, and remains unaffected in its absence. For instance, an insurance firm that has the bulk of its revenues coming from homeowners' insurance in California, might attach a provision that reduces principal and/or interest in the case of a major earthquake. Again, the rationale is to provide the firm with some breathing room when it needs it the most - when a catastrophe creates huge cash outflows for the firm.

Illustration 7.1: Financing Choices in 2003-04 – Disney and Aracruz

Table 7.1 summarizes the existing debt and preferred stock at Disney, broken down by maturity, currency and whether the debt is fixed or floating rate.

Table 7.1: Debt and Preferred Stock Breakdown for Disney: September 2003

Type of Debt	*2003*	*Stated interest rate*	*Float*	*Fiixed*	*Matures in*
Medium term paper	8114	6.07%	1510	6604	2006-2022
Convertible Senior Notes	1323	2.13%	0	1323	2023
Other U.S. dollar denominated debt	597	5.74%	0	597	2004-2032
Privately Placed Debt	343	7%	343	0	2007
Euro medium-term debt	1519	2.84%	1099	420	2004-2007
Preferred Stock	485	7.56%	102	383	2004
Capital Cities Debt	191	9.08%	0	191	2021
Other	528	NA	0	528	2006
Total	13100	5.16%	3054	10046	

Of the total debt and preferred stock of $13,100 million, 23.31% is floating rate and 11.6% is in foreign currency (euros). In addition, Disney did specify that $2,457 million in debt would come due in the next year, which is 18.76% of the total debt outstanding. In addition, as noted in chapter 4, Disney has more than $ 2 billion in operating lease commitments, with a present value of $1.75 billion.

Aracruz reported as $1,371 million in gross debt outstanding in December 2003 and provided the breakdown of the debt in table 7.2:

Table 7.2: Debt Outstanding (in US dollar terms) at Aracruz

Debt Due in	*Local Currency*	*US Dollar*	*Total*	*% Due*
2004	43.2	348.9	392.1	28.59%
2005	38.3	85	123.3	8.99%
2006	38.4	177.9	216.3	15.77%
2007	38.4	228.5	266.9	19.46%
2008	36.5	124.2	160.7	11.72%
2009 and after	18.2	194	212.2	15.47%
Total	213	1158.5	1371.5	

Of the total debt, 15.53% is in local currency and none of the debt was floating rate debt.

Financing Choices and a Firm's Life Cycle

While we spent the last section looking at the different financing choices available to a firm, they all represent external financing, i.e, funds raised from outside the firm. Many firms meet the bulk of their funding needs internally, with cash flows from existing assets. In this section, we begin by presenting the distinction between internal and external financing, and the factors that may affect how much firms draw on each source. We then turn our attention again to external financing. We consider how and why the financing choices may change as a firm goes through different stages of its life cycle, from start-up to expansion to high growth to stable growth and on to decline. We will follow up by looking why some choices dominate in some stages and do not play a role in others.

Internal versus External Financing

Cash flows generated by the existing assets of a firm can be categorized as internal financing. Since these cash flows belong to the equity owners of the business, they are called **internal equity**. Cash flows raised outside the firm whether from private sources or from financial markets can be categorized as **external financing**. External financing can, of course, take the form of new debt, new equity or hybrids.

A firm may prefer internal to external financing for several reasons. For private firms, external financing is typically difficult to raise, and even when it is available (through a venture capitalist, for instance) it is accompanied by a loss of control and flexibility. For publicly traded firms, external financing may be easier to raise, but it is still expensive in terms of issuance costs (in the case of new equity) or lost flexibility (in the case of new debt). Internally generated cash flows, on the other hand, can be used to finance operations without incurring large transactions costs or losing flexibility.

Despite these advantages, there are limits to the use of internal financing to fund projects. First, firms have to recognize that internal equity has the same cost as external equity, before the transactions cost differences are factored in. The cost of equity, computed using a risk and return model such as the CAPM or APM, applies as much to internal as to external equity. Thus, Disney has a cost of equity of 10.00% for internal equity (or retained earnings) and external equity (new stock or equity option issues). This equivalence implies that a project financed with internal equity should pass the same test as a project financed with external equity; Disney has to earn a return on equity for investors that is greater than 10% on projects funded with either external equity or retained earnings. Second, internal equity is clearly limited to the cash flows generated by the firm for its stockholders. Even if the firm does not pay dividends, these cash flows may not be sufficient to finance the firm's projects. Depending entirely upon internal equity can therefore result in project delays or the possible loss of these projects to competitors. Third, managers should not make the mistake of thinking that the stock price does not matter, just because they use only internal equity for financing projects. In reality, stockholders in firms whose stock prices have dropped are much less likely to trust their managers to reinvest their cash flows for them than are stockholders in firms with rising stock prices.

Growth, Risk and Financing

As firms grow and mature, their cash flows and risk exposure follow fairly predictable patterns. Cash flows become larger, relative to firm value, and risk approaches the average risk for all firms. The financing choices that a firm makes will reflect these changes. To understand these choices, let us consider five stages in a firm's life cycle:

1. *Start-up*: This represents the initial stage after a business has been formed. Generally, this business will be a private business, funded by owner's equity and perhaps bank debt. It will also be restricted in its funding needs, as it attempts to gain customers and get established.
2. *Expansion*: Once a firm succeeds in attracting customers and establishing a presence in the market, its funding needs increase as it looks to expand. Since this firm is unlikely to be generating high cash flows internally at this stage and investment needs will be high, the owners will generally look to private equity or venture capital initially to fill the gap. Some firms in this position will make the transition to publicly traded firms and raise the funds they need by issuing common stock.

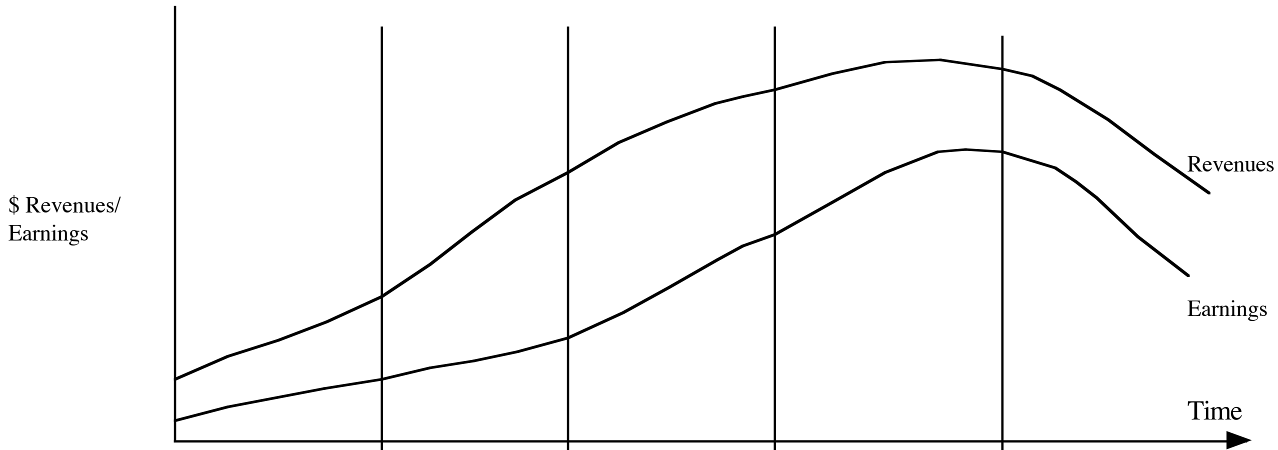
3. *High Growth*: With the transition to a publicly traded firm, financing choices increase. While the firm's revenues are growing rapidly, earnings are likely to lag behind revenues, and internal cash flows lag behind reinvestment needs. Generally, publicly traded firms at this stage will look to more equity issues, in the form of common stock, warrants and other equity options. If they are using debt, convertible debt is most likely to be used to raise capital.
4. *Mature Growth*: As growth starts leveling off, firms will generally find two phenomena occurring. The earnings and cash flows will continue to increase rapidly, reflecting past investments, and the need to invest in new projects will decline. The net effect will be an increase in the proportion of funding needs covered by internal financing, and a change in the type of external financing used. These firms will be more likely to use debt in the form of bank debt or corporate bonds to finance their investment needs.
5. *Decline*: The last stage in this life cycle is decline. Firms in this stage will find both revenues and earnings starting to decline, as their businesses mature and new competitors overtake them. Existing investments are likely to continue to produce cash flows, albeit at a declining pace, and the firm has little need for new investments. Thus, internal financing is likely to exceed reinvestment needs. Firms are unlikely to be making fresh stock or bond issues, but are more likely to be retiring existing debt and buying back stock. In a sense, the firm is gradually liquidating itself.

Figure 7.2 summarizes both the internal financing capabilities and external financing choices of firms at different stages in the growth life cycle.

Not all firms go through these five phases, and the choices are not the same for all of them. First, many firms never make it past the start-up stage in this process. Of the tens of thousands of businesses that are started each year by entrepreneurs, many fail to survive, and even those that survive often continue as small businesses with little expansion potential. Second, not all successful private firms become publicly traded corporations. Some firms, like Cargill and Koch Industries, remain private and manage to raise enough capital to continue growing at healthy rates over long periods. Thirdly, there are firms like Microsoft that are in high growth and seem to have no need for external financing, as internal funds prove more than sufficient to finance this growth. There are high growth firms that issue debt, and low growth firms that raise equity capital. In short, there are numerous exceptions, but the life cycle framework still provides a useful device to explain why different kinds of firms do what they do, and what causes them to deviate from the prescribed financing choices.

Note that while we look at a firm's choices in terms of debt and equity at different stages in the growth life cycle, there are two things we do not do in this analysis. First, we do not explain in any detail why firms at each stage in the growth life cycle pick the types of financing that they do. Second, we do not consider what kind of debt is best for a firm – short term or long term, dollar or foreign currency, fixed rate or floating rate. The reason is that this choice has more to do with the types of assets the firm owns and the nature of the cash flows from these assets, than with where in its life cycle a firm is in. We will return to examine this issue in more detail in chapter 9.

Figure 7.2: Life Cycle Analysis of Financing

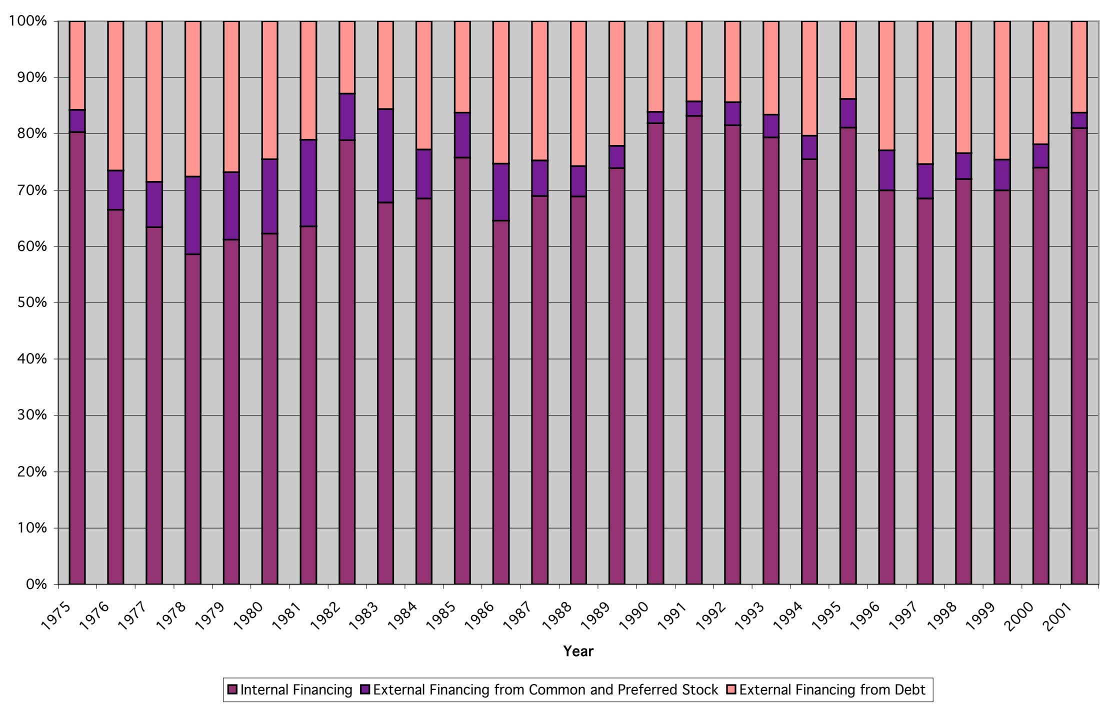


External funding needs	High, but constrained by infrastructure	High, relative to firm value.	Moderate, relative to firm value.	Declining, as a percent of firm value	Low, as projects dry up.
Internal financing	Negative or low	Negative or low	Low, relative to funding needs	High, relative to funding needs	More than funding needs
External Financing	Owner's Equity Bank Debt	Venture Capital Common Stock	Common stock Warrants Convertibles	Debt	Retire debt Repurchase stock
Growth stage	Stage 1 Start-up	Stage 2 Rapid Expansion	Stage 3 High Growth	Stage 4 Mature Growth	Stage 5 Decline
Financing Transitions	Accessing private equity	Inital Public offering	Seasoned equity issue	Bond issues	

How Firms have Actually Raised Funds

In the first part of this chapter, we noted the range of choices in terms of both debt and equity that are available to firms to raise funds. Before we look at which of these choices firms should use, it is worth noting how firms have historically raised funds for operations. While firms have used debt, equity and hybrids to raise funds, their dependence on each source has varied across time. In the United States, for instance, firms have generally raised external financing through debt issues rather than equity issues, and have primarily raised equity funds internally from operations. Figure 7.3 illustrates the proportion of funds from new debt and equity issues, as well as from internal funds, for U.S. corporations between 1975 and 2001.

Figure 7.3: External and Internal Financing at US Firms



Source: Compustat

In every year, firms have relied more heavily on internal financing to meet capital needs than on external financing. Furthermore, when external financing is used, it is more likely to be new debt rather than new equity or preferred stock.

There are wide differences across firms in the United States in how much and what type of external financing they use. The evidence is largely consistent with the conclusions that emerge from looking at a firm's place in the growth cycle in Figure 7.2. Fluck, Holtz-Eakin and Rosen (1998) looked at several thousand firms that were incorporated in Wisconsin[2]; most of these firms were small, private businesses. The authors find that these firms depend almost entirely on internal financing, owner's equity and bank debt to cover their capital needs. The proportion of funds provided by internal financing increases as the firms became older and more established. A small proportion of private businesses manage to raise capital from venture capitalists and private equity investors. Many of these firms plan on ultimately going public, and the returns to the private equity investors come at the time of the public offering. Bradford and Smith (1997) looked at 60 computer-related firms prior to their initial public offerings and noted that 41 of these firms had private equity infusions before the public offering. The median number of private equity investors in these firms was between two and three, and the median proportion of the firm owned by these investors was 43.8%; an average of 3.2 years elapsed between the private equity investment and the initial public offering at these firms. While this is a small sample of firms in one sector, it does suggest that private equity plays a substantial role in allowing firms to bridge the gap between private businesses and publicly traded firms.

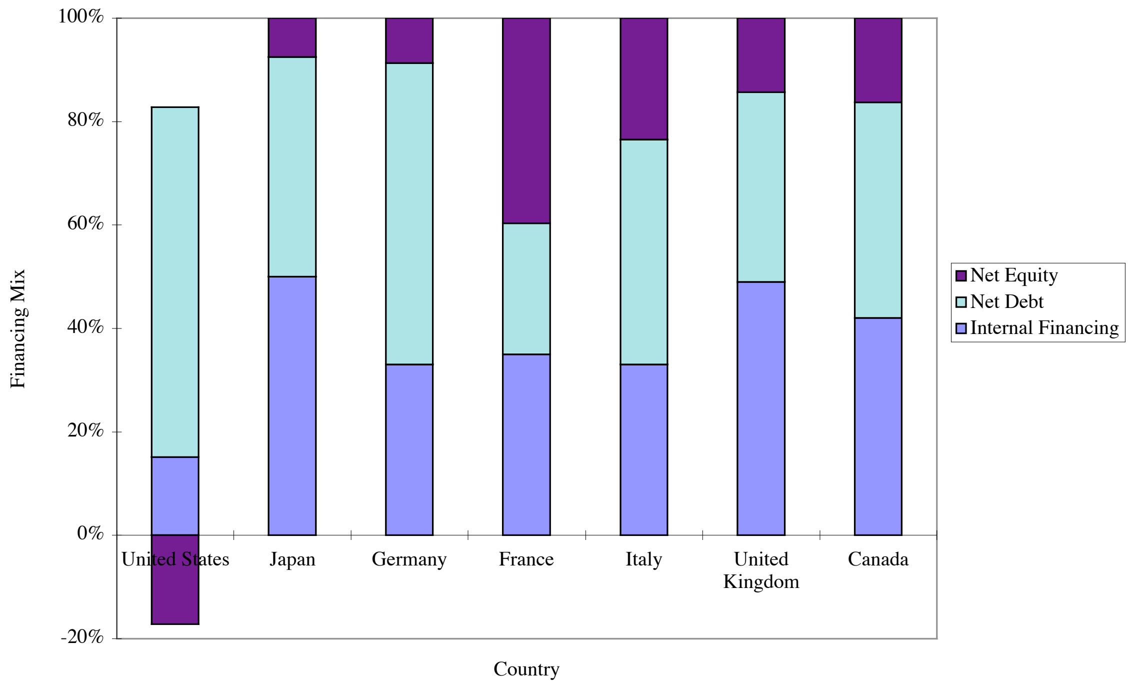
In comparing the financing patterns of U.S. companies to companies in other countries, we find some evidence that U.S. companies are much more heavily dependent upon debt than equity for external financing than their counterparts in other countries. Figure 7.4 summarizes new security issues[3] in the G-7 countries[4] between 1984 to 1991–

[2] This is a unique data set, since this information is usually either not collected or not available to researchers.

[3] This is based upon OECD data, summarized in the OECD publication " Financial Statements of Non-Financial Enterprises". This data is excerpted from Rajan and Zingales (1995).

[4] The G-7 countries represent seven of the largest economies in the world. The leaders of these countries meet every year to discuss economic policy.

Figure 7.4: Financing Patterns for G-7 Countries – 1984-91

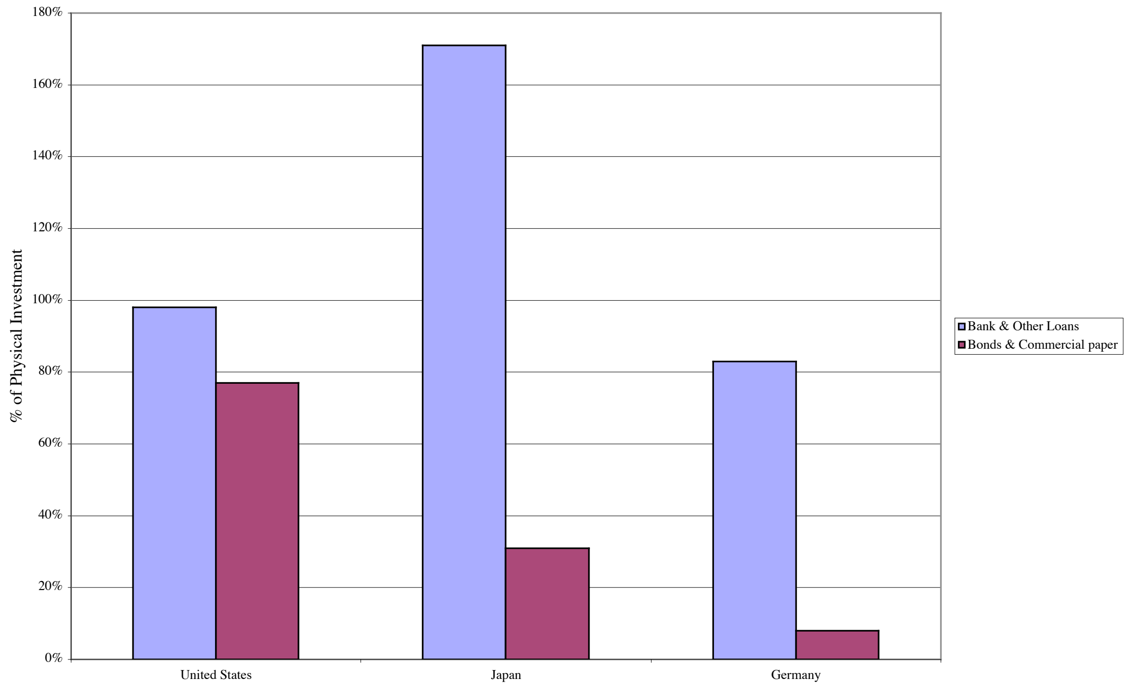


Source: OECD

Net equity, in this graph, refers to the difference between new equity issues and stock buybacks. Firms in the United States, during the period of this comparison, bought back more stock than they issued, leading to negative net equity. In addition, a comparison of financing patterns in the United States, Germany and Japan reveals that German and Japanese firms are much more dependent upon bank debt than firms in the United States, which are much likely to issue bonds.[5] Figure 7.5 provides a comparison of bank loans and bonds as sources of debt for firms in the three countries, as reported in Hackethal and Schmidt (1999).

[5] Hackethal and Schmidt (1999) compare financing patterns in the three countries.

Figure 7.5: Bonds versus Bank Loans - 1990-96



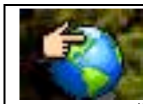
Source: Hackethal and Schmidt (1999)

There is also some evidence that firms in some emerging markets, such as Brazil and India, use equity (internal and equity) much more than debt to finance their operations. Some of this dependence can be attributed to government regulation that discourages the use of debt, either directly by requiring the debt ratios of firms to be below specified limits or indirectly by limiting the deductibility of interest expenses for tax purposes. One of the explanations for the greater dependence of U.S. corporations on debt issues relies on where they are in their growth life cycle. Firms in the United States, in contrast to firms in emerging markets, are much more likely to be in the mature growth stage of the life cycle. Consequently, firms in the US should be less dependent upon external equity. Another factor is that firms in the United States have far more access to corporate bond markets than do firms in other markets. Firms in Europe, for instance, often have to raise new debt from banks, rather than bond markets. This may constrain them in the use of new debt.

7.8. ☞ **: Corporate Bond Markets and the use of debt**

Companies in Europe and emerging markets have historically depended upon bank debt to borrow and have had limited access to corporate bond markets. In recent years, their access to corporate bond markets, both domestically and internationally, has increased. As a result, which of the following would you expect to happen to debt ratios in these countries?

a. Debt ratios should go up
b. Debt ratios should go down
c. Debt ratios should not change much


finUS.xls: There is a dataset on the web that has aggregate internal and external financing, for US firms, from 1975 to 1998.

The Process of Raising Capital

Looking back at figure 7.2, we note four financing transitions, where the source of funding for a firm is changed by the introduction of a new financing choice. The first occurs when a private firm approaches a private equity investor or venture capitalist for new financing. The second occurs when a private firm decides to offer its equity to financial markets and become a publicly traded firm. The third takes place when a publicly traded firm decides to revisit equity markets to raise more equity. The fourth occurs when a publicly traded firms decides to raise debt from financial markets by issuing bonds. In this section, we examine the process of making each of these transitions. Since the processes for making seasoned equity and bond issues are very similar, we will consider them together.

Private Firm Expansion: Raising Funds from Private Equity

Private firms that need more equity capital than can be provided by their owners can approach venture capitalists and private equity investors. Venture capital can prove useful at different stages of a private firm's existence. **Seed-money venture capital**, for instance, is provided to start-up firms that want to test a concept or develop a new product, while **start-up venture capital** allows firms that have established products and concepts to develop and market them. Additional rounds of venture capital allow private firms that have more established products and markets to expand. There are five steps associated with how venture capital gets to be provided to firms, and how venture capitalists ultimately profit from these investments.

1. *Provoke equity investor's interest*: The first step that a private firm wanting to raise private equity has to take is to get private equity investors interested in investing in it. There are a number of factors that help the private firm, at this stage. One is the *type of business* that the private firm is in, and how attractive this business is to private equity investors. The second factor is the track record of the top manager or managers of the firm. Top managers, who have a track record of converting private businesses into publicly traded firms, have an easier time raising private equity capital.
2. *Valuation and Return Assessment*: Once private equity investors become interested in investing in a firm, the value of the private firm has to be assessed by looking at both its current and expected prospects. This is usually done using the **venture capital method**, where the earnings of the private firm are forecast in a future year, when the company can be expected to go public. These earnings, in conjunction with a price-earnings multiple, estimated by looking at publicly traded firms in the same business, is used to assess the value of the firm at the time of the initial public offering; this is called the **exit or terminal value**.

   For instance, assume that Bookscape is expected to have an initial public offering in 3 years, and that the net income in three years for the firm is expected to be \$ 4 million. If the price-earnings ratio of publicly traded retail firms is 25, this would yield an estimated exit value of \$ 100 million. This value is discounted back to the present at what venture capitalists call a *target rate of return*, which measures what venture capitalists believe is a justifiable return, given the risk that they are exposed to. This target rate of return is usually set at a much higher level[6] than the traditional cost of equity for the firm.

   Discounted Terminal Value = Estimated exit value /(1+ Target return)^n

[6] By 1999, for instance, the target rate of return for private equity investors was in excess of 30%.

Using the Bookscape example again, if the venture capitalist requires a target return on 30% on his or her investment, the discounted terminal value for Bookscape would be

Discounted Terminal value for Bookscape = \$ 100 million/1.30^3 = \$ 45.52 million

3. *Structuring the Deal*: In structuring the deal to bring private equity into the firm, the private equity investor and the firm have to negotiate two factors. First, the private equity investor has to determine what proportion of the value of the firm he or she will demand, in return for the private equity investment. The owners of the firm, on the other hand, have to determine how much of the firm they are willing to give up in return for the same capital. In these assessments, the amount of new capital being brought into the firm has to be measured against the estimated firm value. In the Bookscape example, assuming that the venture capitalist is considering investing \$ 12 million, he or she would want to own at least 26.36% of the firm.[7]

   Ownership proportion = Capital provided/ Estimated Value

   = \$ 12/ \$ 45.52 = 26.36%

   Second, the private equity investor will impose constraints on the managers of the firm in which the investment is being made. This is to ensure that the private equity investors are protected and that they have a say in how the firm is run.
4. *Post-deal Management*: Once the private equity investment has been made in a firm, the private equity investor will often take an active role in the management of the firm. Private equity investors and venture capitalists bring not only a wealth of management experience to the process, but also contacts that can be used to raise more capital and get fresh business for the firm.
5. *Exit*: Private equity investors and venture capitalists invest in private businesses because they are interested in earning a high return on these investments. How will these returns be manifested? There are three ways in which a private equity investor can profit from an investment in a business. The first and usually the most lucrative alternative is an initial public offering made by the private firm. While venture

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[7] Many private equity investors draw a distinction between pre-money valuation, or the value of the company without the cash inflow from the private equity investor, and post-money valuation, which is the

capitalists do not usually liquidate their investments at the time of the initial public offering, they can sell at least a portion of their holdings once they are traded[8]. The second alternative is to sell the private business to another firm; the acquiring firm might have strategic or financial reasons for the acquisition. The third alternative is to withdraw cash flows from the firm and liquidate the firm over time. This strategy would not be appropriate for a high growth firm, but it may make sense if investments made by the firm no longer earn excess returns.

From Private to Publicly Traded Firm: The Initial Public Offering

A private firm is restricted in its access to external financing, both for debt and equity. In our earlier discussion of equity choices, we pointed out the hard bargain venture capitalists extract for investing equity in a private business. As firms become larger and their capital needs increase, some of them decide to become publicly traded and to raise capital by issuing shares of their equity to financial markets.

Staying Private versus Going Public

When a private firm becomes publicly traded, the primary benefit is increased access to financial markets and to capital for projects. This access to new capital is a significant gain for high growth businesses, with large and lucrative investment opportunities. A secondary benefit is that the owners of the private firm are able to cash in on their success by attaching a market value to their holdings. These benefits have to be weighed against the potential costs of being publicly traded. The most significant of these costs is the loss of control that may ensue from being a publicly traded firm. As firms get larger and the owners are tempted to sell some of their holdings over time, the owner's share of the outstanding shares will generally decline. If the stockholders in the firm come to believe that the owner's association with the firm is hurting rather than helping it, they may decide to put pressure for the owner's removal. Other costs associated with being a publicly traded firm are the information disclosure requirements

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value of the company with the cash influx from the private equity investors. They argue that their ownership of the firm should be based upon the former (lower) value.

[8] Black and Gilson (1998) argue that one of the reasons why venture capital is much more active in the U.S. than in Japan or Germany is because the option to go public is much more easily exercised in the U.S.

and the legal requirements[9]. A private firm experiencing challenging market conditions (declining sales, higher costs) may be able to hide its problems from competitors, whereas a publicly traded firm has no choice but to reveal the information. Yet another cost is that the firm has to spend a significant portion of its time on investor relations, a process in which equity research analysts following the firm are cultivated[10] and provided with information about the firm's prospects.

Overall, the net tradeoff to going public will generally be positive for firms with large growth opportunities and funding needs. It will be smaller for firms that have smaller growth opportunities, substantial internal cash flows, and owners who value the complete control they have over the firm.

Steps in an initial public offering

Assuming that the benefits outweigh the costs, there are five steps involved in an initial public offering.

Step 1: Choose an investment banker based upon reputation and marketing skills. In most initial public offerings, this investment banker underwrites the issue and guarantees a specified price for the stock. This investment banker then puts together a group of several banks (called a syndicate) to spread the risk of the offering and to increase marketing reach.

Step 2: Assess the value of the company and set issue details: This valuation is generally done by the lead investment bank, with substantial information provided by the issuing firm. The value is sometimes estimated using discounted cash flow models. More often, though, the value is estimated by using a multiple, like a price earnings ratio, and by looking at the pricing of comparable firms that are already publicly traded. Whichever approach is used, the absence of substantial historical information, in conjunction with the fact that these are small companies with high growth prospects, makes the estimation of value an uncertain one at best. Once the value for the company has been estimated, the

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[9] The costs are two fold. One is the cost of producing and publicising the information itself. The other is the loss of control over how much and when to reveal information about the firm to others.

[10] This may sound like an odd term, but it is accurate. Buy recommendations from equity research analysts following the firm provoke investor interest and can have a significant impact on the stock price; sell

value per share is obtained by dividing by the number of shares, which is determined by the price range the issuer would like to have on the issue. If the equity in the firm is valued at $ 50 million, for example, the number of shares would be set at 5 million to get a target price range of $10, or at 1 million shares to get a target price range of $ 50 per share. The final step in this process is to set the offering price per share. Most investment banks set the offering price below the estimated value per share for two reasons. First, it reduces the bank's risk exposure. If the offering price is set too high and the investment bank is unable to sell all of the shares being offered, it has to use its own funds to buy the shares at the offering price. Second, investors and investment banks view it as a good sign if the stock increases in price in the immediate aftermath of the issue. For the clients of the investment banker who get the shares at the offering price, there is an immediate payoff; for the issuing company, the ground has been prepared for future issues.

Step 3: Gauge investor demand at the offering price: In setting the offering price, investment bankers have the advantage of first checking investor demand. This process, which is called **building the book**, involves polling institutional investors prior to pricing an offering, to gauge the extent of the demand for an issue. It is also at this stage in the process that the investment banker and issuing firm will present information to prospective investors in a series of presentations called **road shows**. In this process, if the demand seems very strong, the offering price will be increased; in contrast, if the demand seems weak, the offering price will be lowered. In some cases, a firm will withdraw[11] an initial public offering at this stage, if investors are not enthusiastic about it.

Step 4: Meet SEC filing requirements and issue a prospectus: In order to make a public offering the United States, firms have to meet several requirements. First, they have to file a registration statement and prospectus with the SEC, providing information about the firm's financial history, its forecasts for the future and how it plans for the funds it raises from the initial public offering. The prospectus provides information about the riskiness and prospects of the firm for prospective investors in its stock. The SEC reviews this information and either approves the registration or sends out a deficiency

recommendations, on the other, can cause the stock price to drop. This is especially true for small, unknown firms.

memorandum asking for more information. While the registration is being reviewed, the firm may not sell any securities, though it can issue a preliminary prospectus, titled a **red herring**, for informational purposes only. Once the registration has been approved by the SEC, the firm can place a **tombstone advertisement** in newspapers and other publications.

Step 5: Allocate stock to those who apply to buy it at offering price: If the demand for the stock exceeds the supply (which will happen if the offering price is set too low), you will have to ration the stock. If the supply exceeds the demand, the investment banker will have to fulfill the underwriting guarantee and buy the remaining stock at the offering price.

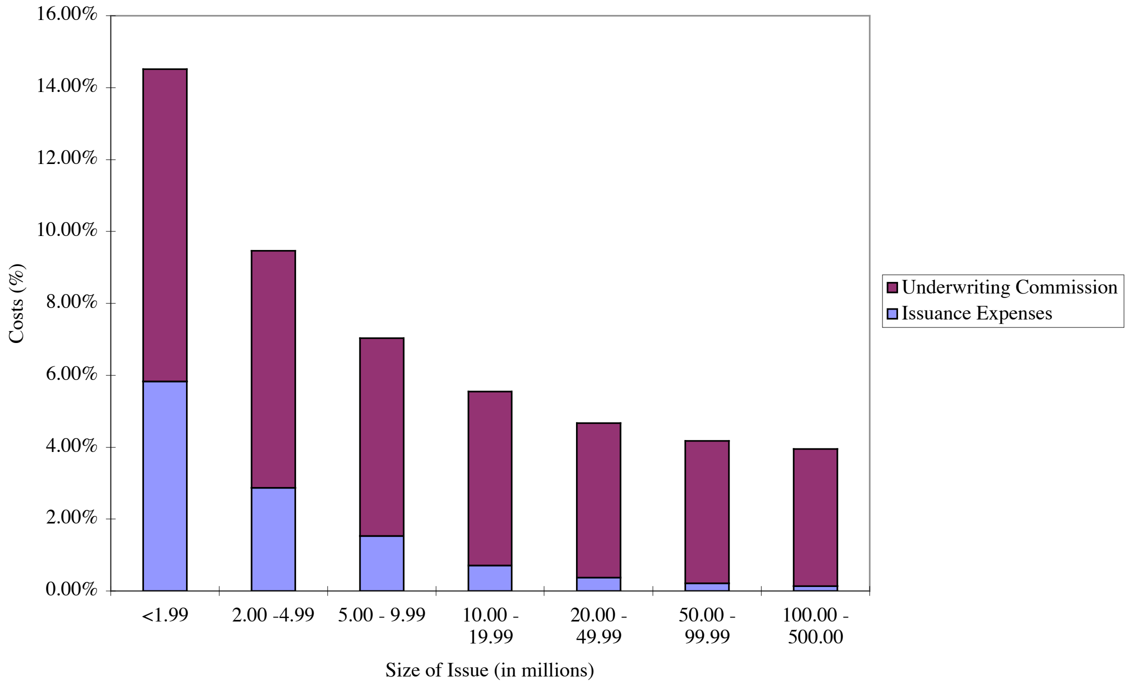
On the offering date — the first date the shares can be traded — the market price is determined by demand and supply. If the offering price has been set too high, as is sometimes the case, the investment bankers will have to discount the offering to sell it and make up the difference to the issuer, because of the underwriting agreement. If the offering price is set too low, as is often the case, the traded price on the offering date will be much higher than the market price, thus enriching those who were allocated shares in the initial public offering.

The Costs of Going Public

There are three costs associated with an initial public offering. First, the firm must consider the legal and administrative cost of making a new issue, including the cost of preparing registration statements and filing fees. Second, the firm should examine the underwriting commission — the gross spread between the offering price and what the firm receives per share, which goes to cover the underwriting, management, and selling fees on the issue. This commission can be substantial and decreases as the size of the issue increases. Figure 7.6 summarizes the average issuance and underwriting costs for issues of different sizes, reported by Ritter (1998).

[11] One study of initial public offerings between 1979 and 1982 found that 29% of firms terminated their initial public offerings at this stage in the process.

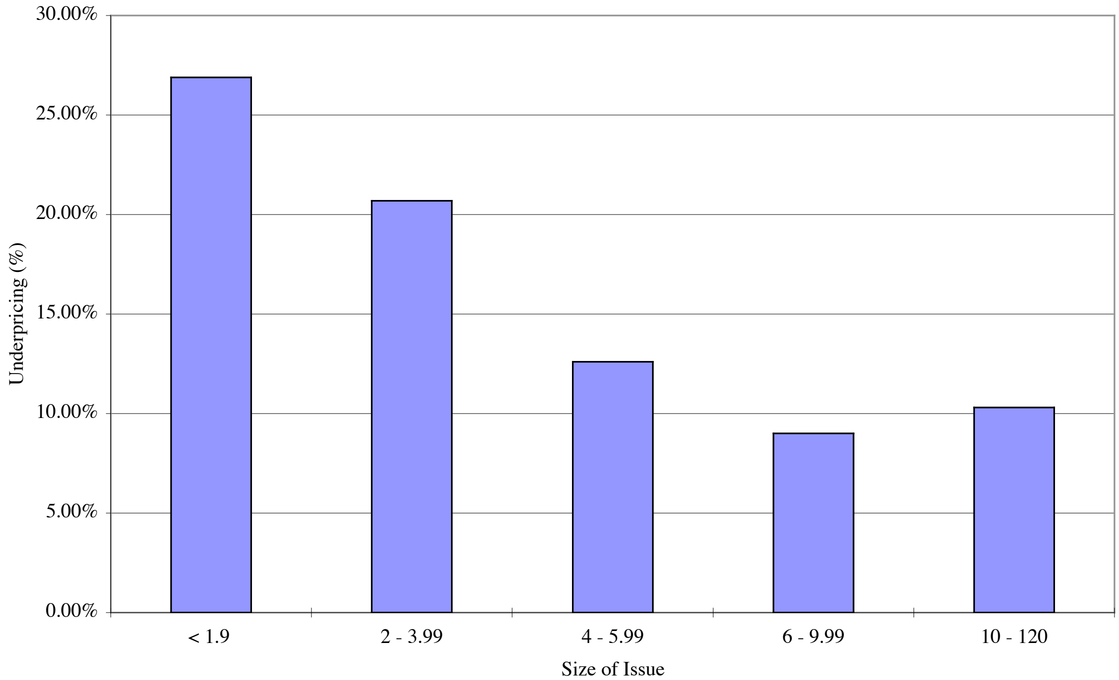
Figure7.6: Issuance Costs by Size of Issue



Source: Ritter

The third cost is any underpricing on the issue**,** which provides a windfall to the investors who get the stock at the offering price and sell it at the much higher market price. Thus, for Netscape, whose offering price was $29 and whose stock opened at $50, the difference of $21 per share on the shares offered, is an implicit cost to the issuing firm. While precise estimates vary from year to year, the average initial public offering seems to be underpriced by 10-15%. Ibbotson, Sindelar, and Ritter (1993), in a study of the determinants of underpricing, estimate its extent as a function of the size of the issue. Figure 7.7 summarizes the underpricing as a percent of the price by size of issue.

Figure 7.7: Underpricing as percent of Price - By Issue Size



Source: Ibbotson, Sindelar and Ritter

Private firms tend to pick investment bankers based upon reputation and expertise, rather than price. A good reputation provides the credibility and the comfort level needed for investors to buy the stock of the firm; expertise applies not only to the pricing of the issue and the process of going public but also to other financing decisions that might be made in the aftermath of a public issue. The investment banking agreement is then negotiated, rather than opened up for competition.

Illustration 7.2: The Initial Public Offering for United Parcel Service

On July 21, 1999, United Parcel Service, the world's largest private package company, announced plans to sell its shares to the public. The company, which was wholly owned by its managers and employees, announced that it was going public in order to raise capital to make acquisitions in the future. UPS reported revenues of $ 24.8 billion and net income of $ 1.7 billion in 1998 and at that time employed about 330,000 people.

UPS followed the initial announcement by filing a prospectus with the SEC on the same day, announcing its intention of creating two classes of shares. Class A shares, with 10 votes per share, would be held by the existing owners of UPS, and class B shares, having one vote per share, would be offered to the public.

The firm chose Morgan Stanley as its lead investment banker, and Morgan Stanley put together a syndicate that included Goldman Sachs and Merrill Lynch as senior co-managers. Other co-managers included Credit Suisse, Salomon Smith Barney and Warburg Dillon Read. On October 20, 1999, UPS filed a statement with the SEC (called an S-1 registration statement) announcing that it planned to issue 109.4 million shares (about 10% of the 1.1 billion outstanding shares) at a price range[12] of $ 36 to $ 42, and that the initial public offering would occur sometime in early November.

Based upon the strong demand from institutional investors, gauged in the process of building the book, the investment banking syndicate increased the offering price to $ 50 per share on November 8, 1999, and set the offering date at November 10, 1999. At that time, it was the largest initial public offering ever by a U.S. company.

On November 10, 1999, the stock went public. The stock price jumped to $ 70.1325 from the offering price of $ 50. At the end of the trading day, UPS shares were trading at $ 67.25. Based upon this price and the total number of shares outstanding, the market value of UPS was assessed at $ 80.9 billion.

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[12] The process by which this price range was set was not made public. We would assume that it was partially based upon how the market was pricing two other publicly traded rivals – Fed Ex and Airborne Freight.

7.9. ☞ : **The Cost of Underrpricing**

Assume that the market is correct in its assessment of UPS value and that the investment bankers underpriced the issue. How much did the underpricing cost the owners of UPS?

a. About $ 22 billion
b. About $ 50 billion
c. About $ 2.2 billion
d. None of the above

In Practice: The Underpricing of IPOs

Investment bankers generally underprice initial public offerings and are fairly open about the fact that they do. This gives rise to two questions. First, why don't the offering firms express more outrage about the value left on the table by the underpricing? Second, can investors take advantage of the underpricing by subscribing to dozens of initial public offerings? There are simple answers to both questions.

It is true that an underpriced initial public offering results in less proceeds going to the issuing firms. However, the loss of wealth is a function of how much of the equity of the firm is offered in the initial offering. If, as in the UPS offering, only 10% of the stock is being offered, we can see why many issuing firms go along with the underpricing. The favorable publicity associated with a strong opening day of trading may act as promotion for subsequent offerings that the firm plans to make in future months or even years.

It is not easy constructing an investment strategy that takes advantage of the IPO mispricing. If an investor applies for shares in a number of offerings, she is likely to get all the shares she requests in the offerings that are over priced and only a fraction of the shares she requests in the offerings that are underpriced (where there will be rationing because of excess demand). The resulting portfolio will be overweighted in overpriced public offerings and underweighted with the underpriced offerings, and the returns will not match up to those reported in IPO studies.

The Choices for a Publicly Traded Firm

Once a firm is publicly traded, it can raise new financing by issuing more common stock, equity options or corporate bonds. Additional equity offerings made by firms that are already publicly traded are called seasoned equity issues. In making stock and bond offerings, a publicly traded firm has several choices. It can sell these securities with underwritten general subscriptions, through stocks and bonds are offered to the public at an offering price guaranteed by the investment banker. It can also privately place both bonds and stocks with institutional investors, or issue stocks and bonds directly to investors, without any middlemen.

General Subscriptions

In a **general subscription**, the issue is open to any member of the general public to subscribe. In that sense, it is very similar to an initial public offering, though there are some basic differences:

- *Underwriting Agreement*: The underwriting agreement of an initial public offering almost always involves a firm guarantee and is generally negotiated with the investment banker, while the underwriting agreements for seasoned issues take on a wider variety of forms. First, there is the potential for competitive bids to arise on seasoned issues, since investment bankers have the information[13] to promise a fixed price. There is evidence that competitive bids reduce the spread, though even seasoned firms continue to prefer negotiated offerings. Second, seasoned issues also offer a wider range of underwriting guarantees; some issues are backed up by a **best efforts guarantee**, which does not guarantee a fixed price; other issues come with **stand-by guarantees**, where the investment banker provides back-up support, in case the actual price falls below the offering price. The payoff from relaxing the guarantee comes as lower underwriting commissions.
- *Pricing of Issue*: The issuer of an initial public offering has to estimate the value of the firm and then the per-share value before pricing the issue, while the pricing of a

[13] The information takes two forms. The first are the filings that every publicly traded firm has to make with the SEC. The other, and more important, is the current stock price.

seasoned issue starts with the current market price, simplifying the process. Often, the price of a seasoned issue will be set just below the current market price.

The overall evidence on the cost of public offerings indicates that it is still clearly much more expensive to issue stock rather than bonds, and the cost of the issue is a decreasing function of the size of the issue.

Private Placements

An alternative to a general subscription is a **private placement**, in which securities are sold directly to one or a few investors. The terms for the securities are negotiated between the two parties. The primary advantage of private placements over general subscriptions is the lower cost, since there are fewer intermediaries and no need for underwriting guarantees or marketing. There are also substantial savings in time and administrative costs because the SEC registration requirements are bypassed. The other advantages are that the terms of the bond can be tailored to meet the specific needs of the buyer, and the firm can convey proprietary information (presumably positive) to the potential investors.

The primary disadvantage of private placements is that there are relatively few potential investors, since large private placements may expose the investor to firm-specific risks. This is why private placements of corporate bonds are much more common than private placement of equity. In a typical private placement, the buyer tends to be a long-term institutional investor, such as a life insurance company or a pension fund. These investors tend to invest in these bonds and hold them until maturity. Private placements generally range from $ 25 million to $ 250 million in size and have more restrictions associated with them than typical corporate bond issues.

Rights Offerings

The third option available to seasoned issuers is a **rights offering**. In this case, instead of trying to sell new stock at the current market price to all investors, the existing investors in the firm are given the right to buy additional shares, in proportion to their current holdings, at a price much lower than the current market price.

A company that uses a rights offering generally issues one right for each outstanding common share, allowing each stockholder to use those rights to buy additional shares in the company at a **subscription price**, generally much lower than the market price. Rational stockholders will either exercise the right or sell it. Those investors who let a right expire without doing either will find that the market value of their remaining holding shrinks — the market price will almost certainly drop when the rights are exercised since the subscription price is set much lower than the market price. In general, the value of a right should be equal to the difference between the stock price with the rights attached — the **rights-on price** — and the stock price without the rights attached — the **ex-rights price**. The reasoning is simple. If this were not true, there would be opportunities for easy profits on the part of investors and the resulting price would not be stable. To illustrate, if the price of the right were greater than the difference between the rights-on price and the ex-rights price, every stockholder would be better off selling the right rather than exercising it. This, in turn, would push the price down toward the equilibrium price. If the price of the right were lower than the difference between the rights-on and the ex-right price, there would be an equally frenzied rush to buy the right and exercise it, which, in turn, would push the price up towards the equilibrium price. The value of a right can be estimated using the following equation –

Price of a right = (Rights-on Price - Subscription Price)/(n + 1)

where n is the number of rights required for each new share.

Rights offerings are a much less expensive way of raising capital than public issues, for two reasons. First, the underwriting commissions are much lower, since a rights offering has little risk of not receiving subscriptions if the subscription price is set well below the market price. Second, the other transactions and administrative costs should also be lower because there is a far smaller need for marketing and distribution.

What is the drawback of making a rights issue? The primary reservation seems to be that it increases the number of shares outstanding far more than a general subscription at the existing stock price. To illustrate, a firm that makes a rights issue at $ 5 per share when the stock price is $ 10 will have to issue 10 million shares to raise $ 50 million. In contrast, the same firm would have had to issue only 5 million shares, if the issue had been at the existing stock price of $ 10. Some financial managers argue that this dilutes the share holding and lowers the market price. While this is true in a technical sense, the existing stockholders should not object since they are the only ones who receive the rights. In other words, the stock price will drop, but everyone will own proportionately more shares in the firm. In general, firms in the United States have been much more reluctant to use rights issues than European firms, in spite of the significant cost savings that could accrue from them. Part of this reluctance can be attributed to the fear of dilution.

Illustration 7.3: Valuing a Rights Offering — Tech Temp Inc.

Tech Temp Inc. has 10 million shares outstanding, trading at \$ 25 per share. It needs to raise \$ 25 million in new equity and decides to make a rights offering. Each stockholder is provided with one right for every share owned, and 5 rights can be used to buy an additional share in the company at \$12.50 per share. The value of a right can be calculated as follows:

	Before Rights Exercised	*After Rights Exercised*
Number of Shares	10 million	12 million
Value of Equity	\$ 250 million	\$ 275 million
Price per share	\$ 25.00	\$ 22.92

The rights-on price is \$ 25.00 per share, and the ex-rights price is \$ 22.92, leading to a per right value of \$ 2.08. This can be confirmed by using the equation:

Value per Right = (Rights-on Price - Subscription Price)/(n + 1)

= (\$25 - \$ 12.50)/ (5 + 1)

= \$ 12.50 /6 = \$ 2.08

If the rights price were greater than this value, investors would want to sell their rights. Alternatively, if the rights could be acquired for less than \$ 2.08, there would be an opportunity to gain by acquiring the rights at the lower price and exercising them.

rights.xls: This spreadsheet allows you to estimate the ex-rights price and the value per right, in a rights issue.

7.10. ☞: Rights Issues and existing stockholders

Assume that you own 1000 shares in Tech Temp, trading at $25 a share, and that you receive the rights described in the last illustration. Assume also that, due to an oversight, you neither exercise the right nor sell it. How much would you expect to lose as a result of the oversight?

a. Nothing. You still own the shares.
b. $ 416
c. $ 2,080
d. $12,500

Shelf Registrations

Firms that want to raise external financing have to disclose information and file the required statements with the SEC before they can issue securities. This registration process is costly and time consuming and is one reason why some firms rely on internal financing. In response to this criticism, the SEC simplified its rules and allowed firms more flexibility in external financing. Rule 415, which was issued in 1982, allows firms to make a **shelf registration**, in which they can file a single prospectus for a series of issues the firm expects to make over the next two years.

Besides making the process less cumbersome, shelf registration also gives firms more flexibility in terms of timing, since stock and bond issues can be made when windows of opportunity open up. Thus, a firm might make a shelf registration for $200 million in bonds and make the bond issue when interest rates are at a low point. This flexibility in timing also allows firms to open up the process to aggressive bidding from investment banks, reducing transactions costs substantially. Some firms make the issues themselves rather than use investment bankers, since the process is simpler and faster.

Overall, the spreads on new issues, especially for bonds, have been under pressure since the passage of shelf registration. In spite of its benefits, however, shelf registration is more likely to be used by large firms making bond issues and less likely to be used by small firms making equity issues.

The Trade off of Debt

Now that we have defined debt and considered how financing choices change as a function of where a firm is in it's life cycle, we can tackle a fundamental question. Why use debt instead of equity? In this section, we will first examine the benefits of using debt instead of equity and then follow up by looking at the costs.

The Benefits of Debt

In the broadest terms, debt provides two differential benefits over equity. The first is the *tax benefit* : interest payments on debt are tax deductible, while cash flows on equity are not. The second is the *added discipline imposed on management* , by having to make payments on debt. Both benefits can and should be quantified if firms want to make reasonable judgments on debt capacity.

> ***Double Taxation:*** There is double taxation when the same income gets taxed twice, once at the entity level and once at the individual level. Thus, dividends, which are paid out of after-tax corporate profits, are double taxed when individuals have to pay taxes on them, as well.

1. Debt Has A Tax Advantage

The primary benefit of debt relative to equity, is the tax advantage it confers on the borrower. In the United States, interest paid on debt is tax deductible, whereas cash flows on equity (such as dividends) have to be paid out of after-tax cash flows. For the most part, this is true in other countries as well, though some countries try to provide partial protection against the double taxation of dividends by providing a tax credit to investors who receive the dividends for the corporate taxes paid (Britain) or by taxing retained earnings at a rate higher than dividends (Germany).

The tax benefits from debt can be presented in three ways. The first two measure the benefit in absolute terms whereas the third measures it as a percentage cost.

- In the first approach, the dollar tax savings in any financial year created by interest expenses can be computed by multiplying the interest expenses by the marginal tax rate of the firm. Consider a firm that borrows **$B** to finance it operations, on which it faces an interest rate of **r%,** and assume that it faces a marginal tax rate of **t** on income. The annual tax savings from the interest tax deduction can be calculated as follows:

Annual Interest Expense arising from the Debt = r B

Annual Tax Savings arising from the Interest Payment = t r B

- In the second approach, we can compute the present value of tax savings arising from interest payments over time. The present value of the annual tax savings can be computed by making three other assumptions. The first is that the debt is perpetual, which also means that the dollar savings are a perpetuity. The second is that the appropriate discount rate for this cash flow is the interest rate on the debt, since it reflects the riskiness of the debt. The third is that the expected tax rate for the firm will remain unchanged over time, and that the firm is in a tax paying position. With these three assumptions, the present value of the savings can be computed as follows:

  Present Value of Tax Savings from Debt = t r B / r = t B

  = Marginal tax rate * Debt

  While the conventional view is to look at the tax savings as a perpetuity, the approach is general enough to be used to compute the tax savings over a shorter period (say, ten years.) Thus, a firm that borrows $ 100 million at 8% for ten years and has a tax rate of 40%, can compute the present value of its tax savings as follows –

  Present Value of Interest Tax Savings = Annual Tax Savings (PV of Annuity)

  = (.08* 0.4 * $ 100 million) (PV of Annuity, 8%,10 years) = $ 21.47 million

  When asked to analyze the effect of adding debt on value, some analysts use a short cut and simply add the tax benefit from debt to the value of the firm with no debt:

  Value of Levered Firm with debt B = Value of Unlevered Firm + t B

  The limitation of this approach is that it considers only the tax benefit from borrowing and none of the additional costs. It also yields the unrealistic conclusion that firm value increases monotonically with more debt.

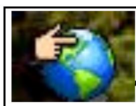
- In the third approach, the tax benefit from debt is expressed in terms of the difference between the pre-tax and after-tax cost of debt. To illustrate, if r is the interest rate on debt, and t is the marginal tax rate, the after-tax cost of borrowing (k_d) can be written as follows:

After-tax Cost of Debt (k_d) = r (1 - t)

This is the familiar formula used for calculating the cost of debt in the cost of capital calculation. In this formula, the after-tax cost of debt is a decreasing function of the tax rate. A firm with a tax rate of 40%, which borrows at 8%, has an after-tax cost of debt of 4.8%. Another firm with a tax rate of 70%, which borrows at 8%, has an after-tax cost of debt of 2.4%.

Other things remaining equal, the benefits of debt are much greater when tax rates are higher. Consequently, there are three predictions that can be made about debt ratios across companies and across time.

- The debt ratios of entities facing higher tax rates should be higher than the debt ratios of comparable entities facing lower tax rates. Other things remaining equal, you would expect German companies that face a 38.5% marginal corporate tax rate to borrow more money than Irish companies that face a 12.5% marginal corporate tax rate.
- If tax rates increase over time, we would expect debt ratios to go up over time as well, reflecting the higher tax benefits of debt.
- Companies with large net operating losses carried forward should get far less in tax benefits from debt than firms without these net operating losses.

There is a data set on the web that summarizes, by sector, the effective tax rates of firms in the sector.

7.11. ☞: **Net Operating Loss Carryforward and Tax Benefits**

You have been asked to assess the after-tax cost of debt for a firm that has $ 2 billion in net operating losses to carry forward, and operating income of roughly $ 2 billion this year. If the company can borrow at 8%, and the marginal corporate tax rate is 40%, the after-tax cost of debt this year is

a. 8%

b. 4.8%

What would your after-tax cost of debt be next year?

2. Debt may make managers more disciplined

In the 1980s, in the midst of the leveraged buyout boom, a group of practitioners and academics, led by Michael Jensen at Harvard, developed and expounded a new rationale for borrowing, based upon improving firms' efficiency in the utilization of their free cash flows. Free cash flows represent cash flows made on operations over which managers have discretionary spending power – they may use them to take projects, pay them out to stockholders or hold them as idle cash balances. The group argued that managers in firms that have substantial free cash flows and no or low debt have such a large cash cushion against mistakes that they have no incentive to be efficient in either project choice or project management. One way to introduce discipline into the process is to force these firms to borrow money, since borrowing creates the commitment to make interest and principal payments, increasing the risk of default on projects with sub-standard returns. It is this difference between the forgiving nature of the equity commitment and the inflexibility of the debt commitment that have led some to call equity a cushion and debt a sword.

> ***Free Cash Flows (Jensen's):*** The free cash flows referred to here are the operating cash flows after taxes, but before discretionary capital expenditures.

The underlying assumptions in this argument are that there is a conflict of interest between managers and stockholders, and that managers will not maximize shareholder wealth without a prod (debt). From our discussion in chapter 2, it is clear that this assumption is grounded in fact. Most large U.S. corporations employ managers who own only a very small portion of the outstanding stock in the firm; they receive most of their income as managers rather than stockholders. Furthermore, evidence indicates that managers, at least sometimes, put their interests ahead those of stockholders.

The argument that debt adds discipline to the process also provides an interesting insight into management perspectives on debt. Based purely upon managerial incentives, the optimal level of debt may be much lower than that estimated based upon shareholder wealth maximization. Left to themselves, why would managers want to burden themselves with debt, knowing fully well that they will have to become more efficient and pay a larger price for their mistakes? The corollary to this argument is that the debt ratios of firms in countries in which stockholder power to influence or remove managers is minimal will be much lower than optimal because managers enjoy a more comfortable existence by carrying less debt than they can afford to. Conversely, as stockholders acquire power, they will push these firms to borrow more money and, in the process, increase their stock prices.

Do increases in leverage lead to improved efficiency? The answer to this question should provide some insight into whether the argument for added discipline has some basis. Do increases in debt lead to improved efficiency and higher returns on investments? The answer to this question should provide some insight into whether the argument for added discipline has some basis. A number of studies have attempted to answer this question, though most have done so indirectly.

- Firms that are acquired in hostile takeovers are generally characterized by poor performance in both accounting profitability and stock returns. Bhide (1993), for instance, notes that the return on equity of these firms is 2.2% below their peer group, while the stock returns are 4% below the peer group's returns. While this poor performance by itself does not constitute support for the free cash flow hypothesis, Palepu (1986) presents evidence that target firms in acquisitions carry less debt than similar firms that are not taken over.
- There is evidence that increases in leverage are followed by improvements in operating efficiency, as measured by operating margins and returns on capital. Palepu (1990) presents evidence of modest improvements in operating efficiency at firms involved in leveraged buyouts. Kaplan(1989) and Smith (1990) also find that firms earn higher returns on capital following leveraged buyouts. Denis and Denis (1993) present more direct evidence on improvements in operating performance after leveraged recapitalizations[14]. In their study of 29 firms that increased debt substantially, they report a median increase in

> - ***Leveraged Recapitalization:*** In a leveraged recapitalization, a firm borrows money and either buys back stock or pays a dividend, thus increasing its debt ratio substantially.

the return on assets of 21.5%. Much of this gain seems to arise out of cutbacks in unproductive capital investments, since the median reduction in capital expenditures of these firms is 35.5%.

Of course, we must consider that the evidence presented above is consistent with a number of different hypotheses. For instance, it is possible that the management itself changes at these firms, and that it is the change of management rather than the additional debt that leads to higher investment returns.

7.12. ☞**: Debt as a Discplining Mechanism**

Assume that you buy into this argument that debt adds discipline to management. Which of the following types of companies will most benefit from debt adding this discipline?

a. Conservatively financed, privately owned businesses
b. Conservatively financed, publicly traded companies, with a wide and diverse stock holding
c. Conservatively financed, publicly traded companies, with an activist and primarily institutional holding.

(By conservatively financed, we mean primarily with equity)

The Costs of Debt

As any borrower will attest, debt certaintly has disadvantages. In particular, borrowing money can expose the firm to default and eventual liquidation, increase the agency problems arising from the conflict between the interests of equity investors and lenders, and reduce the flexibility of the firm to take actions now or in the future.

1. Debt increases expected bankruptcy costs

The primary concern when borrowing money is the increase in expected bankruptcy costs that typically follows. The expected bankruptcy cost can be written as a product of the probability of bankruptcy and the direct and indirect costs of bankruptcy.

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[14] In a leverage recapitalization, firms replace a substantial portion of their equity with debt, increasing debt ratios.

The Probability of Bankruptcy

The probability of bankruptcy is the likelihood that a firm's cash flows will be insufficient to meet its promised debt obligations (interest or principal). While such a failure does not automatically imply bankruptcy, it does trigger default, with all its negative consequences. Using this definition, the probability of bankruptcy is a function of the following –

(1) *Size of operating cash flows relative to size of cash flows on debt obligations*: Other things remaining equal, the larger the operating cash flows relative to the cash flows on debt obligations, the smaller the likelihood of bankruptcy. Accordingly, the probability of bankruptcy increases marginally for all firms, as they borrow more money, irrespective of how large and stable their cash flows might be.

(b) *Variance in Operating Cash Flows*: Given the same cash flows on debt, a firm with completely stable and predictable cash flows has a lower probability of bankruptcy than does another firm with a similar level of operating cash flows, but with far greater variability in these cash flows.

The Cost of Bankruptcy

The cost of going bankrupt is neither obvious nor easily quantified. It is true that bankruptcy is a disaster for all involved in the firm — lenders often get a fraction of what they are owed, and equity investors get nothing — but the overall cost of bankruptcy includes the indirect costs on operations of being perceived as having high default risk.

a. Direct Costs

The direct, or deadweight, cost of bankruptcy is that which is incurred in terms of cash outflows at the time of bankruptcy. These costs include the legal and administrative costs of a bankruptcy, as well as the present value effects of delays in paying out the cash flows. Warner (1977) estimated the legal and administrative costs of 11 railroads to be, on average, 5.3% of the value of the assets at the time of the bankruptcy. He also estimated that it took, on average, 13 years before the railroads were reorganized and released from the bankruptcy costs. These costs, while certaintly not negligible, are not overwhelming, especially in light of two additional factors. First, the direct cost as a percentage of the value of the assets decreases to 1.4% if the asset value is computed five years before the bankruptcy. Second, railroads, in general, are likely to have higher bankruptcy costs than other companies, because of the nature of their assets (real estate and fixed equipment).

b. Indirect Costs

If the only costs of bankruptcy were the direct costs noted above, the low leverage maintained by many firms would be puzzling. There are, however, much larger costs associated with taking on debt and increasing default risk, which arise prior to the bankruptcy, largely as a consequence of the perception that a firm is in financial trouble. The first is the perception on the part of the customers of the firm that the firm is in trouble. When this happens, customers may stop buying the product or service, because of the fear that the company will go out of business. In 1980, for example, when car buyers believed that Chrysler was on the verge of bankruptcy, they chose to buy from Ford, GM, and other car manufacturers, largely because they were concerned about receiving service and parts for their cars after their purchases. Similarly, in the late 1980s, when Continental Airlines found itself in financial trouble, business travelers switched to other airlines because they were unsure about whether they would be able to accumulate and use their frequent flier miles on the airline. The second indirect cost is the stricter terms suppliers start demanding to protect themselves against the possibility of default, leading to an increase in working capital and a decrease in cash flows. The third cost is the difficulty the firmmay experience trying to raise fresh capital for its projects — both debt and equity investors are reluctant to take the risk, leading to capital rationing constraints, and the rejection of good projects.

Shapiro and Titman point out that the indirect costs of bankruptcy are likely to be higher for the following types of firms:

- Firms that sell durable products with long lives that require replacement parts and service: Thus, a personal computer manufacturer would have higher indirect costs associated with bankruptcy than would a grocery store.
- Firms that provide goods or services for which quality is an important attribute but is difficult to determine in advance: Since the quality cannot be determined easily in advance, the reputation of the firm plays a significant role in whether the customer

will buy the product in the first place. For instance, the perception that an airline is in financial trouble may scare away customers who worry that the planes belonging to the airline will not be maintained in good condition.

- Firms producing products whose value to customers depends on the services and complementary products supplied by independent companies: Returning to the example of personal computers, a computer system is valuable only insofar as there is software available to run it. If the firm manufacturing the computers is perceived to be in trouble, it is entirely possible that the independent suppliers that produce the software might stop providing it. Thus, if Apple Computers gets into financial trouble, many software manufacturers might stop producing software for its computers, leading to an erosion in its potential market.
- Firms that sell products that require continuous service and support from the manufacturer: A manufacturer of copying machines for which constant service seems to be a necessary operating characteristic, would be affected more adversely by the perception of default risk than would a furniture manufacturer, for example.

Implications for Optimal Capital Structure

If the expected bankruptcy cost is indeed the product of the probability of bankruptcy and the direct and indirect bankruptcy cost, interesting and testable implications emerge for capital structure decisions –

- Firms operating in businesses with volatile earnings and cash flows should use debt less than should otherwise similar firms with stable cash flows. For instance, regulated utilities in the United States have high leverage because the regulation and the monopolistic nature of their businesses result in stable earnings and cash flows. At the other extreme, toy manufacturing firms such as Mattel can have large shifts in income from one year to another, based upon the commercial success or failure of a single toy[15]; These firms should use leverage far less in meeting their funding needs.
- If firms can structure their debt in such a way that the cash flows on the debt increase and decrease with their operating cash flows, they can afford to borrow more. This is

[15] In years past, a single group of toys such as the Teenage Mutant Ninja turtles or the Power Rangers, could account for a substantial proportion of a major toy manufacturer's profits.

because the probability of default is greatest when operating cash flows decrease, and the concurrent reduction in debt cash flows makes the default risk lower. Commodity companies, whose operating cash flows increase and decrease with commodity prices, may be able to use more debt if the debt payments are linked to commodity prices. Similarly, a company whose operating cash flows increase as interest rates (and inflation) go up and decrease when interest rates go down may be able to use more debt if the debt has a floating rate feature.

- If an external entity provides protection against bankruptcy, by providing either insurance or bail outs, firms will tend to borrow more. To illustrate, the deposit insurance offered by the FSLIC and the FDIC enables savings & loans and banks to maintain higher leverage than they otherwise could. While one can argue for this insurance on the grounds of preserving the integrity of the financial system, under charging for the insurance will accentuate this tendency and induce high risk firms to take on too much debt, letting taxpayers bear the cost. Similarly, governments that step in and regularly bail out firms on social grounds (e.g., to save jobs) will encourage all firms to overuse debt.
- Since the direct bankruptcy costs are higher, when the assets of the firm are not easily divisible and marketable, firms with assets that can be easily divided and sold should be able to borrow more than firms with assets that do not share these features. Thus, a firm, such as Weyerhauser, whose value comes from its real estate holdings should be able to borrow more money than a firm such as Coca Cola, which derives a great deal of its value from its brand name.
- Firms that produce products that require long-term servicing and support generally have lower leverage than firms whose products do not share this feature, as we discussed above.

7.13. ☞**: Debt and Bankruptcy**

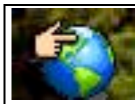
Rank the following companies on the magnitude of bankruptcy costs from most to least, taking into account both explicit and implicit costs:

a. A Grocery Store

b. An Airplane Manufacturer

c. High Technology company

Explain.

There is a data set on the web that summarizes, by sector, variances in operating earnings.

2. Debt creates agency costs

Equity investors, who receive a residual claim on the cash flows, tend to favor actions that increase the value of their holdings, even if that means increasing the risk that the bondholders (who have a fixed claim on the cash flows) will not receive their promised payments. Bondholders, on the other hand, want to preserve and increase the security of their claims. Since the equity investors generally control the firm's management and decision making, their interests will dominate bondholder interests unless bondholders take some protective action. By borrowing money, a firm exposes itself to this conflict and its negative consequences and it pays the price in terms of both higher interest rates and a loss of freedom in decision making.

The conflict between bondholder and stockholder interests appears in all three aspects of corporate finance: (1) deciding what projects to take (making investment decisions), (2) choosing how to finance these projects and (3) determining how much to pay out as dividends:

Risk Shifting: Risk shifting refers to the tendency of stockholders in firms and their agents (managers) to take on much riskier projects than bondholders expect them to.

- *Risky projects*: In the section on investment analysis, we argued that a project that earn a return that exceed the hurdle rate, adjusted to reflect the risk of the project, should be accepted and will increase firm value. The caveat, though, is that bondholders may be hurt if the firm accepts some of these projects. Bondholders lend money to the firm with the expectation that the projects accepted will have a certain risk level, and they set the interest rate on the bonds accordingly. If the firm chooses projects that are riskier than expected, however, bondholders will lose on their existing holdings because the price of the holdings will decrease to reflect the higher risk.

- *Subsequent Financing*: The conflict between stockholder and bondholder interests also arises when new projects have to be financed. The equity investors in a firm may favor new debt, using the assets of the firm as security and giving the new lenders prior claims over existing lenders. Such actions will reduce the interest rate on the new debt. The existing lenders in a firm, obviously do not want to give new lenders priority over their claims, because it makes the existing debt riskier (and less valuable). A firm may adopt a conservative financial policy and borrow money at low rates, with the expectation of keeping its default risk low. Once it has borrowed the money, however, the firm might choose to shift to a strategy of higher debt and default risk, leaving the original lenders worse off.
- *Dividends and Stock Repurchases*: Dividend payments and equity repurchases also divide stockholders and bond holders. Consider a firm that has built up a large cash reserve but has very few good projects available. The stockholders in this firm may benefit if the cash is paid out as a dividend or used to repurchase stock. The bondholders, on the other hand, will prefer that the firm retain the cash, since it can be used to make payments on the debt, reducing default risk. It should come as no surprise that stockholders, if not constrained, will pay the dividends or buy back stock, overriding bondholder concerns. In some cases, the payments are large and can increase the default risk of the firm dramatically.

The potential for disagreement between stockholders and bondholders can show up in as real costs in two ways:

a. If bondholders believe there is a significant chance that stockholder actions might make them worse off, they can build this expectation into bond prices by demanding much higher interest rates on debt.
b. If bondholders can protect themselves against such actions by writing in restrictive covenants, two costs follow –
    - the direct cost of monitoring the covenants, which increases as the covenants become more detailed and restrictive.

- the indirect cost of lost investments, since the firm is not able to take certain projects, use certain types of financing, or change its payout; this cost will also increase as the covenants becomes more restrictive.

As firms borrow more and more and expose themselves to greater agency costs, these costs will also increase.

Since agency costs can be substantial, two implications relating to optimal capital structure follow. First, the agency cost arising from risk shifting is likely to be greatest in firms whose investments cannot be easily observed and monitored. For example, a lender to a firm that invests in real estate is less exposed to agency cost than is a lender to a firm that invests in people or intangible assets. Consequently, it is not surprising that manufacturing companies and railroads, which invest in substantial real assets, have much higher debt ratios than service companies. Second, the agency cost associated with monitoring actions and second-guessing investment decisions is likely to be largest for firms whose projects are long term, follow unpredictable paths, and may take years to come to fruition. Pharmaceutical companies in the United States, for example, which often take on research projects that may take years to yield commercial products, have historically maintained low debt ratios, even though their cash flows would support more debt.

7.14. ☞: **Risk Shifting and Bondholders**

It is often argued that bondholders who plan to hold their bonds until maturity and collect the coupons and the face value are not affected by risk shifting that occurs after they buy the bonds, since the effect is only on market value. Do you agree?

a. Yes

b. No

Explain.

3. Using up excess debt capacity reduces financial flexibility

As noted earlier, one of the by-products of the conflict between stockholders and bondholders is the introduction of strict bond covenants that reduce the flexibility of firms to make investment, financing, or dividend decisions. It can be argued that this is part of a much greater loss of flexibility arising from taking on debt. One of the reasons firms do not use their debt capacity is that they like to preserve it for a rainy day, when they might need the debt to meet funding needs or specific contingencies. Firms that borrow to capacity lose this flexibility and have no fallback funding if they do get into trouble.

> ***Financial Flexibility:*** Financial flexibility refers to the capacity of firms to meet any unforeseen contingencies that may arise (such as recessions and sales downturns) and take advantage of unanticipated opportunities (such as great projects), using the funds they have on hand and any excess debt capacity that they might have nurtured.

Firms value financial flexibility for two reasons. First, the value of the firm may be maximized by preserving some flexibility to take on future projects, as they arise. Second, flexibility provides managers with more breathing room and more power, and it protects them from the monitoring that comes with debt. Thus, while the argument for maintaining flexibility in the interests of the firm is based upon sound principles, it is sometimes used as camouflage by managers pursuing their own interests. There is also a trade-off between not maintaining enough flexibility (because a firm has too much debt) and having too much flexibility (by not borrowing enough).

So, how best can we value financial flexibility? If flexibility is needed to allow firms to take advantage of unforeseen investment opportunities, its value should ultimately be derived from two variables. The first is access to capital markets. After all, firms that have unlimited access to capital markets will not need to maintain excess debt capacity since they can raise funds as needed for new investments. Smaller firms and firms in emerging markets, on the other hand, should value financial flexibility more. The second is the potential for excess returns on new investments. If a firm operates in a mature business where new investments, unpredictable though they might be, earn the cost of capital, there is no value to maintaining flexibility. Alternatively, a firm that operates in a volatile business with high excess returns should attach a much higher value to financial flexibility.

7.15. ☞: **Value of Flexibility and Firm Characteristics**

Both Ford and Microsoft have huge cash balances (as a percent of firm value), and you are a stockholder in both firms. The management of both firms claim to hold the cash because they need the flexibility. Which of the two managements are you more likely to accept this argument from?

a. Microsoft's management

b. Ford's management

Explain.

The Trade-off in a Balance Sheet Format

Bringing together the benefits and the costs of debt, we can present the trade off in a balance sheet format in table 7.3:

Table 7.3: Trade off on Debt versus Equity

Advantages of Borrowing	Disadvantages of Borrowing
1. Tax Benefit: Higher tax rates --> Higher tax benefit	*1. Bankruptcy Cost:* Higher business risk --> Higher Cost
2. Added Discipline: Greater the separation between managers and stockholders --> Greater the benefit	*2. Agency Cost:* Greater the separation between stock-holders and lenders --> Higher Cost
	3. Loss of Future Financing Flexibility: Greater the uncertainty about future financing needs --> Higher Cost

Overall, if the marginal benefits of borrowing exceed the marginal costs, the firm should borrow money. Otherwise, it should use equity.

What do firms consider when they make capital structure decisions? To answer this question, Pinegar and Wilbricht surveyed financial managers at 176 firms in the United States. They concluded that the financial principles listed in Table 7.4 determine capital structure decisions, in the order of importance in which they were given.

Table 7.4: Financial Principles Determining Capital Structure Decisions

Planning Principle by Order of Importance	Percentage of Responses Within Each Rank[a] Unimportant	2	3	4	Important	Not Ranked	Mean[b]
1. Maintaining financial flexibility	0.6	0.0	4.5	33.0	61.4	0.6	4.55
2. Ensuring long-term survivability	4.0	1.7	6.8	10.8	76.7	0.0	4.55
3. Maintaining a predictable source of funds	1.7	2.8	20.5	39.2	35.8	0.0	4.05
4. Maximizing security prices	3.4	4.5	19.3	33.5	37.5	1.7	3.99
5. Maintaining financial independence	3.4	4.5	22.2	27.3	40.9	1.7	3.99
6. Maintaining a high debt rating	2.3	9.1	32.4	43.2	13.1	0.0	3.56
7. Maintaining comparability with other firms in the industry	15.9	36.9	33.0	10.8	2.8	0.6	2.47

The foremost principles the survey participants identified were maintaining financial flexibility and ensuring long term survivability (which can be construed as avoiding bankruptcy). Surprisingly few managers attached much importance to maintaining comparability with other firms in their industries or maintaining a high debt rating.

Illustration 7.4: Evaluating the Debt Trade off – Disney, Aracruz and Bookscape

In table 7.5, we summarize our views on the potential benefits and costs to using debt, instead of equity, at Disney, Aracruz and Bookscape.

Table 7.5: The Debt Equity Trade Off: Disney, Aracruz and Bookscape

Item	*Disney*	*Aracruz*	*Bookscape*
Tax Benefits	Significant. The firm has a marginal tax rate of 35%. It does have large depreciation tax shields.	Significant. The firm has a marginal tax rate of 34%, as well. It does not have very much in non-interest tax shields.	Significant. The owners of Bookscape face a 40% tax rate. By borrowing money, the income that flows through to the investor can be reduced.
Added Discipline	Benefits will be high, since managers are not large stockholders.	Benefits are smaller, since the voting shares are closely held by insiders.	Benefits are non-existent. This is a private firm.
Bankruptcy Cost	Movie and broadcasting businesses have volatile earnings. Direct costs of bankruptcy are likely to be small, but indirect costs can be significant.	Variability in paper prices makes probability of bankruptcy high. Direct and indirect costs of bankruptcy likely to be moderate.	Costs may be small but the owner has all of his wealth invested in the firm. Since his liability, in the event of failure, is not limited, the costs will viewed as very large.
Agency Costs	High. While theme park assets are tangible and fairly liquid, is is much more difficult to monitor movie and broadcasting businesses.	Low. Assets are tangible and liquid.	Low. Prime asset is leasehold, which is liquid.
Flexibility Needs	Low in theme park business but high in media	Low. Business is mature and investment needs are	Low. Book store is established and additional

	businesses because technological change makes future investment uncertain.	well established.	investments are limited.

Based upon this analysis, qualitative though it might be, we would argue that all three firms could benefit from borrowing, as long as the borrowing does not push it below an acceptable default risk threshold.

No Optimal Capital Structure

We have just argued that debt has advantages, relative to equity, as well as disadvantages. Will trading off the costs and benefits of debt yield an optimal mix of debt and equity for a firm? In this section, we will present arguments that it will not, and the resulting conclusion that there is no such optimal mix. The seeds of this argument were sown in one of the most influential papers ever written in corporate finance, containing one of corporate finance's best-known theorems, the *Modigliani-Miller Theorem.*

When they first looked at the question of whether there is an optimal capital structure, Miller and Modigliani drew their conclusions in a world void of taxes, transactions costs, and the possibility of default. Based upon these assumptions, they concluded that the value of a firm was unaffected by its leverage and that investment and financing decisions could be separated. Their conclusion can be confirmed in several ways; we present two in this section. We will also present a more complex argument for why there should be no optimal capital structure even in a world with taxes, made by Miller almost two decades later.

The Irrelevance of Debt in a Tax-free World

In their initial work, Miller and Modigliani made three significant assumptions about the markets in which their firms operated. First, they assumed there were no taxes. Second, they assumed firms could raise external financing from debt or equity, with no issuance costs. Third, they assumed there were no costs –direct or indirect – associated with bankruptcy. Finally, they operated in an environment in which there were no agency costs; managers acted to maximize stockholder wealth, and bondholders did not have to worry about stockholders expropriating wealth with investment, financing or dividend decisions.

In such an environment, reverting back to the trade off that we summarized in Table 7.3, it is quite clear that all the advantages and disadvantages disappear, leaving debt with no marginal benefits and no costs. In Table 18.5, we modify table 18.1 to reflect the assumptions listed above:

Table 7.6: The Trade Off on Debt: No Taxes, Default Risk and Agency Costs

Advantages of Debt	*Disadvantages of Debt*
1. Tax Benefit: Zero, because there are no taxes	*1. Bankruptcy Cost:* Zero, because there are no bankruptcy costs
2. Added Discipline: Zero, because managers already maximize Stockholder wealth.	*2. Agency Cost:* Zero, because bondholders are fully protected from wealth transfer
	3. Loss of Future Financing Flexibility: Not costly, because firms can raise external financing costlessly.

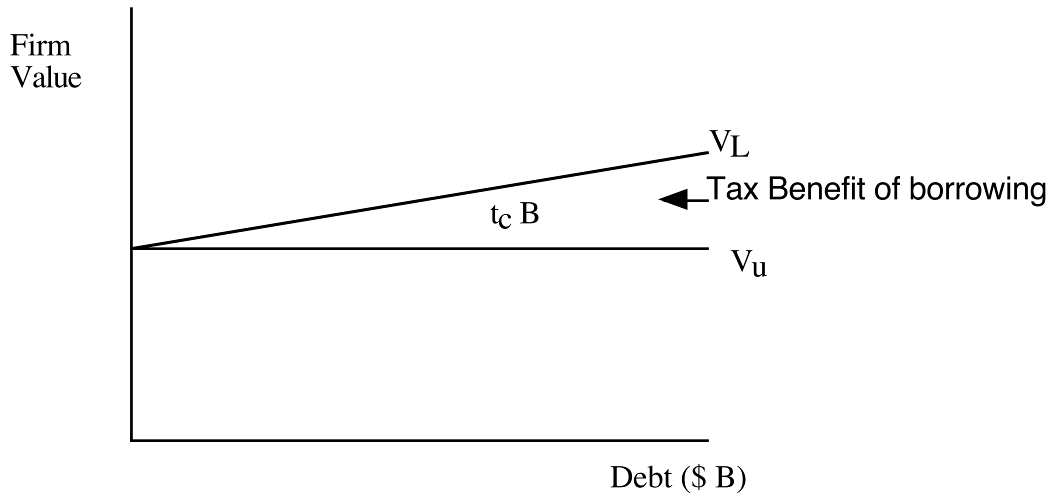
Debt creates neither benefits nor costs and thus has a neutral effect on value. In such an environment, the capital structure decision becomes irrelevant.

In a later paper, Miller and Modigliani preserved the environment they introduced above but made one change, allowing for a tax benefit for debt. In this scenario, where debt continues to have no costs, the optimal debt ratio for a firm is 100% debt. In fact, in such an environment the value of the firm increases by the present value of the tax savings for interest payments (See Figure 18.4).

Value of Levered Firm = Value of Unlevered Firm + t_c B

where t_c is the corporate tax rate and B is the dollar borrowing. Note that the second term in this valuation is the present value of the interest tax savings from debt, treated as a perpetuity. Figure 7.8 graphs the value of a firm with just the tax benefit from debt.

Figure 7.8: Value of Levered Firm: MM with Taxes



Miller and Modigliani presented an alternative proof of the irrelevance of leverage, based upon the idea that debt does not affect the underlying cash flows of the firm, in the absence of taxes. Consider two firms that have the same cash flow (X) from operations. Firm A is an all-equity firm, while firm B has both equity and debt. The interest rate on debt is r. Assume you are an investor and you buy a fraction(α) of the equity in firm A, and the same fraction of both the equity and debt of firm B. Table 7.7 summarizes the cash flows that you will receive in the next period.

Table 7.7: Cash Flows to Investor from Levered and All-Equity Firm

	Firm A	*Firm B*
Type of firm	All-Equity firm (V_u = E)	Has some Equity and Debt
Actions now	Investor buys a fraction a of the firm ($\alpha\ V_u$)	Investor buys a fraction a of both equity and debt of the firm $\alpha\ E_L + \alpha\ D_L$
Next period	Investor receives a fraction a of the cash flow (α X)	Investor receives the following $\alpha(X\text{-}rD_L) + \alpha\ r\ D_L = \alpha\ X$

Since you receive the same total cash flow in both firms, the price you will pay for either firm has to be the same. This equivalence in values of the two firms implies that leverage does not affect the value of a firm. Note that this proof works only if the firm does not receive a tax benefit from debt; a tax benefit would give Firm B a higher cash flow than Firm A.

The Irrelevance of Debt with Taxes

It is clear, in the Miller-Modigliani model, that when taxes are introduced into the model, debt does affect value. In fact, introducing both taxes and bankruptcy costs into the model creates a trade off, where the financing mix of a firm affects value, and there is an optimal mix. In an address in 1979, however, Merton Miller argued that the debt irrelevance theorem could apply even in the presence of corporate taxes, if taxes on the equity and interest income individuals receive from firms were included in the analysis.

To demonstrate the Miller proof of irrelevance, assume that investors face a tax rate of t_d on interest income and a tax rate of t_e on equity income. Assume also that the firm pays an interest rate of r on debt and faces a corporate tax rate of t_c. The after-tax return to the investor from owning debt can then be written as:

$$\text{After-tax Return from owning Debt} = r\,(1-t_d)$$

The after-tax return to the investor from owning equity can also be estimated. Since cash flows to equity have to be paid out of after-tax cash flows, equity income is taxed twice –– once at the corporate level and once at the equity level:

$$\text{After-tax Return from owning Equity} = k_e\,(1 - t_c)\,(1 - t_e)$$

The returns to equity can take two forms — dividends or capital gains; the equity tax rate is a blend of the tax rates on both. In such a scenario, Miller noted that the tax benefit of debt, relative to equity becomes smaller, since both debt and equity now get taxed, at least at the level of the individual investor.

$\text{Tax Benefit of Debt, relative to Equity} = \{1 - (1-t_c)\,(1-t_e)\}/(1-t_d)$

With this relative tax benefit, the value of the firm, with leverage, can be written as:

$$V_L = V_u + [1- (1-t_c)\,(1-t_e))/(1-t_d)]\,B$$

where V_L is the value of the firm with leverage, V_U is the value of the firm without leverage, and B is the dollar debt. With this expanded equation, that includes both personal and corporate taxes, there are several possible scenarios:

a. *Personal tax rates on both equity and dividend income are zero*: if we ignore personal taxes, this equation compresses to the original equation for the value of a levered firm, in a world with taxes but no bankruptcy costs:

$$V_L = V_u + t_c B$$

b. *The personal tax rate on equity is the same as the tax rate on debt*: If this were the case, the result is the same as the original one — the value of the firm increases with more debt.

$$V_L = V_u + t_c B$$

c. *The tax rate on debt is higher than the tax rate on equity*: In such a case, the differences in the tax rates may more than compensate for the double taxation of equity cash flows. To illustrate, assume that the tax rate on ordinary income is 70%, the tax rate on capital gains on stock is 28% and the tax rate on corporations is 35%. In such a case, the tax liabilities for debt and equity can be calculated for a firm that pays no dividend as follows:

   Tax Rate on Debt Income = 70%

   Tax Rate on Equity Income = 1 - (1-0.35) (1-.28) = 0.532 or 53.2%

   This is a plausible scenario, especially considering tax law in the United States until the early 1980s. In this scenario, debt creates a tax disadvantage to investors.

d. *The tax rate on equity income is just low enough to compensate for the double taxation*: In this case, we are back to the original debt irrelevance theorem.

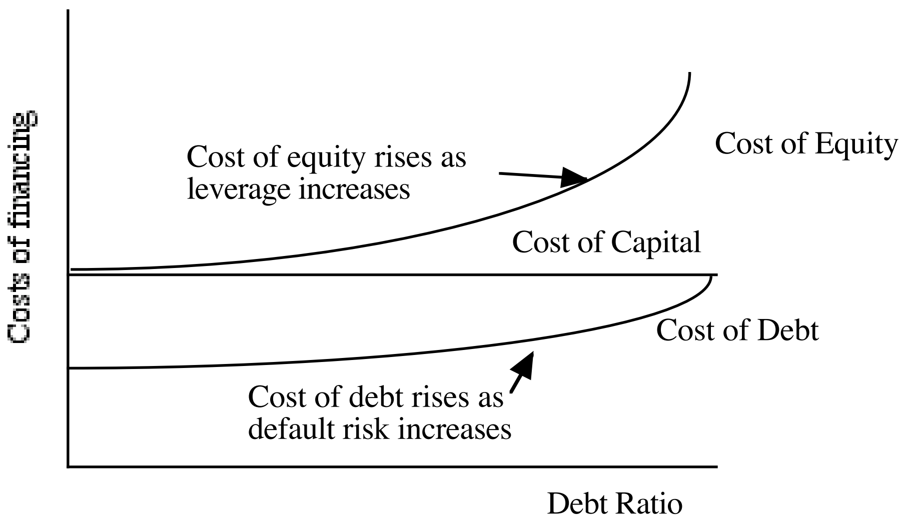
   $(1 - t_d) = (1-t_c)\ (1-t_e)$ .... Debt is irrelevant

Miller's analysis brought investor tax rates into the analysis for the first time and provided some insight into the role of investor tax preferences on a firm's capital structure. As Miller himself notes, however, this analysis does not reestablish the irrelevance of debt under all circumstances; rather, it opens up the possibility that debt could still be irrelevant, despite its tax advantages.

The Consequences of Debt Irrelevance

If the financing decision is irrelevant, as proposed by Miller and Modigliani, corporate financial analysis is simplified in a number of ways. The cost of capital, which is the weighted average of the cost of debt and the cost of equity, is unaffected by changes in the proportions of debt and equity. This might seem unreasonable, especially since the cost of debt is much lower than the cost of equity. In the Miller-Modigliani world, however, any benefits incurred by substituting cheaper debt for more expensive equity are offset by increases in both their costs, as shown in Figure 7.9.

Figure 7.9: Cost of Capital in the MM World



The value of the firm is also unaffected by the amount of leverage it has. Thus, if the firm is valued as an all-equity entity, its value will remain unchanged if it is valued with any other debt ratio. (This actually follows from the implication that the cost of capital is unaffected by changes in leverage and from the assumption that the operating cash flows are determined by investment decisions rather than financing decisions.)

Finally, the investment decision can be made independently of the financing decision. In other words, if a project is a bad project when evaluated as an all-equity project, it will remain so using any other financing mix.

The Contribution of the Miller-Modigliani Theorem

It is unlikely that capital structure is irrelevant in the real world, given the tax preferences for debt and existence of default risk. In spite of this, Miller and Modigliani were pioneers in moving capital structure analysis from an environment in which firms picked their debt ratios based upon comparable firms and management preferences, to one that recognized the trade-offs. They also drew attention to the impact of good investment decisions on firm value. To be more precise, a firm that invests in poor projects cannot hope to recoup the lost value by making better financing decisions; a firm that takes good projects will succeed in creating value, even if it uses the wrong financing mix. Finally, while the concept of a world with no taxes, default risk, or agency problems may seem a little far-fetched, there are some environments in which the description might hold. Assume, for instance, that the U.S. government decides to encourage small businesses to invest in urban areas by relieving them of their tax burden and providing a back-up guarantee on loans (default protection). Firms that respond to these initiatives might find that their capital structure decisions do not affect their value.

Finally, surveys of financial managers indicate that, in practice, they do not attach as much weight to the costs and benefits of debt as we do in theory. In a survey by Pinegar and Wilbricht, managers were asked to cite the most important inputs governing their financial decisions. Their responses are ranked in the order of the importance managers attached to them in Table 7.8.

Table 7.8: Inputs into Capital Structure Decisions

	Percentage of Responses Within Each Rank *Least Important……………………..Most Important*						
Inputs/Assumptions by Order of Importance	*1*	*2*	*3*	*4*	*5*	*Not Ranked*	*Mean*
1. Projected cash flow from asset to be financed	1.7%	1.1%	9.7%	29.5%	58.0%	0.0%	4.41
2. Avoiding dilution of common equity's claims	2.8%	6.3%	18.2%	39.8%	33.0%	0.0%	3.94
3. Risk of Asset to be financed	2.8%	6.3%	20.5%	36.9%	33.0%	0.6%	3.91
4. Restrictive covenants on senior securities	9.1%	9.7%	18.7%	35.2%	27.3%	0.0%	3.62
5. Avoiding mispricing of securities to be issued.	3.4%	10.8%	27.3%	39.8%	18.7%	0.0%	3.60
6. Corporate Tax Rate	4.0%	9.7%	29.5%	42.6%	13.1%	1.1%	3.52
7. Voting Control	17.6%	10.8%	21.0%	31.2%	19.3%	0.0%	3.24
8. Depreciation & Other Tax shields	8.5%	17.6%	40.9%	24.4%	7.4%	1.1%	3.05
9. Correcting mispricing of securities	14.8%	27.8%	36.4%	14.2%	5.1%	1.7%	2.66
10. Personal tax rates of debt and equity holders	31.2%	34.1%	25.6%	8.0%	1.1%	0.0%	2.14
11. Bankruptcy Costs	69.3%	13.1%	6.8%	4.0%	4.5%	2.3%	1.58

Financial managers seem to weigh financial flexibility and potential dilution much more heavily than bankruptcy costs and taxes in their capital structure decisions.

In Practice: The Dilution Bogey

The dilution effect refers to the possible decrease in earnings per share from any action that might lead to an increase in the number of shares outstanding. As evidenced in table 7.8, managers, especially in the United States, weigh these potential dilution effects heavily in decisions on what type of financing to use, and how to fund projects. Consider, for instance, the choice between raising equity using a rights issue, where the stock is issued at a price below the current market price, and a public issue of stock at the market price. The latter is a much more expensive option, from the perspective of investment banking fees and other costs, but is chosen, nevertheless, because it results in fewer shares being issued (to raise the same amount of funds). The fear of dilution is misplaced for the following reasons:

1. Investors measure their returns in terms of total return and not just in terms of stock price. While the stock price will go down more after a rights issue, each investor will be compensated adequately for the price drop (by either receiving more shares or by being able to sell their rights to other investors). In fact, if the transactions costs are considered, stockholders will be better off after a rights issue than after an equivalent public issue of stock.
2. While the earnings per share will always drop in the immediate aftermath of a new stock issue, the stock price will not necessarily follow suit. In particular, if the stock issue is used to finance a good project (i.e., a project with a positive net present value), the increase in value should be greater than the increase in the number of shares, leading to a higher stock price.

Ultimately, the measure of whether a company should issue stock to finance a project should depend upon the quality of the investment. Firms that dilute their stockholdings to take good investments are choosing the right course for their stockholders.

There Is An Optimal Capital Structure

The counter to the Miller-Modigliani proposition is that the trade-offs on debt may work in favor of the firm, at least initially, and that borrowing money may lower the cost of capital and increase firm value. We will examine the mechanics of putting this argument into practice in the next chapter; here, we will make a case for the existence of an optimal capital structure, and looking at some of the empirical evidence for and against it.

The Case for an Optimal Capital Structure

If the debt decision involves a trade-off between the benefits of debt (tax benefits and added discipline) and the costs of debt (bankruptcy costs, agency costs and lost flexibility), it can be argued that the marginal benefits will be offset by the marginal costs only in exceptional cases, and not always (as argued by Miller and Modigliani). In fact, under most circumstances, the marginal benefits will either exceed the marginal costs (in which case, debt is good and will increase firm value) or fall short of marginal costs (in which case, equity is better). Accordingly, there is an optimal capital structure for most firms at which firm value is maximized.

Of course, it is always possible that managers may be operating under an illusion that capital structure decisions matter when the reality might be otherwise. Consequently, we examine some of the empirical evidence to see if it is consistent with the theory of an optimal mix of debt and equity.

Empirical Evidence

The question of whether there is an optimal capital structure can be answered in a number of ways. The first is to see if differences in capital structure across firms can be explained systematically by differences in the variables driving the trade-offs. Other things remaining equal, we would expect to see relationships listed in Table 7.9.

Table 7.9: Debt Ratios and Fundamentals

Variable	*Effect on Debt Ratios*
Marginal Tax Rate	As marginal tax rates increase, debt ratios increase.
Separation of Ownership and Management	The greater the separation of ownership and management, the higher the debt ratio.
Variability in Operating Cash Flows	As operating cash flows become more variable, the bankruptcy risk increases, resulting in lower debt ratios.

Debt holders' difficulty in monitoring firm actions, investments and performance.	The more difficult it is to monitor the actions taken by a firm, the lower the optimal debt ratio.
Need for Flexibility	The greater the need for decision making flexibility in future periods, the lower the optimal debt ratio.

While this may seem like a relatively simple test to run, keeping all other things equal in the real world is often close to impossible. In spite of this limitation, attempts to see if the direction of the relationship is consistent with the theory have produced mixed results.

Bradley, Jarrell and Kim (1984) analyzed whether differences in debt ratios can be explained by proxies for the variables involved in the capital structure trade-off. They noted that the debt ratio is:

- negatively correlated with the volatility in annual operating earnings, as predicted by the bankruptcy cost component of the optimal capital structure trade off
- positively related to the level of non-debt tax shields, which is counter to the tax hypothesis, which argues that firms with large non-debt tax shields should be less inclined to use debt.
- negatively related to advertising and R&D expenses used as a proxy for agency costs; this is consistent with optimal capital structure theory.

Others who have attempted to examine whether cross-sectional differences in capital structure are consistent with the theory have come to contradictory conclusions.

A second test of whether differences in capital structure can be explained by differences in firm characteristics involve examining differences in debt ratios across industries.

An alternate test of the optimal capital structure hypothesis is to examine the stock price reaction to actions taken by firms either to increase or decrease leverage. In evaluating the price response, we have to make some assumptions about the motivation of the firms making these changes. If we assume that firms are rational and that they make these changes to get closer to their optimal, both leverage-increasing and decreasing actions should be accompanied by positive excess returns, at least on average. Smith(1988) notes that the evidence is not consistent with an optimal capital structure hypothesis, however, since leverage-increasing actions seem to be accompanied by positive excess returns while leverage-reducing actions seem to be followed by negative returns. The only way to reconcile this tendency with an optimal capital structure argument is by assuming that managerial incentives (desire for stability and flexibility) keep leverage below the optimal for most firms and that actions by firms to reduce leverage are seen as serving managerial interests rather than stockholder interests.

There is a data set on the web that summarizes, by sector, debt ratios and averages for the fundamental variables that should determine debt ratios.

How Firms Choose their Capital Structures

We have argued that firms should choose the mix of debt and equity by trading off the benefit of borrowing against the costs. There are, however, three alternative views of how firms choose a financing mix. The first is that the choice between debt and equity is determined by where a firm is in the growth life cycle. High-growth firms will tend to use debt less than more mature firms. The second is that firms choose their financing mix by looking at other firms in their business. The third view is that firms have strong preferences in for the kinds of financing they prefer to use, i.e. a financing hierarchy, and that they deviate from these preferences only when they have no choice. We will argue that, in each of these approaches, firms still implicitly make the trade off between costs and benefits, though the assumptions needed for each approach to work are different.

Financing Mix and a Firm's Life Cycle

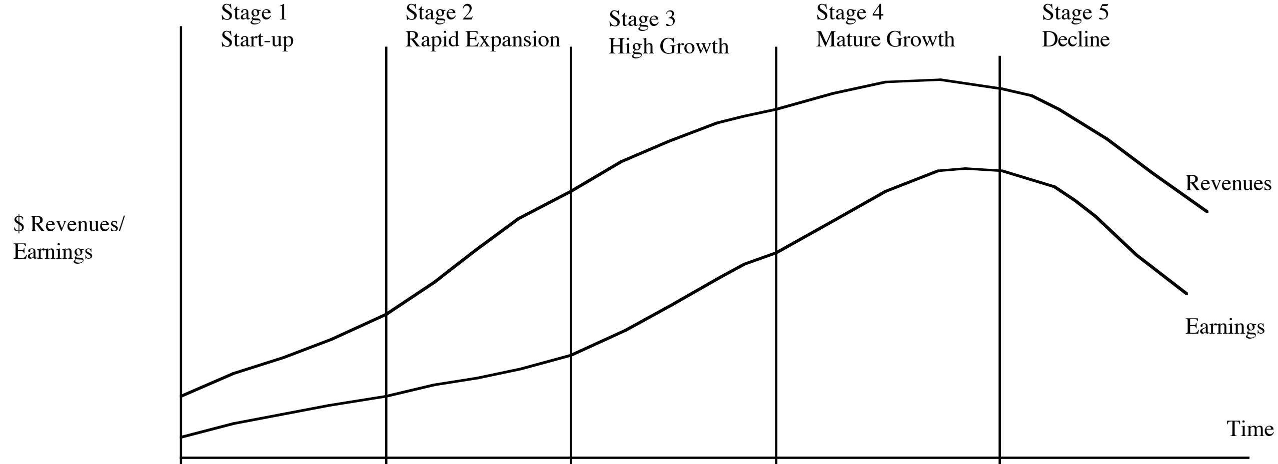
Earlier in this chapter, we looked at how a firm's financing choices might change as it makes the transition from a start-up firm to a mature firm to final decline. We could look at how a firm's financing mix changes over the same life cycle. Typically, start-up firms and firms in rapid expansion use debt sparingly; in some cases, they use no debt at all. As the growth eases, and as cash flows from existing investments become larger and more predictable, we see firms beginning to use debt. Debt ratios typically peak when firms are in mature growth.

How does this empirical observation relate to our earlier discussion of the benefits and costs of debt? We would argue that the behavior of firms at each stage in the life cycle is entirely consistent with making this trade off. In the start-up and high growth phases, the tax benefits to firms from using debt tend to be small or non-existent, since earnings from existing investments are low or negative. The owners of these firms are usually actively involved in the management of these firms, reducing the need for debt as a disciplinary mechanism.

On the other side of the ledger, the low and volatile earnings increase the expected bankruptcy costs. The absence of significant existing investments or assets and the magnitude of new investments makes lenders much more cautious about lending to the firm, increasing the agency costs; these costs show up as more stringent covenants or in higher interest rates on borrowing. As growth eases, the trade off shifts in favor of debt. The tax benefits increase and expected bankruptcy costs decrease as earnings from existing investments become larger and more predictable. The firm develops both an asset base and a track record on earnings, which allows lenders to feel more protected when lending to the firm. As firms get larger, the separation between owners (stockholders) and managers tends to grow, and the benefits of using debt as a disciplinary mechanism increase. We have summarized the trade off at each stage in the life cycle in figure 7.10.

As with our earlier discussion of financing choices, there will be variations between firms in different businesses at each stage in the life cycle. For instance, a mature steel company may use far more debt than a mature pharmaceutical company, because lenders feel more comfortable lending on a steel company's assets (that are tangible and easy to liquidate) than on a pharmaceutical company's assets (which might be patents and other assets that are difficult to liquidate). Similarly, we would expect a company like IBM to have a higher debt ratio than a firm like Microsoft, at the same stage in the life cycle, because Microsoft has large insider holdings, making the benefit of discipline that comes from debt a much smaller one.

Figure 7.10: The Debt-Equity Trade off and Life Cycle



	Stage 1 Start-up	Stage 2 Rapid Expansion	Stage 3 High Growth	Stage 4 Mature Growth	Stage 5 Decline
Tax Benefits	Zero, if losing money	Low, as earnings are limited	Increase, with earnings	High	High, but declining
Added Disceipline of Debt	Low, as owners run the firm	Low. Even if public, firm is closely held.	Increasing, as managers own less of firm	High. Managers are separated from owners	Declining, as firm does not take many new investments
Bamkruptcy Cost	Very high. Firm has no or negative earnings.	Very high. Earnings are low and volatile	High. Earnings are increasing but still volatile	Declining, as earnings from existing assets increase.	Low, but increases as existing projects end.
Agency Costs	Very high, as firm has almost no assets	High. New investments are difficult to monitor	High. Lots of new investments and unstable risk.	Declining, as assets in place become a larger portion of firm.	Low. Firm takes few new investments
Need for Flexibility	Very high, as firm looks for ways to establish itself	High. Expansion needs are large and unpredicatble	High. Expansion needs remain unpredictable	Low. Firm has low and more predictable investment needs.	Non-existent. Firm has no new investment needs.
Net Trade Off	Costs exceed benefits Minimal debt	Costs still likely to exceed benefits. Mostly equity	Debt starts yielding net benefits to the firm	Debt becomes a more attractive option.	Debt will provide benefits.

Financing Mix based on Comparable Firms

Firms often try to use a financing mix similar to that used by other firms in their business. With this approach, Bookscape would use a low debt to capital ratio because other book retailers have low debt ratios. Bell Atlantic, on the other hand, would use a high debt to capital ratio because other phone companies have high debt to capital ratios.

The empirical evidence about the way firms choose their debt ratios strongly supports the hypothesis that they tend not to stray too far from their sector averages. In fact, when we look at the determinants of the debt ratios of individual firms, the strongest determinant is the average debt ratio of the industries to which these firms belong. While some would view this approach to financing as contrary to the approach where we trade off the benefits of debt against the cost of debt, we would not view it thus. If firms within a business or sector share common characteristics, it should not be surprising if they choose similar financing mixes. For instance, software firms have volatile earnings and high growth potential, and choose low debt ratios. In contrast, phone companies have significant assets in place and high and stable earnings; they tend to use more debt in their financing. Thus, choosing a debt ratio similar to that of the industry in which you operate is appropriate, when firms in the industry are at the same stage in the life cycle and, on average, choose the right financing mix for that stage.

It can be dangerous to choose a debt ratio based upon comparable firms under two scenarios. The first occurs when there are wide variations in growth potential and risk across companies within a sector. Then, we would expect debt ratios to be different across firms. The second occurs when firms, on average, have too much or too little debt, given their characteristics. This can happen when an entire sector changes. For instance, phone companies have historically had stable and large earnings, because they have had monopoly power. As technology and new competition breaks down this power, it is entirely possible that earnings will become more volatile and that these firms should carry a lot less debt than they do currently.

Following A Financing Hierarchy

There is evidence that firms follow a *financing hierarchy*: retained earnings are the most preferred choice for financing, followed by debt, new equity, common and preferred; convertible preferred is the least preferred choice. For instance, in the survey by Pinegar and Wilbricht (Table 7.10), managers were asked to rank six different sources of financing - internal equity, external equity, external debt, preferred stock, and hybrids (convertible debt and preferred stock)- from most preferred to least preferred.

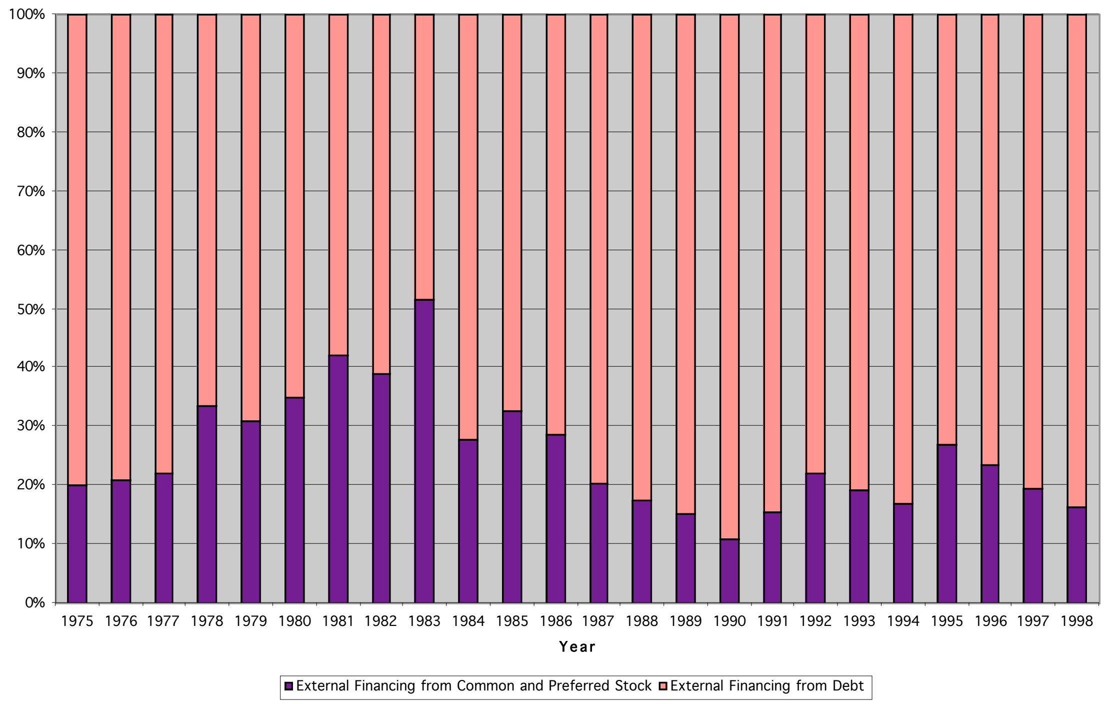
Table 7.10: Survey Results on Planning Principles

Ranking	*Source*	*Planning Principle cited*
1	Retained Earnings	None
2	Straight Debt	Maximize security prices
3	Convertible Debt	Cash Flow & Survivability
4	Common Stock	Avoiding Dilution
5	Straight Preferred Stock	Comparability
6	Convertible Preferred	None

One reason for this hierarchy is that managers value *flexibility and control*. To the extent that external financing reduces flexibility for future financing (especially if it is debt) and control (bonds have covenants; new equity attracts new stockholders into the company and may reduce insider holdings as a percentage of total holding), managers prefer retained earnings as a source of capital. Another reason is it costs nothing in terms of issuance costs to use retained earnings, *it costs more* to use external debt and even more to use external equity.

The survey yielded some other interesting conclusions as well. External debt is strongly preferred over external equity as a way of raising funds. The values of external debt and external equity issued between 1975 and 1998 by U.S. corporations are shown in Figure 7.11 and bear out this preference.

Figure 15.6: External Equity vs External Debt



Source: Compustat

Given a choice, firms would much rather use straight debt than convertible debt, even though the interest rate on convertible debt is much lower. Managers perhaps have a much better sense of the value of the conversion option than is recognized.

A firm's choices may say a great deal about its financial strength. Thus, the 1993 decisions by RJR Nabisco and GM to raise new funds through convertible preferred stock were seen by markets as an admission by these firms of their financial weakness. Not surprisingly, the financial market response to the issue of securities listed in Table 7.10 mirrors the preferences: the most negative responses are reserved for securities near the bottom of the list, the most positive (or at least the least negative) for those at the top of the list.

Why do firms have a financing hierarchy? In the discussion of financing choices so far, we have steered away from questions about how firms convey information to financial markets with their financing choices and how well the securities that the firms issue are priced. Firms know more about their future prospects than do the financial markets that they deal with; markets may under or overprice securities issued by firms. Myers and Majluf (1984) note that, in the presence of this asymmetric information, firms that believe their securities are under priced, given their future prospects, may be inclined to reject good projects rather than raise external financing. Alternatively, firms that believe their securities are overpriced are more likely to issue these securities, even if they have no projects available. In this environment, the following implications emerge –

- Managers prefer retained earnings to external financing, since it allows them to consider projects on their merits, rather than depending upon whether markets are pricing their securities correctly. It follows then that firms will be more inclined to retain earnings over and above their current investment requirements to finance future projects.
- When firms issue securities, markets will consider the issue a signal that these securities are overvalued. This signal is likely to be more negative for securities, such as stocks, where the asymmetry of information is greater, and smaller for securities, such as straight bonds, where the asymmetry is smaller. This would explain both the rankings in the financial hierarchy and the market reaction to these security issues.

7.17. ☞ **: Value of Flexibility and Firm Characteristics**

You are reading the Wall Street Journal and notice a tombstone ad for a company, offering to sell convertible preferred stock. What would you hypothesize about the health of the company issuing these securities?

a. Nothing

b. Healthier than the average firm

c. In much more financial trouble than the average firm

Conclusion

In this chapter, we have laid the ground work for analyzing a firm's optimal mix of debt and equity by laying out the benefits and the costs of borrowing money. In particular, we made the following points:

- We differentiated between debt and equity, at a generic level, by pointing out that any financing approach that results in fixed cash flows and has prior claims in the case of default, fixed maturity, and no voting rights is debt, while a financing approach that provides for residual cash flows and has low or no priority in claims in the case of default, infinite life, and a lion's share of the control is equity.

- While all firms, private as well as public, use both debt and equity, the choices in terms of financing and the type of financing used change as a firm progresses through the life cycle, with equity dominating at the earlier stages and debt as the firm matures.
- The primary benefit of debt is a tax benefit: interest expenses are tax deductible and cash flows to equity (dividends) are not. This benefit increases with the tax rate of the entity taking on the debt. A secondary benefit of debt is that it forces managers to be more disciplined in their choice of projects by increasing the costs of failure; a series of bad projects may create the possibility of defaulting on interest and principal payments.
- The primary cost of borrowing is an increase in the expected bankruptcy cost — the product of the probability of default and the cost of bankruptcy. The probability of default is greater for firms that have volatile cash flows. The cost of bankruptcy includes both the direct costs (legal and time value) of bankruptcy and the indirect costs (lost sales, tighter credit and less access to capital). Borrowing money exposes the firm to the possibility of conflicts between stock and bond holders over investment, financing, and dividend decisions. The covenants that bondholders write into bond agreements to protect themselves against expropriation cost the firm in both monitoring costs and lost flexibility. The loss of financial flexibility that arises from borrowing money is more likely to be a problem for firms with substantial and unpredictable investment opportunities.
- In the special case where there are no tax benefits, default risk, or agency problems, the financing decision is irrelevant. This is known as the Miller-Modigliani theorem. In most cases, however, the trade-off between the benefits and costs of debt will result in an optimal capital structure, whereby the value of the firm is maximized.
- Firms generally choose their financing mix in one of three ways – based upon where they are in the life cycle, by looking at comparable firms or by following a financing hierarchy where retained earnings is the most preferred option and convertible preferred stock the least.

Live Case Study

Analyzing A Firm's Current Financing Choices

Objective: To examine a firm's current financing choices and to categorize them into debt (borrowings) and equity and to examine the trade off between debt and equity for your firm.

Key Questions:

- Where and how does the firm get its current financing?
- Would these financing choices be classified as debt, equity or as hybrid securities?
- How large, in qualitative or quantitative terms, are the advantages to this company from using debt?
- How large, in qualitative or quantitative terms, are the disadvantages to this company from using debt?
- From the qualitative trade off, does this firm look like it has too much or too little debt?

Framework for Analysis:

- *Assessing Current Financing*

  1.1. How does the firm raise equity?

  If it is a publicly traded firm, it can raise equity from common stock and warrants or options

  If is a private firm, the equity can come from personal savings and venture capital.

  1.2. How (if at all) does the firm borrow money?

  If it is a publicly traded firm, it can raise debt from bank debt or corporate bonds

  1.3. Does the firm use any hybrid approaches to raising financing, that combine some of the features of debt and some of equity?

  Examples would include preferred stock, convertible bonds and bonds with warrants attached to them

2. *Detailed Description of Current Financing*

   2.1. If the firm raises equity from warrants or convertibles, what are the characteristics of the options? (Exercise price, maturity etc.)

2.2. If the firm has borrowed money, what are the characteristics of the debt? (Maturity, Coupon or Stated interest rate, call features, fixed of floating rate, secured or unsecured and currency)

2.3. If the firm has hybrid securities, what are the features of the hybrid securities?

3. *Break Down into Debt and Equity*

    3.1. If the firm has financing with debt and equity components (such as convertible bonds), how much of the value can be attributed to debt and how much to equity?

    3.2. Given the coupon or stated interest rate and maturity of the non-traded debt, what is the current estimated market value of the debt?

    3.3 What is the market value of equity that the firm has outstanding?

4. *Trade off on Debt versus Equity*

    Benefits of Debt

    - What marginal tax rate does this firm face and how does this measure up to the marginal tax rates of other firms? Are there other tax deductions that this company has (like depreciation) to reduce the tax bite?
    - Does this company have high free cash flows (for eg. EBITDA/Firm Value)? Has it taken and does it continue to have good investment projects? How responsive are managers to stockholders? (Will there be an advantage to using debt in this firm as a way of keeping managers in line or do other (cheaper) mechanisms exist?)

    Costs of Debt

    - How high are the current cash flows of the firm (to service the debt) and how stable are these cash flows? (Look at the variability in the operating income over time)
    - How easy is it for bondholders to observe what equity investors are doing? Are the assets tangible or intangible? If not, what are the costs in terms of monitoring stockholders or in terms of bond covenants?
    - How well can this firm forecast its future investment opportunities and needs?

Getting Information about Current Financing Choices

The information about current financing choices can almost all be extracted from the financial statements. The balance sheet should provide a summary of the book values of the various financing choices made by the firm, though hybrids are usually categorized into debt (if they are debt hybrids) and equity (if they are equity hybrids). The description of warrants outstanding as well as the details of the borrowing that the firm has should be available in the footnotes to the balance sheets. In particular, the maturity dates for different components of borrowing, the coupon rates and information on any other special features should be available in the footnotes.

Online sources of information:

http://www.stern.nyu.edu/~adamodar/cfin2E/project/data.htm

Problems

1. An income bond holder receives interest payments only if the firm makes income. If the firm does not make interest payments in a year, the interest is cumulated and paid in the first year the firm makes income. A preferred stock receives preferred dividends only if the firm makes income. If a firm does not make preferred dividend payments in a year, the dividend is cumulated and paid in the first year the firm makes income. Are income bonds really preferred stock? What are the differences? For purposes of calculating debt how would you differentiate between income bonds and regular bonds?

2. A commodity bond links interest and principal payments to the price of a commodity. Differentiate a commodity bond from a straight bond, and then from equity. How would you factor these differences into your analysis of the debt ratio of a company that has issued exclusively commodity bonds?

3. You are analyzing a new security that has been promoted as equity, with the following features:

- The dividend on the security is fixed in dollar terms for the life of the security, which is 20 years.
- The dividend is not tax deductible.
- In the case of default, the holders of this security will receive cash only after all debt holders, secured as well as unsecured, are paid.
- The holders of this security will have no voting rights.

Based upon the description of debt and equity in the chapter, how would you classify this security? If you were asked to calculate the debt ratio for this firm, how would you categorize this security?

4. You are analyzing a convertible preferred stock, with the following characteristics for the security:

- There are 50,000 preferred shares outstanding, with a face value of $ 100 and a 6% preferred dividend rate.

- The firm has straight preferred stock outstanding, with a preferred dividend rate of 9%.
- The preferred stock is trading at $105.

Estimate the preferred stock and equity components of this preferred stock.

5. You have been asked to calculate the debt ratio for a firm that has the following components to its financing mix –

- The firm has 1 million shares outstanding, trading at $ 50 per share.
- The firm has $ 25 million in straight debt, carrying a market interest rate of 8%.
- The firm has 20,000 convertible bonds outstanding, with a face value of $1000, a market value of $1100, and a coupon rate of 5%.

Estimate the debt ratio for this firm.

6. You have been asked to estimate the debt ratio for a firm, with the following financing details:

- The firm has two classes of shares outstanding; 50,000 shares of class A stock, with 2 voting rights per share, trading at $ 100 per share and 100,000 shares of class B stock, with 1/2 voting right per share, trading at $ 90 per share.
- The firm has $ 5 million in bank debt, and the debt was taken on recently.

Estimate the debt ratio. Why does it matter when the bank debt was taken on?

7. Zycor Corporation obtains most of its funding internally. Assume that the stock has a beta of 1.2, the riskless rate is 6.5% and the market risk premium is 6%.
    a. Estimate the cost of internal equity.
    b. Now assume that the cost of issuing new stock is 5% of the proceeds. Estimate the cost of external equity.

8. Office Helpers is a private firm that manufactures and sells office supplies. The firm has limited capital and is estimated to have a value of $ 80 million with the capital constraints. A venture capitalist is willing to contribute $ 20 million to the firm in exchange for 30% of the value of the firm. With this additional capital, the firm will be worth $ 120 million.
    a. Should the firm accept the venture capital?

b. At what percentage of firm value would you (as the owner of the private firm) break even on the venture capital financing?

9. Assume now that Office Helpers in problem 2 decides to go public and that it would like to have its shares trade at a target price of $ 10 per share. If the initial public offering is likely to be under priced by 20%, how many shares should the firm have?

10. You are a venture capitalist and have been approached by Cirrus Electronics, a private firm. The firm has no debt outstanding and does not have earnings now but is expected to be earning $ 15 million in four years, when you also expect it to go public. The average price earnings ratio of other firms in this business is 50.

    a. Estimate the exit value of Cirrus Electronics.

    b. If your target rate of return is 35%, estimate the discounted terminal value of Cirrus Electronics

    c. If you are contributing $ 75 million of venture capital to Cirrus Electronics, at the minimum, what percentage of the firm value would you demand in return?

11. The unlevered beta of electronics firms, on average, is 1.1. The riskless rate is 6.5% and the market risk premium is 6%.

    a. Estimate the expected return, using the capital asset pricing model.

    b. As a venture capitalist, why might your have a target rate of return much higher than this expected return?

12. Sunshine Media has just completed an initial public offering, where 50 million shares of the 125 million shares outstanding were issued to the public at an offering price of $ 22 per share. On the offering date, the stock price zoomed to $ 40 per share. Who gains from this increase in the price? Who loses, and how much?

13. Initial public offerings are difficult to value because firms going public tend to be small and little information is available about them. Investment bankers have to under price initial public offerings because they bear substantial pricing risk. Do you agree with this statement? How would you test it empirically?

14. You are the owner of a small and successful firm with an estimated market value of $ 50 million. You are considering going public.
    a. What are the considerations you would have in choosing an investment banker?
    b. You want to raise $ 20 million in new financing, which you plan to reinvest back in the firm. (The estimated market value of $ 50 million is based upon the assumption that this $20 million is reinvested.) What proportion of the firm would you have to sell in the initial public offering to raise $ 20 million?
    c. How would your answer to (b) change if the investment banker plans to under price your offering by 10%?
    d. If you wanted your stock to trade in the $20-$25 range, how many shares would you have to create? How many shares would you have to issue?

15. You have been asked for advice on a rights offering by a firm with 10 million shares outstanding, trading at $ 50 per share. The firm needs to raise $ 100 million in new equity. Assuming that the rights subscription price is $ 25, answer the following questions:
    a. How many rights would be needed to buy one share at the subscription price?
    b. Assuming that all rights are subscribed to, what will the ex-rights price be?
    c. Estimate the value per right.
    d. If the price of a right were different (higher or lower) than the value estimated in (c), how would you exploit the difference?

16. You are stockholder in a SmallTech Inc., a company that is planning to raise new equity. The stock is trading at $ 15 per share, and there are 1 million shares outstanding. The firm issues 500,000 rights to buy additional shares at $ 10 per share to its existing stockholders.
    a. What is the expected stock price after the rights are exercised?
    b . If the rights are traded, what is the price per right?
    c. As a stockholder, would you be concerned about the dilution effect lowering your stock price? Why or why not?

17. Assume that SmallTech has net income of \$ 1 million and that the earnings will increase in proportion with the additional capital raised.
    a. Estimate the earning per share that SmallTech will have after the rights issue described in the last problem.
    b. Assume that SmallTech could have raised the capital by issuing 333,333 shares at the prevailing market price of \$ 15 per share (thus raising the same amount of equity as was raised in the rights issue) to the public. Estimate the earnings per share that SmallTech would have had with this alternative.
    c. As a stockholder, are you concerned about the fact that the rights issue results in lower earnings per share than the general subscription offering (described in (b)).

18. MVP Inc., a manufacturing firm with no debt outstanding and a market value of \$100 million is considering borrowing \$ 40 million and buying back stock. Assuming that the interest rate on the debt is 9% and that the firm faces a tax rate of 35%, answer the following questions:

    a. Estimate the annual interest tax savings each year from the debt.

    b. Estimate the present value of interest tax savings, assuming that the debt change is permanent.

    c. Estimate the present value of interest tax savings, assuming that the debt will be taken on for 10 years only.

    d. What will happen to the present value of interest tax savings, if interest rates drop tomorrow to 7% but the debt itself is fixed rate debt?

19. A business in the 45% tax bracket is considering borrowing money at 10%.

    a. What is the after-tax interest rate on the debt?

    b. What is the after-tax interest rate if only half of the interest expense is allowed as a tax deduction?

    c. Would your answer change if the firm is losing money now and does not expect to have taxable income for three years?

20. WestingHome Inc. is a manufacturing company that has acccumulated an net operating loss of $ 2 billion over time. It is considering borrowing $ 5 billion to acquire another company.

    a. Based upon the corporate tax rate of 36%, estimate the present value of the tax savings that could accrue to the company.

    b. Does the existence of a net operating loss carry forward affect your analysis? (Will the tax benefits be diminished as a consequence?)

21. Answer true or false to the following questions relating to the free cash flow hypothesis (as developed by Jensen).

    a. Companies with high operating earnings have high free cash flows.

    b. Companies with large capital expenditures, relative to earnings, have low free cash flows.

    c. Companies that commit to paying a large portion of their free cash flow as dividends do not need debt to add discipline.

    d. The free cash flow hypothesis for borrowing money makes more sense for firms in which there is a separation of ownership and management.

    e. Firms with high free cash flows are inefficiently run.

22. Assess the likelihood that the following firms will be taken over, based upon your understanding of the free cash flow hypothesis.

    a. A firm with high growth prospects, good projects, low leverage, and high earnings.

    b. A firm with low growth prospects, poor projects, low leverage, and poor earnings.

    c. A firm with high growth prospects, good projects, high leverage, and low earnings.

    d. A firm with low growth prospects, poor projects, high leverage, and good earnings.

    e. A firm with low growth prospects, poor projects, low leverage, and good earnings.

    You can assume that earnings and free cash flows are highly correlated.

23. Nadir, Inc., an unlevered firm, has expected earnings before interest and taxes of $2 million per year. Nadir's tax rate is 40%, and the market value is V=E=$12 million. The stock has a beta of 1, and the risk free rate is 9%. [Assume that $E(R_m)-R_f=6\%$] Management is

considering the use of debt; debt would be issued and used to buy back stock, and the size of the firm would remain constant. The default free interest rate on debt is 12%. Since interest expense is tax deductible, the value of the firm would tend to increase as debt is added to the capital structure, but there would be an offset in the form of the rising cost of bankruptcy. The firm's analysts have estimated, approximately, that the present value of any bankruptcy cost is $8 million and the probability of bankruptcy will increase with leverage according to the following schedule:

Value of debt	Probability of failure
$ 2,500,000	0.00%
$ 5,000,000	8.00%
$ 7,500,000	20.5%
$ 8,000,000	30.0%
$ 9,000,000	45.0%
$10,000,000	52.5%
$12,500,000	70.0%

a. What is the cost of equity and WACC at this time?

b. What is the optimal capital structure when bankruptcy costs are considered?

c. What will the value of the firm be at this optimal capital structure?

24. A firm that has no debt has a market value of $100 million and a cost of equity of 11%. In the Miller-Modigliani world,

a. What happens to the value of the firm as the leverage is changed? (Assume no taxes)

b. What happens to the cost of capital as the leverage is changed? (Assume no taxes)

c. How would your answers to (a) and (b) change if there are taxes?

25. Assume that personal investors pay a 40% tax rate on interest income and only a 20% tax rate on equity income. If the corporate tax rate is 30%, estimate whether debt has a tax benefit, relative to equity. If a firm with no debt and $ 100 million in market value borrows money in this world, estimate what the value of the firm will be if the firm borrows $ 50 million.

26. In the illustration above, what would the tax rate on equity income need to be for debt to not have an effect on value?

27. XYZ Pharma Inc. is a pharmaceutical company that traditionally has not used debt to finance its projects. Over the last 10 years, it has also reported high returns on its projects and growth, and made substantial research and development expenses over the time period. The health care business overall is growing much slower now, and the projects that the firm is considering have lower expected returns.
a. How would you justify the firm's past policy of not using debt?
b. Do you think the policy should be changed now? Why or why not?

28. Unitrode Inc., which makes analog/linear integrated circuits for power management, is a firm that has not used debt in the financing of its projects. The managers of the firm contend that they do not borrow money because they want to maintain financial flexibility.
a. How does not borrowing money increase financial flexibility?
b. What is the trade-off you would be making, if you have excess debt capacity, and you choose not to use it, because you want financial flexibility?

29. Consolidated Power is a regulated electric utility which has equity with a market value of $ 1.5 billion and debt outstanding of $ 3 billion. A consultant notes that this is a high debt ratio relative to the average across all firms, which is 27%, and suggests that the firm is overlevered.
a. Why would you expect a electric utility to be able to maintain a higher debt ratio than the average company?
b. Does the fact that the company is a regulated monopoly affect its capacity to carry debt?

CHAPTER 8

CAPITAL STRUCTURE: THE OPTIMAL FINANCIAL MIX

What is the optimal mix of debt and equity for a firm? While in the last chapter we looked at the qualitative trade off between debt and equity, we did not develop the tools we need to analyze whether debt should be 0%, 20%, 40% or 60% of capital. Debt is always cheaper than equity, but using debt increases risk in terms of default risk to lenders, and higher earnings volatility for equity investors. Thus, using more debt can increase value for some firms and decrease value for others, and for the same firm, debt can be beneficial up to a point and destroy value beyond that point. We have to consider ways of going beyond the generalities in the last chapter to specific ways of identifying the right mix of debt and equity.

In this chapter, we explore three ways to find an optimal mix. The first approach begins with a distribution of future operating income; we can then decide how much debt to carry by defining the maximum possibility of default we are willing to bear. The second approach is to choose the debt ratio that minimizes the cost of capital. Here, we review the role of cost of capital in valuation and discuss its relationship to the optimal debt ratio. The third approach, like the second, also attempts to maximize firm value, but it does so by adding the value of the unlevered firm to the present value of tax benefits and then netting out the expected bankruptcy costs. The final approach is to base the financing mix on the way comparable firms finance their operations.

Operating Income Approach

The *operating income approach* is the simplest and one of the most intuitive ways of determining how much a firm can afford to borrow. We determine the firm's maximum acceptable probability of default. Based upon the distribution of operating income, we then determine how much debt the firm can carry.

Steps in Applying Operating Income Approach

We begin with an analysis of a firm's operating income and cash flows, and we consider how much debt it can afford to carry based upon its cash flows. The steps in the operating income approach are as follows:

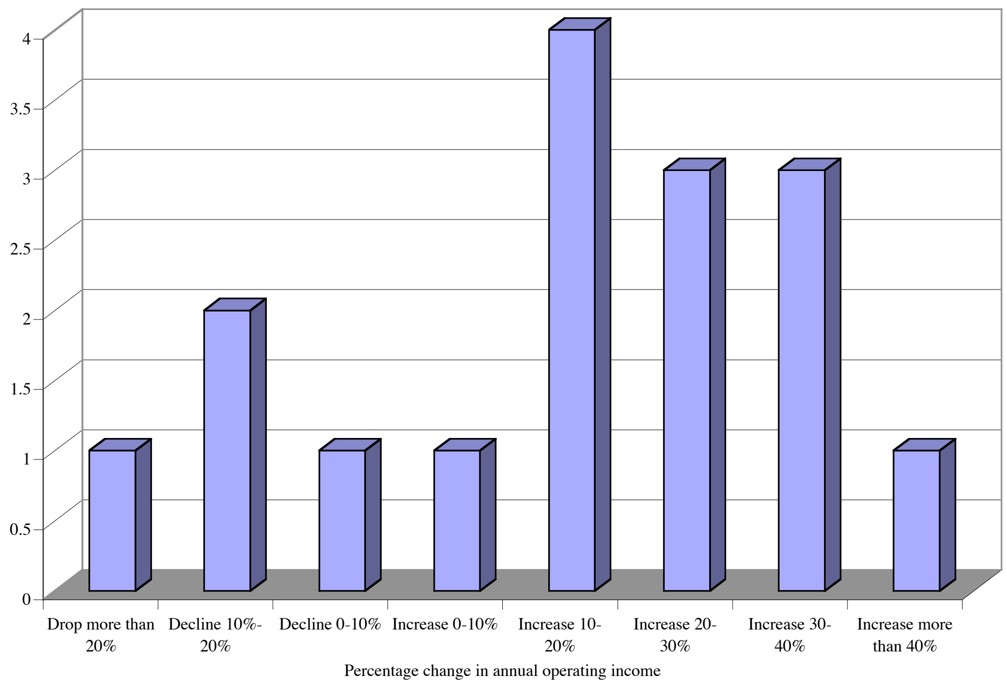
1. We assess the firm's capacity to generate operating income based upon both current conditions and past history. The result is a distribution for expected operating income, with probabilities attached to different levels of income.
2. For any given level of debt, we estimate the interest and principal payments that have to be made over time.
3. Given the probability distribution of operating cash flows and the debt payments, we can estimate the probability that the firm will be unable to make those payments.
4. We set a limit on the probability of its being unable to meet debt payments. Clearly, the more conservative the management of the firm, the lower this probability constraint will be.
5. We compare the estimated probability of default at a given level of debt to the probability constraint. If the probability of default is higher than the constraint, the firm chooses a lower level of debt; if it is lower than the constraint, the firm chooses a higher level of debt.

Illustration 8.1: Estimating Debt Capacity Based Upon Operating Income Distribution

In the following analysis, we apply the operating income approach to analyzing whether Disney should issue an additional $ 5 billion in new debt.

Step 1: We derive a probability distribution for expected operating income from Disney's historical earnings and estimate operating income changes from 1988 to 2003 and present it in figure 8.1.

Figure 8.1: Disney: Operating Income Changes - 1988-2003



The average change in operating income on an annual basis over the period was 10.09%, and the standard deviation in the annual changes is 19.54%. If we assume that the changes are normally distributed, these statistics are sufficient for us to compute the approximate probability of being unable to meet the specified debt payments.

Step 2: We estimate the interest and principal payments on a proposed bond issue of $ 5 billion by assuming that the debt will be rated BBB, lower than Disney's current bond rating of BBB+[1]. Based upon this rating, we estimated an interest rate of 5.5% on the debt. In addition, we assume that the sinking fund payment set aside to repay the bonds is 5% of the bond issue. This results in an annual debt payment of $ 550 million–

Additional Debt Payment	= Interest Expense	+ Sinking Fund Payment	
	= 0.055 * 5,000	+ .05 * 5,000	= $ 525 million

The total debt payment then can be computed by adding the interest payment on existing debt in 2003— $ 666 million — as well as the operating lease expenses from 2003 - $

[1] This is Disney's current bond rating.

556 million - to the additional debt payment that will be created by taking on $ 5 billion in additional debt.

Total Debt Payment = Interest on Existing Debt + Operating lease expense + Additional Debt Payment = $ 666 million + $ 556 million + $ 525 million = $ 1,747 million

Step 3: We can now estimate the probability[2] of default from the distribution of operating income by assuming that the percentage changes in operating income are normally distributed and by considering the operating income of $ 2,713 million that Disney earned in 2003 as the base year income.

T statistic = (Current EBIT- Debt Payment) / σ_{OI} (Current Operating Income)

= ($ 2,713- $ 1747 million) / (.1954 * $2713) = 1.82

Based upon the t statistic, the probability that Disney will be unable to meet its debt payments in the next year is 3.42%.

Step 4: Assume that the management at Disney set a constraint that the probability of default be no greater than 5%.

Step 5: Since the estimated probability of default is indeed less than 5%, Disney can afford to borrow more than $ 5 billion. If the distribution of operating income changes is normal, we can estimate the level of debt payments Disney can afford to make for a probability of default of 5%.

T statistic for 5% probability level = 1.645

Consequently, the debt payment can be estimated as

($2,713 - X)/ (.1954* $2,713) = 1.645

Solving for X, we estimate a breakeven debt payment of -

Break Even Debt Payment = $ 1,841 million

Subtracting out the existing interest and lease payments from this amount yields a break-even additional debt payment of $619 million

Break-Even Additional Debt Payment = 1841- 666 – 556 = $619 million

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[2] This is the probability of defaulting on interest payments in one period. The cumulative probability of default over time will be much higher.

If we assume that the interest rate remains unchanged at 5.5% and the sinking fund will remain at 5% of the outstanding debt, this yields an optimal debt level of $ 5,895 million.

Optimal Debt Level = Break Even Debt Payment / (Interest Rate + Sinking Fund Rate)

= $ 619 / (.055 + .05) = $ 5,895 million

The optimal debt level will be lower if the interest rate increases as Disney borrows more money.

Limitations of the Operating Income Approach

Although this approach may be intuitive and simple, it has some drawbacks. First, estimating a distribution for operating income is not as easy as it sounds, especially for firms in businesses that are changing and volatile. For instance, the operating income of firms can vary widely from year to year, depending upon the success or failure of individual products. Second, even when we can estimate a distribution, the distribution may not fit the parameters of a normal distribution, and the annual changes in operating income may not reflect the risk of consecutive bad years. This can be remedied by calculating the statistics based upon multiple years of data. For Disney, in the above example, if operating income is computed over rolling two-year periods[3], the standard deviation will increase and the optimal debt ratio will decrease..

This approach is an extremely conservative way of setting debt policy because it assumes that debt payments have to be made out of a firm's cash balances and operating income and that the firm has no access to financial markets. Finally, the probability constraint set by management is subjective and may reflect management concerns more than stockholder interests. For instance, management may decide that it wants no chance of default and refuse to borrow money as a consequence.

Refinements on the Operating Income Approach

The operating income approach described in this section is simplistic because it is based upon historical data and the assumption that operating income changes are

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[3] By rolling two-year periods, we mean 1980 & 1981, 1981 & 1982, 1982 & 1983 .... The resulting standard deviation is corrected for the multiple counting of the same observations.

normally distributed. We can make it more sophisticated and robust by making relatively small changes:

- You can look at simulations of different possible outcomes for operating income, rather than looking at historical data; the distributions of the outcomes are based both upon past data and upon expectations for the future.
- Instead of evaluating just the risk of defaulting on debt, you can consider the indirect bankruptcy costs that can accrue to a firm, if operating income drops below a specified level.
- You can compute the present value of the tax benefits from the interest payments on the debt, across simulations, and thus compare the expected cost of bankruptcy to the expected tax benefits from borrowing.

With thee changes, you can look at different financing mixes for a firm, and estimate the optimal debt ratio as that mix that maximizes the firm's value.[4]

Cost of Capital Approach

In chapters 3 and 4, we estimated the minimum acceptable hurdle rates for equity investors (the cost of equity), and for all investors in the firm - (the cost of capital). We defined the cost of capital to be the weighted average of the costs of the different components of financing — including debt, equity and hybrid securities — used by a firm to fund its financial requirements. By altering the weights of the different components, firms might be able to change their cost of capital[5]. In the cost of capital approach, we estimate the costs of debt and equity at different debt ratios, use these costs to compute the costs of capital, and look for the mix of debt and equity that yields the lowest cost of capital for the firm. At this cost of capital, we will argue that firm value is maximized.[6].

[4] Opler, Grinblatt and Titman have an extended discussion of this approach.
[5] If capital structure is irrelevant, the cost of capital will be unchanged as the capital structure is altered.
[6] If capital structure is irrelevant, the cost of capital will be unchanged as the capital structure is altered.

Definition of the Weighted Average Cost of Capital (WACC)

The weighted average cost of capital (WACC) is defined as the weighted average of the costs of the different components of financing used by a firm.

$$WACC = k_e \, (E/ (D+E+PS)) + k_d \, (D/ (D+E+PS)) + k_{ps} \, (PS/ (D+E+PS))$$

where WACC is the weighted average cost of capital, k_e, k_d and k_{ps} are the costs of equity, debt and preferred stock, and E, D and PS are their respective market values.

The estimation of the costs of the individual components - equity, debt, and preferred stock, and of the weights in the cost of capital formulation are explored in detail in Chapter 4. To summarize:

- The cost of equity should reflect the riskiness of an equity investment in the company. The standard models for risk and return — the capital asset pricing model and the arbitrage pricing model — measure risk in terms of market risk, and convert the risk measure into an expected return.
- The cost of debt should reflect the default risk of the firm - the higher the default risk, the greater the cost of debt - and the tax advantage associated with debt - interest is tax deductible.

  Cost of Debt = Pre-tax Interest Rate on Borrowing (1 - tax rate)
- The cost of preferred stock should reflect the preferred dividend and the absence of tax deductibility.

  Cost of Preferred Stock = Preferred Dividend / Preferred Stock Price
- The weights used for the individual components should be market value weights rather than book value weights.

The Role of Cost of Capital in Investment Analysis and Valuation

In order to understand the relationship between the cost of capital and optimal capital structure, we first have to establish the relationship between firm value and the cost of capital. In chapter 5, we noted that the value of a project to a firm could be computed by discounting the expected cash flows on it at a rate that reflected the riskiness of the cash flows, and that the analysis could be done either from the viewpoint of equity investors alone or from the viewpoint of the entire firm. In the latter approach, we discounted the cash flows to the firm on the project, i.e., the project cash flows prior to debt payments but after taxes, at the project's cost of capital. Extending this principle, the value of the entire firm can be estimated by discounting the aggregate expected cash flows over time at the firm's cost of capital. The firm's aggregate cash flows can be estimated as cash flows after operating expenses, taxes and any capital investments needed to create future growth in both fixed assets and working capital.

Cash Flow to Firm = EBIT (1-t) - (Capital Expenditures - Depreciation) - Change in Working Capital

The value of the firm can then be written as –

$$\text{Value of Firm} = \sum_{t=1}^{t=n} \frac{\text{CF to Firm}_t}{(1+\text{WACC})^t}$$

The value of a firm is therefore a function of its cash flows and its cost of capital. In the specific case where the cash flows to the firm are unaffected as the debt/equity mix is changed, and the cost of capital is reduced, the value of the firm will increase. If the objective in choosing the financing mix for the firm is the maximization of firm value, this can be accomplished, in this case, by minimizing the cost of capital. In the more general case where the cash flows to the firm are a function of the debt-equity mix, the optimal financing mix is the one that maximizes firm value.[7]

The optimal financing mix for a firm is simple to compute if one is provided with a schedule that relates the costs of equity and debt to the leverage of the firm.

Illustration 8.2: WACC, Firm Value, and Leverage

Assume that you are given the costs of equity and debt at different debt levels for Belfan's, a leading manufacturer of chocolates and other candies, and that the cash flows to this firm are currently \$200 million. Belfan's is in a relatively stable market, and these cash flows are expected to grow at 6% forever, and are unaffected by the debt ratio of the firm. The WACC schedule is provided in Table 8.1, along with the value of the firm at each level of debt.

Table 8.1: WACC, Firm Value and Debt Ratios

D/(D+E)	*Cost of Equity*	*Cost of Debt*	*WACC*	*Firm Value*

[7] In other words, the value of the firm might not be maximized at the point that cost of capital is minimized, if firm cash flows are much lower at that level.

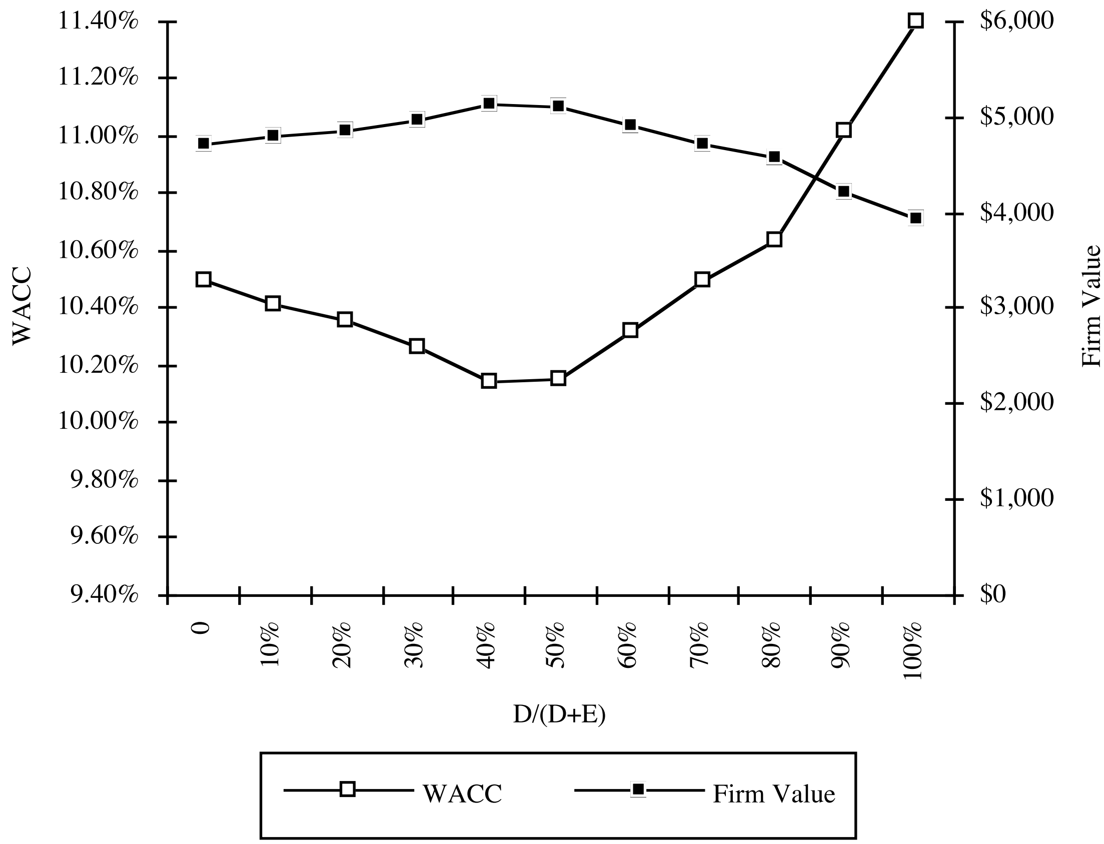
0	10.50%	4.80%	10.50%	$4,711
10%	11.00%	5.10%	10.41%	$4,807
20%	11.60%	5.40%	10.36%	$4,862
30%	12.30%	5.52%	10.27%	$4,970
40%	13.10%	5.70%	10.14%	$5,121
50%	14.00%	6.30%	10.15%	$5,108
60%	15.00%	7.20%	10.32%	$4,907
70%	16.10%	8.10%	10.50%	$4,711
80%	17.20%	9.00%	10.64%	$4,569
90%	18.40%	10.20%	11.02%	$4,223
100%	19.70%	11.40%	11.40%	$3,926

Note that the value of the firm = Cash flows to firm*(1+g)/ (WACC - g)

= $200 * 1.06 / (WACC - .06)

The value of the firm increases (decreases) as the WACC decreases (increases), as illustrated in Figure 8.2.

WACC AND FIRM VALUE AS A FUNCTION OF LEVERAGE



While this illustration makes the choice of an optimal financing mix seem trivial, it obscures some real problems that may arise in its applications. First, an analyst typically does not have the benefit of having the entire schedule of costs of financing prior to an analysis. In most cases, the only level of debt about which there is any certainty about the cost of financing is the current level. Second, the analysis assumes implicitly that the level of cash flows to the firm is unaffected by the financing mix of the firm and, consequently, by the default risk (or bond rating) for the firm. While this may be reasonable in some cases, it might not in others. For instance, a firm that manufactures consumer durables (cars, televisions etc.) might find that its sales drop if its default risk increases because investors are reluctant to buy its products.

8.1. ☞: **Minimizing Cost of Capital and Maximizing Firm Value**

A lower cost of capital will lead to a higher firm value only if

a. the operating income does not change as the cost of capital declines
b. the operating income goes up as the cost of capital goes down
c. any decline in operating income is offset by the lower cost of capital

Steps in the Cost of Capital Approach

We need three basic inputs to compute the cost of capital – the cost of equity, the after-tax cost of debt and the weights on debt and equity. The costs of equity and debt change as the debt ratio changes, and the primary challenge of this approach is in estimating each of these inputs.

Let us begin with the cost of equity. In chapter 4, we argued that the beta of equity will change as the debt ratio changes. In fact, we estimated the levered beta as a function of the debt to equity ratio of a firm, the unlevered beta and the firm's marginal tax rate:

$$\beta_{levered} = \beta_{unlevered}\,[1+(1-t)\text{Debt/Equity}]$$

Thus, if we can estimate the unlevered beta for a firm, we can use it to estimate the levered beta of the firm at every debt ratio. This levered beta can then be used to compute the cost of equity at each debt ratio.

Cost of Equity = Riskfree rate + $\beta_{levered}$ (Risk Premium)

The cost of debt for a firm is a function of the firm's default risk. As firms borrow more, their default risk will increase and so will the cost of debt. If we use bond ratings as our measure of default risk, we can estimate the cost of debt in three steps. First, we estimate a firm's dollar debt and interest expenses at each debt ratio; as firms increase their debt ratio, both dollar debt and interest expenses will rise. Second, at each debt level, we compute a financial ratio or ratios that measures default risk and use the ratio(s) to estimate a rating for the firm; again, as firms borrow more, this rating will decline. Third, a default spread, based upon the estimated rating, is added on to the riskfree rate to arrive at the pre-tax cost of debt. Applying the marginal tax rate to this pre-tax cost yields an after-tax cost of debt.

Once we estimate the costs of equity and debt at each debt level, we weight them based upon the proportions used of each to estimate the cost of capital. While we have not explicitly allowed for a preferred stock component in this process, we can have preferred stock as a part of capital. However, we have to keep the preferred stock portion fixed, while changing the weights on debt and equity. The debt ratio at which the cost of capital is minimized is the optimal debt ratio.

In this approach, the effect on firm value of changing the capital structure is isolated by keeping the operating income fixed and varying only the cost of capital. In practical terms, this requires us to make two assumptions. First, the debt ratio is decreased by raising new equity and retiring debt; conversely, the debt ratio is increased by borrowing money and buying back stock. This process is called **recapitalization**. Second, the pre-tax operating income is assumed to be unaffected by the firm's financing mix and, by extension, its bond rating. If the operating income changes with a firm's default risk, the basic analysis will not change, but minimizing the cost of capital may not be the optimal course of action, since the value of the firm is determined by both the cashflows and the cost of capital. The value of the firm will have to be computed at each debt level and the optimal debt ratio will be that which maximizes firm value.

Illustration 8.3: Analyzing the Capital Structure for Disney: March 2004

The cost of capital approach can be used to find the optimal capital structure for a firm, as we will for Disney in March 2004. Disney had $13,100 million in debt on its books. The estimated market value of this debt was $12,915 million was added the present value of operating leases, of $1,753 million to arrive at a total market value for the debt of $14,668 million. [8] The market value of equity at the same time was $55,101 million; the market price per share was $ 22.26, and there were 2475.093 million shares outstanding. Proportionally, 21.02% of the overall financing mix was debt, and the remaining 78.98% was equity.

The beta for Disney's stock in March 2004, as estimated in chapter 7, was 1.2456. The treasury bond rate at that time was 4%. Using an estimated market risk premium of 4.82%, we estimated the cost of equity for disney to be 10.00%:

Cost of Equity = Riskfree rate + Beta * (Market Premium)

=4.00% + 1.2456 (4.82%) = 10.00%

[8] The details of this calculation are in illustration 4.15 in chapter 4.

Disney's senior debt was rated BBB+. Based upon this rating, the estimated pre-tax cost of debt for Disney is 5.25%. The tax rate used for the analysis is 37.30%.

Value of Firm = 14,668+ 55,101 = $ 69,769 million

After-tax Cost of debt = Pre-tax interest rate (1- tax rate)

= 5.25% (1- 0.373) = 3.29%

The cost of capital was calculated using these costs and the weights based upon market value:

WACC = Cost of Equity (Equity/(Equity + Debt)) + After-tax Cost of Debt (Debt/(Debt +Equity))

= 10.00%* [55,101/69.769] + 3.58% *[14,668/69,769] = 8.59%

8.2. ☞: **Market Value, Book Value and Cost of Capital**

Disney had a book value of equity of approximately $ 16.5 billion. Using the book value of debt of $ 13.1 billion, estimate the cost of capital for Disney using book value weights.

I. Disney's Cost of Equity and Leverage

The cost of equity for Disney at different debt ratios can be computed using the unlevered beta of the firm, and the debt equity ratio at each level of debt. We use the levered betas that emerge to estimate the cost of equity. The first step in this process is to compute the firm's current unlevered beta, using the current market debt to equity ratio and a tax rate of 37.30%.

Unlevered Beta = Current Beta / (1 + (1-t) Debt/Equity)

= 1.2456/ (1 + (1-0.373) (14,668/55,101))

= 1.0674

Note that this is the bottom-up unlevered beta that we estimated for Disney in chapter 4, based upon its business mix. We continued to use the treasury bond rate of 4% and the market premium of 4.82% to compute the cost of equity at each level of debt. If we keep the tax rate constant at 37.30%, we obtain the levered betas for Disney in table 8.2.

Table 8.2: Leverage, Betas And The Cost Of Equity

Debt Ratio	*D/E Ratio*	*Levered Beta*	*Cost of Equity*
0.00%	0.00%	1.0674	9.15%
10.00%	11.11%	1.1418	9.50%
20.00%	25.00%	1.2348	9.95%
30.00%	42.86%	1.3543	10.53%
40.00%	66.67%	1.5136	11.30%

50.00%	100.00%	1.7367	12.37%
60.00%	150.00%	2.0714	13.98%
70.00%	233.33%	2.6291	16.67%
80.00%	400.00%	3.7446	22.05%
90.00%	900.00%	7.0911	38.18%

In calculating the levered beta in this table, we assumed that all market risk is borne by the equity investors; this may be unrealistic especially at higher levels of debt. We will also consider an alternative estimate of levered betas that apportions some of the market risk to the debt:

$$\beta_{levered} = \beta_u\ [1+(1-t)D/E] - \beta_{debt}\ (1-t)\ D/E$$

The beta of debt is based upon the rating of the bond and is estimated by regressing past returns on bonds in each rating class against returns on a market index. The levered betas estimated using this approach will generally be lower than those estimated with the conventional model.[9]

II. Disney's Cost of Debt and Leverage

Several financial ratios are correlated with bond ratings and, ideally, we could build a sophisticated model to predict ratings. For purposes of this illustration, however, we use a much simpler version: We assume that bond ratings are determined solely by the interest coverage ratio, which is defined as:

Interest Coverage Ratio = Earnings before interest & taxes / Interest Expense

We chose the interest coverage ratio for three reasons. First, it is a ratio[10] used by both Standard and Poor's and Moody's to determine ratings. Second, there is significant correlation not only between the interest coverage ratio and bond ratings, but also between the interest coverage ratio and other ratios used in analysis, such as the debt coverage ratio and the funds flow ratios. Third, the interest coverage ratio changes as a firm changes is financing mix and decreases as the debt ratio increases. The ratings

[9] Consider, for instance, a debt ratio of 40%. At this level the firm's debt will take on some of the characteristics of equity Assume that the beta of debt at a 0% debt ratio is 0.40. The equity beta at that debt ratio can be computed as follows:

Levered beta = 1.0674 (1 + (1-.373)(40/60)- 0.40 (1-.373) (40/60) = 1.335

In the unadjusted approach, the levered beta would have been 1.5136.

[10] S&P lists interest coverage ratio first among the nine ratios that it reports for different ratings classes on its web site.

agencies would argue, however, that subjective factors, such as the perceived quality of management, are part of the ratings process. One way to build these factors into the analysis would be to modify the ratings obtained from the financial ratio analysis across the board to reflect the ratings agencies' subjective concerns[11].

The data in table 8.3 were obtained based upon an analysis of the interest coverage ratios of large manufacturing firms in different ratings classes.

Table 8.3: Bond Ratings and Interest Coverage Ratios

Interest Coverage Ratio	*Rating*
> 8.5	AAA
6.50 - 6.50	AA
5.50 – 6.50	A+
4.25 – 5.50	A
3.00 – 4.25	A-
2.50 – 3.00	BBB
2.05 - 2.50	BB+
1.90 – 2.00	BB
1.75 – 1.90	B+
1.50 - 1.75	B
1.25 – 1.50	B-
0.80 – 1.25	CCC
0.65 – 0.80	CC
0.20 – 0.65	C
< 0.20	D

Source: Compustat

Using this table as a guideline, a firm with an interest coverage ratio of 1.65 would have a rating of B for its bonds.

The relationship between bond ratings and interest rates in March 2004 was obtained by looking at the typical default spreads[12] for bonds in different ratings classes. Table 8.4 summarizes the interest rates/rating relationship and reports the spread for these

[11] For instance, assume that a firm's current rating is AA, but that its financial ratios would result in an A rating. It can then be argued that the ratings agencies are, for subjective reasons, rating the company one notch higher than the rating obtained from a purely financial analysis. The ratings obtained for each debt level can then be increased by one notch across the board to reflect these subjective considerations.

[12] These default spreads were estimated from bondsonline.com, a service that provides, among other data on fixed income securities, updated default spreads for each ratings class.

bonds over treasury bonds and the resulting interest rates, based upon the treasury bond rate of 4%.

Table 8.4: Bond Ratings And Market Interest Rates, March 2004

Rating	*Typical default spread*	*Market interest rate on debt*
AAA	0.35%	4.35%
AA	0.50%	4.50%
A+	0.70%	4.70%
A	0.85%	4.85%
A-	1.00%	5.00%
BBB	1.50%	5.50%
BB+	2.00%	6.00%
BB	2.50%	6.50%
B+	3.25%	7.25%
B	4.00%	8.00%
B-	6.00%	10.00%
CCC	8.00%	12.00%
CC	10.00%	14.00%
C	12.00%	16.00%
D	20.00%	24.00%

Source: bondsonline.com

Since Disney's capacity to borrow is determined by its earnings power, we will begin by looking at the company's income statements in 2002 and 2003 in table 8.5. In 2003, Disney had operating income of $2.713 billion and net income of $1,267 billion.

Table 8.5: Disney's Income Statement for2002 & 2003

	2003	*2002*
Revenues	27061	25329
- Operating expenses (other than depreciation)	23289	21924
EBITDA	3772	3405
- Depreciation and Amortization	1059	1021
EBIT	2713	2384
- Interest Expenses	666	708
+ Interest Income	127	255
Taxable Income	2174	1931
- Taxes	907	695
Net Income	1267	1236

Based upon the earnings before interest and taxes (EBIT) of $2,713 million and interest expenses of $ 666 million, Disney has an interest coverage ratio of 4.07 and should command a rating of A-, a notch above it's actual rating of BBB+. This income statement, however, is based upon treating operating leases as operating expenses. In chapter 4, we argued that operating leases should be considered part of debt and computed the present value of Disney's lease commitments to be $1,753 million. Consequently, we have to adjust the EBIT and EBITDA for the imputed interest expense on Disney's operating leases[13]; this results in an increase of $ 92 million in both numbers – to $ 2,805 million in EBIT and $ 3,864 million in EBITDA.

Adjusted EBIT = EBIT + Pre-tax cost of debt * Present value of operating leases

= 2713 + .0525 * 1753 = 2805

Note that 5.25% is Disney's current pre-tax cost of debt.

Finally, to compute Disney's ratings at different debt levels, we redo the operating income statement at each level of debt, compute the interest coverage ratio at that level of debt and find the rating that corresponds to that level of debt. For example, table 8.6 estimates the interest expenses, interest coverage ratios and bond ratings for Disney at 0% and 10% debt ratios, at the existing level of operating income.

Table 8.6: Effect of Moving to Higher Debt Ratios: Disney

D/(D+E)	*0.00%*	*10.00%*
D/E	0.00%	11.11%
$ Debt	$0	$6,977
EBITDA	$3,882	$3,882
Depreciation	$1,077	$1,077
EBIT	$2,805	$2,805
Interest	$0	$303
Pre-tax Int. cov	∞	9.24
Likely Rating	AAA	AAA
Pre-tax cost of debt	4.35%	4.35%

[13] Multiplying the pre-tax cost of debt by the present value of operating leases yields an approximation. The full adjustment would require us to add back the entire operating lease expense and to subtract out the depreciation on the leased asset.

The dollar debt is computed to be 10% of the current value of the firm, which we compute by adding the current market values of debt ($14,668) and equity ($55,101):

Dollar Debt at 10% debt ratio = .10 (55,101 + 14,668) = $ 6,977 million

Note that the EBITDA and EBIT remain fixed as the debt ratio changes. We ensure this by using the proceeds from the debt to buy back stock. This is called a recapitalization, where the assets of the firm remain unchanged but the financing mix is changed. This allows us to isolate the effect of just changing the debt ratio.

There is circular reasoning involved in estimating the interest expense. The interest rate is needed to calculate the interest coverage ratio, and the coverage ratio is necessary to compute the interest rate. To get around the problem, we began our analysis by assuming that you could borrow $ 6,977 billion at the AAA rate of 4.35%; we then computed an interest expense and interest coverage ratio using that rate, and estimated a new rating of AAA for Disney. This process is repeated for each level of debt from 10% to 90%, and the after-tax costs of debt are obtained at each level of debt in Table 8.7.

Table 8.7: Disney: Cost of Debt and Debt Ratios

Debt Ratio	*Debt*	*Interest expense*	*Interest Coverage Ratio*	*Bond Rating*	*Interest rate on debt*	*Tax Rate*	*Cost of Debt (after-tax)*
0%	$0	$0	∞	AAA	4.35%	37.30%	2.73%
10%	$6,977	$303	9.24	AAA	4.35%	37.30%	2.73%
20%	$13,954	$698	4.02	A-	5.00%	37.30%	3.14%
30%	$20,931	$1,256	2.23	BB+	6.00%	37.30%	3.76%
40%	$27,908	$3,349	0.84	CCC	12.00%	31.24%	8.25%
50%	$34,885	$5,582	0.50	C	16.00%	18.75%	13.00%
60%	$41,861	$6,698	0.42	C	16.00%	15.62%	13.50%
70%	$48,838	$7,814	0.36	C	16.00%	13.39%	13.86%
80%	$55,815	$8,930	0.31	C	16.00%	11.72%	14.13%
90%	$62,792	$10,047	0.28	C	16.00%	10.41%	14.33%

There are two points to make about this computation. We assume that at every debt level, all existing debt will be refinanced at the new interest rate that will prevail after the capital structure change. For instance, Disney's existing debt, which has a BBB+ rating, is assumed to be refinanced at the interest rate corresponding to a BBB rating when Disney moves to a 30% debt ratio. This is done for two reasons. The first is that existing debt-holders might have protective puts that enable them to put their bonds back to the firm and receive face value.[14] The second is that the refinancing eliminates "wealth expropriation" effects — the effects of stockholders expropriating wealth from bondholders when debt is increased, and vice versa, when debt is reduced. If firms can retain old debt at lower rates, while borrowing more and becoming riskier, the lenders of the old debt will lose wealth. If we lock in current rates on existing bonds and recalculate the optimal debt ratio, we will allow for this wealth transfer.[15]

While it is conventional to leave the marginal tax rate unchanged as the debt ratio is increased, we adjust the tax rate to reflect the potential loss of the tax benefits of debt at higher debt ratios, where the interest expenses exceed the earnings before interest and taxes. To illustrate this point, note that the earnings before interest and taxes at Disney is $2,805 million. As long as interest expenses are less than $ 2,703 million, interest expenses remain fully tax deductible and earn the 37.30% tax benefit. For instance, at a 40% debt ratio, the interest expenses are $1,865 million and the tax benefit is therefore 37.30% of this amount. At a 50% debt ratio, however, the interest expenses balloon to $3,349 million, which is greater than the earnings before interest and taxes of $ 2,805 million. We consider the tax benefit on the interest expenses up to this amount:

Maximum Tax Benefit = EBIT * Marginal Tax Rate = $2,805 million * .373 = $ 1,046 million

As a proportion of the total interest expenses, the tax benefit is now only 31.24%:

Adjusted Marginal Tax Rate = Maximum Tax Benefit / Interest Expenses = $1046/$3,349= 31.24%

This, in turn, raises the after-tax cost of debt. This is a conservative approach, since losses can be carried forward. Given that this is a permanent shift in leverage, it does make sense to be conservative.

III. Leverage and Cost of Capital

Now that we have estimated the cost of equity and the cost of debt at each debt level, we can compute Disney's cost of capital. This is done for each debt level in Table

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[14] If they do not have protective puts, it is in the best interests of the stockholders not to refinance the debt (as in the leveraged buyout of RJR Nabisco) if debt ratios are increased.

[15] This will have the effect of reducing interest cost, when debt is increased, and thus interest coverage ratios. This will lead to higher ratings, at least in the short term, and a higher optimal debt ratio.

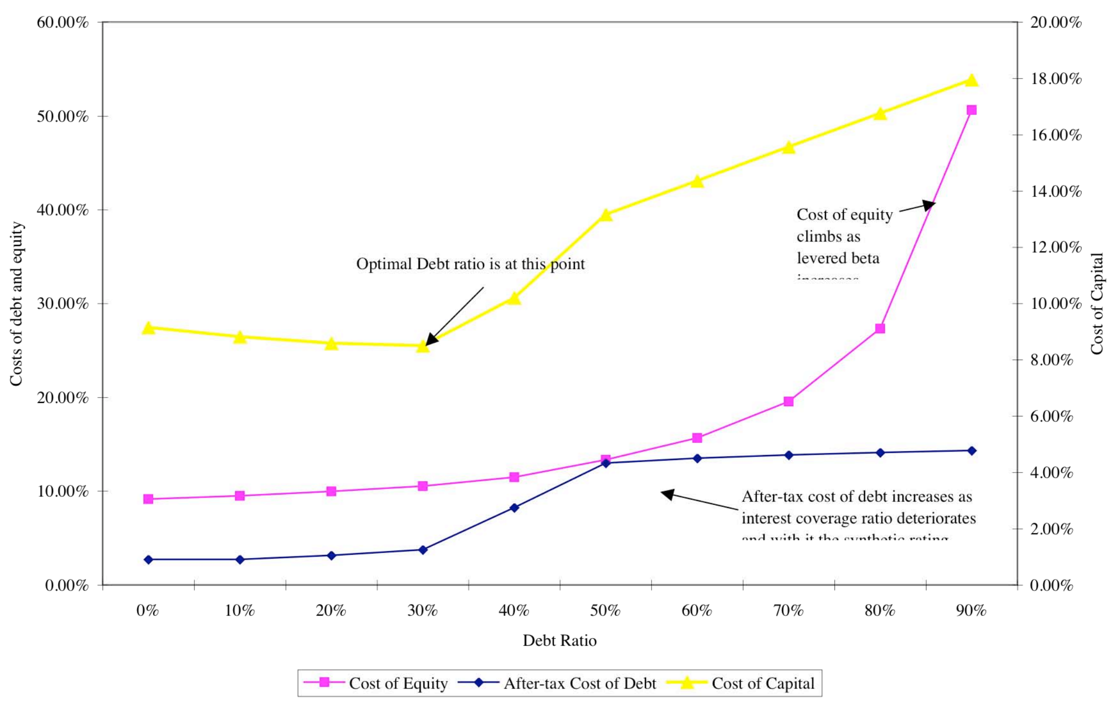
8.8. The cost of capital, which is 9.15%, when the firm is unlevered, decreases as the firm initially adds debt, reaches a minimum of 8.50% at 30% debt and then starts to increase again.

Table 8.8: Cost of Equity, Debt and Capital, Disney

Debt Ratio	Cost of Equity	Cost of Debt (after-tax)	Cost of Capital
0%	9.15%	2.73%	9.15%
10%	9.50%	2.73%	8.83%
20%	9.95%	3.14%	8.59%
30%	10.53%	3.76%	8.50%
40%	11.50%	8.25%	10.20%
50%	13.33%	13.00%	13.16%
60%	15.66%	13.50%	14.36%
70%	19.54%	13.86%	15.56%
80%	27.31%	14.13%	16.76%
90%	50.63%	14.33%	17.96%

The optimal debt ratio is shown graphically in Figure 8.3.

Figure 8.3: Disney Cost of Capital at different Debt Ratios



To illustrate the robustness of this solution to alternative measures of levered betas, we re-estimate the costs of debt, equity and capital under the assumption that debt bears some market risk, and the results are summarized in Table 8.9.

Table 8.9: Costs of Equity, Debt and Capital with Debt carrying Market Risk- Disney

Debt Ratio	*Beta of equity*	*Cost of Equity*	*Interest rate on debt*	*Tax Rate*	*Cost of Debt (after-tax)*	*Beta of debt*	*Cost of Capital*
0%	1.07	9.15%	4.35%	37.30%	2.73%	0.02	9.15%
10%	1.14	9.50%	4.35%	37.30%	2.73%	0.02	8.82%
20%	1.23	9.91%	5.00%	37.30%	3.14%	0.05	8.56%
30%	1.33	10.39%	6.00%	37.30%	3.76%	0.10	8.40%
40%	1.37	10.59%	12.00%	31.24%	8.25%	0.41	9.65%
50%	1.43	10.89%	16.00%	18.75%	13.00%	0.62	11.94%
60%	1.63	11.86%	16.00%	15.62%	13.50%	0.62	12.84%
70%	1.97	13.48%	16.00%	13.39%	13.86%	0.62	13.74%
80%	2.64	16.72%	16.00%	11.72%	14.13%	0.62	14.64%
90%	4.66	26.44%	16.00%	10.41%	14.33%	0.62	15.54%

If the debt holders bear some market risk[16], the cost of equity is lower at higher levels of debt and Disney's optimal debt ratio is still 30%, which is unchanged from the optimal calculated under the conventional calculation of the levered beta.

IV. Firm Value and Cost of Capital

The reason for minimizing the cost of capital is that it maximizes the value of the firm. To illustrate the effects of moving to the optimal on Disney's firm value, we start off with a simple valuation model, designed to value a firm in stable growth.

Firm Value = Cashflow to Firm (1 + g) / (Cost of Capital -g)

where

g = Growth rate in the cashflow to the firm (in perpetuity)

We begin by computing Disney's current free cash flow using its current earnings before interest and taxes of $2,805 million, its tax rate of 37.30%, and its reinvestment in 1998 in working capital and net fixed assets:

EBIT (1- tax rate) = 2805 (1 – 0.373) =	$	1,759
+ Depreciation & Amortization =	$	1,077

[16] To estimate the beta of debt, we used the default spread at each level of debt, and assumed that 25% this risk is market risk. Thus, at a C rating, the default spread is 12%. Based upon the market risk premium of 4.82% that we used elsewhere, we estimated the beta at a C rating to be:

Imputed Debt Beta at a C rating =(12%/4.82%)*0.25 = 0.62

The assumption that 25% of the default risk is market risk is made to ensure that at a D rating, the beta of debt (1.02) is roughly equal to the unlevered beta of Disney (1.09).

- Capital Expenditures =	$	1,049
- Change in Non-cash Working Capital	$	64
Free Cash Flow to the Firm =	$	1,722

The market value of the firm at the time of this analysis was obtained by adding up the estimated market values of debt and equity:

Market Value of Equity =	$	55,101
+ Market Value of Debt =	$	14,668
= Value of the Firm	$	69,769

Based upon the current cost of capital of 8.59%, we solve for the implied growth rate:

Growth rate = (Firm Value * Cost of Capital- CF to Firm)/(Firm Value + CF to Firm)

= (69,769*.0859-1,722)/(69,769+1,722) = .0598 or 5.98%

Now assume that Disney shifts to 30% Debt and a WACC of 8.50%. The firm can now be valued using the following parameters:

Cash flow to Firm = $1,722 million

WACC = 8.50%

Growth rate in Cash flows to Firm = 5.98%

Firm Value = 1,722 *1.0598/(.0850-.0598) = $ 72,419 million

The value of the firm will increase from $69,769 million to $72,419 million if the firm moves to the optimal debt ratio:

Increase in firm value = $ 72,419 mil - $ 69,769 mil = $ 2,650 million

With 2047.6 million shares outstanding, assuming that stockholders can evaluate the effect of this refinancing, we can calculate the increase in the stock price:

Increase in stock price = Increase in Firm Value / Number of shares outstanding

= $ 2,650/2,047.6 = $ 1.29 /share

Since the current stock price is $ 26.91, the stock price can be expected to increase to $28.20, which translates into about a 5% increase in the price.

The limitation of this approach is that the growth rate that we have assumed in perpetuity may be too high; a good rule of thumb for stable growth is that it should not exceed the riskfree rate[17]. We can use an alternate and more conservative approach to estimate the change in firm value. Consider first the change in the cost of capital from 8.59% to 8.50%, a drop of 0.09%. This change in the cost of capital should result in the firm saving on its annual cost of financing its business:

Cost of financing Disney at existing debt ratio = 69,769 * .0859 = $5,993 million

Cost of financing Disney at optimal debt ratio = 69,769 * .0850 = $5,930 million

Annual savings in cost of financing =$5,993 million - $5,930 million = $ 63 million

Note that most of these savings are implicit rather than explicit. [18] The present value of these savings over time can now be estimated using the new cost of capital of 8.50% and the capped growth rate of 4% (set equal to the riskfree rate);

Present value of savings in perpetuity = Expected savings next year / (Cost of capital – g)

= 63 /(.085-.04) = $ 1,400 million

Since this increase in value accrues entirely to stockholders, we can estimate the increase in value per share by dividing by the total number of shares outstanding:

Increase in value per share = $ 1,400/2047.6 = $ 0.68

New stock price = $26.91+ $0.68 = $ 27.59

Using this approach, we estimated the firm value and cost of capital at different debt ratios in Figure 8.4.

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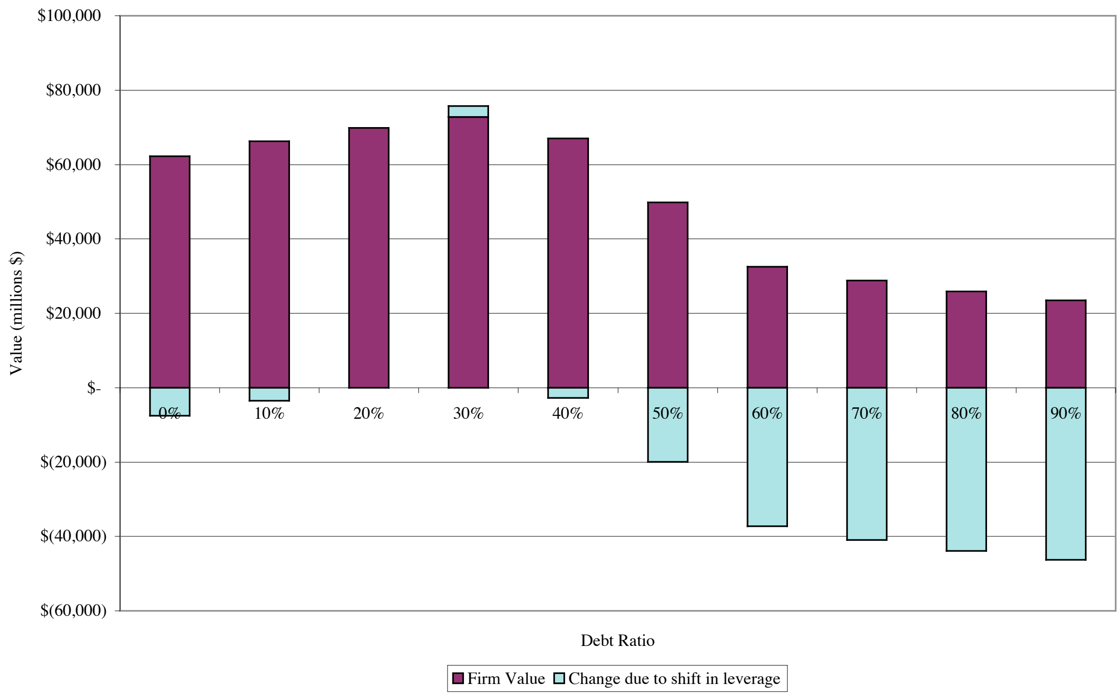
[17] No company can grow at a rate higher than the long term nominal growth rate of the economy. The riskfree rate is a reasonable proxy for the long term nominal growth rate in the economy because it is composed of two components – the expected inflation rate and the expected real rate of return. The latter has to equate to real growth in the long term.

[18] The cost of equity is an implicit cost and does not show up in the income statement of the firm. The savings in the cost of capital are therefore unlikely to show up as higher aggregate earnings. In fact, as the firm's debt ratio increases the earnings will decrease but the per share earnings will increase.

Figure 8.4: Disney Firm Value at Different Debt Ratios



Since the asset side of the balance sheet is kept fixed and changes in capital structure are made by borrowing funds and repurchasing stock, this analysis implies that the stock price would increase to $27.59 on the announcement of the repurchase. Implicit in this analysis is the assumption that the increase in firm value will be spread evenly across both the stockholders who sell their stock back to the firm and those who do not. To the extent that stock can be bought back at the current price of $ 26.91 or some value lower than $ 27.59, the change in stock price will be larger. For instance, if Disney could have bought stock back at the existing price of $ 26.91, the increase[19] in value per share would be $ 0.77.

8.3. ☞: **Rationality and Stock Price Effects**

Assume that Disney does make a tender offer for it's shares but pays $28 per share. What will happen to the value per share for the shareholders who do not sell back?

[19] To compute this change in value per share, we first compute how many shares we would buy back with the additional debt taken on of $ 6,263 billion (Debt at 30% optimal – Current Debt) and the stock price of $ 26.91. We then divide the increase in firm value of $ 1,400 million by the remaining shares outstanding:
Change in stock price = $ 1400 million / (2047.6 – (6263/26.91)) = $ 0.77 per share

a. The share price will drop below the pre-announcement price of $26.91

b. The share price will be between $26.91 and the estimated value (above) or $27.59

c. The share price will be higher than $27.59

This spreadsheet allows you to compute the optimal debt ratio firm value for any firm, using the same information used for Disney. It has updated interest coverage ratios and spreads built in.

Table 8.10: Cost of Capital Worksheet for Disney

D/(D+E)	0.00%	10.00%	20.00%	30.00%	40.00%	50.00%	60.00%	70.00%	80.00%	90.00%
D/E	0.00%	11.11%	25.00%	42.86%	66.67%	100.00%	150.00%	233.33%	400.00%	900.00%
$ Debt	$0	$6,977	$13,954	$20,931	$27,908	$34,885	$41,861	$48,838	$55,815	$62,792
Beta	1.07	1.14	1.23	1.35	1.56	1.93	2.42	3.22	4.84	9.67
EBITDA	$3,882	$3,882	$3,882	$3,882	$3,882	$3,882	$3,882	$3,882	$3,882	$3,882
Depreciation	$1,077	$1,077	$1,077	$1,077	$1,077	$1,077	$1,077	$1,077	$1,077	$1,077
EBIT	$2,805	$2,805	$2,805	$2,805	$2,805	$2,805	$2,805	$2,805	$2,805	$2,805
Interest	∞	9.24	4.02	2.23	0.84	0.50	0.42	0.36	0.31	0.28
Pre-tax Int. cov	∞	0.38	0.17	0.10	0.03	-0.02	-0.03	-0.04	-0.05	-0.06
Likely Rating	AAA	AAA	A-	BB+	CCC	C	C	C	C	C
Pre-tax cost of debt	4.35%	4.35%	5.00%	6.00%	12.00%	16.00%	16.00%	16.00%	16.00%	16.00%
Adj Marginal Tax Rate	37.30%	37.30%	37.30%	37.30%	31.24%	18.75%	15.62%	13.39%	11.72%	10.41%
Cost of equity	9.15%	9.50%	9.95%	10.53%	11.50%	13.33%	15.66%	19.54%	27.31%	50.63%
Cost of debt	2.73%	2.73%	3.14%	3.76%	8.25%	13.00%	13.50%	13.86%	14.13%	14.33%
Cost of Capital	9.15%	8.83%	8.59%	8.50%	10.20%	13.16%	14.36%	15.56%	16.76%	17.96%
Value (perpetual growth)	$62,279	$66,397	$69,837	$71,239	$51,661	$34,969	$30,920	$27,711	$25,105	$22,948

Constrained Cost of Capital Approaches

The cost of capital approach that we have described is unconstrained, since our only objective is to minimize the cost of capital. There are several reasons why a firm may choose not to view the debt ratio that emerges from this analysis as optimal. First, the firm's default risk at the point at which the cost of capital is minimized may be high enough to put the firm's survival at jeopardy. Stated in terms of bond ratings, the firm may have a below-investment grade rating. Second, the assumption that the operating income is unaffected by the bond rating is a key one. If the operating income declines as default risk increases, the value of the firm may not be maximized where the cost of capital is minimized. Third, the optimal debt ratio was computed using the operating income from the most recent financial year. To the extent that operating income is volatile and can decline, firms may want to curtail their borrowing. In this section, we will consider ways in which we can bring each of these considerations into the cost of capital analysis.

Investment Grade Bonds: An investment grade bond is one with a rating greater than BBB. Some institutional investors, such as pension funds, are constrained from holding bonds with lower ratings.

Bond Rating Constraint

One way of using the cost of capital approach, without putting firms into financial jeopardy, is to impose a "bond rating constraint" on the cost of capital analysis. Once this constraint has been imposed, the optimal debt ratio is the one that has the lowest cost of capital, subject to the constraint that the bond rating meets or exceeds a certain level.

While this approach is simple, it is essentially subjective and is therefore open to manipulation. For instance, the management at Disney could insist on preserving a AA rating and use this constraint to justify reducing its debt ratio. One way to make managers more accountable in this regard is to measure the cost of a rating constraint.

Cost of Rating Constraint = Maximum Firm Value without constraints
- Maximum Firm Value with constraints

If Disney insisted on maintaining a AA rating, its constrained optimal debt ratio would be 10%. The cost of preserving the constraint can then be measured as the difference between firm value at 30% and at 20%.

Cost of Rating Constraint = Value at 30% Debt - Value at 10% Debt
= $71,239 - $ 66,397
= $ 4,842 million

This loss in value is probably overstated since we are keeping operating income fixed. Notwithstanding this concern, the loss in value that can accrue from having an unrealistically high rating constraint can be viewed as the cost of being too conservative when it comes to debt policy.

8.4. ☞**: Agency Costs and Financial Flexibility**

In the last chapter, we consider agency costs and lost flexibility as potential costs of using debt. Where in the cost of capital approach do we consider these costs?

a. These costs are not considered in the cost of capital approach
b. These costs are fully captured in the cost of capital through the costs of equity and debt, which increase as you borrow more money.
c. These costs are partially captured in the cost of capital through the costs of equity and debt, which increase as you borrow more money.

Sensitivity Analysis

The optimal debt ratio we estimate for a firm is a function of all the inputs that go into the cost of capital computation – the beta of the firm, the riskfree rate, the risk premium and the default spread. It is also, indirectly, a function of the firm's operating income, since interest coverage ratios are based upon this income, and these ratios are used to compute ratings and interest rates.

The determinants of the optimal debt ratio for a firm can be divided into variables specific to the firm, and macro economic variables. Among the variables specific to the firm that affect its optimal debt ratio are the tax rate, the firm's capacity to generate operating income and its cash flows. In general, the tax benefits from debt increase as the tax rate goes up. In relative terms, firms with higher tax rates will have higher optimal debt ratios than will firms with lower tax rates, other things being equal. It also follows that a firm's optimal debt ratio will increase as its tax rate increases. Firms that generate higher operating income and cash flows, as a percent of firm market value, also can sustain much more debt as a proportion of the market value of the firm, since debt payments can be met much more easily from prevailing cash flows.

The macroeconomic determinants of optimal debt ratios include the level of interest rates and default spreads. As interest rates increase, the costs of debt and equity both increase. However, optimal debt ratios tend to be lower when interest rates are higher, perhaps because interest coverage ratios drop at higher rates. The default spreads commanded by different ratings classes tend to increase during recessions and decrease during recoveries. Keeping other things constant, as the spreads increase, optimal debt ratios decrease, for the simple reason that higher default spreads result in higher costs of debt.

How does sensitivity analysis allow a firm to choose an optimal debt ratio? After computing the optimal debt ratio with existing inputs, firms may put it to the test by changing both firm-specific inputs (such as operating income) and macro-economic inputs (such as default spreads). The debt ratio the firm chooses as its optimal then reflects the volatility of the underlying variables, and the risk aversion of the firm’s management.

Illustration 8.4: Sensitivity Analysis on Disney’s Optimal Debt Ratio

In the base case, in illustration 8.2, we used Disney’s operating income in 2003 to find the optimal debt ratio. We could argue that Disney's operating income is subject to large swings, depending upon the vagaries of the economy and the fortunes of the entertainment business, as shown in Table 8.11.

Table 8.11: Disney's Operating Income History: 1987 – 2003

Year	EBIT	% Change in EBIT
1987	756	
1988	848	12.17%
1989	1177	38.80%
1990	1368	16.23%
1991	1124	-17.84%
1992	1287	14.50%
1993	1560	21.21%

1994	1804	15.64%
1995	2262	25.39%
1996	3024	33.69%
1997	3945	30.46%
1998	3843	-2.59%
1999	3580	-6.84%
2000	2525	-29.47%
2001	2832	12.16%
2002	2384	-15.82%
2003	2713	13.80%

There are several ways of using the information in such historical data to modify the analysis. One approach is to look at the firm's performance during previous downturns. In Disney's case, the operating income in 2002 dropped by 15.82% as the firm struggled with the aftermath of terrorism. In 2000, Disney’s self-inflicted wounds, from over investment in the internet business and poor movies, caused operating income to plummet almost 30%. A second approach is to obtain a statistical measure of the volatility in operating income, so that we can be more conservative in choosing debt levels for firms with more volatile earnings. In Disney’s case, the standard deviation in percentage changes in operating income is 19.54%. Table 8.12 illustrates the impact of lowering operating from current levels on the optimal debt level.

Table 8.12: Effects Of Operating Income On Optimal Debt Ratio

% Drop in EBITDA	*EBIT*	*Optimal Debt Ratio*
0%	$ 2,805	30%
5%	$ 2,665	20%
10%	$ 2,524	20%
15%	$ 2385	20%
20%	$ 2,245	20%

The optimal debt ratio declines to 20% when the operating income decreases by 5% but the optimal stays at 20% for larger decreases in operating income (up to 40%).

In Practice: EBIT versus EBITDA

In recent years, analysts have increasingly turned to using EBITDA as a measure of operating cashflows for a firm. It may therefore seem surprising that we focus on operating income or EBIt far more than EBITDA when computing the optimal capital structure. The interest coverage ratios, for instance, are based upon operating income and not EBITDA. While it is true that depreciation and amortization are non-cash expenses and should be added back to cash flows, it is dangerous for a firm with ongoing operations to depend upon the cashflows generated by these items to service debt payments. After all, firms with high depreciation and amortization expenses usually have high ongoing capital expenditures. If the cash inflows from depreciation and amortization are redirected to make interest payments, the reinvestment made by firms will be insufficient to generate future growth or to maintain existing assets.

Normalized Operating Income

A key input that drives the optimal capital structure is the current operating income. If this income is depressed, either because the firm is a cyclical firm or because there are firm-specific factors that are expected to be temporary, the optimal debt ratio that will emerge from the analysis will be much lower than the firm's true optimal. For example, automobile manufacturing firms would have had very low debt ratios if the optimal debt ratios had been computed based upon the operating income in 2001 and 2002, which were recession years. If the drop in operating income is permanent, however, this lower optimal debt ratio is, in fact, the correct estimate.

Normalized Income: This is a measure of the income that a firm can make in a normal year, where there are no extraordinary gains or losses either from firm-specific factors (such as write offs and one-time sales) or macro economic factors (such as recessions and economic booms).

When evaluating a firm with depressed current operating income, we must first decide whether the drop in income is temporary or permanent. If the drop is temporary, we must estimate the normalized operating income for the firm. The *normalized operating income* is an estimate of how much the firm would earn in a normal year, i.e., a year without the specific events that are depressing earnings this year. Most analysts normalize earnings by taking the average earnings over a period of time (usually 5 years).

*mgnroc.xls*: There is a dataset on the web that summarizes operating margins and returns on capital by industry group in the United States for the most recent quarter.

Operating Income as a Function of Default Risk

In the analysis we just completed for the Disney, we assumed that operating income would remain constant while the debt ratios changed. While this assumption simplifies our analysis substantially, it is not realistic. The operating income, for many firms, will drop as the default risk increases; this, in fact, is the cost we labeled as an indirect bankruptcy cost in the last chapter. The drop is likely to become more pronounced as the default risk falls below an acceptable level; for instance, a bond rating below investment grade may trigger significant losses in revenues and increases in expenses.

A general model for optimal capital structure would allow both operating income and cost of capital to change as the debt ratio changes. We have already described how we can estimate cost of capital at different debt ratios, but we could also attempt to do the same with operating income. For instance, we could estimate how the operating income for the Aracruz would change as debt ratios and default risk changes by looking at the effects of rating downgrades on the operating income of other paper and pulp companies.

If both operating income and cost of capital change, the optimal debt ratio may no longer be the point at which the cost of capital is minimized. Instead, the optimal has to be defined as that debt ratio at which the value of the firm is maximized. We will consider an example of such an analysis in a few pages, when we estimate the optimal debt ratio for J.P. Morgan.

Illustration 8.5: Applying the Cost of Capital Approach with Normalized Operating Income to Aracruz Cellulose

Aracruz Cellulose, the Brazilian pulp and paper manufacturing firm, reported operating income of 887 million BR on revenues of 3176 million BR in 2003. This was significantly higher than it's operating income of 346 million BR in 2002 and 196 million Br in 2001. We estimated the optimal debt ratio for Aracruz, based upon the following information:

- In 2003, Aracruz had depreciation of 553 million BR and capital expenditures amounted to 661 million BR.
- Aracruz had debt outstanding of 4,094 million BR with a dollar cost of debt of 7.25%.

- The corporate tax rate in Brazil is estimated to be 34%.
- Aracruz had 859.59 million shares outstanding, trading 10.69 BR per share. The beta of the stock is estimated, using comparable firms, to be 0.70.

In chapter 4, we estimated Aracruz's current dollar cost of capital to be 10.33%, using an equity risk premium of 12.49% for Brazil:

Current $ Cost of Equity = 4% + 0.70 (12.49%) = 12.79%

Market Value of Equity = 10.69 BR/share * 859.59= 9,189 million BR

Current $ Cost of Capital

= 12.79% (9,189/(9,189+4,094)) + 7.25% (1-.34) (4,094/(9189+4,094) = 10.33%

We made three significant changes in applying the cost of capital approach to Aracruz as opposed to Disney:

- The operating income at Aracruz is a function of the price of paper and pulp in global markets. While 2003 was a very good year for the company, its income history over the last decade reflects the volatility created by pulp prices. We computed Aracruz's average pre-tax operating margin over the last 10 years to be 25.99%. Applying this lower average margin to 2003 revenues generates a normalized operating income of 796.71 million BR. We will compute the optimal debt ratio using this normalized value.
- In chapter 4, we noted that Aracruz's synthetic rating of BBB, based upon the interest coverage ratio, is much higher than its actual rating of B- and attributed the difference to Aracruz being a Brazilian company, exposed to country risk. Since we compute the cost of debt at each level of debt using synthetic ratings, we run to risk of understating the cost of debt. The difference in interest rates between the synthetic and actual ratings is 1.75% and we add this to the cost of debt estimated at each debt ratio from 0% to 90%. You can consider this a country-risk adjusted cost of debt for Aracruz.
- Aracruz has a market value o equity of about $3 billion (9 billion BR). We used the interest coverage ratio/ rating relationship for smaller companies to estimate synthetic ratings at each level of debt. In practical terms, the rating that we assign to Aracruz for any given interest coverage ratio will generally be lower than the rating that Disney, a much larger company, would have had with the same ratio.

Using the normalized operating income, we estimated the costs of equity, debt and capital in table 8.13 for Aracruz at different debt ratios.

Table 8.13: Aracruz Cellulose: Cost of Capital, Firm Value and Debt Ratios

Debt Ratio	*Beta*	*Cost of Equity*	*Bond Rating*	*Interest rate on debt*	*Tax Rate*	*Cost of Debt (after-tax)*	*WACC*	*Firm Value in BR*
0%	0.54	10.80%	AAA	6.10%	34.00%	4.03%	10.80%	12,364
10%	0.58	11.29%	AAA	6.10%	34.00%	4.03%	10.57%	12,794
20%	0.63	11.92%	A	6.60%	34.00%	4.36%	10.40%	13,118
30%	0.70	12.72%	BBB	7.25%	34.00%	4.79%	10.34%	13,256
40%	0.78	13.78%	CCC	13.75%	34.00%	9.08%	11.90%	10,633
50%	0.93	15.57%	CCC	13.75%	29.66%	9.67%	12.62%	9,743
60%	1.20	19.04%	C	17.75%	19.15%	14.35%	16.23%	6,872
70%	1.61	24.05%	C	17.75%	16.41%	14.84%	17.60%	6,177
80%	2.41	34.07%	C	17.75%	14.36%	15.20%	18.98%	5,610
90%	4.82	64.14%	C	17.75%	12.77%	15.48%	20.35%	5,138

The optimal debt ratio for Aracruz using the normalized operating income is 30%, a shade below it's current debt ratio of 30.82% but the cost of capital at the optimal is almost identical to it's current cost of capital. This indicates that Aracruz is at it's optimal debt ratio. There are two qualifiers we would add to this conclusion. The first is that the volatility in paper and pulp prices will undoubtedly cause big swings in operating income over time, and with it the optimal debt ratio. The second is that as an emerging market company, Aracruz is particularly exposed to political or economic risk in Brazil in particular and Latin America in general. . It is perhaps because of this fear of market crises that Aracruz has a cash balance amounting to more than 7% of the total firm value. In fact, the net debt ratio for Aracruz is only about 23%.

In Practice: Normalizing Operating Income

In estimating optimal debt ratios, it is always more advisable to use normalized operating income, rather than current operating income. Most analysts normalize earnings by taking the average earnings over a period of time (usually 5 years). Since this holds the scale of the firm fixed, it may not be appropriate for firms that have changed in size over time. The right way to normalize income will vary across firms:

1. For cyclical firms, whose current operating income may be overstated (if the economy is booming) or understated (if the economy is in recession), the operating

income can be estimated using the average operating margin over an entire economic cycle (usually 5 to 10 years)

Normalized Operating Income = Average Operating Margin (Cycle) * Current Sales

2. For firms which have had a bad year in terms of operating income, due to firm-specific factors (such as the loss of a contract), the operating margin for the industry in which the firm operates can be used to calculate the normalized operating income:

Normalized Operating Income = Average Operating Margin (Industry) * Current Sales

The normalized operating income can also be estimated using returns on capital across an economic cycle (for cyclical firms) or an industry (for firms with firm-specific problems), but returns on capital are much more likely to be skewed by mismeasurement of capital than operating margins.

Extensions of the Cost of Capital Approach

The cost of capital approach, which works so well for manufacturing firms that are publicly traded, may need to be adjusted when we are called upon to compute optimal debt ratios for private firms or for financial service firms, such as banks and insurance companies.

Private Firms

There are three major differences between public and private firms in analyzing optimal debt ratios. One is that unlike the case for publicly traded firms, we do not have a direct estimate of the market value of a private firm. Consequently, we have to estimate firm value before we move to subsequent stages in the analysis. The second difference relates to the cost of equity and how we arrive at that cost. While we use betas to estimate the cost of equity for a public firm, that usage might not be appropriate when we are computing the optimal debt ratio for a private firm, where the owner may not be well diversified. Finally, while publicly traded firms tend to think of their cost of debt in terms of bond ratings and default spreads, private firms tend to borrow from banks. Banks assess default risk and charge the appropriate interest rates.

To analyze the optimal debt ratio for a private firm, we make the following adjustments. First, we estimate the value of the private firm, by looking at how publicly traded firms in the same business are priced by the market. Thus, if publicly traded firms in the business have market values that are roughly three times revenues, we would multiply the revenues of the private firm by this number to arrive at an estimated value. Second, we continue to estimate the costs of debt for a private firm using a bond rating, but the rating is a synthetic rating, based on interest coverage ratios. We tend to require much higher interest coverage ratios to arrive at the same rating, to reflect the fact that banks are likely to be more conservative in assessing default risk at small, private firms.

Illustration 8.6: Applying the Cost of Capital Approach to a Private Firm: Bookscape

Bookscapes as a private firm, has neither a market value for its equity nor a rating for its debt. In chapter 4, we assumed that Bookscape would have a debt to capital ratio of 16.90%, similar to that of publicly traded book retailers, and that the tax rate for the firm is 40%. We computed a cost of capital based on that assumption. We also used a "total beta"of 2.0606 to measure the additional risk that the owner of Bookscape is exposed to because of his lack of diversification.

Cost of equity = Risfree Rate + Total Beta * Risk Premium

= 4% + 2.0606 * 4.82% = 13.93%

Pre-tax Cost of debt = 5.5% (based upon synthetic rating of BBB)

Cost of capital = 13.93% (.8310) + 5.5% (1-.40) (.1690) = 12.14%

In order to estimate the optimal capital structure for Bookscape, we made the following assumptions:

- While Bookscapes has no conventional debt outstanding, it does have one large operating lease commitment. Given that the operating lease has 25 years to run and that the lease commitment is $500,000 for each year, the present value of the operating lease commitments is computed using Bookscape's pre-tax cost of debt of 5.5%:

  Present value of Operating Lease commitments (in thousands) = $500 (PV of annuity, 5.50%, 20 years) = 6,708

Note that Bookscape's pre-tax cost of debt is based upon their synthetic rating of BBB, which we estimated in chapter 4.

- Bookscape had operating income before taxes of $ 2 million in the most recent financial year, after depreciation charges of $400,000 and operating lease expenses of $ 600,000. Since we consider the present value of operating lease expenses to be debt, we add back the imputed interest expense on the present value of lease expenses to the earnings before interest and taxes to arrive at an adjusted earnings before interest and taxes. For the rest of the analysis, operating lease commitments are treated as debt and the interest expense estimated on the present value of operating leases:

  Adjusted EBIT (in '000s) = EBIT + Pre-tax cost of debt * PV of operating lease expenses = $ 2,000+ .055 * $6,7078 = $2,369

- To estimate the market value of equity, we looked at publicly traded book retailers and computed an average price to earnings ratio of 16.31 for these firms. Applying this multiple of earnings to Bookscape's net income of $1,320,000 in 2003 yielded an estimate of Bookscape's market value of equity.

  Estimated Market Value of Equity (in '000s) = Net Income for Bookscape * Average PE for publicly traded book retailers = 1,320 * 16.31 = $21,525

- The interest rates at different levels of debt will be estimated based upon a "synthetic" bond rating. This rating will be assessed using table 8.14, which summarizes ratings and default spreads over the long-term bond rate as a function of interest coverage ratios for small firms that are rated by S&P as of January 2004.

Table 8.14: Interest Coverage Ratios, Rating and Default Spreads: Small Firms

Interest Coverage Ratio	*Rating*	*Spread over T Bond Rate*
> 12.5	AAA	0.35%
9.50-12.50	AA	0.50%
7.5 - 9.5	A+	0.70%
6.0 - 7.5	A	0.85%
4.5 - 6.0	A-	1.00%
4.0 - 4.5	BBB	1.50%
3.5 – 4.0	BB+	2.00%
3.0 - 3.5	BB	2.50%
2.5 - 3.0	B+	3.25%
2.0 - 2.5	B	4.00%

1.5 - 2.0	B-	6.00%
1.25 - 1.5	CCC	8.00%
0.8 - 1.25	CC	10.00%
0.5 - 0.8	C	12.00%
< 0.5	D	20.00%

Note that smaller firms need higher coverage ratios than the larger firms to get the same rating.

- The tax rate used in the analysis is 40% and the long term bond rate at the time of this analysis was 4%.

Based upon this information and using the same approach that we used for Disney, the cost of capital and firm value are estimated for Bookscape at different debt ratios. The information is summarized in Table 8.15.

Table 8.15: Costs of Capital and Firm Value for Bookscape

Debt Ratio	*Total Beta*	*Cost of Equity*	*Bond Rating*	*Interest rate on debt*	*Tax Rate*	*Cost of Debt (after-tax)*	*WACC*	*Firm Value (G)*
0%	1.84	12.87%	AAA	4.35%	40.00%	2.61%	12.87%	$25,020
10%	1.96	13.46%	AAA	4.35%	40.00%	2.61%	12.38%	$26,495
20%	2.12	14.20%	A+	4.70%	40.00%	2.82%	11.92%	$28,005
30%	2.31	15.15%	A-	5.00%	40.00%	3.00%	11.51%	$29,568
40%	2.58	16.42%	BB	6.50%	40.00%	3.90%	11.41%	$29,946
50%	2.94	18.19%	B	8.00%	40.00%	4.80%	11.50%	$29,606
60%	3.50	20.86%	CC	14.00%	39.96%	8.41%	13.39%	$23,641
70%	4.66	26.48%	CC	14.00%	34.25%	9.21%	14.39%	$21,365
80%	7.27	39.05%	C	16.00%	26.22%	11.80%	17.25%	$16,745
90%	14.54	74.09%	C	16.00%	23.31%	12.27%	18.45%	$15,355

The firm value is maximized (and the cost of capital is minimized) at a debt ratio of 40%, though the firm value is relatively flat between 30% and 50%. The default risk increases significantly at the optimal debt ratio, as evidenced by the synthetic bond rating of BB, and the total beta increases to 2.58.

In Practice: Optimal Debt Ratios for Private Firms

Although the trade off between the costs and benefits of borrowing remain the same for private and publicly traded firms, there are differences between the two kinds of firms that may result in private firms borrowing less money.

- Increasing debt increases default risk and expected bankruptcy cost much more substantially for small private firms than for larger publicly traded firms. This is partly because the owners of private firms may be exposed to unlimited liability, and partly because the perception of financial trouble on the part of customers and suppliers can be much more damaging to small, private firms.
- Increasing debt yields a much smaller advantage in terms of disciplining managers in the case of privately run firms, since the owners of the firm tend to be the top managers, as well.
- Increasing debt generally exposes small private firms to far more restrictive bond covenants and higher agency costs than it does large publicly traded firms.
- The loss of flexibility associated with using excess debt capacity is likely to weigh much more heavily on small, private firms than on large, publicly traded firms, due to the former's lack of access to public markets.

All the factors mentioned above would lead us to expect much lower debt ratios at small private firms.

8.5. ☞: **Going Public: Effect on Optimal Debt Ratio**

Assume that Bookscape is planning to make an initial public offering in six months. How would this information change your assessment of the optimal debt ratio?

a. It will increase the optimal debt ratio because publicly traded firms should be able to borrow more than private businesses
b. It will reduce the optimal debt ratio because only market risk counts for a publicly traded firm
c. It may increase or decrease the optimal debt ratio, depending on which effect dominates

Banks and Insurance Companies

There are several problems in applying the cost of capital approach to financial service firms, such as banks and insurance companies[20]. The first is that the interest coverage ratio spreads, which are critical in determining the bond ratings, have to be estimated separately for financial service firms; applying manufacturing company spreads will result in absurdly low ratings for even the safest banks, and very low optimal debt ratios. Furthermore, the relationship between interest coverage ratios and ratings tend to be much weaker for financial service firms than it is for manufacturing firms. The second is a measurement problem that arises partly from the difficulty in estimating the debt on a financial service company's balance sheet.

Given the mix of deposits, repurchase agreements, short term financing and other liabilities that may appear on a financial service firm's balance sheet, one solution is to focus only on long term debt, defined tightly, and to use interest coverage ratios defined using only long term interest expenses. The third problem is that financial service firms are regulated, and have to meet capital ratios that are defined in terms of book value. If, in the process of moving to an optimal market value debt ratio, these firms violate the book capital ratios, they could put themselves in jeopardy.

Illustration 8.7: Applying the Cost of Capital Approach to Deutsche Bank

We analyze the optimal capital structure for Deutsche Bank using data from 2004. To begin, we make the following assumptions:

- The earnings before long-term interest expenses and taxes amounted to 7,405 million Euros in 2003.
- Deutsche Bank was ranked AA- and paid 5.05% on its long-term debt in 2004. It had 82 billion in long term-debt outstanding at the end of the year.
- Deutsche Bank had 581.85 million shares outstanding, trading at 70.40 Euros per share, and the bottom-up beta of 0.98 that we estimated for the company in chapter 4 is the current beta. The tax rate for the firm is 38% and the riskless Euro rate is 4.05%.

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[20] Davis and Lee (1997) consider some of the issues related to estimating the optimal debt ratio for a bank.

- The interest coverage ratios used to estimate the bond ratings are adjusted to reflect the ratings of financial service firms.
- The operating income for Deutsche Bank is assumed to drop if its rating drops. Table 8.16 summarizes the interest coverage ratios and estimated operating income drops for different ratings classes.

Table 8.16: Interest Coverage Ratios, Ratings and Operating Income Declines

Long Term Interest Coverage Ratio	*Rating is*	*Spread is*	*Operating Income Decline*
< 0.05	D	16.00%	-50.00%
0.05 – 0.10	C	14.00%	-40.00%
0.10 – 0.20	CC	12.50%	-40.00%
0.20 - 0.30	CCC	10.50%	-40.00%
0.30 – 0.40	B-	6.25%	-25.00%
0.40 – 0.50	B	6.00%	-20.00%
0.50 – 0.60	B+	5.75%	-20.00%
0.60 – 0.75	BB	4.75%	-20.00%
0.75 – 0.90	BB+	4.25%	-20.00%
0.90 – 1.20	BBB	2.00%	-20.00%
1.20 – 1.50	A-	1.50%	-17.50%
1.50 – 2.00	A	1.40%	-15.00%
2.00 – 2.50	A+	1.25%	-10.00%
2.50 – 3.00	AA	0.90%	-5.00%
> 3.00	AAA	0.70%	0.00%

Thus, we assume that the operating income will drop 5% if Deutsche Bank's rating drops to AA and 20% if it drops to BBB. The drops in operating income were estimated by looking at the effects of ratings downgrades on banks[21].

Based upon these assumptions, the optimal long term debt ratio for Deutsche Bank is estimated to be 40%, lower than it's current long term debt ratio of 67%. Table 8.17 below summarizes the cost of capital and firm values at different debt ratios for the firm.

Table 8.17: Debt Ratios, Cost of Capital and Firm Value: Deutsche Bank

Debt Ratio	*Beta*	*Cost of Equity*	*Bond Rating*	*Interest rate on debt*	*Tax Rate*	*Cost of Debt (after-tax)*	*WACC*	*Firm Value (G)*
0%	0.44	6.15%	AAA	4.75%	38.00%	2.95%	6.15%	$111,034

[21] We were able to find a few down-graded banks upto BBB. Below BBB, we found no banks that remained independent, since the FDIC stepped in to protect depositors. We made the drop in operating income large enough to rule out ratings below BBB.

10%	0.47	6.29%	AAA	4.75%	38.00%	2.95%	5.96%	$115,498
20%	0.50	6.48%	AAA	4.75%	38.00%	2.95%	5.77%	$120,336
30%	0.55	6.71%	AAA	4.75%	38.00%	2.95%	5.58%	$125,597
40%	0.62	7.02%	AAA	4.75%	38.00%	2.95%	5.39%	$131,339
50%	0.71	7.45%	A+	5.30%	38.00%	3.29%	5.37%	$118,770
60%	0.84	8.10%	A	5.45%	38.00%	3.38%	5.27%	$114,958
70%	1.07	9.19%	A	5.45%	38.00%	3.38%	5.12%	$119,293
80%	1.61	11.83%	BB+	8.30%	32.43%	5.61%	6.85%	$77,750
90%	3.29	19.91%	BB	8.80%	27.19%	6.41%	7.76%	$66,966

The optimal debt ratio is the point at which the firm value is maximized. Note that the cost of capital is actually minimized at 70% debt but the firm value is highest at a 40% debt ratio. This is so because the operating income changes as the debt ratio changes. While the cost of capital continues to decline as the debt ratio increases beyond 40%, the decline in operating income more that offsets this drop.

In Practice: Building in Regulatory, Self Imposed and Lender Constraints

In most analyses of optimal capital structure, an analyst will be faced with a series of constraints, some of which come from regulatory requirements, some of which are self imposed and some of which are imposed by existing lenders to the firm. One very common constraint imposed by all three is a constraint that the book value debt ratio not exceed a specified number. Since the analysis we have done so far has focused on market value debt ratios, there is the risk that the book value constraint may be violated. There are two solutions:

1. The first is to do the entire analysis using book value of debt and equity, looking for the optimal debt ratio. Since the approach we have described is driven by cash flows, the optimal dollar debt that is computed should not be affected significantly by doing this.
2. The second and more general approach (since it can be used to analyze any kind of constraint) is to keep track of the book value debt ratio in the traditional analysis, and view the optimal capital structure as the one the minimizes the cost of capital subject to the book value debt ratio being lesser than the specified constraint.

8.6. ☞**: Bankruptcy Costs and Debt Ratios**

The optimal debt ratio obtained by minimizing the cost of capital is too high because it does not consider bankruptcy costs.

a. True

b. False

Explain.

Determinants of Optimal Debt Ratio

The preceding analysis highlights some of the determinants of the optimal debt ratio. We can then divide these determinants into firm-specific and macroeconomic factors.

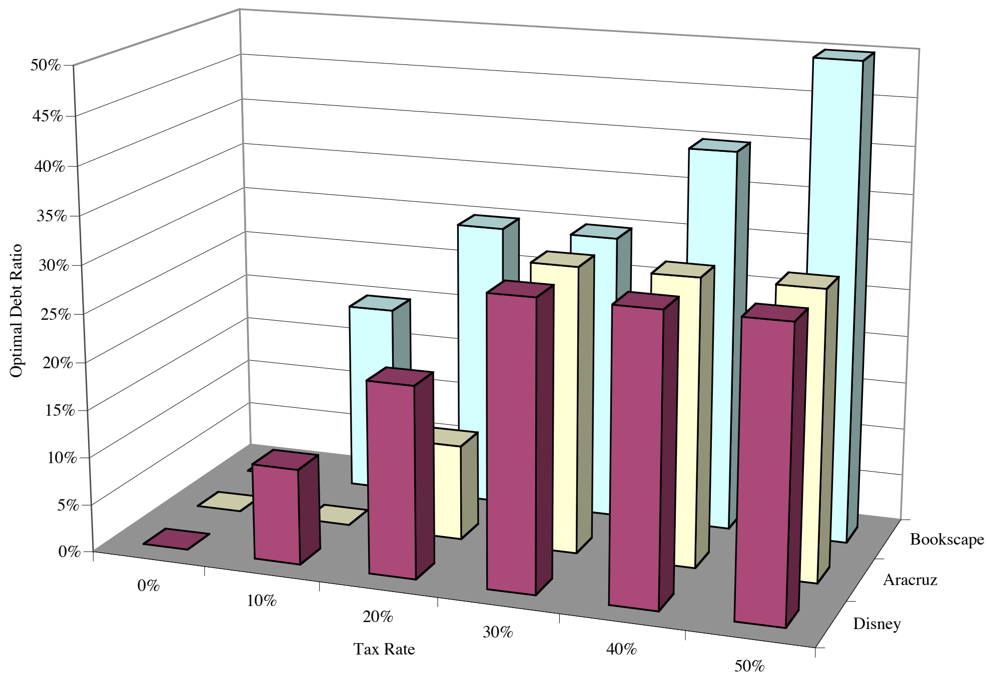
Firm-Specific Factors

Determinants specific to the firm include the firm's tax rate, pre-tax returns and variance in operating income.

(a) Firm's tax rate:

In general, the tax benefits from debt increase as the tax rate goes up. In relative terms, firms with higher tax rates have higher optimal debt ratios than do firms with lower tax rates, other things being equal. It also follows that a firm's optimal debt ratio will increase as its tax rate increases. We can illustrate this by computing the optimal debt ratio for Disney, Aracruz and Bookscape, holding all else constant and just changing the tax rate in Figure 8.4

Figure 8.4: Optimal Debt Ratio and Tax Rate



At a 0% tax rate, the optimal debt ratio is zero for all three firms. Without the benefits that accrue from taxes, the rationale for using debt disappears. As the tax rate increases, the optimal debt ratios increase for all three firms but at different rates. For Aracruz and Disney, the optimal debt ratio does not increase above 30% even if the tax rate increases because the operating income at both firms is not high enough to sustain much higher debt ratios; in other words, there is not enough earnings to claim additional tax benefits. For Bookscape, though, the optimal continues to increase and reaches 50% when the tax rate is 50%.

(b) Pre-Tax Returns on the Firm (in Cash Flow Terms):

The most significant determinant of the optimal debt ratio is a firm's earnings capacity. In fact, the operating income as a percentage of the market value of the firm (debt plus equity) is usually good indicator of the optimal debt ratio. When this number is high (low), the optimal debt ratio will also be high (low). A firm with higher pre-tax earnings can sustain much more debt as a proportion of the market value of the firm, since debt payments can be met much more easily from prevailing earnings. Disney, for example, has operating income of $2,805 million, which is 4.02 % of the market value of the firm of $69,769 million in the base case, and an optimal debt ratio of 30%. Doubling this to 8.04% will increase the optimal debt ratio to 50%.

(c) Variance in Operating Income

The variance in operating income enters the base case analysis in two ways. First, it plays a role in determining the current beta: firms with high (low) variance in operating income have high (low) betas. Second, the volatility in operating income can be one of the factors determining bond ratings at different levels of debt: ratings drop off much more dramatically for higher variance firms as debt levels are increased. It follows that firms with higher (lower) variance in operating income will have lower (higher) optimal debt ratios. The variance in operating income also plays a role in the constrained analysis, since higher variance firms are much more likely to register significant drops in operating income. Consequently, the decision to increase debt should be made much more cautiously for these firms.

Macro-economic Factors

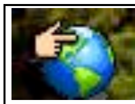
Should macroeconomic conditions affect optimal debt ratios? Obviously. In good economic times, firms will generate higher earnings and be able to service more debt. In recessions, earnings will decline and with it the capacity to service debt. That is why prudent firms borrow based upon normalized earnings rather than current earnings. Holding operating income constant, macroeconomic variables can still affect optimal debt ratios. In fact, both the level of riskfree rate and the magnitude of default spreads can affect optimal debt ratios.

(a) Level of Rates

As interest rates decline, the conventional wisdom is that debt should become cheaper and more attractive for firms. While this may seem intuitive, the effect is muted by the fact that lower interest rates also reduce the cost of equity. In fact, changing the riskfree rate has a surprisingly small effect on the optimal debt ratio, as long as interest rates move within a normal range.[22] When interest rates exceed normal levels, optimal debt ratios do decline partly because we keep operating income fixed. The higher interest payments at every debt ratio reduce bond ratings and affect the capacity of firms to borrow more.

(b) Default Spreads

The default spreads for different ratings classes tend to increase during recessions and decrease during recoveries. Keeping other things constant, as the spreads increase (decrease) optimal debt ratios decrease (increase), for the simple reason that higher spreads penalize firms which borrow more money and have lower ratings. In fact, the default spreads on corporate bonds between 1992 and 2000, leading to higher optimal debt ratios for all firms. In 2001 and 2002, as the economy slowed, default spreads widened again, leading to lower optimal debt ratios.


There is a dataset on the web that summarizes operating margins and returns on capital by industry group in the United States for the most recent quarter.

Adjusted Present Value Approach

In the adjusted present value (APV) approach, we begin with the value of the firm without debt. As we add debt to the firm, we consider the net effect on value by considering both the benefits and the costs of borrowing. The value of the levered firm can then be estimated at different levels of the debt, and the debt level that maximizes firm value is the optimal debt ratio.

Steps in the Adjusted Present Value approach

In the Adjusted Present Value approach, we assume that the primary benefit of borrowing is a tax benefit, and that the most significant cost of borrowing is the added

[22] The normal range for long term interest rates in the United States for the last 40 years has been between 4 and 8%. There was a short period between 1978 and 1982 when long term interest rates were much higher.

risk of bankruptcy. To estimate the value of the firm, with this assumption, we proceed in three steps. We begin by estimating the value of the firm with no leverage. We then consider the present value of the interest tax savings generated by borrowing a given amount of money. Finally, we evaluate the effect of borrowing the amount on the probability that the firm will go bankrupt, and the expected cost of bankruptcy.

Step 1: Estimate the value of the firm with no debt: The first step in this approach is the estimation of the value of the unlevered firm. This can be accomplished by valuing the firm as if it had no debt, i.e., by discounting the expected after-tax operating cash flows at the unlevered cost of equity. In the special case where cash flows grow at a constant rate in perpetuity,

$$\text{Value of Unlevered Firm} = FCFF_o\,(1+g)/(\rho_u - g)$$

where $FCFF_0$ is the current after-tax operating cash flow to the firm, ρ_u is the unlevered cost of equity, and g is the expected growth rate. The inputs needed for this valuation are the expected cashflows, growth rates and the unlevered cost of equity. To estimate the latter, we can draw on our earlier analysis and compute the unlevered beta of the firm –

$$\beta_{unlevered} = \beta_{current}/[1+(1-t)D/E]$$

where

$\beta_{unlevered}$ = Unlevered beta of the firm,

$\beta_{current}$ = Current equity beta of the firm,

t = Tax rate for the firm and

D/E = Current debt/equity ratio.

This unlevered beta can then be used to arrive at the unlevered cost of equity. Alternatively, we can take the current market value of the firm as a given and back out the value of the unlevered firm by subtracting out the tax benefits and adding back the expected bankruptcy cost from the existing debt.

Current Firm Value = Value of Unlevered firm + PV of tax benefits – Expected Bankruptcy cost

Value of Unlevered firm = Current Firm Value – PV of tax benefits + Expected Bankruptcy costs

Step 2: Estimate the present value of tax benefits from debt: The second step in this approach is the calculation of the expected tax benefit from a given level of debt. This tax benefit is a function of the tax rate of the firm and is discounted at the cost of debt to reflect the riskiness of this cash flow. If the tax savings are viewed as a perpetuity,

Value of Tax Benefits =[Tax Rate * Cost of Debt * Debt] / Cost of Debt

= Tax Rate * Debt

= t_c D

The tax rate used here is the firm's marginal tax rate, and it is assumed to stay constant over time. If we anticipate the tax rate changing over time, we can still compute the present value of tax benefits over time, but we cannot use the perpetual growth equation cited above.

Step 3: Estimate the expected bankruptcy costs as a result of the debt: The third step is to evaluate the effect of the given level of debt on the default risk of the firm and on expected bankruptcy costs. In theory, at least, this requires the estimation of the probability of default with the additional debt and the direct and indirect cost of bankruptcy. If π_a is the probability of default after the additional debt and BC is the present value of the bankruptcy cost, the present value of expected bankruptcy cost can be estimated–

> ***Bankruptcy Cost:*** This is the cost associated with going bankruptcy. It includes both direct costs (from going bankrupt) and indirect costs (arising from the perception that a firm may go bankrupt).

PV of Expected Bankruptcy cost = Probability of Bankruptcy * PV of Bankruptcy Cost

= π_a BC

This step of the adjusted present value approach poses the most significant estimation problem, since neither the probability of bankruptcy nor the bankruptcy cost can be estimated directly. There are two basic ways in which the probability of bankruptcy can be estimated indirectly. One is to estimate a bond rating, as we did in the cost of capital approach, at each level of debt and use the empirical estimates of default probabilities for each rating. For instance, table 8.18, extracted from a study by Altman and Kishore, summarizes the probability of default over ten years by bond rating class in 1998.[23]

Table 8.18: Default Rates by Bond Rating Classes

Bond Rating	*Default Rate*
D	100.00%
C	80.00%
CC	65.00%
CCC	46.61%
B-	32.50%
B	26.36%
B+	19.28%
BB	12.20%
BBB	2.30%
A-	1.41%
A	0.53%
A+	0.40%
AA	0.28%
AAA	0.01%

Source: Altman and Kishore (1998)

The other is to use a statistical approach, such as a probit to estimate the probability of default, based upon the firm's observable characteristics, at each level of debt.

The bankruptcy cost can be estimated, albeit with considerable error, from studies that have looked at the magnitude of this cost in actual bankruptcies. Studies that have looked at the direct cost of bankruptcy conclude that they are small[24], relative to firm value. The indirect costs of bankruptcy can be substantial, but the costs vary widely across firms. Shapiro and Titman speculate that the indirect costs could be as large as 25 to 30% of firm value but provide no direct evidence of the costs.

The net effect of adding debt can be calculated by aggregating the costs and the benefits at each level of debt.

$$\text{Value of Levered Firm} = FCFF_o\,(1+g)/(\rho_u - g) + t_c\,D - \pi_a\,BC$$

We compute the value of the levered firm at different levels of debt. The debt level that maximizes the value of the levered firm is the optimal debt ratio.

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[23] This study estimated default rates over ten years only for some of the ratings classes. We extrapolated the rest of the ratings.

In Practice: Using a Probit to Estimate the Probability of Bankruptcy

It is possible to estimate the probability of default using statistical techniques, when there is sufficient data avaialble. For instance, if we have a database that lists all firms that went bankrupt during a period of time, as well as firms that did not go bankrupt during the same period, together with descriptive characteristics on these firms, a probit analysis can be used to estimate the likelihood of bankruptcy as a function of these characteristics. The steps involved in a probit analysis are as follows:

1. Identify the event of interest: Probits work best when the event either occurs or it does not. For bankruptcy, the event might be the filing for bankruptcy protection under the law.
2. Over a specified time period, collect information on all the firms that were exposed to the event. In the bankruptcy case, this would imply collecting information on which firms that filed for bankruptcy over a certain period (say, 5 years).
3. Based upon your knowledge of the event, and other research on it, specify measurable and observable variables that are likely to be good predictors of that event. In the case of bankruptcy, these might include excessive debt ratios, declining income, poor project returns and small market capitalization.
4. Collect information on these variables for the firms that filed for bankruptcy, at the time of the filing. Collect the same information for all other firms that were in existence at the same time, and which have data available on them on these variables. (If this is too data intensive, a random sampling of the firms that were not exposed to the event can be used.) In the bankruptcy analysis, this would imply collecting information on debt ratios, income trends, project returns and market capitalization on the firms that filed for bankruptcy at the time of the filing, and all other firms across the period.
5. In a probit, the dependent variable is the occurrence of the specified event (1 if it occurs, 0 if it does not) and the independent variables are the variables specified in step 3. The output from the probit looks very much like the output from a multiple regression, with statistical significance attached to each of the independent variables.

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[24] In Warner's study of railroad bankruptcies, the direct cost of bankruptcy seems to be about 5%.

Once the probit has been done, the probability of a firm defaulting can be estimated by plugging in that firm's values for the independent variables into the probit. The predicted value that emerges from the probit is the probability of default.

Illustration 8.8: Using the Adjusted Present Value Approach to calculate Optimal Debt Ratio for Disney in 2004

This approach can be applied to estimating the optimal capital structure for Disney. The first step is to estimate the value of the unlevered firm. To do so, we start with the firm value of Disney in 2004 and net out the effect of the tax savings and bankruptcy costs arising from the existing debt.

Current Market Value of Disney = Value of Equity + Value of Debt = $55,101+$14,668 = $ 69,789

We first compute the present value of the tax savings from the existing debt, assuming that the interest payment on the debt constitutes a perpetuity, using a marginal tax rate for Disney of 37.30%.

PV of Tax Savings from Existing Debt = Existing Debt * Tax Rate

= $14,668* 0.373 = $ 5,479 million

Based upon Disney's current rating of BBB+, we estimate a probability of bankruptcy of 1.41% from Table 8.18. The bankruptcy cost is assumed to be 25% of the firm value, prior to the tax savings.[25] Allowing for a range of 10-40% for bankruptcy costs, we have put Disney's exposure to expected bankruptcy costs in the middle of the range. There are some businesses that Disney is in where the perception of distress can be damaging – theme parks, for instance – but the movie and broadcasting businesses are less likely to be affected since projects tend be shorter term and on a smaller scale.

PV of Expected Bankruptcy Cost = Probability of Default * Bankruptcy cost

= 1.41% * (0.25* 69,789) = $ 984 million

We then compute the value of Disney as an unlevered firm.

Value of Disney as an Unlevered Firm

= Current Market Value – PV of Tax Savings + Expected Bankruptcy Costs

= $ 69,789 + $ 5,479 - $ 984

= $ 65,294 million

The next step in the process is to estimate the tax savings in table 8.19 at different levels of debt. While we use the standard approach of assuming that the present value is calculated over a perpetuity, we reduce the tax rate used in the calculation, if interest expenses exceed the earnings before interest and taxes. The adjustment to the tax rate was described more fully earlier in the cost of capital approach.

Table 8.19: Tax Savings From Debt (t_cD): Disney

Debt Ratio	*$ Debt*	*Tax Rate*	*Tax Benefits*
0%	$0	37.30%	$0
10%	$6,979	37.30%	$2,603
20%	$13,958	37.30%	$5,206
30%	$20,937	37.30%	$7,809
40%	$27,916	31.20%	$8,708
50%	$34,894	18.72%	$6,531
60%	$41,873	15.60%	$6,531
70%	$48,852	13.37%	$6,531
80%	$55,831	11.70%	$6,531
90%	$62,810	10.40%	$6,531

The final step in the process is to estimate the expected bankruptcy cost, based upon the bond ratings, the probabilities of default, and the assumption that the bankruptcy cost is 25% of firm value. Table 8.20 summarizes these probabilities and the expected bankruptcy cost, computed based on the levered firm value

Expected Bankruptcy Cost at x% debt

= (Unlevered firm value + Tax benefits from debt at x% debt) * (Bankruptcy cost as % of firm value) * Probability of bankruptcy

Table 8.20: Expected Bankruptcy Cost, Disney

Debt Ratio	Bond Rating	Probability of Default	Expected Bankruptcy Cost
0%	AAA	0.01%	$2
10%	AAA	0.01%	$2
20%	A-	1.41%	$246

[25] This estimate is based upon the Warner study, which estimates bankruptcy costs for large companies to be 10% of the value, and upon the qualitative analysis of indirect bankruptcy costs in Shapiro and Cornell.

30%	BB	7.00%	$1,266
40%	CCC	50.00%	$9,158
50%	C	80.00%	$14,218
60%	C	80.00%	$14,218
70%	C	80.00%	$14,218
80%	C	80.00%	$14,218
90%	C	80.00%	$14,218

The value of the levered firm is estimated in Table 8.21 by aggregating the effects of the tax savings and the expected bankruptcy costs.

Table 8.21: Value of Disney with Leverage

Debt Ratio	$ Debt	Unlevered Firm Value	Tax Benefits	Expected Bankruptcy Cost	Value of Levered Firm
0%	$0	$65,294	$0	$2	$64,555
10%	$6,979	$65,294	$2,603	$2	$67,158
20%	$13,958	$65,294	$5,206	$246	$69,517
30%	$20,937	$65,294	$7,809	$1,266	$71,099
40%	$27,916	$65,294	$8,708	$9,158	$64,107
50%	$34,894	$65,294	$6,531	$14,218	$56,870
60%	$41,873	$65,294	$6,531	$14,218	$56,870
70%	$48,852	$65,294	$6,531	$14,218	$56,870
80%	$55,831	$65,294	$6,531	$14,218	$56,870
90%	$62,810	$65,294	$6,531	$14,218	$56,870

The firm value is maximized at between 20 and 30% debt, which is consistent with the results of the other approaches. These results are, however, very sensitive to both the estimate of bankruptcy cost as a percent of firm value and the probabilities of default.

apv.xls: This spreadsheet allows you to compute the value of a firm, with leverage, using the adjusted present value approach.

Benefits and Limitations of the Adjusted Present Value Approach

The advantage of the APV approach is that it separates the effects of debt into different components and allows the analyst to use different discount rates for each component. In this method, we do not assume that the debt ratio stays unchanged forever, which is an implicit assumption in the cost of capital approach. Instead, we have the flexibility to keep the dollar value of debt fixed and to calculate the benefits and costs of the fixed dollar debt.

These advantages have to be weighed against the difficulty of estimating probabilities of default and the cost of bankruptcy. In fact, many analyses that use the adjusted present value approach ignore the expected bankruptcy costs, leading them to the conclusion that firm value increases as firms borrow money. Not surprisingly, they conclude that the optimal debt ratio for a firm is 100% debt.

In general, with the same assumptions, the APV and the Cost of Capital conclusions give identical answers. However, the APV approach is more practical when firms are evaluating a dollar amount of debt, while the cost of capital approach is easier when firms are analyzing debt proportions.[26]

This spreadsheet allows you to compute the value of a firm, with leverage, using the adjusted present value approach.

Comparative Analysis

The most common approach to analyzing the debt ratio of a firm is to compare its leverage to that of similar firms. A simple way to perform this analysis is to compare a firm's debt ratio to the average debt ratio for the industry in which the firm operates. A more complete analysis would consider the differences between a firm and the rest of the industry, when determining debt ratios. We will consider both ways below.

Comparing to Industry Average

Firms sometimes choose their financing mixes by looking at the average debt ratio of other firms in the industry in which they operate. For instance, the table below compares the debt ratios[27] at Disney and Aracruz to other firms in their industries:

	Disney	*Entertainment*	*Aracruz*	*Paper and Pulp (Emerging Market)*

[26] See Inselbag and Kaufold (1997).
[27] For purposes of this analysis, we looked at debt without operating leases being capitalized because of the difficulty of doing this for all of the comparable firms.

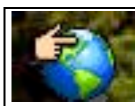
Market Debt Ratio	21.02%	19.56%	30.82%	27.71%
Book Debt Ratio	35.10%	28.86%	43.12%	49.00%

Source: Value Line

Based on this comparison, Disney is operating at a debt ratio slightly higher than those of other firms in the industry in both market and book value terms, while Aracruz has a market debt ratio slightly higher than the average firm but a book debt ratio slightly lower.

Comparable (Firm): This is a firm that is similar to the firm being analyzed in terms of underlying characteristics - risk, growth and cash flow patterns. The conventional definition of comparable firm is one which is the same business as the one being analyzed, and of similar size.

The underlying assumptions in this comparison are that firms within the same industry are comparable, and that, on average, these firms are operating at or close to their optimal. Both assumptions can be questioned, however. Firms within the same industry can have different product mixes, different amounts of operating risk, different tax rates, and different project returns. In fact, most do. For instance, Disney is considered part of the entertainment industry, but its mix of businesses is very different from that of Lion's Gate, which is primarily a movie company, or Liberty Media. Furthermore, Disney's size and risk characteristics are very different from that of Pixar, which is also considered part of the same industry group. There is also anecdotal evidence that since firms try to mimic the industry average, the average debt ratio across an industry might not be at or even close to its optimal.



dbtfund.xls: There is a dataset on the web that summarizes market value and book value debt ratios, by industry, in addition to other relevant characteristics.

Controlling for Differences between Firms

Firms within the same industry can exhibit wide differences on tax rates, capacity to generate operating income and cash flows, and variance in operating income. Consequently, it can be dangerous to compare a firm's debt ratio to the industry, and draw conclusions about the optimal financing mix. The simplest way to control for differences across firms, while using the maximum information available in the market, is to run a regression, regressing debt ratios against these variables, across the firms in a industry:

Debt Ratio = $\alpha_0 + \alpha_1$ Tax Rate $+ \alpha_2$ Pre-tax Returns + α_3 Variance in operating income

There are several advantages to the crosssectional approach. Once the regression has been run and the basic relationship established (i.e., the intercept and coefficients have been estimated), the predicted debt ratio for any firm can be computed quickly using the measures of the independent variables for this firm. If a task involves calculating the optimal debt ratio for a large number of firms in a short time period, this may be the only practical way of approaching the problem, since the other chapters described in this chapter are time intensive.[28]

There are also limitations to this approach. The coefficients tend to shift over time. Besides some standard statistical problems and errors in measuring the variables, these regressions also tend to explain only a portion of the differences in debt ratios between firms.[29] However, the regressions provide significantly more information than does a naive comparison of a firm's debt ratio to the industry average.

Illustration 8.9: Estimating Disney's debt ratio using the cross sectional approach

This approach can be applied to look at differences within a industry or across the entire market. We can illustrate looking at the Disney against firms in the entertainment sector first and then against the entire market.

To look at the determinants of debt ratios within the entertainment industry, we regressed debt ratios of firms in the industry against two variables – the growth in sales over the previous five years and the EBITDA as a percent of the market value of the firm. Based on our earlier discussion of the determinants of capital structure, we would expect firms with higher operating cashflows (EBITDA) as a percent of firm value to borrow more money. We would also expect higher growth firms to weigh financial flexibility

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[28] There are some who have hypothesized that under-leveraged firms are much more likely to be taken over than firms that are over-leveraged or correctly leveraged. If we want to find the 100 firms on the New York Stock Exchange that are most under-leveraged, the cross-sectional regression and the predicted debt ratios that come out of this regression can be used to find this group.

[29] The independent variables are correlated with each other. This multi-collinearity makes the coefficients unreliable and they often have signs that go counter to intuition.

more in their debt decision and borrow less. The results of the regression are reported below, with t statistics in brackets below the coefficients:

Debt to Capital = 0.2156 - 0.1826 (Growth in Sales) + 0.6797 (EBITDA/ Firm Value)

(4.91) (1.91) (2.05)

The dependent variable is the market debt to capital ratio, and the regression has an R-squared of 14%. While there is statistical significance, it is worth noting that the predicted debt ratios will have substantial standard errors associated with them. Even so, if we use the current values for these variables for Dinsey in this regression, we get a predicted debt ratio:

DFR_{Disney}= 0.2156 - 0.1826 (.0668) + 0.6797 (.0767) = 0.2555 or 25.55%

At their existing debt ratio of 21%, Disney is slightly under levered. Thus, relative to the industry in which it operates and its specific characteristics, Disney could potentially borrow more.

One of the limitations of this analysis is that there are only a few firms within each industry. This analysis can be extended to all firms in the market. While firms in different businesses differ in terms of risk and cash flows, and these differences can translate into differences in debt ratios, we can control for the differences in the regression. To illustrate, we regressed debt ratios of all listed firms in the United States against four variables –

- The effective tax rate of the firm, as a proxy for the tax advantages associated with debt.
- Closely held shares as a percent of shares outstanding (CLSH) as a measure of how much separation there is between managers and stockholders (and hence as a proxy for debt as a disciplinary mechanism).
- EBITDA as a percent of enterprise value (E/V) as a measure of the cash flow generating capacity of a firm
- Capital expenditures as a percent of total assets (CPXFR) as a measure of how much firms value flexibility

The results of the regression are presented below[30]:

$$DFR = 0.0488 + 0.810 \text{ Tax Rate} - 0.304 \text{ CLSH} + 0.841 \text{ E/V} - 2.987 \text{ CPXFR}$$
$$(1.41^{a}) \quad (8.70^{a}) \quad (3.65^{b}) \quad (7.92^{b}) \quad (13.03^{a})$$

where DFR is debt as a percentage of the market value of the firm (debt + equity). The R-Squared for this regression is 53.3%. If we plug in the values for Disney into this regression, we get a predicted debt ratio:

$$DFR_{Disney} = 0.0488 + 0.810\,(0.3476) - 0.304\,(0.022) + 0.841\,(.0767) - 2.987\,(.0209)$$
$$= 0.3257 \text{ or } 32.57\%$$

Based upon the debt ratios of other firms in the market and Disney's financial characteristics, we would expect Disney to have a debt ratio of 32.57%. Since its actual debt ratio is 21.02%, Disney is under levered.

8.7. ☞**: Optimal Debt Ratios based upon Comparable Firms**

The predicted debt ratio from the regression shown above will generally yield

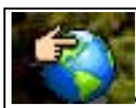
(a) a debt ratio similar to the optimal debt ratio from the cost of capital approach

(b) a debt ratio higher than the optimal debt ratio from the cost of capital approach

(c) a debt ratio lower than the optimal debt ratio from the cost of capital approach

(d) any of the above, depending upon ...

Explain.


dbtreg.xls: There is a dataset on the web that summarizes the latest debt ratio regression across the entire market.

Selecting the Optimal Debt Ratio

Using the different approaches for estimating optimal debt ratios, we do come up with different estimates of the right financing mix for Disney and Aracruz. Table 8.22 summarizes them:

30 The numbers in brackets below the coefficients represent t statistics. The * indicates statistical significance.

Table 8.22: Summary of Predicted Debt Ratios

	Disney	*Aracruz*
Actual Debt Ratio	21.02%	30.82%
Optimal		
I. Operating Income	30.00%	-
II. Cost of Capital		
With no constraints	30.00%	30.00%
With BBB constraint	30.00%	30.00%
III. APV	30.00%	30.00%
V. Comparable		
To Industry	25.55%	28.56%
To Market	32.57%	-

While there are differences in the estimates across the different approaches, a few consistent conclusions emerge: Disney, at its existing debt ratio, is slightly underlevered, though the increase in value from moving to the optimal is small. Aracruz is slightly over levered, based upon normalized operating income.

Bookscape also has excess debt capacity, if we estimate the optimal debt ratio using the cost of capital approach. However, bankruptcy may carry a larger cost to the private owner of Bookscape than it would to the diversified investors of the Disney or Aracruz. We would therefore be cautious about using this excess debt capacity.

Conclusion

This chapter has provided background on four tools that can be used to analyze capital structure.

- The first approach is based upon operating income. Using historical data or forecasts, we develop a distribution of operating income across both good and bad scenarios. We then use a pre-defined acceptably probability of default to specify the maximum borrowing capacity.
- The second approach is the cost of capital – the weighted average of the costs of equity, debt, and preferred stock, where the weights are market value weights and the costs of financing are current costs. The objective is to minimize the cost of capital,

which also maximizes the value of the firm. A general framework is developed to use this model in real-world applications and applied to find the optimal financing mix for Disney. We find that Disney, which had almost about $ 14 billion in debt in 2004, would minimize its cost of capital at a debt level of 30%, leading to an increase in market value of the firm of about $ 3 billion. Even allowing for a much diminished operating income, we find that Disney has excess debt capacity.

- The third approach estimates the value of the firm at different levels of debt by adding the present value of the tax benefits from debt to the unlevered firm's value, and then subtracting out the present value of expected bankruptcy costs. The optimal debt ratio is the one that maximizes firm value.
- The final approach is to compare a firm's debt ratio to 'similar' firms. While comparisons of firm debt ratios to an industry average are commonly made, they are generally not very useful in the presence of large differences among firms within the same industry. A cross-sectional regression of debt ratios against underlying financial variables brings in more information from the general population of firms and can be used to predict debt ratios for a large number of firms.

The objective in all of these analyses is to come up with a mix of debt and equity that will maximize the value of the firm.

Live Case Study

The Optimal Financing Mix

Objective: To estimate the optimal mix of debt and equity for your firm, and to evaluate the effect on firm value of moving to that mix.

Key Questions:

- Based upon the cost of capital approach, what is the optimal debt ratio for your firm?
- Bringing in reasonable constraints into the decision process, what would your recommended debt ratio be for this firm?
- Does your firm have too much or too little debt
  - relative to the industry in which they operate?
  - relative to the market?

Framework for Analysis

1. *Cost of Capital Approach*
    - What is the current cost of capital for the firm?
    - What happens to the cost of capital as the debt ratio is changed?
    - At what debt ratio is the cost of capital minimized and firm value maximized? (If they are different, explain)
    - What will happen to the firm value if the firm moves to its optimal?
    - What will happen to the stock price if the firm moves to the optimal, and stockholders are rational?
2. *Building Constraints into the Process*
    - What rating does the company have at the optimal debt ratio? If you were to impose a rating constraint, what would it be? Why? What is the optimal debt ratio with this rating constraint?
    - How volatile is the operating income? What is the "normalized" operating income of this firm and what is the optimal debt ratio of the firm at this level of income?
3. *Relative Analysis*

- Relative to the industry to which this firm belongs, does it have too much or too little in debt? (Do a regression, if necessary)
- Relative to the rest of the firms in the market, does it have too much or too little in debt? (Use the market regression, if necessary)

Getting Information about optimal capital structure

To get the inputs needed to estimate the optimal capital structure, examine the 10-K report or the annual report. The ratings and interest coverage ratios can be obtained from the ratings agencies (S&P, Moody's) and default spreads can be estimated by finding traded bonds in each ratings class.

You can download information on other firms in the industry individually or look at databases such as Value Line.

Online sources of information:

http://www.stern.nyu.edu/~adamodar/cfin2E/project/data.htm

Problems

1. Rubberman Corporation, a manufacturer of consumer plastic products, is evaluating its capital structure. The balance sheet of the company is as follows (in millions):

Assets		Liabilities	
Fixed Assets	4000	Debt	2500
Current Assets	1000	Equity	2500

In addition, you are provided the following information:

(a) The debt is in the form of long term bonds, with a coupon rate of 10%. The bonds are currently rated AA and are selling at a yield of 12% (the market value of the bonds is 80% of the face value).

(b) The firm currently has 50 million shares outstanding, and the current market price is $80 per share. The firm pays a dividend of $4 per share and has a price/earnings ratio of 10.

(c) The stock currently has a beta of 1.2. The six-month Treasury bill rate is 8%.

(d) The tax rate for this firm is 40%.

I. What is the debt/equity ratio for this firm in book value terms? in market value terms?

II. What is the debt/(debt+equity) ratio for this firm in book value terms? in market value terms?

III. What is the firm's after-tax cost of debt?

IV. What is the firm's cost of equity?

V. What is the firm's current cost of capital?

2. Now assume that Rubberman Corporation is considering a project that requires an initial investment of $100 million and has the following projected income statement:

EBIT	$20 million
- Interest	$ 4 million
EBT	$16 million
Taxes	$ 6.40 million
Net Income	$ 9.60 million

(Depreciation for the project is expected to be $5 million a year forever.)

This project is going to be financed at the same debt/equity ratio as the overall firm and is expected to last forever. Assume that there are no principal repayments on the debt (it too is perpetual).

I. Evaluate this project from the equity investors' standpoint. Does it make sense?

II. Evaluate this project from the firm's standpoint. Does it make sense?

III. In general, when would you use the cost of equity as your discount rate/benchmark?

IV. In general, when would you use the cost of capital as your benchmark?

V. Assume, for economies of scale, that this project is going to be financed entirely with debt. What would you use as your cost of capital for evaluating this project?

3. Rubberman is considering a major change in its capital structure. It has three options:

Option 1: Issue $1 billion in new stock and repurchase half of its outstanding debt. This will make it a AAA rated firm (AAA rated debt is yielding 11% in the market place).

Option 2: Issue $1 billion in new debt and buy back stock. This will drop its rating to A-. (A- rated debt is yielding 13% in the market place).

Option 3: Issue $3 billion in new debt and buy back stock. This will drop its rating to CCC (CCC rated debt is yielding 18% in the market place).

I. What is the cost of equity under each option?

II. What is the after-tax cost of debt under each option?

III. What is the cost of capital under each option?

IV. What would happen to (a) the value of the firm; (b) the value of debt and equity; and (c) the stock price under each option , if you assume rational stockholders?

V. From a cost of capital standpoint, which of the three options would you pick, or would you stay at your current capital structure?

VI. What role (if any) would the variability in XYZ's income play in your decision?

VII. How would your analysis change (if at all) if the money under the three options listed above were used to take new investments (instead of repurchasing debt or equity)?

VIII. What other considerations (besides minimizing the cost of capital) would you bring to bear on your decision?

IX. Intuitively, why doesn’t the higher rating in option 1 translate into a lower cost of capital?

4. Rubberman Corporation is interested in how it compares with its competitors in the same industry.

	XYZ Corporation	Other Competitors
Debt/Equity Ratio	*50%*	*25%*
Variance in EBITDA	20%	40%
EBITDA/MV of Firm	25%	15%
Tax Rate	40%	30%
R&D/ Sales	2%	5%

a. Taking each of these variables, explain at an intuitive level whether you would expect XYZ Corporation to have more more or less debt than its competitors and why.

b. You have also run a regression of debt/equity ratios against these variables for all the firms on the New York Stock Exchange and have come up with the following regression equation:

D/E = .10 - .5 (Variance in EBITDA) + 2.0 (EBITDA/MV) + .4 (Tax rate) + 2.5 (R&D/Sales)

(All inputs to the regression were in decimals, i.e. 20% was inputted as .20 ....)

Given this cross-sectional relationship, what would you expect XYZ's debt/equity ratio to be?

5. As CEO of a major corporation, you have to make a decision on how much you can afford to borrow. You currently have 10 million shares outstanding, and the market price per share is $50. You also currently have about $200 million in debt outstanding (market value). You are rated as a BBB corporation now.

(a) Your stock has a beta of 1.5 and the six-month T.Bill rate is 8%.

(b) Your marginal tax rate is 46%.

(c) You estimate that your rating will change to a B if you borrow $100 million. The BBB rate now is 11%. The B rate is 12.5%.

I. Given the marginal costs and benefits of borrowing the $100 million, should you go ahead with it ?

II. What is your best estimate of the weighted average cost of capital with and without the \$100 million in borrowing ?

III. If you borrow the \$100 million, what will the price per share be after the borrowing

IV. Assume that you have a project that requires an investment of \$100 million. It has expected before-tax revenues of \$50 million, and costs of \$30 million a year in perpetuity. Is this a desirable project by your criteria? Why or Why not?

V. Does it make a difference in your decision if you were told that the cash flows from the project in (IV) are certain?

6. You have been hired as a management consultant by AD Corporation to evaluate whether it has an appropriate amount of debt (the company is worried about a leveraged buyout). You have collected the following information on AD's current position:

(a) There are 100,000 shares outstanding, at \$20/share. The stock has a beta of 1.15.

(b) The company has \$500,000 in long-term debt outstanding and is currently rated 'BBB'. The current market interest rate is 10% on BBB bonds and 6% on T.Bills.

(c) The company's marginal tax rate is 40%.

You proceed to collect the data on what increasing debt will do to the company's ratings:

Additional debt*	New Rating	Interest Rate
\$500,000	BB	10.5
\$1,000,000	B	11.5
\$1,500,000	B-	13.5
\$2,000,000	C	15

* In addition to the existing debt of \$500,000

I. How much additional debt should the company take on?

II. What will the price per share be after the company takes on new debt?

III. What is the weighted average cost of capital before and after the additional debt?

IV. Assume that you are considering a project that has the following earnings in perpetuity and is of comparable risk to existing projects.

Revenues/year	\$1,000,000	
Cost of goods sold	\$ 400,000	(Includes depreciation of \$100,000)
EBIT	\$ 600,000	

Debt payments	$ 100,000	(All Interest payments)
Taxable Income	$ 500,000	
Tax	$ 200,000	
After-tax profit	$ 300,000	

If this project requires an investment of $ 3,000,000, what is its NPV?

7. UB Inc. is examining its capital structure, with the intent of arriving at an optimal debt ratio. It currently has no debt and has a beta of 1.5. The riskless interest rate is 9%. Your research indicates that the debt rating will be as follows at different debt levels:

D/(D+E)	Rating	Interest rate
0%	AAA	10%
10%	AA	10.5%
20%	A	11%
30%	BBB	12%
40%	BB	13%
50%	B	14%
60%	CCC	16%
70%	CC	18%
80%	C	20%
90%	D	25%

The firm currently has 1 million shares outstanding at $ 20 per share (tax rate = 40%).

a. What is the firm's optimal debt ratio?

b. Assuming that the firm restructures by repurchasing stock with debt, what will the value of the stock be after the restructuring?

8. GenCorp, an automorive parts manufacturer, currently has $25 million in outstanding debt and has 10 million shares outstanding. The book value per share is $10, while the market value is $ 25. The company is currently rated A, its bonds have a yield to maturity of 10%, and the current beta of the stock is 1.06. The six-month T.Bill rate is 8% now, and the company's tax is 40%.

a. What is the company's current weighted average cost of capital?

b. The company is considering a repurchase of 4 million shares at $25 per share with new debt. It is estimated that this will push the company's rating down to a B (with a yield to maturity of 13%). What will the company's weighted average cost of capital be after the stock repurchase?

9. You have been called in as a consultant for Herbert's Inc., a sporting good retail firm, which is examining its debt policy. The firm currently has a balance sheet as follows:

Liability		*Assets*	
LT Bonds	$100	Fixed Assets	300
Equity	$300	Current Assets	100
Total	$400	Total	400

The firm's income statement is as follows:

Revenues	250
COGS	175
Depreciation	25
EBIT	50
LT Interest	10
EBT	40
Taxes	16
Net Income	24

The firm currently has 100 shares outstanding, selling at a market price of $5 per share and the bonds are selling at par. The firm's current beta is 1.12, and the six-month T.Bill rate is 7%.

a. What is the firm's current cost of equity?

b. What is the firm's current cost of debt?

c. What is the firm's current weighted average cost of capital?

Assume that management of Herbert's Inc. is considering doing a debt-equity swap (i.e. borrowing enough money to buy back 70 shares of stock at $5 per share). It is believed that this swap will lower the firm's rating to C and raise the interest rate on the company's debt to 15%.

d. What is the firm's new cost of equity?

e. What is the effective tax rate (for calculating the after-tax cost of debt) after the swap?

f. What is the firm's new cost of capital?

11. Terck Inc., a leading pharmaceutical company, currently has a balance sheet that is as follows:

Liability		Assets	
LT Bonds	$1000	Fixed Assets	1700
Equity	$1000	Current Assets	300
Total	$1000	Total	1000

The firm's income statement looks as follows:

Revenues	1000
COGS	400
Depreciation	100
EBIT	500
LT Interest	100
EBT	400
Taxes	200
Net Income	200

The firm's bonds are all 20-year bonds with a coupon rate of 10% which are selling at 90% of face value (the yield to maturity on these bonds is 11%). The stocks are selling at a PE ratio of 9 and have a beta of 1.25. The six-month T.Bill rate is 6%.

a. What is the firm's current cost of equity?

b. What is the firm's current after-tax cost of debt?

c. What is the firm's current weighted average cost of capital?

Assume that management of Terck Inc., which is very conservative, is considering doing an equity-for-debt swap (i.e. issuing $200 more of equity to retire $200 of debt). This action is expected to lower the firm's interest rate by 1%.

d. What is the firm's new cost of equity?

e. What is the new WACC?

f. What will the value of the firm be after the swap?

11. You have been asked to analyze the capital structure of DASA Inc, an environmental waste disposal firm, and make recommendations on a future course of action. DASA Inc. has 40 million shares outstanding, selling at $20 per share, and a debt-equity ratio (in market value terms) of 0.25. The beta of the stock is 1.15, and the firm currently has a AA rating, with a corresponding market interest rate of 10%. The firm's income statement is as follows:

EBIT	\$150 million
Interest Exp.	\$ 20 million
Taxable Inc.	\$130 million
Taxes	\$ 52 million
Net Income	\$ 78 million

The current T.Bill rate is 8%.

a. What is the firm's current weighted average cost of capital?
b. The firm is proposing borrowing an additional \$200 million in debt and repurchasing stock. If it does so, its rating will decline to A, with a market interest rate of 11%. What will the weighted average cost of capital be if they make this move?
c. What will the new stock price be if the firm borrows \$200 million and repurchases stock (assuming rational investors)?
d. Now assume that the firm has another option to raise its debt/equity ratio (instead of borrowing money and repurchasing stock). It has considerable capital expenditures planned for the next year (\$150 million). The company also currently pays \$1 in dividends per share. If the company finances all its capital expenditures with debt and doubles its <u>dividend yield</u> from the current level for the next year, what would you expect the debt/equity ratio to be at the end of the next year.

12. You have been asked by JJ Corporation, a California-based firm that manufacturers and services digital satellite television systems, to evaluate its capital structure. They currently have 70 million shares outstanding trading at \$10 per share. In addition, it has 500,000 convertible bonds, with a coupon rate of 8%, trading at \$ 1000 per bond. JJ Corporation is rated BBB and the interest rate on BBB straight bonds is currently 10%. The beta for the company is 1.2, and the current risk-free rate is 6%. The tax rate is 40%.
a. What is the firm's current debt/equity ratio?
b. What is the firm's current weighted average cost of capital?
JJ Corporation is proposing to borrow \$250 million and use it for the following purposes:

Buy back $100 million worth of stock

Pay $100 million in dividends

Invest $ 50 million in a project with a NPV of $25 million.

The effect of this additional borrowing will be a drop in the bond rating to B, which currently carries an interest rate of 11%.

c. What will the firm's cost of equity be after this additional borrowing?

d. What will the firm's weighted average cost of capital be after this additional borrowing?

e. What will the value of the firm be after this additional borrowing?

13. Baldor Electric, a company which gets 85% of its revenues from industrial electric motors, had 27.5 million shares at $ 25 per share, and $ 25 million in debt outstanding at the end of 1995. The firm has a beta of 0.70, had earnings before interest and taxes of $63.3 million and a book value of equity of $200 million. The following table summarizes the ratings and interest rates for Baldor Electric at different levels of debt.

Debt Ratio	Bond Rating	Interest Rate on Debt
0%	AA	6.70%
10%	A+	7.00%
20%	A-	7.50%
30%	BBB	8.00%
40%	BB	8.50%
50%	B+	9.00%
60%	B	10.00%
70%	B-	11.00%
80%	CCC	12.00%
90%	C	15.00%

The tax rate is 35%.

a. Estimate the cost of equity at each level of debt.

b. Estimate the return on equity at each level of debt.

c. Estimate the optimal debt ratio based upon the differential return.

d. Will the value of the firm be maximized at this level of debt. Why or why not?

14. Pfizer, one of the largest pharmaceutical companies in the United States, is considering what its debt capacity is. In March 1995, Pfizer had an outstanding market value of equity of $ 24.27 billion, debt of $ 2.8 billion and a AAA rating. Its beta was 1.47, and it faced a marginal corporate tax rate of 40%. The treasury bond rate at the time of the analysis was 6.50%, and AAA bonds trade at a spread of 0.30% over the treasury rate.

a. Estimate the current cost of capital for Pfizer.

b. It is estimated that Pfizer will have a BBB rating if it moves to a 30% debt ratio, and that BBB bonds have a spread of 2% over the treasury rate. Estimate the cost of capital if Pfizer moves to its optimal.
c. Assuming a constant growth rate of 6% in the firm value, how much will firm value change if Pfizer moves its optimal? What will the effect be on the stock price?
d. Pfizer has considerable research and development expenses. Will this fact affect whether Pfizer takes on the additional debt?

15. Upjohn, another major pharmaceutical company, is also considering whether it should borrow more. It has $ 664 million in book value of debt outstanding, and 173 million shares outstanding at $ 30.75 per share. The company has a beta of 1.17, and faces a tax rate of 36%. The treasury bond rate is 6.50%.
a. If the interest expense on the debt is $ 55 million, the debt has an average maturity of 10 years, and the company is currently rated AA- (with a market interest rate of 7.50%), estimate the market value of the debt.
b. Estimate the current cost of capital.
c. It is estimated that if Upjohn moves to its optimal debt ratio, and no growth in firm value is assumed, the value per share will increase by $ 1.25. Estimate the cost of capital at the optimal debt ratio.

16. Nucor, an innovative steel company, has had a history of technical innovation and financial conservatism. In 1995, Nucor had only $ 210 million in debt outstanding (book as well as market value), and $ 4.2 billion in market value of equity (with a book value of $ 1.25 billion). In the same year, Nucor had earnings before interest and taxes of $ 372 million, and faced a corporate tax rate of 36%. The beta of the stock is 0.75, and the company is AAA rated (with a market interest rate of 6.80%).
a. Estimate the return differential between return on equity and cost of equity at the current level of debt.
b. Estimate the return differential at a debt ratio of 30%, assuming that the bond rating will drop to A-, leading to market interest rate of 8.00%.

17. Bethlehem Steel, one of the oldest and largest steel companies in the United States, is considering the question of whether it has any excess debt capacity. The firm has \$ 527 million in market value of debt outstanding, and \$ 1.76 billion in market value of equity. The firm has earnings before interest and taxes of \$ 131 million, and faces a corporate tax rate of 36%. The company's bonds are rated BBB, and the cost of debt is 8%. At this rating, the firm has a probability of default of 2.30%, and the cost of bankruptcy is expected to be 30% of firm value.

a. Estimate the unlevered value of the firm.

b. Estimate the levered value of the firm, using the adjusted present value approach, at a debt ratio of 50%. At that debt ratio, the firm's bond rating will be CCC, and the probability of default will increase to 46.61%.

18. Kansas City Southern, a railroad company, had debt outstanding of \$ 985 million and 40 million shares trading at \$ 46.25 per share in March 1995. It earned \$ 203 million in earnings before interest and taxes, and faced a marginal tax rate of 36.56%. The firm was interested in estimating its optimal leverage using the adjusted present value approach. The following table summarizes the estimated bond ratings, and probabilities of default at each level of debt from 0% to 90%.

Debt Ratio	Bond Rating	Probability of Default
0%	AAA	0.28%
10%	AAA	0.28%
20%	A-	1.41%
30%	BB	12.20%
40%	B-	32.50%
50%	CCC	46.61%
60%	CC	65.00%
70%	C	80.00%
80%	C	80.00%
90%	D	100.00%

The direct and indirect bankruptcy cost is estimated to be 25% of the firm value. Estimate the optimal debt ratio of the firm, based upon levered firm value.

19. In 1995, an analysis of the capital structure of Reebok provided the following results on the weighted average cost of capital and firm value.

	Actual	Optimal	Change
Debt Ratio	4.42%	60.00%	55.58%
Beta for the Stock	1.95	3.69	1.74
Cost of Equity	18.61%	28.16%	9.56%
Bond Rating	A-	B+	
After-tax Cost of Debt	5.92%	6.87%	0.95%
WACC	18.04%	15.38%	-2.66%
Firm Value (with no growth)	$ 3,343 mil	$ 3,921 mil	$ 578 mil
Stock Price	$ 39.50	$ 46.64	$ 7.14

This analysis was based upon the 1995 earnings before interest and taxes of $ 420 million, and a tax rate of 36.90%.

a. Why is the optimal debt ratio for Reebok so high?

b. What might be some of your concerns in moving to this optimal?

20. Timberland Inc., a manufacturer and retailer of footwear and sportswear, is considering is highly levered status. In 1995, the firm had $ 237 million in market value of debt outstanding, and 11 million shares outstanding at $ 19.88 per share. The firm had earnings before interest and taxes of $ 44 million, a book value of capital of $ 250 million and a tax rate of 37%. The treasury bond rate is 7.88%, and the stock has a beta of 1.26. The following table summarizes the estimated bond ratings and interest rates at different levels of debt for Timberland –

Debt Ratio	Bond Rating	Interest Rate on Debt
0%	AAA	8.18%
10%	AAA	8.18%
20%	A+	8.88%
30%	A	9.13%
40%	A-	9.38%
50%	BB	10.38%
60%	BB	10.38%

70%	B	11.88%
80%	B-	12.88%
90%	CCC	13.88%

a. Estimate the optimal debt ratio, using the cost of capital approach.

b. Estimate the optimal debt ratio, using the return differential approach.

c. Will the two approaches always give you identical results? Why or why not?

21. You are trying the evaluate whether United Airlines has any excess debt capacity. In 1995, UAL had 12.2 million shares outstanding at $ 210 per share, and debt outstanding of approximately $ 3 billion (book as well as market value). The debt had a rating of B, and carried a market interest rate of 10.12%. In addition, the firm had leases outstanding, with annual lease payments anticipated to by $ 150 million. The beta of the stock is 1.26, and the firm faces a tax rate of 35%. The treasury bond rate is 6.12%.

a. Estimate the current debt ratio for UAL.

b. Estimate the current cost of capital.

c. Based upon 1995 operating income, the optimal debt ratio is computed to be 30%, at which point the rating will be BBB, and the market interest rate is 8.12%.

d. Would the fact that 1995 operating income for airlines was depressed alter your analysis in any way? Explain why.

22. Intel has earnings before interest and taxes of $ 3.4 billion, and faces a marginal tax rate of 36.50%. It currently has $ 1.5 billion in debt outstanding, and a market value of equity of $ 51 billion. The beta for the stock is 1.35, and the pre-tax cost of debt is 6.80%. The treasury bond rate is 6%. Assume that the firm is considering a massive increase in leverage to a 70% debt ratio, at which level the bond rating will be C (with a pre-tax interest rate of 16%).

a. Estimate the current cost of capital.

b. Assuming that all debt gets refinanced at the new market interest rate, what would your interest expenses be at 70% debt? Would you be able to get the entire tax benefit? Why or why not?

c. Estimate the beta of the stock at 70% debt, using the conventional levered beta calculation. Reestimate the beta, on the assumption that C rated debt has a beta of 0.60. Which one would you use in your cost of capital calculation?

d. Estimate the cost of capital at 70% debt.

e. What will happen to firm value if Intel moves to a 70% debt ratio?

f. What general lessons on capital structure would you draw for other growth firms?

23. NYNEX, the phone utility for the New York Area, has approached you for advice on its capital structure. In 1995, NYNEX had debt outstanding of $ 12.14 billion and equity outstanding of $ 20.55 billion. The firm had earnings before interest and taxes of $ 1.7 billion, and faced a corporate tax rate of 36%. The beta for the stock is 0.84, and the bonds are rated A- (with a market interest rate of 7.5%). The probability of default for A-rated bonds is 1.41%, and the bankruptcy cost is estimated to be 30% of firm value.

a. Estimate the unlevered value of the firm.

b. Value the firm, if it increases its leverage to 50%. At that debt ratio, its bond rating would be BBB, and the probability of default would be 2.30%.

c. Assume now that NYNEX is considering a move into entertainment, which is likely to be both more profitable and riskier than the phone business. What changes would you expect in the optimal leverage?

24. A small, private firm has approached you for advice on its capital structure decision. It is in the specialty retailing business, and it had earnings before interest and taxes last year of $ 500,000.

- The book value of equity is $ 1.5 million, but the estimated market value is $ 6 million.
- The firm has $ 1 million in debt outstanding, and paid an interest expense of $ 80,000 on the debt last year. (Based upon the interest coverage ratio, the firm would be rated AA, and would be facing an interest rate of 8.25%.)
- The equity is not traded, but the average beta for comparable traded firms is 1.05, and their average debt/equity ratio is 25%.

a. Estimate the current cost of capital for this firm.

b. Assume now that this firm doubles it debt from \$ 1 million to \$ 2 million, and that the interest rate at which it can borrow increases to 9%. Estimate the new cost of capital, and the effect on firm value.

c. You also have a regression that you have run of debt ratios of publicly traded firms against firm characteristics –

DBTFR = 0.15 + 1.05 (EBIT/FIRM VALUE) - 0.10 (BETA)

Estimate the debt ratio for the private firm, based upon this regression.

d. What are some of the concerns you might have in extending the approaches used by large publicly traded firms to estimate optimal leverage to smaller firms?

25. XCV Inc., which manufactures automobile parts for assembly, is considering the costs and the benefits of leverage. The CFO notes that the return on equity of the firm, which is only 12.75% now, based upon the current policy of no leverage, could be increased substantially by borrowing money. Is this true? Does it follow that the value of the firm will increase with leverage? Why or why not?

CAPITAL STRUCTURE - THE FINANCING DETAILS

In chapter 7, we looked at the wide range of choices available to firms to raise capital. In chapter 8, developed the tools needed to estimate the optimal debt ratio for a firm. In this chapter, we discuss how firms can use this information to choose the mix of debt and equity they use to finance investments, and on the financing instruments they will employ to reach that mix.

We begin by examining whether, having identified an optimal debt ratio, firms should move to that debt ratio from current levels. A variety of concerns may lead a firm not to use its excess debt capacity, if it is under levered, or to lower its debt, if it is over levered. A firm that decides to move from its current debt level to its optimal financing mix has two decisions to make. First, it has to consider how quickly it wants to move. The degree of urgency will vary widely across firms, depending upon how much of a threat they perceive from being under (or over) levered. The second decision is whether to increase (or decrease) the debt ratio by recapitalizing its investments, by divesting assets and using the cash to reduce debt or equity, by investing in new projects with debt or equity, or by changing its dividend policy.

In the second part of this chapter, we consider how firms should choose the right financing vehicle for raising capital for their investments. We argue that a firm's choice of financing should be determined largely by the nature of the cash flows on its assets. Matching financing choices to asset characteristics decreases default risk for any given level of debt, and allows the firm to borrow more. We then consider a number of real world concerns including tax law, the views of ratings agencies, and information effects that might lead firms to modify their financing choices.

A Framework for Capital Structure Changes

A firm whose actual debt ratio is very different from its optimal has several choices to make. First, it has to decide <u>whether to move towards the optimal</u> <u>or to preserve the status quo</u>. Second, once it decides to move towards the optimal, the firm has to choose <u>between changing its leverage quickly or moving more deliberately</u>. This decision may also be governed by pressure from external sources, such as impatient stockholders or bond ratings agency concerns. Third, if the firm decides to move gradually to the optimal, it has to decide whether to use new financing to take new projects, or to shift its financing mix on existing projects.

In the last chapter, we presented the rationale for moving towards the optimal in terms of the value that could be gained for stockholders by doing so. Conversely, the cost of preserving the status quo is this potential value increment. While managers nominally make this decision, they will often find themselves under some pressure from stockholders, if they are under levered, or under threat of bankruptcy, if they are over levered, to move towards their optimal debt ratios.

Immediate or Gradual Change

In chapter 7 we discussed the trade off between using debt and using equity. In chapter 8, we developed a number of approaches that we used to determine the optimal financing mix for a firm. The next logical step, it would seem, is for firms to move to this optimal mix. In this section, we will first consider what might lead some firms not to make this move, and we follow up by looking at some of the decisions firms that choose this move then have to make.

No change, gradual change or immediate change

In the last chapter, we implicitly assumed that firms that have debt ratios different from their optimal debt ratios, once made aware of this gap, will want to move to the optimal ratios. That does not always turn out to be the case. There are a number of firms that look under levered, using any of the approaches described in the last section, but choose not to use their excess debt capacity. Conversely, there are a number of firms with too much debt that choose not to pay down debt. At the other extreme, there are firms that shift their financing mix overnight to reflect the optimal mix. In this section, we look at the factors a firm might have to consider in deciding whether to leave its debt ratio unchanged, change gradually or change immediately to the optimal mix.

To change or not to change

Firms that are under of overlevered might choose not to move to their optimal debt ratios for a number of reasons. Given our identification of the optimal debt ratio as the mix at which firm value is maximized, this inaction may seem not only irrational but value destroying for stockholders. In some cases, it is. In some cases, however, not moving to the optimal may be consistent with value maximization.

Let us consider under levered firms first. The first reason a firm may choose not to move to its optimal debt ratio, estimated using one of the approaches described in the last chapter, is that it does not view its objective as maximizing firm value. If the objective of a firm is to maximize net income or maintain a high bond rating, having less debt is more desirable than having more. Stockholders should clearly take issue with managers who avoid borrowing because they have an alternative objective and force them to justify their use of the objective.

Even when firms agree on firm value maximization as the objective, there are a number of reasons why under levered firms may choose not to use their excess debt capacity.

- When firms borrow, the debt usually comes with covenants that restrict what the firm can do in the future. Firms that value flexibility may choose not to use their perceived debt capacity.
- The flexibility argument can also be extended to cover future financing needs. Firms that are uncertain about future financing needs may want to preserve excess debt capacity to cover these needs.
- In closely held or private firms, the likelihood of bankruptcy that comes with debt may be weighted disproportionately[1] in making the decision to borrow.

These are all viable reasons for not using excess debt capacity, and they may be consistent with value maximization. We should, however, put these reasons to the financial test. For instance, we estimated in illustration 7.3 that the value of Disney, as a firm, will increase almost $ 3 billion if it moves to its optimal debt ratio. If the reason given by the firm's management for not using excess debt capacity is the need for financing flexibility, the value of this flexibility has to be greater than $ 3 billion.

[1] We do consider the likelihood of default in all the approaches described in the last chapter. However, this consideration does not allow for the fact that cost of default may vary widely across firms. The manager of a publicly traded firm may lose only his or her job, in the event of default, whereas the owner of a private business may lose both wealth and reputation, if he or she goes bankrupt.

Firms that have too much debt, relative to their optimal, should have a fairly strong incentive to try to reduce it. Here, again, there might be reasons why a firm may choose not to take this path. The primary fear of over levered firms is bankruptcy. If the government makes a practice of shielding firms from the costs associated with default, by either bailing out firms that default on their debt or backing up the loans made to them by banks, firms may choose to remain over levered. This would explain why Korean firms, that looked over levered using any financial yardstick in the 1990s did nothing to reduce their debt ratios, until the government guarantee collapsed.

In Practice: Valuing Financial Flexibility as an option

If we assume that unlimited and costless access to capital markets, a firm will always be able to fund a good projects by raising new capital. If, on the other hand, we assume that there are internal or external constraints on raising new capital, financial flexibility can be valuable. To value financial flexibility as an option, assume that a firm has expectations about how much it will need to reinvest in future periods, based upon its own past history and current conditions in the industry. Assume also that a firm has expectations about how much it can raise from internal funds and its normal access to capital markets in future periods. There is uncertainty about future reinvestment needs; for simplicity, we will assume that the capacity to generate funds is known with certainty to the firm. The advantage (and value) of having excess debt capacity or large cash balances is that the firm can meet any reinvestment needs, in excess of funds available, using its debt capacity. The payoff from these projects, however, comes from the excess returns the firm expects to make on them.

With this framework, we can specify the types of firms that will value financial flexibility the most.

a. *Access to capital markets*: Firms with limited access to capital markets – private business, emerging market companies and small market cap companies – should value financial flexibility more that firms with wider access to capital.

b. *Project quality*: The value of financial flexibility accrues not just from the fact that excess debt capacity can be used to fund projects but from the excess returns that these projects earn. Firms in mature and competitive businesses, where excess returns are close to zero, should value financial flexibility less than firms with substantial competitive advantages and high excess returns.

c. *Uncertainty about future investment needs*: Firms that can forecast their reinvestment needs with certainty do not need to maintain excess debt capacity since they can plan to raise capital well in advance. Firms in volatile businesses where investment needs can shift dramatically from period to period will value financial flexibility more.

The bottom line is that firms that value financial flexibility more should be given more leeway to operate with debt ratios below their theoretical optimal debt ratios (where the cost of capital is minimized).

Gradual versus Immediate Change

Many firms attempt to move to their optimal debt ratios, either gradually over time or immediately. The advantage of an immediate shift to the optimal debt ratio is that the firm immediately receives the benefits of the optimal leverage, which include a lower cost of capital and a higher value. The disadvantage of a sudden change in leverage is that it changes both the way managers make decisions and the environment in which these decisions are made. If the optimal debt ratio has been incorrectly estimated, a sudden change may also increase the risk that the firm has to backtrack and reverse its financing decisions. To illustrate, assume that a firm's optimal debt ratio has been calculated to be 40% and that the firm moves to this optimal from its current debt ratio of 10%. A few months later, the firm discovers that its optimal debt ratio is really 30%. It will then have to repay some of the debt it has taken on in order to get back to the optimal leverage.

Gradual versus Immediate Change for Under Levered firms

For underlevered firms, the decision to increase the debt ratio to the optimal either quickly or gradually is determined by four factors:

1. Degree of Confidence in the Optimal Leverage Estimate: The greater the possible error in the estimate of optimal leverage, the more likely the firm will choose to move gradually to the optimal.

2. Comparability to Industry: When the optimal debt ratio for a firm differs markedly from that of the industry to which the firm belongs, the firm is much less likely to shift to the optimal quickly, because analysts and ratings agencies might not look favorably on the change.

3. Likelihood of a Takeover: Empirical studies of the characteristics of target firms in acquisitions have noted that underlevered firms are much more likely to be acquired than are overlevered firms[2]. Often, the acquisition is financed at least partially by the target firm's unused debt capacity. Consequently, firms with excess debt capacity that delay increasing debt run the risk of being taken over. The greater this risk, the more likely the firm will choose to take on additional debt quickly. Several additional factors may determine the likelihood of a takeover. One is the prevalence of anti-takeover laws (at the state level) and amendments in the corporate charter designed specifically to prevent hostile acquisitions. Another is the size of the firm. Since raising financing for an acquisition is far more difficult for a $ 100 billion firm than for a $ 1 billion firm, larger firms may feel more protected from the threat of hostile takeovers. The third factor is the extent of holdings by insiders and managers in the company. Insiders and managers with substantial stakes may be able to prevent hostile acquisitions.

4. Need for Financial Flexibility: On occasions, firms may require excess debt capacity to meet unanticipated needs for funds, either to maintain existing projects, or to invest in new ones. Firms that need and value this flexibility will be less likely to shift quickly to their optimal debt ratios and use up their excess debt capacity.

9.1. ☞: **Insider Holdings and Leverage**

Closely held firms (where managers and insiders hold a substantial portion of the outstanding stock) are less likely to increase leverage quickly than firms with widely dispersed stockholdings.

a. True

b. False

Explain.

[2] Palepu (1986) notes that one of the variables that seems to predict a takeover is a low debt ratio, in conjunction with poor operating performance.

Illustration 9.1: Debt Capacity and Takeovers

The Disney acquisition of Capital Cities in 1996, although a friendly acquisition, illustrates some of advantages to the acquiring firm of acquiring an under levered firm. At the time of the acquisition, Capital Cities had $ 657 million in outstanding debt and 154.06 million shares outstanding, trading at $ 100 per share. Its market value debt ratio was only 4.07%. With a beta of 0.95, a borrowing rate of 7.70%, and a corporate tax rate of 43.50%, this yielded a cost of capital of 11.90%. (The treasury bond rate at the time of the analysis was 7%)

Cost of Capital

= Cost of Equity(Equity/(Debt+ Equity)+Cost of Debt(Debt/(Debt + Equity)

= 12.23% (15,406/(15,406+657)) + 7.70% (1-.435) (657/(15,406+657))

= 11.90%

Table 9.1 summarizes the costs of equity, debt, and capital, as well as the estimated firm values and stock prices at different debt ratios for Capital Cities:

Table 9.1: Costs of Financing, Firm Value and Debt Ratios: Capital Cities

Debt Ratio	*Beta*	*Cost of Equity*	*Interest Coverage Ratio*	*Bond Rating*	*Interest Rate*	*Cost of Debt*	*Cost of Capital*	*Firm Value*	*Stock Price*
0.00%	0.93	12.10%	∞	AAA	7.30%	4.12%	12.10%	$15,507	$96.41
10.00%	0.99	12.42%	10.73	AAA	7.30%	4.12%	11.59%	$17,007	$106.15
20.00%	1.06	12.82%	4.75	A	8.25%	4.66%	11.19%	$18,399	$115.19
30.00%	1.15	13.34%	2.90	BBB	9.00%	5.09%	10.86%	$19,708	$123.69
40.00%	1.28	14.02%	1.78	B	11.00%	6.22%	10.90%	$19,546	$122.63
50.00%	1.45	14.99%	1.21	CCC	13.00%	7.35%	11.17%	$18,496	$115.81
60.00%	1.71	16.43%	1.00	CCC	13.00%	7.35%	10.98%	$19,228	$120.57
70.00%	2.37	20.01%	0.77	CC	14.50%	9.63%	12.74%	$13,939	$86.23
80.00%	3.65	27.08%	0.61	C	16.00%	11.74%	14.81%	$10,449	$63.58
90.00%	7.30	47.16%	0.54	C	16.00%	12.21%	15.71%	$9,391	$56.71

Note that the firm value is maximized at a debt ratio of 30%, leading to an increase in the stock price of $ 23.69 over the market price of $ 100.

Although debt capacity was never stated as a reason for Disney's acquisition of Capital Cities, Disney borrowed about $ 10 billion for this acquisition and paid $ 125 per share. Capital Cities' stockholders could well have achieved the same premium, if management had borrowed the money and repurchased stock. Although Capital Cities stockholders did not lose as a result of the acquisition, they would have (at least based on our numbers) if Disney had paid a smaller premium on the acquisition.

Gradual versus Immediate Change for Overlevered firms

Firms that are over levered also have to decide whether they should shift gradually or immediately to the optimal debt ratios. As in the case of underlevered firms, the precision of the estimate of the optimal leverage will play a role, with more precise estimates leading to quicker adjustments. So will comparability to other firms in the sector. When most or all of the firms in a sector become over levered, as was the case with the telecommunications sector in the late 1990s, firms seem to feel little urgency to reduce their debt ratios even though they might be straining to make their payments. In contrast, the pressure to reduce debt is much greater when a firm has a high debt ratio in a sector where most firms have lower debt ratios.

The other factor, in the case of over levered firms, is the possibility of default. Too much debt also results in higher interest rates and lower ratings on the debt. Thus, the greater the chance of bankruptcy, the more likely the firm is to move quickly to reduce debt and move to its optimal. How can we assess the probability of default? If firms are rated, their bond ratings offer a noisy but simple measure of default risk. A firm with a below investment grade rating (below BBB) has a significant probability of default. Even if firms are not rated, we can use their synthetic ratings (based upon interest coverage ratios) to come to the same conclusion.

9.2. ☞ **: Indirect Bankruptcy Costs and Leverage**

In chapter 7, we talked about indirect bankruptcy costs, where the perception of default risk affected sales and profits. Assume that a firm with substantial indirect bankruptcy costs has too much debt. Is the urgency to get back to an optimal debt ratio for this firm greater than or lesser than it is for a firm without such costs?

a. Greater

b. Lesser

Explain.

Implementing Changes in Financial Mix

A firm that decides to change its financing mix has several alternatives. In this section, we begin by considering the details of each of these alternatives to changing the financing mix, and we conclude by looking at how firms can choose the right approach for them.

Ways of changing the financing mix

There are four basic paths available to a firm that wants to change its financing mix. One is to change the current financing mix, using new equity to retire debt or new debt to reduce equity; this is called **recapitalization**. The second path is to sell assets and use the proceeds to pay off debt, if the objective is to reduce the debt ratio, or to reduce equity, if the objective is to increase the debt ratio. The third is to use a disproportionately high debt or equity ratio, relative to the firm's current ratios, to finance new investments over time. The value of the firm increases, but the debt ratio will also be changed in the process. The fourth option is to change the proportion of earnings that a firm returns to its stockholders in the form of dividends or by buying back stock. As this proportion changes, the debt ratio will also change over time.

Recapitalization

The simplest and often the quickest way to change a firm's financial mix is to change the way existing investments are financed. Thus, an underlevered firm can increase its debt ratio by borrowing money and buying back stock or replacing equity with debt of equal market value.

- *Borrowing money and buying back stock (or paying a large dividend)* increases the debt ratio because the borrowing increases the debt, while the equity repurchase or dividend payment concurrently reduces the equity. Many companies have used this approach to increase leverage quickly, largely in response to takeover attempts. For example, in 1985, to

> ***Debt-for-Equity Swaps:*** This is a voluntary exchange of outstanding equity for debt of equal market value.

stave off a hostile takeover[3], Atlantic Richfield borrowed $ 4 billion and repurchased stock to increase its debt to capital ratio from 12% to 34%.

- In a *debt-for-equity swap*, a firm replaces equity with debt of equivalent market value by swapping the two securities. Here again, the simultaneous increase in debt and the decrease in equity causes the debt ratio to increase substantially. In many cases, firms offer equity investors a combination of cash and debt in lieu of equity. In 1986, for example, Owens Corning gave its stockholders $ 52 in cash and debt, with a face value of $ 35, for each outstanding share, thereby increasing its debt and reducing equity.

In each of these cases, the firm may be restricted by bond covenants that explicitly prohibit these actions or impose large penalties on the firm. The firm will have to weigh these restrictions against the benefits of the higher leverage and the increased value that flows from it. A recapitalization designed to increase the debt ratio substantially is called a **leveraged recapitalization**, and many of these recapitalizations are motivated by a desire to prevent a hostile takeover[4].

Though it is far less common, firms that want to lower their debt ratios can adopt a similar strategy. An overlevered firm can attempt to *renegotiate debt agreements*, and try to convince some of the lenders to take an equity stake in the firm in lieu of some or all of their debt in the firm. It can also try to get lenders to offer more generous terms, including longer maturities and lower interest rates. Finally, the firm can issue new equity and use it pay off some of the outstanding debt. The best bargaining chip such a firm possesses is the possibility of default, since default creates substantial losses for lenders. In the late 1980s, for example, many U.S. banks were forced to trade in their Latin American debt for equity stakes or receive little or nothing on their loans.

Divestiture and Use of Proceeds

Firms can also change their debt ratios by selling assets and using the cash they receive from the divestiture to reduce debt or equity. Thus, an underlevered firm can sell some of its assets and use the proceeds to repurchase stock or pay a large dividend. While

[3] The stock buyback increased the stock price and took away a significant rationale for the acquisition.

this action reduces the equity outstanding at the firm, it will increase the debt ratio of the firm only if the firm already has some debt outstanding. An overlevered firm may choose to sell assets and use the proceeds to retire some of the outstanding debt and reduce its debt ratio.

If a firm chooses this path, the choice of which assets to divest is a critical one. Firms usually want to divest themselves of investments that are earning less than their required returns, but that cannot be the overriding consideration in this decision. The key question is whether there are potential buyers for the asset who are willing to pay fair value or more for it, where the fair value measures how much the asset is worth to the firm, based upon its expected cash flows.

9.3. ☞: **Asset Sales to Reduce Leverage**

Assume that a firm has decided to sell assets to pay off its debt. In deciding which assets to sell, the firm should

a. Sell its worst performing assets to raise the cash
b. Sell its best performing assets to raise the cash
c. Sell its most liquid assets to raise the cash
d. None of the above (Specify the alternative)

Explain.

Financing New Investments

Firms can also change their debt ratios by financing new investments disproportionately with debt or equity. If they use a much higher proportion of debt in financing new investments than their current debt ratio, they will increase their debt ratios. Conversely, if they use a much higher proportion of equity in financing new investments than their existing equity ratio, they will decrease their debt ratios.

There are two key differences between this approach and the previous two. First, since new investments are spread out over time, the debt ratio will adjust gradually over the period. Second, the process of investing in new assets will increase both the firm

[4] An examination of 28 re-capitalizations between 1985 and 1988 indicates that all but 5 were motivated by the threat of hostile takeovers.

value and the dollar debt that goes with any debt ratio. For instance, if Disney decides to increase its debt ratio to 30% and proposes to do so by investing in new stores, the value of the firm will increase from the existing level.

Changing Dividend Payout

While we will not be considering dividend policy in detail until the next chapter, a firm can change its debt ratio over time by changing the proportion of its earnings that it returns to stockholders in each period. Increasing the proportion of earnings paid out in dividends (the dividend payout ratio) or buying back stock each period will increase the debt ratio for two reasons. First, the payment of the dividend or buying back stock will reduce[5] the equity in the firm; holding debt constant, this will increase the debt ratio. Second, paying out more of the earnings to stockholders increases the need for external financing to fund new investments; if firms fill this need with new debt, the debt ratio will be increased even further. Decreasing the proportion of earnings returned to stockholders will have the opposite effects.

Firms that choose this route have to recognize that debt ratios will increase gradually over time. In fact, the value of equity in a firm can be expected to increase each period by the expected price appreciation rate. This rate can be obtained from the cost of equity, after netting out the expected portion of the return that will come from dividends. This portion is estimated with the dividend yield, which measures the expected dollar dividend as a percent of the current stock price:

Expected price appreciation = Cost of equity – Expected dividend yield

To illustrate, in 2004, Disney had a cost of equity of 10.00% and an expected dollar dividend per share of \$0.21. Based upon the stock price of \$ 26.91, the expected price appreciation can be computed:

$\text{Expected price appreciation}_{\text{Disney}} = 10.00\% - (\$0.21/26.91) = 9.22\%$

Disney's market value of equity can be expected to increase 9.22% next period. The dollar debt would have to increase by more than that amount for the debt ratio to increase.

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[5] The payment of dividends takes cash out of the firm and puts it in the hands of stockholders. The firm has to become less valuable, as a result of the action. The stock price reflects this effect.

9.4. ☞: **Dollar Debt versus Debt Ratio**

Assume that a firm, worth $ 1 billion, has no debt and needs to get to a 20% debt ratio. How much would the firm need to borrow if it wants to buy back stock?

a. $ 200 million

b. $ 250 million

c. $ 260 million

d. $ 160 million

How much would it need to borrow if it were planning to borrow money and invest in new projects (with zero net present value)? What if the projects had a net present value of $ 50 million?

Choosing between the alternatives

Given the choice between recapitalizating, divestitng, financing new investments and changing dividend payout, how can a firm choose the right way to change debt ratios? The choice will be determined by three factors. The first is the *urgency with which the firm is trying to move to its optimal debt ratio*. Recapitalizations and divestitures can be accomplished in a few weeks and can change debt ratios significantly. Financing new investments or changing dividend payout, on the other hand, is a long term strategy to change debt ratios. Thus, a firm that needs to change its debt ratio quickly, because it is either under threat of a hostile takeover or faces imminent default, is more likely to use recapitalizations than to finance new investments.

The second factor is the *quality of new investments*. In the earlier chapters on investment analysis, we defined a good investment as one that earns a positive net present value and a return greater than its hurdle rate. Firms with good investments will gain more by financing these new investments with new debt if the firm is under levered, or with new equity if the firm is over levered. Not only will the firm value increase by the value gain we computed in chapter 8, based upon the change in the cost of capital, but the positive net present value of the project will also accrue to the firm. On the other hand, using excess debt capacity or new equity to invest in poor projects is a bad strategy, since the projects will destroy value.

The final consideration is the *marketability of existing investments*. Two considerations go into marketability. One is whether existing investments earn excess returns; firms are often more willing to divest themselves of assets that are earning less than the required return. The other, and in our view the more important consideration is whether divesting these assets will generate a price high enough to compensate the firm for the cash flows lost by selling them. Ironically, firms often find that their best investments are more likely to meet the second criterion than their worst investments.

We summarize our conclusions about the right route to follow to the optimal, based upon all these determinants, in table 9.2:

Table 9.2: Optimal Route to Financing Mix

Desired Speed of Adjustment	*Marketability of existing investments*	*Quality of new investments*	*Optimal Route to changing debt ratio*
Urgent	Poor	Poor	Recapitalize
Urgent	Good	Good	Divest & buy back stock or retire debt Finance new investments with debt
Urgent	Good	Poor	Divest & buy back stock or retire debt
Gradual	Neutral or Poor	Neutral or poor	Increase payout to stockholders or retire debt over time.
Gradual	Good	Neutral or poor	Divest and increase payout to stockholders or retire debt over time.
Gradual	Neutral or Poor	Good	Finance new investments with debt or equity.

We also summarize our discussion of whether a firm should shift to its financing mix quickly or gradually, as well as the question of how to make this shift, in figure 9.1.

While we have presented this choice in stark terms, where firms decide to use one or another of the four alternatives described above, a combination of actions may be what is needed to get a firm to its desired debt ratio. This is especially likely when the firm is large and the change in debt ratio is significant. In the illustrations following this section, we consider three companies. The first, Nichols Research, is a small firm that gets to its optimal debt ratio by borrowing money and buying back stock. The other two, Disney and Time Warner, choose a combination of new investments and recapitalization, Disney to increase its debt ratio, and Time Warner to decrease its debt ratio.

FIGURE 9.1: A FRAMEWORK FOR CHANGING DEBT RATIOS

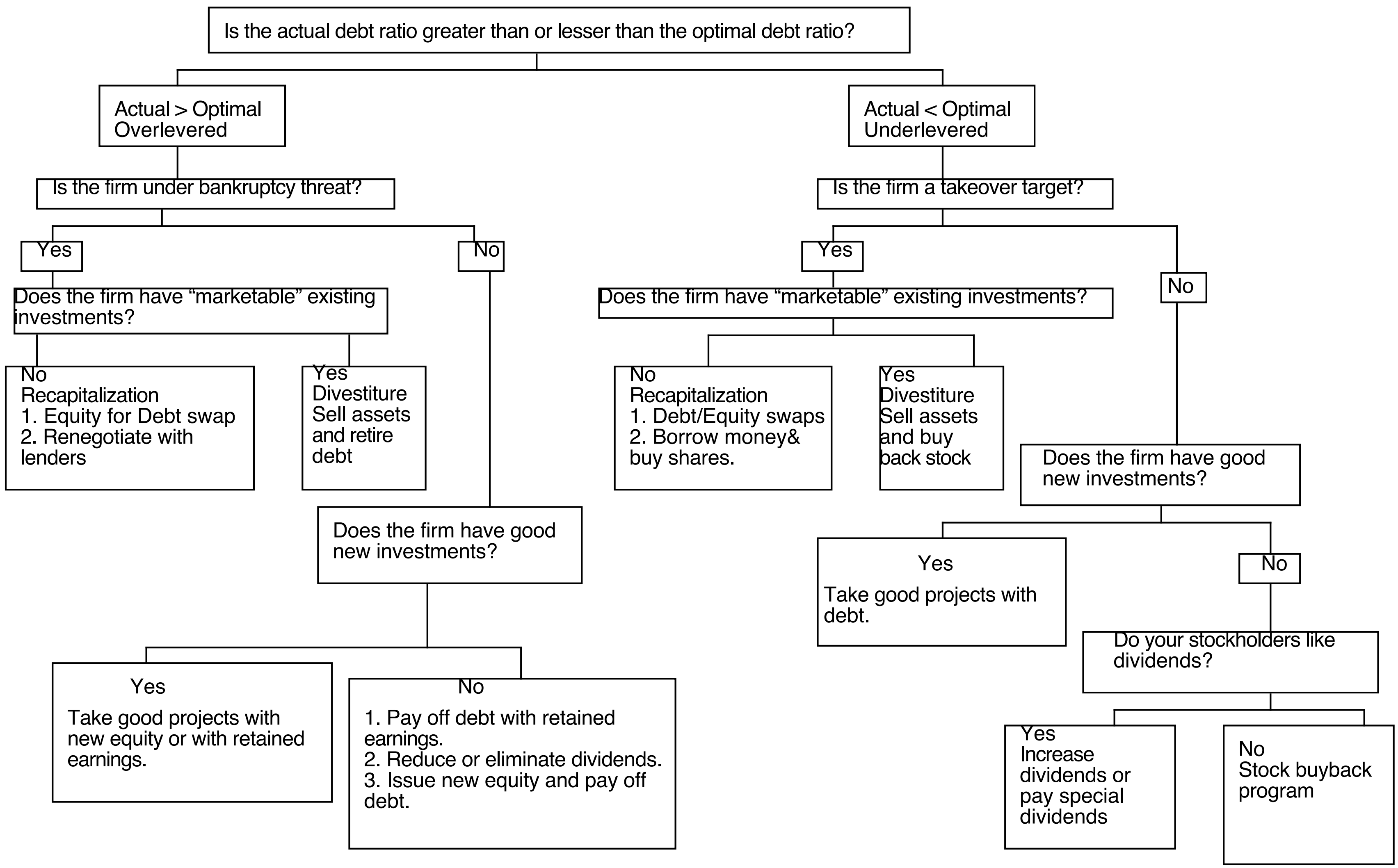

Illustration 9.2: Increasing financial leverage quickly: Nichols Research

In 1994, Nichols Research, a firm that provides technical services to the defense industry, had debt outstanding of $ 6.8 million and market value of equity of $ 120 million. Based upon its EBITDA of $ 12 million, Nichols had an optimal debt ratio of 30%, which would lower the cost of capital to 12.07% (from the current cost of capital of 13%) and increase the firm value to $ 146 million (from $126.8 million). There are a number of reasons for arguing that Nichols should increase its leverage quickly:

- Its small size, in conjunction with its low leverage and large cash balance ($25.3 million), make it a prime target for an acquisition.
- While 17.6% of the shares are held by owners and directors, this amount unlikely to hold off a hostile acquisition, since institutions own 60% of the outstanding stock.
- The firm has been reporting steadily decreasing returns on its projects, due to the shrinkage in the defense budget. In 1994, the return on capital was only 10%, which is much lower than the cost of capital.

If Nichols decides to increase leverage, it can do so in a number of ways:

- It can borrow enough money to get to 30% of its overall firm value ($ 146 million at the optimal debt ratio) and buy back stock. This would require $ 37 million in new debt.
- It can borrow $ 37 million and pay a special dividend of that amount.
- It can use the cash balance of $ 25 million to buy back stock or pay dividends, and increase debt to 30% of the remaining firm value(30% of $ 121 million). [6] This would require approximately $ 29.5 million in new debt, which can be used to buy back stock.

Illustration 9.3: Charting a Framework for Increasing Leverage: Disney (before Comcast hostile bid)

Reviewing the capital structure analysis done for Disney in chapter 8, Disney had a debt ratio of approximately 21% in early 2004, with $ 14.7 billion in debt (estimated

[6] We are assuming that the optimal debt ratio will be unaffected by the paying out of the special dividend. It is entirely possible that the paying out of the cash will make the firm riskier (leading to a higher unlevered beta) and lower the optimal debt ratio.

market value) and $ 55.1 billion in equity. Its optimal debt ratio, based upon minimizing cost of capital, was 30%. Table 9.3 summarizes the debt ratios, costs of capital and firm value at debt ratios ranging from 0% to 90%.

Table 9.3: Debt Ratio, WACC and Firm Value – Disney

Debt Ratio	*Cost of Capital*	*Firm Value*
0%	9.15%	$62,279
10%	8.83%	$66,397
20%	8.59%	$69,837
30%	8.50%	$71,239
40%	10.20%	$51,661
50%	13.16%	$34,969
60%	14.36%	$30,920
70%	15.56%	$27,711
80%	16.76%	$25,105
90%	17.96%	$22,948

The optimal debt ratio for Disney is 30%, since the cost of capital is minimized and the firm value is maximized at this debt level.

In early 2004, Disney looked like it was not under any immediate pressure to increase its leverage, partly because of its size ($69 billion) and partly because its stock price had recovered from its lows of 2000[7]. However, Disney's management was under pressure to produce results quickly for its stockholders. Let us assume, therefore, that Disney decides to increase its leverage over time towards its optimal.

The question of how to increase leverage over time can be best answered by looking at the quality of the projects that Disney had available to it in 2003. In chapter 5, we compute the return on capital that Disney earned in 2004:

Return on Capital = EBIT (1-tax rate) / (BV of Debt + BV of Equity)

= 1701 (1-.373)/(14,130+ 23,879)

= 4.48%

This is lower than the cost of capital[8] of 8.59% that Disney faced in 2003 and the 8.40% it will face if it moves to the optimal. If we assume that these negative excess returns are

[7] See Jensen's alpha calculation in Chapter 4. Over the last 5 years, Disney has earned an excess return of 1.81% a year.

[8] The correct comparison should be to the cost of capital that Disney will have at its optimal debt ratio. It is, however, even better if the return on capital also exceeds the current cost of capital, since it will take time to get to the optimal.

likely to continue into the future, the path to a lower optimal debt ratio is to either increase dividends or to enter into a stock buyback program for the next few years. The change in the tax treatment of dividends[9] in 2003 makes the choice more difficult than in prior years, when stocky buybacks would have been more tax efficient.

To make forecasts of changes in leverage over time, we made the following assumptions:

- Revenues, operating earnings, capital expenditures, and depreciation are expected to grow 8% a year from 2004 to 2008 (based upon analyst estimates of growth). The current value for each of these items is provided in Table 9.4 below.
- In 2003, non-cash working capital was 1.92% of revenues, and that ratio is expected to be unchanged over the next 5 years.
- The interest rate on new debt is expected to be 5.25%, which is Disney's pre-tax cost of debt. The bottom-up beta is 1.25, as estimated in chapter 4.
- The dividend payout ratio in 2003 was 33.86%.
- The treasury bond rate is 4%, and the risk premium is assumed to be 4.82%.

To estimate the expected market value of equity in future periods, we will use the cost of equity computed from the beta in conjunction with dividends. The estimated values of debt and equity, over time, are estimated as follows.

$$\text{Equity}_t = \text{Equity}_{t-1}\ (1 + \text{Cost of Equity}_{t-1}) - \text{Dividends}_t$$

The rationale is simple: The cost of equity measures the expected return on the stock, inclusive of price appreciation and the dividend yield, and the payment of dividends reduces the value of equity outstanding at the end of the year.[10] The value of debt is estimated by adding the new debt taken on to the debt outstanding at the end of the previous year.

We begin this analysis by looking at what would happen to the debt ratio, if Disney maintains its existing payout ratio of 33.86%, does not buy back stock and applies excess funds to pay off debt. Table 9.5 uses the expected capital expenditures and non-

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[9] The 2003 tax law reduced the tax rate on dividends to 15% to match the tax rate on capital gains, thus eliminating a long standing tax disadvantage borne by investors on dividends.

[10] The effect of dividends on the market value of equity can best be captured by noting the effect the payment on dividends has on stock prices on the ex-dividend day. Stock prices tend to drop on ex-dividend day by about the same amount as the dividend paid.

cash working capital needs over the next five years, in conjunction with external financing needs, to estimate the debt ratio in each year.

Table 9.5: Estimated Debt Ratios with Existing Payout Ratios– Disney

	Current Year	*1*	*2*	*3*	*4*	*5*
Equity	$55,101	$60,150	$65,586	$71,436	$77,730	$84,499
Debt	$14,668	$13,794	$12,831	$11,769	$10,600	$9,312
Debt/(Debt+Equity)	21.02%	18.65%	16.36%	14.14%	12.00%	9.93%
Revenues	27061	$29,226	$31,564	$34,089	$36,816	$39,761
Non-cash working capital	519	$561	$605	$654	$706	$763
Capital Expenditures	$1,049	$1,133	$1,224	$1,321	$1,427	$1,541
+ Chg in Work. Cap	$65	$42	$45	$48	$52	$56
- Depreciation	$1,059	$1,144	$1,235	$1,334	$1,441	$1,556
- Net Income	$1,267	$1,368	$1,507	$1,659	$1,826	$2,011
+ Dividends	$429	$463	$510	$562	$618	$681
= New Debt	($783)	($874)	($963)	($1,061)	($1,169)	($1,288)
Beta	1.25	1.22	1.20	1.18	1.16	1.14
Cost of Equity	10.00%	9.88%	9.78%	9.68%	9.59%	9.50%
Growth Rate		8.00%	8.00%	8.00%	8.00%	8.00%
Dividend Payout Ratio	33.86%	33.86%	33.86%	33.86%	33.86%	33.86%

[a] Net Income_t = Net Income_{t-1} (1+ g) - Interest Rate (1-t) * (Debt_t - Debt_{t-1})

There are two points to note in these forecasts. The first is that the net income is adjusted for the change in interest expenses that will occur as a result of the debt being paid off. The second is that the beta is adjusted to reflect the changing debt to equity ratio from year to year. Disney produces a cash surplus every year, since internal cash flows (net income+ depreciation) are well in excess of capital expenditures and working capital needs. If this is applied to paying off debt, the increase in the market value of equity over time will cause the debt ratio to drop from 21.02% to 9.93% by the end of year 5.

If Disney wants to increase its debt ratio to 30%, it will need to do one or a combination of the following:

<u>1. Increase its dividend payout ratio</u>: The higher dividend increases the debt ratio in two ways. It increases the need for debt financing in each year, and it reduces the expected price appreciation on the equity. In Table 9.6, for instance, increasing the dividend payout ratio to 60% results in a debt ratio of 12.33% at the end of the fifth year (instead of 9.93%).

Table 9.6: Estimated Debt Ratio with Higher Dividend Payout Ratio

	Current Year	*1*	*2*	*3*	*4*	*5*
Equity	$55,101	$59,792	$64,820	$70,206	$75,975	$82,150
Debt	$14,668	$14,152	$13,587	$12,969	$12,295	$11,557
Debt/(Debt+Equity)	21.02%	19.14%	17.33%	15.59%	13.93%	12.33%
Capital Expenditures	$1,049	$1,133	$1,224	$1,321	$1,427	$1,541
+ Chg in Work. Cap	$65	$42	$45	$48	$52	$56
- Depreciation	$1,059	$1,144	$1,235	$1,334	$1,441	$1,556
- Net Income	$1,267	$1,368	$1,495	$1,633	$1,784	$1,949
+ Dividends	$429	$821	$897	$980	$1,070	$1,169
= New Debt	($783)	($517)	($565)	($617)	($675)	($738)
Beta	1.25	1.23	1.21	1.19	1.18	1.16
Cost of Equity	10.00%	9.91%	9.82%	9.74%	9.67%	9.60%
Growth Rate		8.00%	8.00%	8.00%	8.00%	8.00%
Dividend Payout Ratio	33.86%	60.00%	60.00%	60.00%	60.00%	60.00%

In fact, increasing dividend payout alone is unlikely to increase the debt ratio substantially.

<u>2. Repurchase stock each year</u>: This affects the debt ratio in much the same way as does increasing dividends, because it increases debt requirements and reduces equity. For instance, if Disney bought back 5% of the stock outstanding each year, the debt ratio at the end of year 5 would be significantly higher as shown in Table 9.7.

Table 9.7: Estimated Debt Ratio with Equity Buyback of 5% a Year

	Current Year	*1*	*2*	*3*	*4*	*5*
Equity	$55,101	$57,142	$59,312	$61,617	$64,065	$66,666
Debt	$14,668	$16,801	$19,025	$21,347	$23,774	$26,316
Debt/(Debt+Equity)	21.02%	22.72%	24.29%	25.73%	27.07%	28.30%

Capital Expenditures	$1,049	$1,133	$1,224	$1,321	$1,427	$1,541
+ Chg in Work. Cap	$65	$42	$45	$48	$52	$56
- Depreciation	$1,059	$1,144	$1,235	$1,334	$1,441	$1,556
- Net Income	$1,267	$1,368	$1,408	$1,447	$1,486	$1,525
+ Dividends	$429	$463	$477	$490	$503	$516
+ Stock Buybacks		$3,007	$3,122	$3,243	$3,372	$3,509
= New Debt	($783)	$2,133	$2,224	$2,322	$2,427	$2,542
Beta	1.25	1.26	1.28	1.30	1.32	1.33
Cost of Equity	10.00%	10.09%	10.18%	10.26%	10.34%	10.42%
Growth Rate		8.00%	8.00%	8.00%	8.00%	8.00%
Dividend Payout Ratio	33.86%	33.86%	33.86%	33.86%	33.86%	33.86%

In this scenario, Disney will need to borrow money each year to cover its stock buybacks and the debt ratio increases to 28.30% by the end of year 5.

3. Increase capital expenditures each year: While the first two approaches increase the debt ratio by shrinking the equity, the third approach increases the scale of the firm. It does so by increasing the capital expenditures, which incidentally includes acquisitions of other firms, and financing these expenditures with debt. Disney could increase its debt ratio fairly significantly by increasing capital expenditures. In Table 9.8, we estimate the debt ratio for Disney if it doubles its capital expenditures (relative to the estimates in the earlier tables) and meets its external financing needs with debt.

Table 9.8: Estimated Debt Ratio with 100% higher Capital Expenditures

	Current Year	*1*	*2*	*3*	*4*	*5*
Equity	$55,101	$60,150	$65,622	$71,553	$77,980	$84,945
Debt	$14,668	$14,927	$15,224	$15,566	$15,959	$16,408
Debt/(Debt+Equity)	21.02%	19.88%	18.83%	17.87%	16.99%	16.19%
Capital Expenditures	$1,049	$2,266	$2,447	$2,643	$2,854	$3,083
+ Chg in Work. Cap	$65	$42	$45	$48	$52	$56
- Depreciation	$1,059	$1,144	$1,235	$1,334	$1,441	$1,556
- Net Income	$1,267	$1,368	$1,469	$1,577	$1,692	$1,814
+ Dividends	$429	$463	$510	$562	$618	$681
+ Stock Buybacks		$0	$0	$0	$0	$0
= New Debt	($783)	$259	$298	$342	$392	$450
Beta	1.25	1.23	1.22	1.21	1.20	1.20

Cost of Equity	10.00%	9.95%	9.89%	9.85%	9.81%	9.77%
Growth Rate		8.00%	8.00%	8.00%	8.00%	8.00%
Dividend Payout Ratio	33.86%	33.86%	33.86%	33.86%	33.86%	33.86%

With the higher capital expenditures and maintaining the existing dividend payout ratio of 33.86%, the debt ratio is 16.19% by the end of year 5. This is the riskiest strategy of the three, since it presupposes the existence of enough good investments (or acquisitions) to cover $ 15 billion in new investments over the next 5 years. It may, however, be the strategy that seems most attractive to management that intent on building a global entertainment empire.

All of this analysis was based upon the presumption that Disney would not be the target of a hostile acquisition. In February 2004, Comcast announced that it would try to acquire Disney. While the bid was withdrawn three months later and excess debt capacity was never cited as a reason for it, is does put pressure on the time table that Disney faces both for raising the debt ratio and improving returns on investments.

9.5. ☞: **Cash Balances and Changing Leverage**

Companies with excess debt capacity often also have large cash balances. Which of the following actions by a company with a large cash balance will increase its debt ratio?

a. Using the cash to acquire another company
b. Paying a large special dividend
c. Paying off debt
d. Buying back stock

Explain.

Illustration 9.4: Decreasing Leverage gradually: Time Warner

In 1994, Time Warner had 379.3 million shares outstanding, trading at $ 44 per share, and $9.934 billion in outstanding debt, left over from the leveraged acquisition of Time by Warner Communications in 1989. The EBITDA in 1994 was $ 1.146 billion, and Time Warner had a beta of 1.30. The optimal debt ratio for Time Warner, based upon this operating income, is only 10%. Table 9.9 examines the effect on leverage of cutting dividends to zero and using operating cash flows to take on projects and repay debt.

Table 9.9: Estimated Debt Ratios – Time Warner

	Current Year	*1*	*2*	*3*	*4*	*5*
Equity	$16,689	$19,051	$21,694	$24,651	$27,960	$31,663
Debt	$9,934	$9,745	$9,527	$9,276	$8,988	$8,655
Debt/(Debt+Equity)	37.31%	33.84%	30.52%	27.34%	24.33%	21.47%
Capital Expenditures	$300	$330	$363	$399	$439	$483
- Depreciation	$437	$481	$529	$582	$640	$704
- Net Income	$35	$39	$52	$68	$88	$112
- Dividends	$67	$0	$0	$0	$0	$0
= New Debt	($105)	($189)	($218)	($251)	($289)	($332)
Beta	1.30	1.25	1.21	1.17	1.14	1.11
Cost of Equity	14.15%	13.87%	13.63%	13.42%	13.24%	13.08%
Growth Rate		10.00%	10.00%	10.00%	10.00%	10.00%
Payout Ratio	11%	0%	0%	0%	0%	0%

Allowing for a growth rate of 10% in operating income, Time Warner repays $ 189 million of its outstanding debt in the first year. By the end of the fifth year, the growth in equity and the reduction in debt combine to lower the debt ratio to 21.47%.

This spreadsheet allows you to estimate the effects of changing dividend policy or capital expenditures on debt ratios over time.

9.6. ☞: **Investing in Other Business Lines**

In the analysis above, we have argued that firms should invest in projects as long as the return on equity is greater than the cost of equity. Assume that a firm is considering acquiring another firm with its debt capacity. In analyzing the return on equity the acquiring firm can make on this investment, we should compare the return on equity to

a. the cost of equity of the acquiring firm

b. the cost of equity of the acquired firm

c. a blended cost of equity of the acquired and acquiring firm

d. none of the above

Explain.

In Practice: Security Innovation and Changing Capital Structure

While the changes in leverage discussed so far in this chapter have been accomplished using traditional securities such as straight debt and equity, firms that have specific objectives on leverage may find certain products that are designed to meet those objectives. Consider a few examples:

- Hybrid securities such as convertible bonds are combinations of debt and equity that change over time as the firm changes. To be more precise, if the firm prospers and its equity value increases, the conversion option in the convertible bond will become more valuable, thus increasing the equity component of the convertible bond and decreasing the debt component (as a percent of the value of the bond). If the firm does badly and its stock price slides, the conversion option (and the equity component) will become less valuable and the debt ratio of the firm will increase.
- An alternative available to a firm that wants to increase leverage over time is a forward contract to buy a specified number of shares of equity in the future. These contracts lock the firms into reducing their equity over time and may carry a more positive signal to financial markets than would an announcement of plans to repurchase stock, since firms are not obligated to carry through on these announcements.

- A firm with high leverage, faced with a resistance from financial markets to common stock issues, may consider more inventive ways of raising equity, such as using warrants and contingent value rights. Warrants represent call options on the firm's equity whereas contingent value rights are put options on the firm's stock. The former have appeal to those who are optimistic about the future of the company and the latter make sense for risk averse investors who are concerned about the future.

Choosing the Right Financing Instruments

In Chapter 7, we presented a variety of ways in which firms can raise debt and equity. Debt can be bank debt or corporate bonds, can vary in maturity from short to long term, can have fixed or floating rates and can be in different currencies. In the case of equity there are fewer choices, but firms can still raise equity from common stock, warrants or contingent value rights. While we suggested broad guidelines that could be used to determine when firms should consider each type of financing, we did not develop a way in which a specific firm can pick the right kind of financing.

In this section, we lay out a sequence of steps by which a firm to choose the right financing instruments. This analysis is useful not only in determining what kind of securities should be issued to finance new investments, but also in highlighting limitations in a firm's existing financing choices. The first step in the analysis is an examination of the cash flow characteristics of the assets or projects that will be financed; the objective is to try to match the cash flows on the liability stream as closely as possible to the cash flows on the asset stream. We then superimpose a series of considerations that may lead the firm to deviate from or modify these financing choices.

First, we consider the tax savings that may accrue from using different financing vehicles, and weigh the tax benefits against the costs of deviating from the optimal choices. Next, we examine the influence that equity research analysts and ratings agency views have on the choice of financing vehicles; instruments that are looked on favorably by either or, better still, both groups will clearly be preferred to those that evoke strong negative responses from one or both groups. We also factor in the difficulty that some firms might have in conveying information to markets; in the presence of asymmetric information, firms may have to make financing choices that do not reflect their asset mix. Finally, we allow for the possibility that firms may want to structure their financing to reduce agency conflicts between stockholders and bondholders.

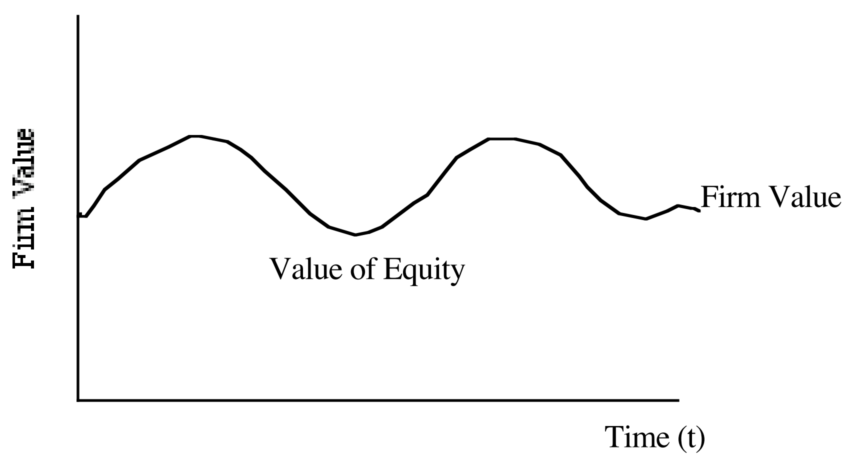
I. Matching financing cash flows with asset cash flows

The first and most important characteristic a firm has to consider in choosing the financing instrument it will use to raise funds is the cash flow patterns of the assets that are to be financed with this instrument.

Why match Asset Cash Flows to Cash Flows on Liabilities

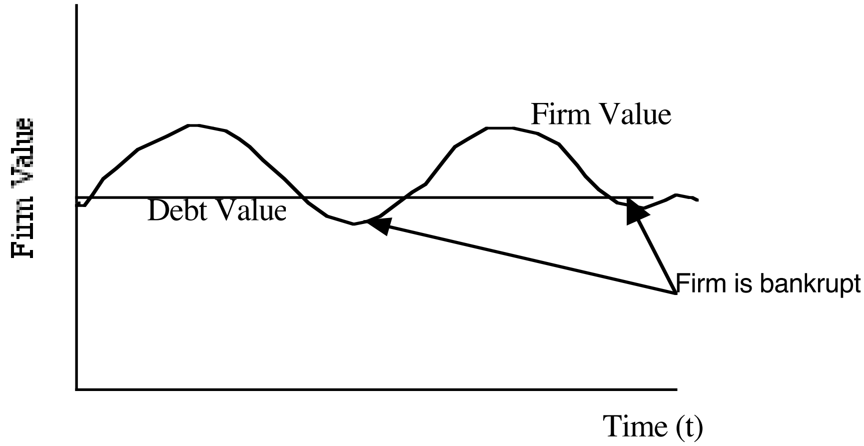
We will begin with the premise that the cash flows of a firm's liability stream should match the cash flows of the assets that they finance. Let us begin by defining firm value as the present value of the cash flows generated by the assets owned by the firm. This firm value will vary over time, not only as a function of firm-specific factors such as project success, but also as a function of broader macro economic variables such as interest rates, inflation rates, economic cycles and exchange rates. Figure 9.2 represents the time series of firm value for a hypothetical firm, where all the changes in firm value are assumed to result from changes in macro economic variables.

Figure 9.2: Firm Value over time with Short Term Debtt



This firm can choose to finance these assets with any financing mix it wants. The value of equity at any point in time is the difference between the value of the firm and the value of outstanding debt. Assume, for instance, that the firm chooses to finance the assets shown in Figure 20.2 using very short term debt, and that this debt is unaffected by changes in macro economic variables. Figure 9.3 provides the firm value, debt value, and equity value over time for the firm.

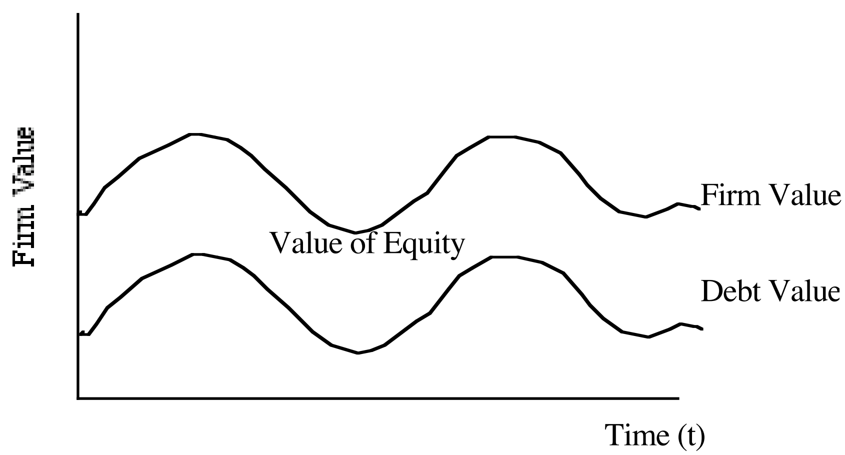
Figure 9.3: Firm Value over time with Long Term Debtt



Note that there are periods when the firm value drops below the debt value, which would suggest that the firm is technically bankrupt in those periods. Firms that weigh this possibility into their financing decision will therefore borrow less.

Now consider a firm which finances the assets described in Figure 9.2 with debt that matches the assets exactly, in terms of cash flows, and also in terms of the sensitivity of debt value to changes in macro economic variables. Figure 9.4 provides the firm value, debt value and equity value for this firm.

Figure 9.4: Firm Value over time with Long Term Debtt



Since debt value and firm value move together, the possibility of default is significantly reduced. This, in turn, will allow the firm to carry much more debt, and the added debt should provide tax benefits that make the firm more valuable. Thus, matching liability cash flows to asset cash flows allows firms to have higher optimal debt ratios.

9.7. ☞: The Rationale for Asset and Liability Matching

In chapter 4, we argued that firms should focus on only market risk, since firm-specific risk can be diversified away. By the same token, it should not matter if firms use short term debt to finance long term assets, since investors in these firms can diversify away this risk anyway.

a. True

b. False

Comment.

Matching Liabilities to Assets

The first step every firm should take towards making the right financing choices is to understand how cash flows on its assets vary over time. In this section, we consider five aspects of financing choices, and how they are guided by the nature of the cash flows generated by assets. We begin by looking at the question of financing maturity, i.e, the choice between long term, medium term and short term debt, and argue that this choice will be determined by how long term asset cash flows are. Next, we examine the choice between fixed and floating rate debt, and how this choice will be affected by the way inflation affects the cash flows on the assets financed by the debt. Third, we look at the currency of in which the debt is to be denominated and link it to the currency in which asset cash flows are generated. Fourth, we evaluate when firms should use convertible debt instead of straight rate debt, and how this determination should be linked to how much growth there is in asset cash flows. Finally, we analyze other features that can be attached to debt, and how these options can be used to insulate a firm against specific factors that affect cash flows on assets, either positively or negatively.

A. Financing Maturity

Firms can issue debt of varying maturities, ranging from very short term to very long term. In making this choice, they should first be guided by how long term the cash flows on their assets are. For instance, firms should not finance assets that generate cash flows over the short term (say 2 to 3 years) using 20-year debt. In this section, we begin

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by examining how best to assess the life of assets and liabilities, and then we consider alternative strategies to matching financing with asset cash flows.

Measuring the Cashflow Lives of Liabilities and Assets

When we talk about projects as having a 10-year life or a bond as having a 30-year maturity, we are referring to the time when the project ends or the bond comes due. The cash flows on the project, however, occur over the 10-year period, and there are usually interest payments on the bond every six months until maturity. The **duration** of an asset or liability_is a weighted maturity of all the cash flows on that asset or liability, where the weights are based upon both the timing and the magnitude of the cash flows. In general, larger and earlier cash flows are weighted more than are smaller and later cash flows. The duration of a 30-year bond, with coupons every six months, will be lower than 30 years, and the duration of a 10-year project, with cash flows each year, will generally be lower than 10 years.

A simple measure[11] of duration for a bond, for instance, can be computed as follows:

$$\text{Duration of Bond} = \frac{dP/dr}{(1+r)} = \frac{\left[\sum_{t=1}^{t=N} \frac{t * \text{Coupon}_t}{(1+r)^t} + \frac{N * \text{Face Value}}{(1+r)^N}\right]}{\left[\sum_{t=1}^{t=N} \frac{\text{Coupon}_t}{(1+r)^t} + \frac{\text{Face Value}}{(1+r)^N}\right]}$$

where N is the maturity of the bond, and t is when each coupon comes due. Holding other factors constant, the duration of a bond will increase with the maturity of the bond and decrease with the coupon rate on the bond. For example, the duration of a 7%, 30-year coupon bond, when interest rates are 8% and coupons are paid each year, can be written as follows:

$$\text{Duration of 30 - year Bond} = \frac{dP/dr}{(1+r)} = \frac{\left[\sum_{t=1}^{t=30} \frac{t * \$\,70}{(1.08)^t} + \frac{30 * \$1000}{(1.08)^{30}}\right]}{\left[\sum_{t=1}^{t=30} \frac{\$\,70}{(1.08)^t} + \frac{\$1000}{(1.08)^N}\right]} = 12.41$$

[11] This measure of duration estimated above is called *Macaulay duration*, and it does make same strong assumptions about the yield curve; specifically, the yield curve is assumed to be flat and move in parallel shifts. Other duration measures change these assumptions. For purposes of our analysis, however, a rough measure of duration will suffice.

What does the duration tell us? First, it provides a measure of when, on average, the cash flows on this bond come due, factoring in both the magnitude of the cash flows and the present value effects. This 30-year bond, for instance, has cash flows that come due in about 12.41 years, after considering both the coupons and the face value. Second, it is an approximate measure of how much the bond price will change for small changes in interest rates. For instance, this 30-year bond will drop in value by approximately 12.41% for a 1% increase in interest rates. Note that the duration is lower than the maturity. This will generally be true for coupon-bearing bonds, though special features in the bond may sometimes increase duration.[12] For zero-coupon bonds, the duration is equal to the maturity.

This measure of duration can be extended to any asset with expected cash flows. Thus, the duration of a project or asset can be estimated in terms of its pre-debt operating cash flows:

$$\text{Duration of Project/Asset} = \text{dPV/dr} = \frac{\left[\sum_{t=1}^{t=N} \frac{t * CF_t}{(1+r)^t} + \frac{N * \text{Terminal Value}}{(1+r)^N}\right]}{\left[\sum_{t=1}^{t=N} \frac{CF_t}{(1+r)^t} + \frac{\text{Terminal Value}}{(1+r)^N}\right]}$$

where CF_t is the after-tax cash flow on the project in year t, the terminal value is a measure of how much the project is worth at the end of its lifetime of N years. The duration of an asset measures both when, on average, the cash flows on that asset come due, and how much the value of the asset changes for a 1% change in interest rates.

One limitation of this analysis of duration is that it keeps cash flows fixed, while interest rates change. On real projects, however, the cash flows will be adversely affected by the increases in interest rates, and the degree of the effect will vary from business to business - more for cyclical firms (automobiles, housing) and less for non-cyclical firms (food processing). Thus the actual duration of most projects will be higher than the estimates obtained by keeping cash flows constant. One way of estimating duration without depending upon the traditional bond duration measures is to use historical data. If

[12] For instance, making the coupon rate floating, rather than fixed, will reduce the duration of a bond. Similarly, adding a call feature to a bond will decrease duration, while making bonds extendible will increase duration.

the duration is, in fact, a measure of how sensitive asset values are to interest rate changes, and a time series of data of asset value and interest rate changes is available, a regression of the former on the latter should yield a measure of duration:

$$\Delta \text{ Asset Value}_t = a + b \, \Delta \text{ Interest Rate}_t$$

In this regression, the coefficient 'b' on interest rate changes should be a measure of the duration of the assets. For firms with publicly traded stocks and bonds, the asset value is the sum of the market values of the two. For a private company or for a public company with a short history, the regression can be run, using changes in operating income as the dependent variable –

$$\Delta \text{ Operating Income}_t = a + b \, \Delta \text{ Interest Rate}_t$$

Here again, the coefficient "b" is a measure of the duration of the assets.

Illustration 9.5: Calculating Duration for Disney Theme Park

In this application, we will calculate duration using the traditional measures for the Disney Bangkok Theme Park that we analyzed in chapter 5. The cash flows for the project are summarized in Table 9.10, together with the present value estimates, calculated using the cost of capital for this project of 10.66%.

Table 9.10: Calculating a Project's Duration: Disney Theme Park

Year	*Annual Cashflow*	*Terminal Value*	*Present Value*	*Present value *t*
0	-$2,000		-$2,000	$0
1	-$1,000		-$904	-$904
2	-$833		-$680	-$1,361
3	-$224		-$165	-$496
4	$417		$278	$1,112
5	$559		$337	$1,684
6	$614		$334	$2,006
7	$658		$324	$2,265
8	$726		$323	$2,582
9	$802		$322	$2,899
10	$837	$9,857	$3,882	$38,821
			$2,050	$48,609

Duration of the Project = 48,609/2,050 = 23.71 years

This would suggest that the cash flows on this project come due, on average, in 23.71 years. The duration is longer than the life of the project because the cash flows in the first few years are negative.

9.8. ☞: **Project Life and Duration**

In investment analyses, analysts often cut off project lives at an arbitrary point and estimate a salvage or a terminal value. If these cash flows are used to estimate project duration, we will tend to

a. understate duration

b. overstate duration

c. not affect the duration estimate

Explain.

Duration Matching Strategies

In the last section, we considered ways of estimating the duration of assets and liabilities. The basic idea is to match the duration of a firm's assets to the duration of its liabilities. This can be accomplished in two ways: by matching individual assets and liabilities, or by matching the assets of the firm with its collective liabilities. In the first approach, the Disney Theme Park project would be financed with bonds with duration of approximately 24 years. While this approach provides a precise matching of each asset's characteristics to those of the financing used for it, it has several limitations. First, it is expensive to arrange separate financing for each project, given the issuance costs associated with raising funds. Second, this approach ignores interactions and correlations between projects which might make project-specific financing sub-optimal for the firm. Consequently, this approach works only for companies that have very large, independent projects.

It is far more straightforward, and often cheaper, to match the duration of a firm's collective assets to the duration of its collective liabilities. If there is a significant difference, the firm might have to consider changing the duration of its liabilities. For instance, if Disney's assets have a duration of 15 years, and its liabilities have a duration of only 5 years, the firm should try to extend the duration of its liabilities. It can do so in one of three ways. First, it can finance its new investments with debt of much longer duration; thus, using 100-year bonds to finance the new theme park will increase the weighted average duration of all its liabilities. Second, it can repay some of its short term debt and replace it with long term debt. Third, it can exchange or swap short term debt for long term debt.

9.9. ☞: **Project and Firm Duration**

Which of the following types of firms should be most likely to use project specific financing (as opposed to financing the portfolio of projects)?

a. Firms with a few large homogeneous projects
b. Firms with a large number of small homogeneous projects
c. Firms with a few larger heterogeneous projects
d. Firms with a large number of small heterogeneous projects

Explain.

B. The Fixed/Floating Rate Choice

One of the most common choices firms face is whether to make the coupon rate on bonds (and the interest rate on bank loans) a fixed rate or a floating rate, pegged to an index rate such as the LIBOR. In making this decision, we once again examine the characteristics of the projects being financed with the debt. In particular, we argue that the use of floating rate debt should be more prevalent for firms that are uncertain about the duration of future projects, and that have cash flows that move with the inflation rate.

Floating Rate Debt: The interest rate on floating rate debt varies from period to period and is linked to a specified short term rate; for instance, many floating rate bonds have coupon rates that are tied to the London Interbank Borrowing Rate (LIBOR).

Uncertainty about Future Projects

The duration of assets and liabilities can be matched up to select financing with the right maturity if the assets and projects of a firm are well identified so that their interest rate sensitivity can be estimated easily. For some firms, this estimation may be difficult to do, however. The firm might be changing its business mix by divesting itself of some assets and acquiring new assets. Alternatively, the industry to which the firm belongs might be changing. In such cases, the firm may use short term or floating rate loans that are easy to change[13], until it feels more certain about its future investment plans.

Cash Flows and Inflation

Floating rate loans have interest payments that increase as market interest rates rise and fall as rates fall. If a firm has assets whose earnings increase as interest rates go up, and decrease as interest rates go down, it should finance those assets with floating rate loans. The expected inflation rate is a key ingredient determining interest rates. On floating rate loans, this rate will lead to high interest payments in periods when inflation is high, and low interest payments in periods when inflation is low. Firms whose earnings increase in periods of high inflation, and decrease in periods with low inflation should therefore also be more likely to use floating rate loans.

A number of factors determine whether a firm's earnings move with inflation. One critical ingredient is the degree of pricing power the firm possesses. Firms that have significant pricing power, either because they produce a unique product or because they are price-leaders in their industries, have a much higher chance of being able to increase their earnings as inflation increases. Consequently, these firms should gain more by using floating rate debt. Firms that do not have pricing power are much more likely to be see cash flows decline with unexpected inflation, and they should be more cautious about using floating rate debt.

PERLS: This is a bond, denominated in the domestic currency, where the principal payment at maturity is based upon the domestic currency equivalent of a fixed foreign currency amount. For instance, this could be a dollar denominated bond with the payment at maturity set equal to the dollar value of 1600 Deutsche Marks. Thus, if the dollar strengthens against the DM during the life of the bond, the principal payment will decrease.

C. The Currency Choice

Many of the points we have made about interest rate risk exposure also apply to currency risk exposure. If any of a firm's assets or projects creates cash flows denominated in a currency other than the one in which the equity is denominated, currency risk exists. The liabilities of a firm can be issued in these currencies to reduce

[13] The presence of derivatives provides an alternative for firms that are faced with this uncertainty. They can use the financing mix that is most appropriate given their current asset mix and use derivatives to manage the intermediate risk.

the currency risk. A firm that expects 20% of its cash flows to be in Euros, for example, would attempt to issue Euro-denominated debt in the same proportion to mitigate the currency risk. If the Euro weakens and the assets become less valuable, the value of the debt will decline proportionately.

In recent years, firms have used more sophisticated variations on traditional bonds to manage foreign exchange risk on investments. For instance, Philip Morris issued a dual currency bond in 1985 — coupon payments were made in Swiss Francs, while the principal payment was in U.S. Dollars. In 1987, Westinghouse issued Principal Exchange Rate Linked Securities (PERLS), in which the principal payment was the US Dollar value of 70.13 New Zealand dollars. Finally, firms have issued bonds embedded with foreign currency options called Indexed Currency Option Notes (ICON), which combine a fixed rate bond with an option on a foreign currency. This approach is likely to work only for firms that have fairly predictable currency flows, however. For firms that do not have predictable currency flows, currency options or futures may be a cheaper way to manage currency risk, since the currency exposure changes from period to period.

D. The Choice between Straight and Convertible Bonds

Firms vary in terms of how much of their value comes from projects or assets they already own and how much comes from future growth. Firms that derive the bulk of their value from future growth should use different types of financing and design their financing differently than do those that derive most of their value from assets in place. This is so because the current cash flows on high growth firms will be low, relative to the market value. These cash flows can be expected to grow substantially over time, as the firm invests in new projects. Accordingly, the financing approach should not create large cash outflows early; it can create substantial cash outflows later, however, reflecting the cash flow patterns of the firm. In addition, the financing should exploit the value that the perception of high growth adds to securities, and it should put relatively few constraints on investment policies.

Straight bonds do not quite fit the bill, because they create large interest payments and do not gain much value from the high growth perceptions. Furthermore, they are likely include covenants designed to protect the bondholders, which restrict investment and future financing policy. Convertible bonds, by contrast, create much lower interest payments, impose fewer constraints, and gain value from higher growth perceptions. They might be converted into common stock, but only if the firm is successful. In 1999, for instance, Amazon.com, the online retailer, raised $ 1.25 billion from a convertible bond issue with a coupon rate of 3.5%.

E. Special Financing Features

Every firm is exposed to risk, coming from macro economic sources such as recessions, acts of god such as the weather, acts of competitors or technological shifts. If a firm's exposure to any or all these sources of risk is substantial, it may choose not to borrow, rather than risk default. One way in which firms can partially protect themselves against this default risk is to incorporate special features into bonds or debt, shielding themselves against the most serious risk or risks. Two examples of bonds provide good illustrations:

- Insurance companies, for instance, have issued bonds whose payments can be drastically curtailed if there is a catastrophe[14] that creates a substantial liability for the insurance company. By doing so, they reduce their debt payments in those periods when their overall cash flows are most negative, thereby reducing their likelihood of default.
- Companies in commodity businesses have issued bonds whose principal and interest payments are tied to the price of the commodity. Since the operating cash flows in these firms are also positively correlated with commodity prices, adding this feature to debt decreases the likelihood of default and allows the firm to use more debt. In 1980, for instance, Sunshine Mining issued 15-year silver linked bond issues, which combined a debt issue with an option on silver prices. As silver prices increased, the coupon rate on the bond increased; as silver prices decreased, the coupon rate on the bond decreased as well.

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[14] As an example of a catastophe bond issue, consider the bond issue made by USAA Insurance Company. The company privately placed $ 477 million of these bonds, backed up by reinsurance premiums, in June 1997. The company was protected in the event of any hurricane that created more that $ 1 billion in damage to the East Coast anytime before June 1998. The bonds came in two classes; in the first class, called principal-at-risk, the company could reduce the principal on the bond in the event of a hurricane; in the second class, which was less risky to investors, the coupon payments would be suspended in the event of a hurricance, but the principal would be protected. In return, the investors in these bonds, in October 1997,

In Practice: Customized Bonds

In keeping with the notion of customizing bonds to match asset cashflows, firms have come up with increasingly creative solutions in recent years. In this endeavor, they have been assisted by two developments. The first is that investors in bond markets are more open to both pricing and buying complex bonds than they were in the 1970s and even the 1980s. The second is that advancements in option pricing allow us to value complicated securities with multiple options embedded in them. Let us consider a few examples:

- In the early 1990s, David Bowie acquired the rights to all of his songs, bundled them and sold bonds backed record sales. What made the bonds unique was the fact that the interest rate on the bonds was tied to the sales of his record – higher (lower) rates with higher (lower) sales.
- In 2001, an Italian soccer team issued bonds to fund the construction of a stadium but tied the interest rate on the bond to the success of the team. Specifically, the interest rate on the bond would rise if the team stayed in the first division (and draw larger crowds and revenues) and drop if the team dropped to the second division.

9.10. ☞: **Special Features and Interest Rates**

Adding special features to bonds, such as linking coupon payments to commodity prices or catastrophes, will reduce their attractiveness to investors and make the interest rates paid on them higher. It follows then that

a. companies should not add these special features to bonds
b. adding these special features cannot create value for the firm if the bonds are fairly priced.
c. adding special features can still create value even if the bonds are fairly priced

Explain.

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were earnings an extra yield of almost 1.5% on the principal-at-risk bonds and almost 0.5% on the principal-protected bonds.

II. Tax Implications

As firms become more creative with their financing choices and structure debt that behaves more and more like equity, there is a danger that the tax authorities might decide to treat the financing as equity and prevent the firm from deducting interest payments. Since the primary benefit of borrowing is a tax benefit, it is important that firms preserve and, if possible, increase this tax benefit.

It is also conceivable that the favorable tax treatment of some financing choices may encourage firms to use them more than others, even if it means deviating from the choices that would be dictated by the asset characteristics. Thus, a firm that has assets that generate cash flows in Japanese yen may decide to issue dollar-denominated bonds to finance these assets, if it derives a larger tax benefit from issuing dollar debt than yen debt.

The danger of structuring financing with the intention of saving on taxes is that changes in the tax law can very quickly render the benefit moot and leave the firm with a financing mix, that is unsuited to its asset mix.

III. Views of Ratings Agencies, Equity Research Analysts and Regulatory Authorities

Firms are rightfully concerned about the views of equity research analysts and ratings agencies on their actions, though in our view, they often overestimate the influence of both groups. Analysts represent stockholders, and ratings agencies represent bondholders; consequently they take very different views of the same actions. For instance, analysts may view a stock repurchase by a company with limited project opportunities as a positive action, while ratings agencies may view it as a negative action and lower ratings in response. Analysts and ratings agencies also measure the impact of financing choices made by a firm, using very different criteria. In general, analysts view a firm's actions through the prism of higher earnings per share and by looking at the firm relative to comparable firms, using multiples such as price earnings or price to book value ratios. Ratings agencies, on the other hand, measure the effect of actions on the financial ratios, such as debt ratios and coverage ratios, which they then use to assess default risk and assign ratings.

Given the weight attached to the views of both these groups, firms sometimes design securities with the intent of satisfying both groups. In some cases, they find ways of raising funds that seem to make both groups happy, at least on the surface. To illustrate, consider the use of leasing, before generally accepted accounting principles required capitalizing of leases. Leasing increased the real leverage of the company, and thus, the earnings per share, but it did not affect the measured leverage of the company because it was not viewed as debt. To the degree that analysts and ratings agencies rely on quantitative measures and do not properly factor in the effects of these actions, firms can exploit their limitations. In fact, they still do with operating leases. In a more recent example, trust preferred stock, , has become popular largely because of the different ways in which it is viewed by different entities. It is viewed as debt by the equity research analysts and tax authorities, with the preferred dividend being tax deductible. Trust preferred is viewed as equity by ratings agencies, allowing the firms issuing it to retain high ratings.[15]

When securities are designed in such a way, the real question is whether the markets are fooled, and if so, for how long. A firm that substitutes leases and trust preferred for debt may fool the ratings agencies and even the debt markets for some period of time, but it cannot evade the reality that it is much more levered and hence much riskier.

This balancing act becomes even more precarious for regulated firms such as banks and insurance companies. These firms also have to make sure that any financing actions they take are viewed favorably by regulatory authorities. For instance, financial service firms have to maintain equity capital ratios that exceed regulatory minimums. However, regulatory authorities use a different definition of equity capital than ratings agencies and equity research analysts, and firms can exploit these differences. For instance, banks are among the heaviest users of preferred stock, since preferred stock is treated as equity by bank regulators. In the last few years, insurance companies in the

[15] Ratings agencies initially treated trust preferred as equity. Over time, they have become more cautious. By the late nineties, firms were being given credit for only a portion of the trust preferred (about 40%).

United States have issued surplus notes[16], which are considered debt for tax purposes and equity under insurance accounting rules, enabling them to have the best of both worlds — they could issue debt, while counting it as equity.[17]

IV. The Effects of Asymmetric Information

Firms generally have more information about their future prospects than do financial markets. This asymmetry in information creates frictions when firms try to raise funds. In particular, firms with good prospects try to distinguish themselves from firms without such prospects by taking actions that are costly and difficult to imitate. Firms also try to design securities to reduce the effect of uncertainty in future cash flows. Firms may therefore issue securities that may not be optimal from the standpoint of matching their asset cash flows but are specifically designed to convey information to financial markets and reduce the effects of uncertain cash flows on value.

A number of researchers have used this information asymmetry argument to draw very different conclusions about the debt structure firms should use. Myers (1977) argued that firms tend to under invest as a consequence of the asymmetry of information. One proposed solution to the problem is to issue short term debt, even if the assets being financed are long term assets.[18] Flannery (1986) and Kale and Noe (1990) note that while both short-tem and long-term debt will be mispriced in the presence of asymmetric information, long-term debt will be mispriced more.[19] Consequently, they argue that high quality firms will issue short-term debt, while low quality firms will issue long-term debt.

Goswami, Noe, and Rebello (1995) analyze the design of securities and relate it to uncertainty about future cash flows.[20] They conclude that if the asymmetry of information concerns uncertainty about long-term cash flows, firms should issue coupon-

[16] As defined in chapter 16, surplus notes are bonds where the interest payments need to be made only if the firm is profitable. If it is not, the interest payments are cumulated and paid in subsequent periods.

[17] In 1994 and 1995, insurance companies issued a total of $ 6 billion of surplus notes in the private placement market.

[18] Myers, S.C., 1977, *Determinants Of Corporate Borrowing*, Journal of Financial Economics, v5(2), 147-175.

[19] Flannery, M. J. *Asymmetric Information And Risky Debt Maturity Choice*, Journal of Finance, 1986, v41(1), 19-38; Kale, J.R. and T. H. Noe, *Risky Debt Maturity Choice in A Sequential Game Equilibrium*, Journal of Financial Research, 8, 155-165.

[20] Goswami, G.,T. Noe and M. Rebello. *Debt Financing Under Asymmetric Information*, Journal of Finance, 1995, v50(2), 633-659.

bearing long term debt, with restrictions on dividends. In contrast, firms with uncertainty about near-term cash flows and significant refinancing risk should issue long term debt, without restrictions on dividend payments. When uncertainty about information is uniformly distributed across time, firms should finance with short term debt.

V. Implications for Agency Costs

The final consideration in designing securities is the provision of features intended to reduce the agency conflicts between stockholders and bondholders. As we noted in Chapter 7, differences between bondholders and stockholders on investment, financing and dividend policy decisions can influence capital structure decisions, either by increasing the costs of borrowing or by increasing the constraints associated with borrowing. In some cases, firms design securities with the specific intent of reducing this conflict and its associated costs:

- We explained that convertible bonds are a good choice for growth companies because of their cash flow characteristics. Convertible bonds can also reduce the anxiety of bondholders about equity investors investing in riskier projects and expropriating wealth, by allowing bondholders to become stockholders if the stock price increases enough.
- More corporate bonds include embedded put options that allow bondholders to put the bonds back at face value if the firm takes a specified action (such as increasing leverage) or if its rating drops. In a variation, in 1988, Manufacturer Hanover issued rating sensitive notes promising bondholders higher coupons if the firm's rating deteriorated over time. Thus, bond investors would be protected in the event of a downgrade.
- Merrill Lynch introduced LYONs (Liquid Yield Option Notes), which incorporated put and conversion features to protect against both the risk shifting and claim substitution to which bondholders are exposed.

Barclay and Smith (1996) examine debt issues by U.S. companies between 1981 and 1993 and conclude that high growth firms are more likely to issue short term debt with higher priority.[21] This finding is consistent with both the information asymmetry argument and the agency cost argument, since lenders are more exposed to both costs with high growth firms.

In Summary

In choosing the right financing vehicles to use, firms should begin by examining the characteristics of the assets they are financing and try to match the maturity, interest rate and currency mix, and special features of their financing to these characteristics. They can then superimpose tax considerations, the views of analysts and ratings agencies, agency costs and the effects of asymmetric information to modify this financing mix. Figure 9.5 summarizes the discussion on the preceding pages.

In Practice: The Role of Derivatives and Swaps

In the last 30 years, the futures and options markets have developed to the point that firms can hedge exchange rate, interest rate, commodity price and other risks using derivatives. In fact, firms can use derivatives to protect themselves against risk exposures that are generated by mismatching debt and assets. Thus, a firm that borrows in dollars to fund projects denominated in Yen can use dollar/yen forward, futures and options contracts to reduce or even eliminate the resulting risk. Given the existence of these derivatives, you may wonder why it is even necessary to go through the process that we have just described to arrive at the perfect debt. We would offer tow reasons. The first is that the use of derivatives can be costly, if used recurrently. Thus, a firm with a stable portion of its revenues coming from Yen will find it cheaper to use Yen debt rather than using derivatives to correct mismatched debt. Derivatives are useful, however, to hedge against risk exposure that is transient and volatile. A company like Boeing, for instance, whose currency exposure can shift from year to year depending upon who they sell planes to will find it cheaper to use derivatives to hedge the shifting risk. The second problem with derivatives is that while they are widely available in some cases, they are much more difficult to find in others. Thus, a Brazilian firm that borrows in US dollars to

[21] Barclay, M.J., and C.W. Smith, On Financial Architecture: Leverage, Maturity and Priority, Journal of Applied Corporate Finance, v8(4), 4-17.

fund Brazilian real denominated projects will find it very difficult to hedge against risk beyond the short term because there are no long term forward and futures contracts available for dollars versus Real.

What about swaps? Swaps can be useful for firms that have a much better reputation among investors in one country (usually, the domestic market in which they operate) than in other markets. In such cases, these firms may choose to raise their funds domestically even for overseas projects, because they get better terms on their financing. This creates a mismatch between cash inflows and outflows, which can be resolved by using currency swaps, where a firm's liabilities in one currency can be swapped for liabilities in another currency. This enables the firm to take advantage of its reputation effect and match cash flows at the same time.Generally speaking, swaps can be used to take advantage of any "market" imperfections that a firm might observe. Thus, if floating rate debt is attractively priced relative to fixed rate debt, a firm which does not need floating rate debt can issue it, and then swap it for fixed rate debt at a later date.

FIGURE 9.5: The Design of Debt: An Overview of the Process

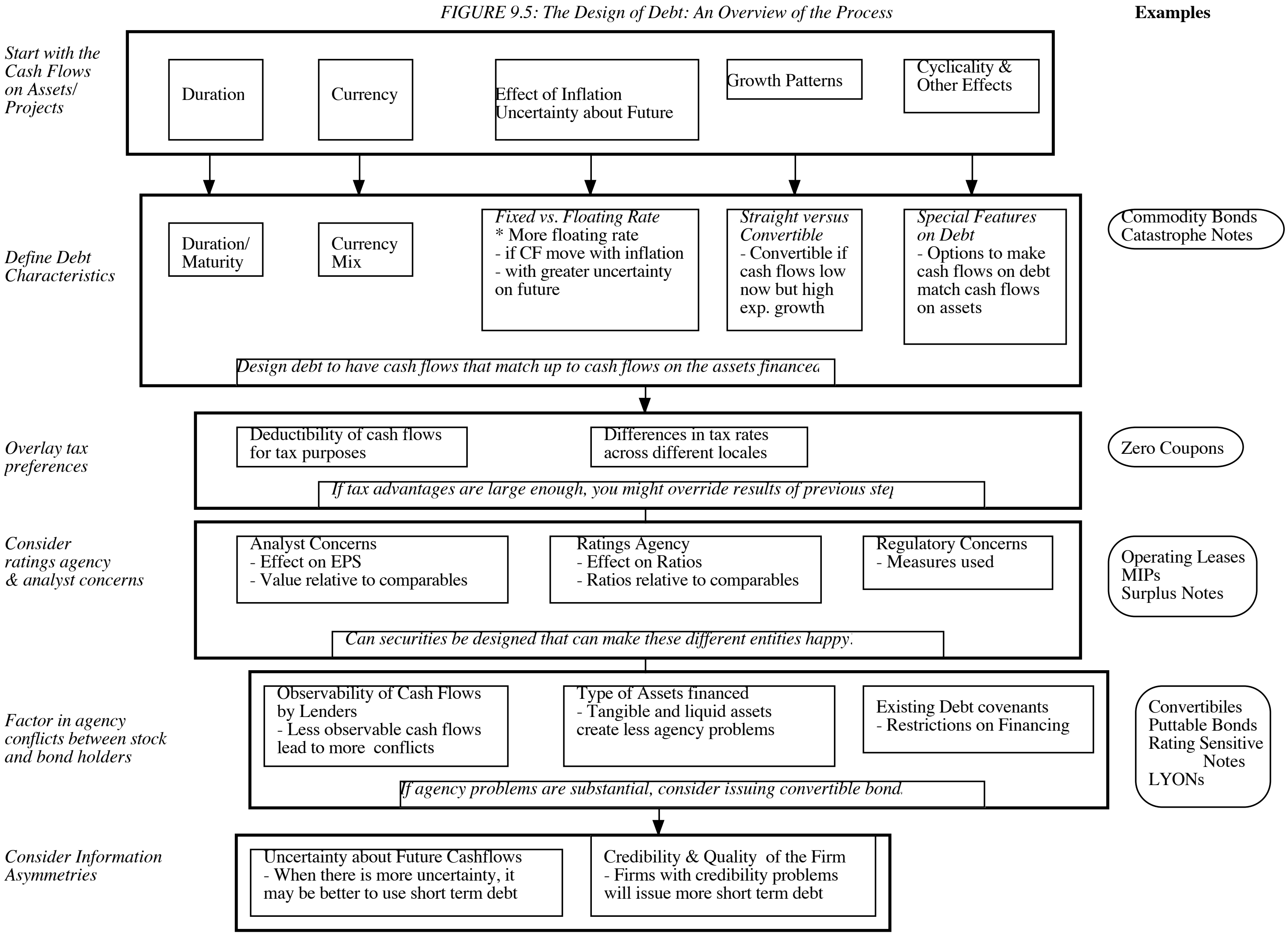

Illustration 9.6: Coming Up With The Financing Details: Disney

In this illustration, we describe how we would make financing choices for Disney, using two approaches, one intuitive and the other more quantitative. Both approaches should be considered in light of the analysis done in the previous chapter, which suggested that Disney had untapped debt potential that could be used for future projects.

Intuitive Approach

The intuitive approach begins with an analysis of the characteristics of a typical project and uses it to make recommendations for the firm's financing. For Disney, the analysis is complicated by the fact that as a diverse entertainment business with theme park holdings, its typical project varies by type of business. In chapter 4, we broke down Disney into four businesses – movies, broadcasting, theme parks and consumer products. In table 9.11 , we consider the typical project in each business and the appropriate debt for each:

Figure 9.11: Designing Disney's perfect debt – Intuitive Analysis

Business	*Project Cash Flow Characteristics*	*Type of Financing*
Movies	Projects are likely to 1. Be short term 2. Have cash outflows primarily in dollars (since Disney makes most of its movies in the U.S.) but cash inflows could have a substantial foreign currency component (because of overseas sales) 3. Have net cash flows that are heavily driven by whether the movie is a "hit", which is often difficult to predict.	Debt should be 1. Short term 2. Primarily dollar debt. 3. If possible, tied to the success of movies. (Lion King or Nemo Bonds)
Broadcasting	Projects are likely to be 1. Short term 2. Primarily in dollars, though foreign component is growing 3. Driven by advertising revenues and show success	Debt should be 1. Short term 2. Primarily dollar debt 3. If possible, linked to network ratings.
Theme Parks	Projects are likely to be 1. Very long term 2. Primarily in dollars, but a significant proportion of revenues come from foreign tourists, who are likely to stay away if the dollar strengthens	Debt should be 1. Long term 2. Mix of currencies, based upon tourist make up.

	3. Affected by success of movie and broadcasting divisions.	
Consumer Products	Projects are likely to be short to medium term and linked to the success of the movie division. Most of Disney's product offerings are derived from their movie productions.	Debt should be a. Medium term b. Dollar debt.

A Quantitative Approach

A quantitative approach estimates Disney's sensitivity to changes in a number of macro-economic variables, using two measures: Disney's firm value (the market value of debt and equity) and its operating income.

Value Sensitivity to Factors: Past Data

The value of a firm is the obvious choice when it comes to measuring its sensitivity to changes in interest rates, inflation rates, or currency rates, because firm value reflects the effect of these variables on current and future cash flows as well as on discount rates. We begin by collecting past data on firm value, operating income and the macroeconomic variables against which we want to measure its sensitivity. In the case of the Disney, we choose four broad measures (See Table 9.12):

- *Long-term treasury bond rate*, since the sensitivity of firm value to changes in interest rates provides a measure of the duration of the projects. It also provides insight into whether the firm should use fixed or floating rate debt; a firm whose operating income changes with interest rates should consider using floating rate loans.
- *Real GDP*, since the sensitivity of firm value to this variable provides a measure of the cyclicality of the firm.
- *Currency rate*, since the sensitivity of firm value to the currency rate provides a measure of the exposure to currency rate risk and thus helps determine what the currency mix for the debt should be.
- *Inflation rate*, since the sensitivity of firm value to the inflation rate helps determine whether the interest rate on the debt should be fixed or floating rate debt.

Table 9.12: Disney's Firm Value and Macroeconomic Variables

Period	*Operating Income*	*Firm value*	*T.Bond Rate*	*Change in rate*	*GDP (Deflated)*	*% Chg in GDP*	*CPI*	*Change in CPI*	*Weighted Dollar*	*% Change in $*
2003	$2,713	$68,239	4.29%	0.40%	10493	3.60%	2.04%	0.01%	88.82	-14.51%
2002	$2,384	$53,708	3.87%	-0.82%	10128	2.98%	2.03%	-0.10%	103.9	-3.47%

2001	$2,832	$45,030	4.73%	-1.20%	9835	-0.02%	2.13%	-1.27%	107.64	1.85%
2000	$2,525	$47,717	6.00%	0.30%	9837	3.53%	3.44%	0.86%	105.68	11.51%
1999	$3,580	$88,558	5.68%	-0.21%	9502	4.43%	2.56%	1.05%	94.77	-0.59%
1998	$3,843	$65,487	5.90%	-0.19%	9099	3.70%	1.49%	-0.65%	95.33	0.95%
1997	$3,945	$64,236	6.10%	-0.56%	8774	4.79%	2.15%	-0.82%	94.43	7.54%
1996	$3,024	$65,489	6.70%	0.49%	8373	3.97%	2.99%	0.18%	87.81	4.36%
1995	$2,262	$54,972	6.18%	-1.32%	8053	2.46%	2.81%	0.19%	84.14	-1.07%
1994	$1,804	$33,071	7.60%	2.11%	7860	4.30%	2.61%	-0.14%	85.05	-5.38%
1993	$1,560	$22,694	5.38%	-0.91%	7536	2.25%	2.75%	-0.44%	89.89	4.26%
1992	$1,287	$25,048	6.35%	-1.01%	7370	3.50%	3.20%	0.27%	86.22	-2.31%
1991	$1,004	$17,122	7.44%	-1.24%	7121	-0.14%	2.92%	-3.17%	88.26	4.55%
1990	$1,287	$14,963	8.79%	0.47%	7131	1.68%	6.29%	1.72%	84.42	-11.23%
1989	$1,109	$16,015	8.28%	-0.60%	7013	3.76%	4.49%	0.23%	95.10	4.17%
1988	$789	$9,195	8.93%	-0.60%	6759	4.10%	4.25%	-0.36%	91.29	-5.34%
1987	$707	$8,371	9.59%	2.02%	6493	3.19%	4.63%	3.11%	96.44	-8.59%
1986	$281	$5,631	7.42%	-2.58%	6292	3.11%	1.47%	-1.70%	105.50	-15.30%
1985	$206	$3,655	10.27%	-1.11%	6102	3.39%	3.23%	-0.64%	124.56	-10.36%
1984	$143	$2,024	11.51%	-0.26%	5902	4.18%	3.90%	-0.05%	138.96	8.01%
1983	$134	$1,817	11.80%	1.20%	5665	6.72%	3.95%	-0.05%	128.65	4.47%
1982	$141	$2,108	10.47%	-3.08%	5308	-1.61%	4%	-4.50%	123.14	6.48%

Firm Value = Market Value of Equity + Book Value of Debt

Once these data have been collected, we can then estimate the sensitivity of firm value to changes in the macroeconomic variables by regressing changes in firm value each year against changes in each of the individual variables.

I. Sensitivity to changes in interest rates

As we discussed earlier, the duration of a firm's projects provides useful information for determining the maturity of its debt. While bond-based duration measures may provide some answers, they will understate the duration of assets or projects if the cash flows on these assets or projects themselves vary with interest rates. Regressing changes in firm value against changes[22] in interest rates over this period yields the following result (with t statistics in brackets):

Change in Firm Value = 0.2081 - 4.16 (Change in Interest Rates)

(2.91) (0.75)

Based upon this regression, the duration of Disney's projects collectively is about 4.16 years. If this were a reliable estimate, Disney should try to keep the duration of its bond issues to at least 3.71 years. Unfortunately, though, there is significant noise in the estimate, and the coefficient is not a reliable estimate of duration.

II. Sensitivity to Changes in the Economy

Is Disney a cyclical firm? One way to answer this question is to measure the sensitivity of firm value to changes in economic growth. Regressing changes in firm value against changes in the real Gross Domestic Product (GDP) over this period yields the following result:

Change in Firm Value = 0.2165 + 0.26 (GDP Growth)
(1.56) (0.07)

Disney's value as a firm has not been affected significantly by economic growth. Again, to the extent that we trust the coefficients from this regression, this would suggest that Disney is not a cyclical firm.

III. Sensitivity to Changes in the Inflation Rates

We earlier made the argument, based upon asset/liability matching, that firms whose values tend to move with inflation should be more likely to issue floating rate debt. To examine whether Disney fits this pattern, we regressed changes in firm value against changes in the inflation rate over this period with the following result:

Change in Firm Value = 0.2262 + 0.57 (Change in Inflation Rate)
(3.22) (0.13)

Disney's firm value is unaffected by changes in inflation since the coefficient on inflation is not statistically different from zero. Since interest payments have to be made out of operating cash flows, we will also have to look at how operating income changes with inflation before we can make a final decision on this issue.

IV. Sensitivity to Changes in the Dollar

We can answer the question of how sensitive Disney's value is to changes in currency rates by looking at how the firm's value changes as a function of changes in currency rates. Regressing changes in firm value against changes in the dollar over this period yields the following regression:

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[22] To ensure that the coefficient on this regression is a measure of duration, we compute the change in the interest rate as follows: $(r_t - r_{t-1})/(1+r_{t-1})$. Thus, if the long term bond rate goes from 8% to 9%, we compute

Change in Firm Value = 0.2060 -2.04 (Change in Dollar)

(3.40) (2.52)

Statistically, this yields the strongest relationship. Disney's firm value decreases as the dollar strengthens.. If this pattern continues, Disney should consider using non-dollar debt. If it had not been very sensitive to exchange rate changes, Disney could have issued primarily dollar debt.

Cash Flow Sensitivity to Factors: Past Data

In some cases, it is more reasonable to estimate the sensitivity of operating cash flows directly against changes in interest rates, inflation, and other variables. This is particularly the case when we are designing interest payments on debt, since these payments to be made out of operating income. For instance, while our regression of firm value against inflation rates showed a negative relationship and led to the conclusion that Disney should not issue floating rate debt, we might reverse our view if operating income were positively correlated with inflation rates. For Disney, we repeated the analysis using operating income as the dependent variable, rather than firm value. Since the procedure for the analysis is similar, we summarize the conclusions below:

- Regressing changes in operating cash flow against changes in interest rates over this period yields the following result –

  Change in Operating Income = 0.2189 + 6.59 (Change in Interest Rates)

  (2.74) (1.06)

  Disney's operating income, unlike its firm value, has moved with interest rates. Again, this result has to be considered in light of the low t statistics on the coefficients. In general, regressing operating income against interest rate changes should yield a lower estimate of duration than the firm value measure, for two reasons. One is that income tends to be smoothed out relative to value, and the other is that the current operating income does not reflect the effects of changes in interest rates on discount rates and future growth.
- Regressing changes in operating cash flow against changes in Real GDP over this period yields the following regression –

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the change to be (.09-.08)/1.08.

Change in Operating Income = 0.1725 + 0.66 (GDP Growth)
(1.10) (0.15)

Disney's operating income, like its firm value, does not reflect any sensitivity to overall economic growth, confirming the conclusion that Disney is not a cyclical firm.

- Regressing changes in operating cash flow against changes in the dollar over this period yields the following regression –

Change in Operating Income = 0.1768 -1.76 (Change in Dollar)
(2.42) (1.81)

Disney's operating income, like its firm value, is negatively affected by a stronger dollar.

- Regressing changes in operating cash flow against changes in inflation over this period yields the following result –

Change in Operating Income = 0.2192 +9.27 (Change in Inflation Rate)
(3.01) (1.95)

Unlike firm value which is unaffected by changes in inflation, Disney's operating income moves strongly with inflation, rising as inflation increases. This would suggest that Disney has substantial pricing power, allowing it to transmit inflation increases into its prices and operating income. This makes a strong case for the use of floating rate debt.

The question of what to do when operating income and firm value have different results can be resolved fairly simply. For issues relating to the overall design of the debt, the firm value regression should be relied on more; for issues relating to the design of interest payments on the debt, the operating income regression should be used more. Thus, for the duration measure, the regression of firm value on interest rates should, in general, give a more precise estimate. For the inflation rate sensitivity, since it affects the choice of interest payments (fixed or floating), the operating income regression should be relied on more.

Bottom up Estimates for Debt Design

While this type of analysis yields quantitative results, those results should be taken with a grain of salt. They make sense only if the firm has been in its current business for a long time and expects to remain in it for the foreseeable future. In today's environment, in which firms find their business mixes changing dramatically from period to period as they divest some businesses and acquire new ones, it is unwise to base too many conclusions on a historical analysis. In such cases, we might want to look at the characteristics of the industry in which a firm plans to expand, rather than using past earnings or firm value as a basis for the analysis. Furthermore, the small sample sizes used tend to yield regression estimates that are not statistically significant (as is the case with the duration estimate that we obtained for Disney from the firm value regression).

To illustrate, we looked at the sector estimates[23] for each of the sensitivity measures for the entertainment, theme park and consumer product businesses:

	Coefficients on firm value regression				
	Interest Rates	GDP Growth	Inflation	Currency	Disney Weights
Movies	-3.70	0.56	1.41	-1.23	25.62%
Theme Parks	-6.47	0.22	-1.45	-3.21	20.09%
Broadcasting	-4.50	0.70	-3.05	-1.58	49.25%
Consumer Products	-4.88	0.13	-5.51	-3.01	5.04%
Disney	-4.71	0.54	-1.71	-1.89	100%

These bottom-up estimates suggest that Disney should be issuing long term fixed-rate debt with a duration of 4.71 years, and that firms in this sector are relatively unaffected by both the overall economy. Like Disney, firms in these businesses tend to be hurt by a stronger dollar, but,, unlike Disney, they do not seem have much pricing power (note the negative coefficient on inflation. The sector averages also have the advantage of more precision than the firm-specific estimates and can be relied on more.

Overall Recommendations

Based upon the analyses of firm value and operating income, as well as the sector averages, our recommendations would essentially match those of the intuitive approach,

[23] These sector estimates were obtained by aggregating the firm values of all firms in a sector on a quarter-by-quarter basis going back 12 years, and then regressing changes in this aggregate firm value against changes in the macro-economic variable each quarter.

but they would have more depth to because of the additional information we have acquired from the quantitative analysis:

- The debt issued should be long term and should have duration of between 4 and 5 years.
- A significant portion of the debt should be floating rate debt, reflecting Disney's capacity to pass inflation through to its customers and the fact that operating income tends to increase as interest rates go up.
- Given Disney's sensitivity to a stronger dollar, a portion of the debt should be in foreign currencies. The specific currency used and the magnitude of the foreign currency debt should reflect where Disney makes its revenues. Based upon 2003 numbers at least, this would indicate that about 20% of the debt should be in Euros and about 10% of the debt in Japanese Yen reflecting Disney's larger exposures in Europe and Asia. As its broadcasting businesses expand into Latin America, it may want to consider using either Mexican Peso or Brazilian Real debt as well.

These conclusions can be used to both design the new debt issues that the firm will be making going forward, and to evaluate the existing debt on the firm's books to see if there is a mismatching of assets and financing in the current firm. Examining Disney's debt at the end of 2003, we note the following.

- Disney has $13.1 billion in debt with an average maturity of 11.53 years. Even allowing for the fact that the maturity of debt is higher than the duration, this would indicate that Disney's debt is far too long term for its existing business mix.
- Of the debt, about 12% is Euro debt and no yen denominated debt. Based upon our analysis, a larger portion of Disney's debt should be in foreign currencies.
- Disney has about $1.3 billion in convertible debt and some floating rate debt, though no information is provided on its magnitude. If floating rate debt is a relatively small portion of existing debt, our analysis would indicate that Disney should be using more of it.

If Disney accepts the recommendation that its debt should be more short term, more foreign currency and more floating rate debt, it can get there in two ways:

- It can swap some of its existing long term, fixed rate, dollar debt with shorter term, floating rate, foreign currency debt. Given Disney's standing in financial markets and its large market capitalization, this should not be difficult to do.
- If Disney is planning new debt issues, either to get to a higher debt ratio or to fund new investments, it can use primarily short term, floating rate, foreign currency debt to fund these new investments. While it may be mismatching the funding on these investments, its debt matching will become better at the company level.

*macrodur.xls*: This spreadsheet allows you to estimate the sensitivity of firm value and operating income to changes in macro-economic variables.

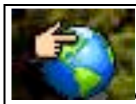
*dursect.xls*: There is a dataset on the web that summarizes the results of regressing firm value against macroeconomic variables, by sector, for U.S. companies.

Illustration 9.7: Estimating the Right Financing Mix for Bookscape, Aracruz and Deutsche Bank

While we will not examine the right financing type for Bookscape, Aracruz and Deutsche Bank in the same level of detail as we did for Disney, we will summarize, based upon our understanding of their businesses, what we think will be the best kind of financing for each of these firms:

- *Bookscape*: Given Bookscape's dependence upon revenues at its New York bookstores, we would design the debt to be
    - Long term, since the store is a long term investment
    - Dollar-denominated, since all the cash flows are in dollars
    - Fixed rate debt, since Bookscapes lack of pricing power makes it unlikely that they can keep pace with inflation

  It is worth noting that operating leases fulfill all of these conditions, making it the apprpriate debt for Bookscape. Since that is the only debt that Bookscape carries currently, we would suggest no changes.
- *Aracruz*: Aracruz operates most of its paper plants in Brazil, but gets a significant proportion of its products overseas. More than 80% of its revenues in 2003 were to

other countries, and the bulk of these revenues were dollar-denominated. Given this structure, we would design debt to be

  - Long term, since a typical paper plant has a life in excess of 20 years,
  - Dollar-denominated, since the cash inflows are primarily in dollars,
  - Given the volatility of paper prices, we would try to link the interest rate on debt to pulp prices, if possible.

The existing debt at Aracruz is primarily dollar debt but it is short term, with an average maturity of 3.20 years. While this may reflect the difficulties that Brazilian firms have faced in borrowing long term historically, the constraints on borrowing long term are easing for many emerging market companies that derive the bulk of their revenues in dollars.

- *Deutsche Bank:* In the case of Deutsche Bank, the recommendation is made simpler by the fact that the debt ratio we are analyzing is the long-term debt ratio. In addition to being long term, however, the debt should reflect
  - The mix of currencies in which Deutsche Bank gets its cash flows, which should lead to significant dollar (from its U.S. holdings) and British Pound (from its Morgan Grenfell subsidiary) debt issues. In future years, this would expand to include more emerging market debt issues to reflect Deutsche Bank's greater dependence on cash flows from these markets.
  - The changing mix of Deutsche Bank's business to reflect its increasing role in investment banking.

  It is possible that Deutsche Bank's reputation in Europe may allow it to borrow more cheaply in some markets (say, Germany) than in others. If that is the case, it can either issue its dollar-denominated or pound-denominated debt in those markets, or issued debt in Euros and then swap the debt into U.S. dollar or British pound debt.

Summary

In this chapter, we examine how firms change debt ratios towards the optimal, and how they choose the right financing vehicles to use, to both finance existing assets and new investments.

Some firms that are under or over levered may choose to not change their debt ratios to the optimal. This may arise either because they do not share the objective of maximizing firm value that underlies optimal debt ratios, or because they feel that the costs of moving to the optimal outweigh the benefits. Firms that do decide to change their financing mixes can change either gradually or quickly. Firms are much more likely to change their financing mixes quickly if external pressure is brought to bear on the firm. For under levered firms, the pressure takes the form of hostile acquisitions, whereas for over levered firms, the threat is default and bankruptcy. Firms that are not under external pressure for change have the luxury of changing towards their optimal debt ratios gradually.

Firms can change their debt ratios in four ways. They can recapitalize existing investments, using new debt to reduce equity or new equity to retire debt. They can divest existing assets, and use the cash to reduce equity or retire debt. They can invest in new projects, and finance these investments disproportionately with debt or equity. Finally, they can increase or decrease the proportion of their earnings that are returned to stockholders, in the form of dividends or stock buybacks. To decide between these alternatives, firms have to consider how quickly they need to change their debt ratios, the quality of the new investments they have and the marketability of existing investments.

In the final section, we examine how firms choose between financing vehicles. Matching cash flows on financing to the cash flows on assets reduces default risk and increases the debt capacity of firms. Applying this principle, long-term assets should be financed with long term debt, assets with cash flows that move with inflation should be financed with floating rate debt, assets with cash flows in a foreign currency should be financed with debt in the same currency, and assets with growing cash flows should be financed with convertible debt. This matching can be done intuitively, by looking at a typical project, or can be based upon historical data. Changes in operating income and value can be regressed against changes in macroeconomic variables to measure the sensitivity of the firm to these variable. This can then be used to design the optimal financing vehicle for the firm. Once we identified the right financing vehicle, we have to make sure that we preserve the tax advantages of debt, and keep equity research analysts and ratings agencies happy.

Live Case Study

Mechanics of Moving to the Optimal

Objective: To determine whether your firm should move to its optimal mix, and if so, how, and to analyze the right type of debt for your firm.

Key Questions:

- If your firm's actual debt ratio is different from its "recommended" debt ratio, how should they get from the actual to the optimal? In particular,
  a. should they do it gradually over time or should they do it right now?
  b. should they alter their existing mix (by buying back stock or retiring debt), should they invest in new projects with debt or equity or should they change how much they return to stockholders?
- What type of financing should this firm use? In particular,
  a. should the financing be short term or long term?
  b. what currency should it be in?

c. what special features should the financing have?

Framework for Analysis

1. *The Immediacy Question*
   - If the firm is under levered, does it have the characteristics of a firm that is a likely takeover target? (Target firms in hostile takeovers tend to be smaller, have poorer project and stock price performance than their peer groups and have lower insider holdings)
   - If the firm is over levered, is it in danger of bankruptcy? (Look at the bond rating, if the company is rated. A junk bond rating suggests high bankruptcy risk.)
2. *Alter Financing Mix or Take Proejcts*
   - What kind of projects does this firm expect to have? Can it expect to make excess returns on these projects? (Past project returns is a reasonable place to start - see the section under investment returns)
   - What type of stockholders does this firm have? If cash had to be returned to them, would they prefer dividends or stock buybacks? (Again, look at the

past. If the company has paid high dividends historically, it will end up with investors who like dividends)

3. *Financing Type*
    - How sensitive has this firm's value been to changes in macro economic variables such as interest rates, currency movements, inflation and the economy?
    - How sensitive has this firm's operating income been to changes in the same variables?
    - How sensitive is the sector's value and operating income to the same variables?
    - What do the answers to the last 3 questions tell you about the kind of financing that this firm should use?

Getting Information on mechanics of capital structure

To get the inputs needed to estimate the capital structure mechanics, you can get the information on macro economic variables such as interest rates, inflation, GNP growth and exchange rates from my web site. You can get historical information on your own firm by looking at the Value Line page for your firm, which has information for the last 15 years on revenues and operating income.

Online sources of information:

http://www.stern.nyu.edu/~adamodar/cfin2E/project/data.htm

Problems

1. BMD Inc is a firm with no debt on its books currently and a market value of equity of $ 2 billion. Based upon its EBITDA of $ 200 million, it can afford to have a debt ratio of 50%, at which level the firm value should be $ 300 million higher.

   a. Assuming that the firm plans to increase its leverage instantaneously, what are some of the approaches it could use to get to 50%?

   b. Is there a difference between repurchasing stock and paying a special dividend? Why or why not?

   c. If BMD has a cash balance of $ 250 million at this time, will it change any of your analysis?

2. MiniSink Inc. is a manufacturing company that has $ 100 million in debt outstanding and 9 million shares trading at $ 100 per share. The current beta is 1.10, and the interest rate on the debt is 8%. In the latest year, MiniSink reported a net income of $ 7.50 per share, and analysts expect earnings growth to be 10% a year for the next 5 years. The firm faces a tax rate of 40% and pays out 20% of its earnings as dividends (the treasury bond rate is 7%).

a. Estimate the debt ratio each year for the next 5 years, assuming that the firm maintains it current payout ratio.

b. Estimate the debt ratio each year for the next 5 years, assuming that the firm doubles its dividends and repurchases 5% of the outstanding stock every year.

3. IOU Inc. has $ 5 billion in debt outstanding (carrying an interest rate of 9%), and 10 million shares trading at $ 50 per share. Based upon its current EBIT of $ 200 million, its optimal debt ratio is only 30%. The firm has a beta of 1.20, and the current treasury bond rate is 7%. Assuming that the operating income will increase 10% a year for the next five years and that the firm's depreciation and capital expenditures both amount to $ 100 million annually for each of the five years, estimate the debt ratio for IOU if

a. it maintains its existing policy of paying $ 50 million a year in dividends for the next 5 years.

b. it eliminates dividends.

4. DGF Corporation has come to you for some advice on how best to increase their leverage over time. In the most recent year, DGF had EBITDA of $ 300 million, owed $ 1 billion in both book value and market value terms, and had a net worth of $ 2 billion (the market value was twice the book value). It had a beta of 1.30, and the interest rate on its debt is 8% (the treasury bond rate is 7%). If it moves to its optimal debt ratio of 40%, the cost of capital is expected to drop by 1%.

a. How should the firm move to its optimal? In particular, should it borrow money and take on projects or should it pay dividends/repurchase stock?

b. Are there any other considerations that may affect your decision?

5. STL Inc. has asked you for advice on putting together the details of the new debt issues it is planning to make. What information would you need to obtain to provide this advice?

6. Assume now that you have uncovered the following facts about the types of projects STL takes:

a. The projects are primarily infrastructure projects, requiring large initial investments and long gestation periods.

b. Most of the new projects will be in emerging markets, and the cash flows are expected to be in the local currencies, when they do occur.

c. The magnitude of the cash flows will, in large part, depend upon how quickly the economies of the emerging markets grow in the long term.

How would you use this information in the design of the projects?

7. You are attempting to structure a debt issue for Eaton Corporation, a manufacturer of automotive components. You have collected the following information on the market values of debt and equity for the last ten years:

Year	*Market Value of Equity*	*Debt*
1985	1824.9	436

1986	2260.6	632
1987	2389.6	795
1988	1960.8	655
1989	2226	836
1990	1875.9	755
1991	2009.7	795
1992	2589.3	833
1993	3210	649
1994	3962.7	1053

In addition, you have the following information on the changes in long term interest rates, inflation rates, GNP, and exchange rates over the same period.

Year	Long Bond Rate	GNP Growth	Weighted Dollar	Inflation Rate
1985	11.40%	6.44%	125.95	3.50%
1986	9.00%	5.40%	112.89	1.90%
1987	9.40%	6.90%	95.88	3.70%
1988	9.70%	7.89%	95.32	4.10%
1989	9.30%	7.23%	102.26	4.80%
1990	9.30%	5.35%	96.25	5.40%
1991	8.80%	2.88%	98.82	4.20%
1992	8.10%	6.22%	104.58	3.00%
1993	7.20%	5.34%	105.22	3.00%
1994	8.00%	5.97%	98.6	2.60%

Using this information,

a. Estimate the duration of this firm's projects. How would you use this information in designing the debt issue?

b. How cyclical is this company? How would that affect your debt issue?

c. Estimate the sensitivity of firm value to exchange rates. How would you use this information in designing the debt issue?

d. How sensitive is firm value to inflation rates? How would you use this information in designing the debt issue?

e. What factors might lead you to override the results of this analysis?

8. Repeat the analysis in problem 7 for a private firm that has provided you with the following estimates of operating income for the ten years for which you have the macro economic data:

Year	*Operating Income*
1985	463.05
1986	411.696
1987	483.252
1988	544.633
1989	550.65
1990	454.875
1991	341.481
1992	413.983
1993	567.729
1994	810.968

9. Assuming that you do the analysis in problem 8 with both firm value and operating income, what are the reasons for the differences you might find in the results, using each? When would you use one over the other?

10. Pfizer, a major pharmaceutical company, has a debt ratio of 10.30% and is considering increasing its debt ratio to 30%. Its cost of capital is expected to drop from 14.51% to 13.45%. Pfizer had earnings before interest and taxes of $ 2 billion in 1995, and a book value of capital (debt + equity) of approximately $ 8 billion. It also faced a tax rate of 40% on its income. The stock in the firm is widely held, but the corporate charter includes significant anti-takeover restrictions.

a. Should Pfizer move to its desired debt ratio quickly or gradually? Explain.

b. Given the choice in part a, explain how you would move to the optimal?

c. Pfizer is consider using the excess debt capacity for an acquisition. What are some of the concerns it should have?

11. Upjohn, which is also a major pharmaceutical company, is considering increasing its debt ratio from 11% to 40%, which is its optimal debt ratio. Its beta is 1.17, and the current treasury bond rate is 6.50%. The return on equity was 14.5% in the most recent year, but it is dropping, as health care matures as a business. The company has also been mentioned as a possible takeover target, and is widely held.

a. Would you suggest that Upjohn move to the optimal ratio immediately? Explain.

b. How would you recommend that Upjohn increase its debt ratio?

12. U.S. steel companies have generally been considered mature in terms of growth, and often take on high leverage to finance their plant and equipment. Steel companies in some emerging markets often have high growth rates and good growth prospects. Would you expect these companies to also have high leverage? Why or why not?

13. You are trying to decide whether the debt structure that Bethlehem Steel has currently is appropriate, given its assets. You regress changes in firm value against changes in interest rates, and arrive at the following equation –

Change in Firm Value = 0.20% - 6.33 (Change in Interest Rates)

a. If Bethlehem Steel has primarily short term debt outstanding, with a maturity of 1 year, would you deem it appropriate?

b. Why might Bethlehem Steel be inclined to use short term debt to finance longer term assets?

14. Railroad companies in the United States tend to have long term, fixed rate, dollar denominated debt. Explain why.

15. The following table summarizes the results of regressing changes in firm value against changes in interest rates for six major footwear companies –

Change in Firm Value = a + b (Change in Long Term Interest Rates)

Company	Intercept (a)	Slope Coefficient (b)
LA Gear	-0.07	-4.74
Nike	0.05	- 11.03
Stride Rite	0.01	-8.08
Timberland	0.06	-22.50
Reebok	0.04	- 4.79
Wolverine	0.06	-2.42

a. How would you use these results to design debt for each of these companies?

b. How would you explain the wide variation across companies? Would you use the average across the companies in any way?

16. You have run a series of regressions of firm value changes at Motorola, the semiconductor company, against changes in a number of macro-economic variables. The results are summarized below –

Change in Firm Value = 0.05 - 3.87 (Change in Long Term Interest Rate)

Change in Firm Value = 0.02 + 5.76 (Change in Real GNP)

Change in Firm Value = 0.04 - 2.59 (Inflation Rate)

Change in Firm Value = 0.05 - 3.40 ($/DM)

a. Based upon these regressions, how would you design Motorola's financing?

b. Motorola, like all semiconductor companies, is sensitive to the health of high technology companies. Is there any special feature you can add to the debt to reflect this dependence?

CHAPTER 10

DIVIDEND POLICY

At the end of each year, every publicly traded company has to decide whether to return cash to its stockholders and, if yes, how much in the form of dividends. The owner of a private company has to make a similar decision about how much cash he plans to withdraw from the business, and how much to reinvest. This is the dividend decision, and we begin this chapter by providing some background on three aspects of dividend policy. One is a purely procedural question about how dividends are set and paid out to stockholders. The second is an examination of widely used measures of how much a firm pays in the dividends. The third is an empirical examination of some patterns that firms follow in dividend policy.

Having laid this groundwork, we look at three schools of thought on dividend policy. The dividend irrelevance school believes that dividends do not really matter, because they do not affect firm value. This argument is based upon two assumptions. The first is that there is no tax disadvantage to an investor to receiving dividends, and the second is that firms can raise funds in capital markets for new investments without bearing significant issuance costs. The proponents of the second school feel that dividends are bad for the average stockholder because of the tax disadvantage they create, which results in lower value. Finally, there are those in a third group who argue that dividends are clearly good because stockholders (or at least some of them) like them.

Although dividends have traditionally been considered the primary approach for publicly traded firms to return cash or assets to their stockholders, they comprise only one of many ways available to the firm to accomplish this objective. In particular, firms can return cash to stockholders through equity repurchases, where the cash is used to buy back outstanding stock in the firm and reduce the number of shares outstanding. In addition, firms can return some of their assets to their stockholders in the form of spin offs and split offs. This chapter will focus on dividends specifically, but the next chapter will examine the other alternatives available to firms, and how to choose between dividends and these alternatives.

Background on Dividend Policy

In this section, we consider three issues. First, how do firms decide how much to pay in dividends, and how do those dividends actually get paid to the stockholders? We next consider two widely used measures of how much a firm pays in dividends, the dividend payout ratio and the dividend yield. We follow up by looking at some empirical evidence on firm behavior in setting and changing dividends.

The Dividend Process

Firms in the United States generally pay dividends every quarter, whereas firms in other countries typically pay dividends on a semi-annual or annual basis. Let us look at the time line associated with dividend payment and define different types of dividends.

The Dividend Payment Time Line

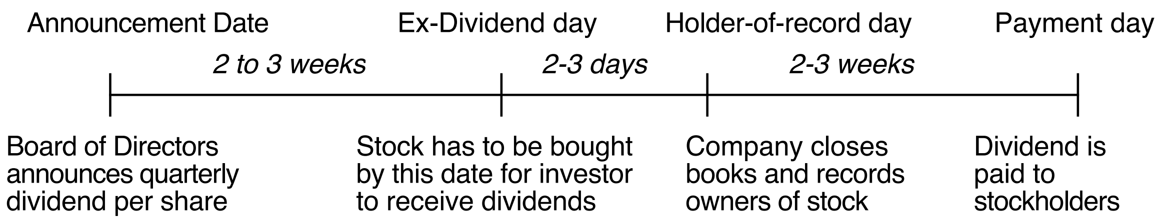
Dividends in publicly traded firms are usually set by the board of directors and paid out to stockholders a few weeks later. There are several key dates between the time the board declares the dividend until the dividend is actually paid.

- The first date of note is the **dividend declaration date**, the date on which the board of directors declares the dollar dividend that will be paid for that quarter (or period). This date is important because by announcing its intent to increase, decrease, or maintain dividend, the firm conveys information to financial markets. Thus, if the firm changes its dividends, this is the date on which the market reaction to the change is most likely to occur.
- The next date of note is the **ex-dividend date**, at which time investors have to have bought the stock in order to receive the dividend. Since the dividend is not received by investors buying stock after the ex-dividend date, the stock price will generally fall on that day to reflect that loss.
- At the close of the business a few days after the ex-dividend date, the company closes its stock transfer books and makes up a list of the shareholders to date on the **holder-of-record date**. These shareholders will receive the dividends. There should be generally be no price effect on this date.
- The final step involves mailing out the dividend checks on the **dividend payment date**. In most cases, the payment date is two to three weeks after the holder-of-record

date. While stockholders may view this as an important day, there should be no price impact on this day either.

Figure 10.1 presents these key dates on a time line.

Figure 10.1: The Dividend Time Line



Types of Dividends

There are several ways to classify dividends. First, dividends can be paid in cash or as additional stock. **Stock dividends** increase the number of shares outstanding and generally reduce the price per share. Second, the dividend can be a **regular dividend**, which is paid at regular intervals (quarterly, semi-annually, or annually), or a **special dividend**, which is paid in addition to the regular dividend. Most U.S. firms pay regular dividends every quarter; special dividends are paid at irregular intervals. Finally, firms sometimes pay dividends that are in excess of the retained earnings they show on their books. These are called **liquidating dividends** and are viewed by the Internal Revenue Service as return on capital rather than ordinary income. Consequently, they can have different tax consequences for investors.

Measures of Dividend Policy

We generally measure the dividends paid by a firm using one of two measures. The first is the **dividend yield**, which relates the dividend paid to the price of the stock:

Dividend Yield = Annual Dividends per share / Price per share

The dividend yield is significant because it provides a measure of that component of the total return that comes from dividends, with the balance coming from price appreciation.

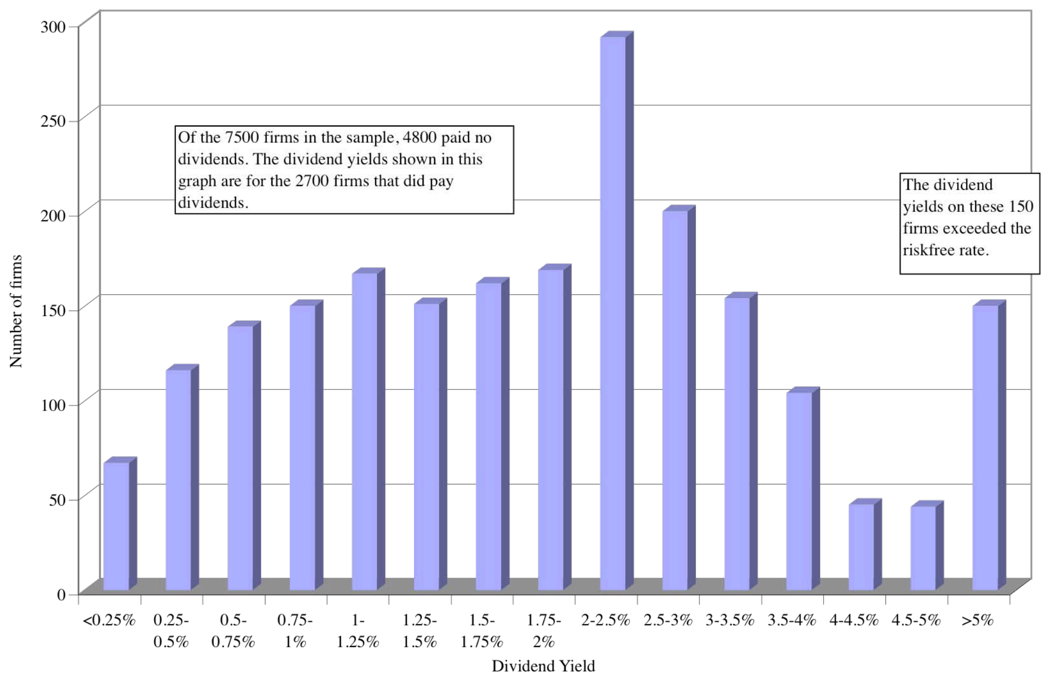
Expected Return on Stock = Dividend Yield + Price Appreciation

Some investors also use the dividend yield as a measure of risk and as an investment screen, i.e., they invest in stocks with high dividend yields. Studies indicate that stocks with high dividend yields earn excess returns, after adjusting for market performance and risk.

> ***Dividend Yield:*** This is the dollar dividend per share divided by the current price per share.

Figure 10.2 tracks dividend yields on the 2700 listed stocks in the United States that paid dividends on the major exchanges in January 2004. Note, though, that 4800 firms out of the total sample of 7500 firms did not pay dividends. Strictly speaking, the median dividend yield for a stock in the United States is zero.

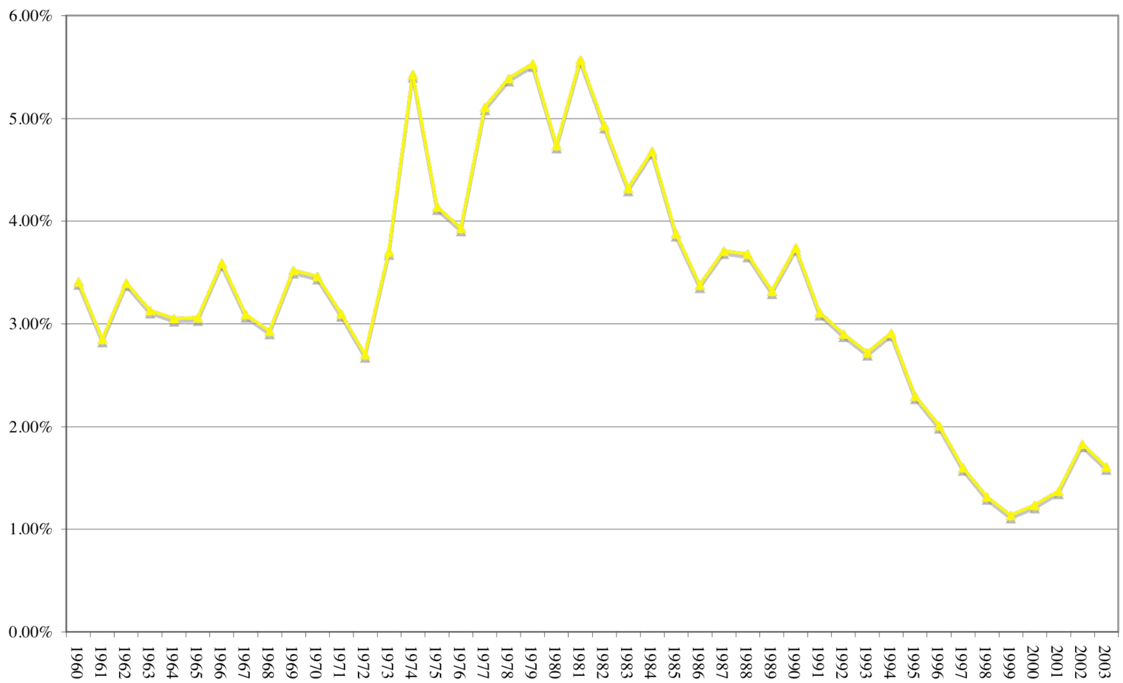
Figure 10.2: Dividend Yields: Dividend Paying firms in the United States - January 2004



[a] Estimated using Value Line data on companies in January 2004

The median dividend yield among dividend paying stocks is 1.80%, and the average dividend yield of 2/12% is low by historical standards, as evidenced by Figure 10.3, which plots average dividend yields by year from 1960 to 2003.

Figure 10.3: Dividend Yield for U.S. stocks - 1960 - 2003



[a] Estimated using S&P 500 data from 1960 to 2003; Source is Bloomberg.

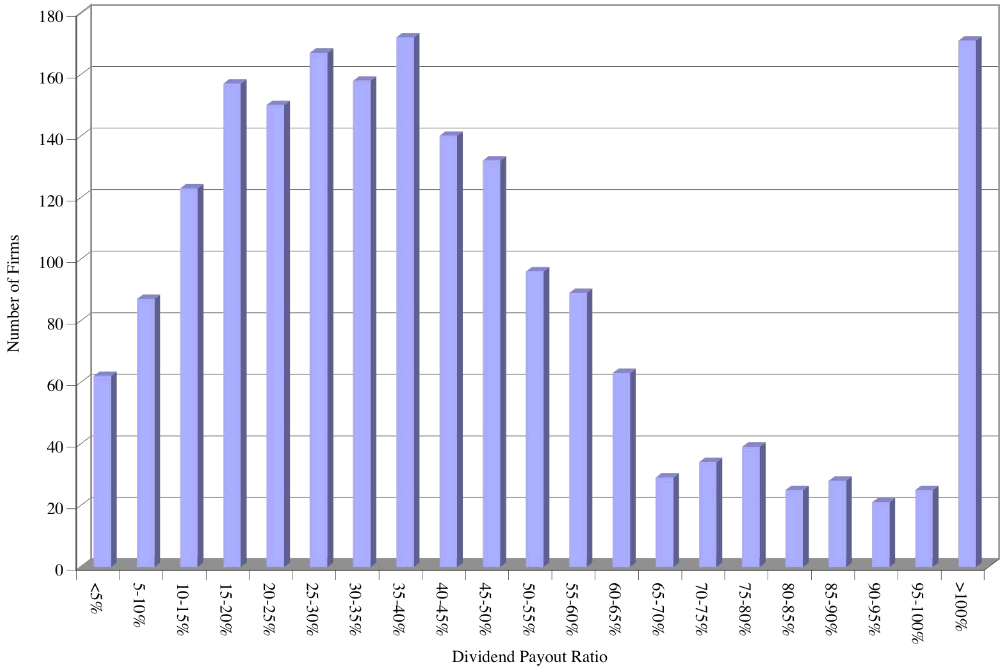
The second widely used measure of dividend policy is the **dividend payout ratio**, which relates dividends paid to the earnings of the firm.

Dividend Payout Ratio = Dividends / Earnings

> ***Dividend Payout:*** This is the dividend paid as a percent of the net income of the firm. If the earnings are negative, it is not meaningful.

The payout ratio is used in a number of different settings. It is used in valuation as a way of estimating dividends in future periods, since most analysts estimate growth in earnings rather than dividends. Second, the retention ratio — the proportion of the earnings reinvested in the firm (Retention Ratio = 1 -Dividend Payout Ratio) — is useful in estimating future growth in earnings; firms with high retention ratios (low payout ratios) generally have higher growth rates in earnings than do firms with lower retention ratios (higher payout ratios). Third, the dividend payout ratio tends to follow the life cycle of the firm, starting at zero when the firm is in high growth and gradually increasing as the firm matures and its growth prospects decrease. Figure 10.4 graphs the dividend payout ratios of U.S. firms that paid dividends in January 2004.

Figure 10.4: Dividend Payout Ratios for Dividend Paying U.S. Companies - January 2004



[a] Estimated using Value Line data on companies in January 2004

The payout ratios greater than 100% represent firms that paid out more than their earnings as dividends. The median dividend payout ratio in January 2004 among dividend paying stocks, was about 30 % while the average payout ratio was approximately 35%.

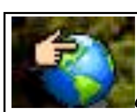
10.1. ☞: **Dividends that Exceed Earnings**

Companies should never pay out more than 100% of their earnings as dividends.

a. True

b. False

Explain.

*divUS.xls*: There is a dataset on the web that summarizes dividend yields and payout ratios for U.S. companies from 1960 to the present.

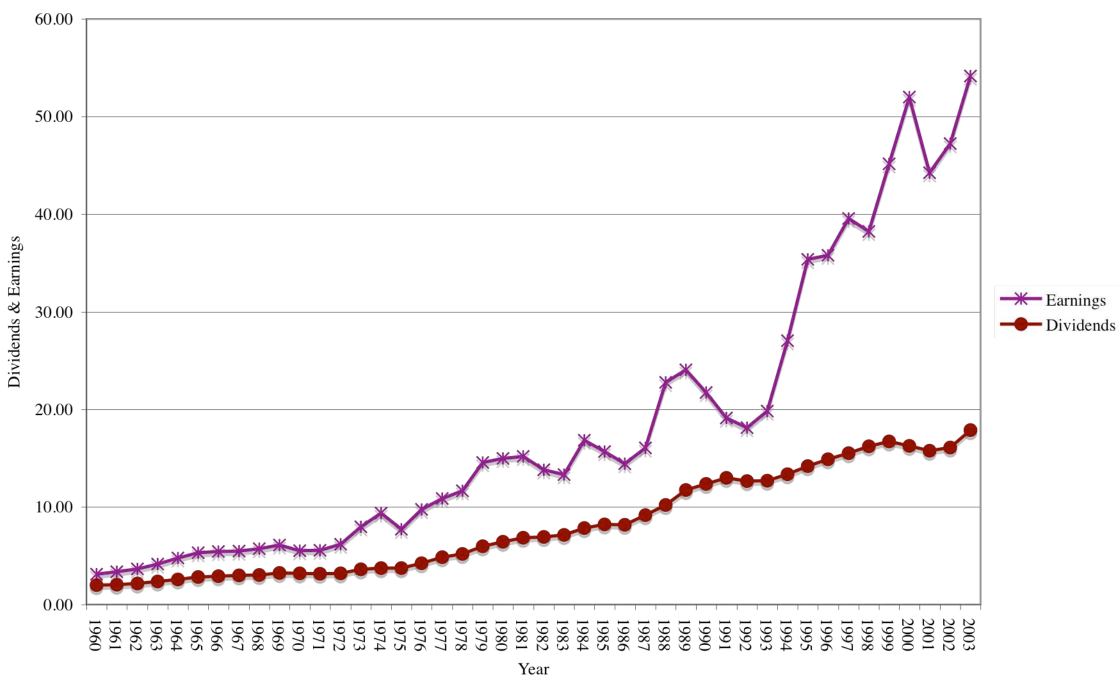
Empirical Evidence on Dividend Policy

We observe several interesting patterns when we look at the dividend policies of firms in the United States in the last 50 years. First, dividends tend to lag behind earnings; that is, increases in earnings are followed by increases in dividends, and decreases in earnings sometimes by dividend cuts. Second, dividends are "sticky" because firms are typically reluctant to change dividends; in particular, firms avoid cutting dividends even when earnings drop. Third, dividends tend to follow a much smoother path than do earnings. Finally, there are distinct differences in dividend policy over the life cycle of a firm, resulting from changes in growth rates, cash flows, and project availability.

Dividends Tend To Follow Earnings

It should not come as a surprise that earnings and dividends are positively correlated over time, because dividends are paid out of earnings. Figure 10.5 shows the movement in both earnings and dividends between 1960 and 1998.

Figure 10.5: Dividends and Earnings on U.S. companies - 1960 - 2004



[a] Estimated from Compustat annual database

Notice two trends in this graph. First, dividend changes trail earnings changes over time. Second, the dividend series is much smoother than is the earnings series.

> ***Target Dividend Payout Ratio:*** This is the desired proportion of earnings that a firm wants to pay out in dividends.

In the 1950s, John Lintner studied the way firms set dividends and noted three consistent patterns.[1] First, firms set target dividend payout ratios, by deciding on the fraction of earnings they are willing to pay out as dividends in the long term. Second, they change dividends to match long-term and sustainable shifts in earnings, but they increase dividends only if they feel they can maintain these higher dividends. Because firms avoid cutting dividends, dividends lag earnings. Finally, managers are much more concerned about changes in dividends than about levels of dividends.

Fama and Babiak identified a lag between earnings and dividends, by regressing changes in dividends against changes in earnings in both current and prior periods[2]. They confirmed Lintner's findings that dividend changes tend to follow earnings changes.

10.2. ☞**: Determinants of Dividend Lag**

Which of the following types of firms is likely to wait least after earnings go up before increasing dividends?

a. A cyclical firm, whose earnings have surged because of an economic boom
b. A pharmaceutical firm whose earnings have increased steadily over the last 5 years, due to a successful new drug.
c. A personal computer manufacturer, whose latest laptop's success has translated into a surge in earnings

Explain.

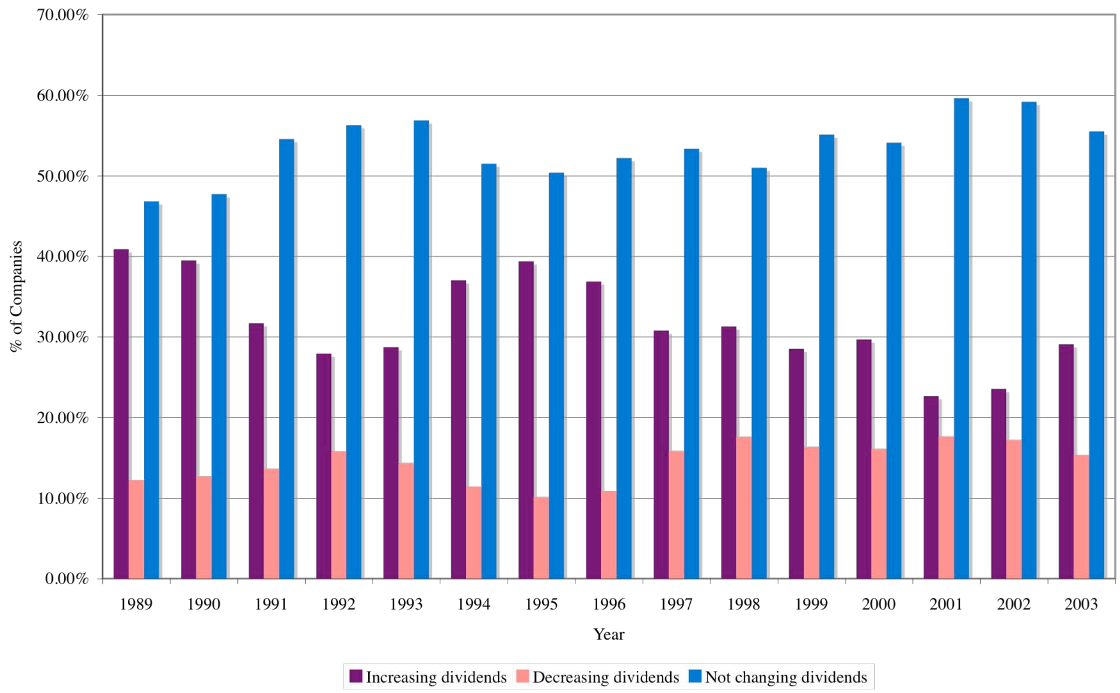
Dividends Are Sticky

Firms generally do not change their dollar dividends frequently. This reluctance to change dividends, which results in 'sticky dividends,' is rooted in several factors. One is

[1] Lintner, J., *Distribution of Income of Corporations among Dividends, Retained Earnings and Taxes,* American Economic Review, 1956, v46, 97-113.
[2] Fama, E. F. and H. Babiak. *Dividend Policy: An Empirical Analysis*, Journal of the American Statistical Association, 1968, v63(324), 1132-1161.

the firm's concern about its capability to maintain higher dividends in future periods. Another is the negative market view of dividend decreases, and the consequent drop in the stock price. Figure 10.6 provides a summary of the percentages of all firms that increased, decreased, or left unchanged their annual dividends per share from 1989 to 1998.

Figure 10.6: Dividend Changes - U.S. Corporations



[a] Estimated using Compustat annual database.

As you can see, in most years the number of firms that do not change their dollar dividends far exceeds the number that do. Among the firms that change dividends, a much higher percentage, on average, increase dividends than decrease them.

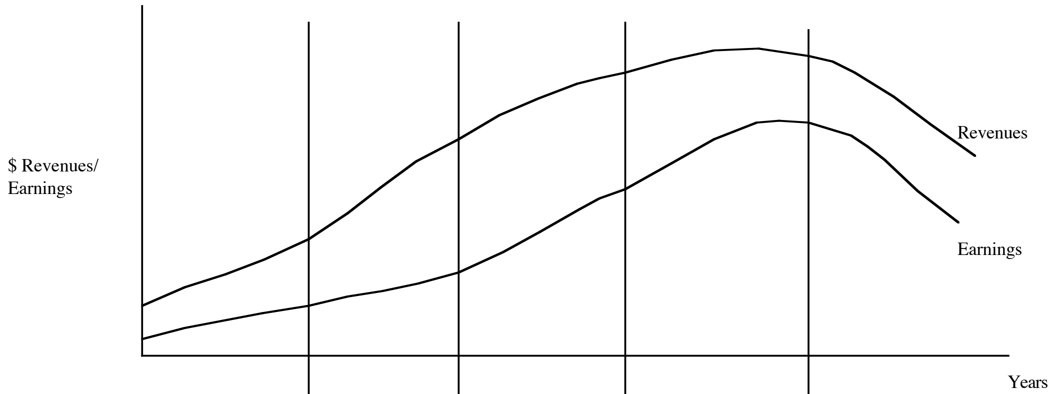
Dividends Follow a Smoother Path than Earnings

As a result of the reluctance of firms to raise dividends until they feel able to maintain them, and to cut dividends unless they absolutely have to, dividends follow a much smoother path than earnings. This view that dividends are not as volatile as earnings on a year-to-year basis is supported by a couple of empirical facts. First, the variability in historical dividends is significantly lower than the variability in historical earnings. Using annual data on aggregate earnings and dividends from 1960 to 2003, for instance, the standard deviation of dividends is 5% while the standard deviation in earnings is about 14%. Second, the standard deviation in earnings yields across companies is significantly higher than the standard deviation in dividend yields. In other words, the variation in earnings yields across firms is much greater than the variation in dividend yields.

A Firm's Dividend Policy Tends To Follow The Life Cycle Of The Firm

In chapter 7, we introduced the link between a firm's place in the life cycle and its financing mix and choices. In particular, we noted five stages in the growth life cycle – start up, rapid expansion, high growth, mature growth and decline. In this section, we will examine the link between a firm's place in the life cycle and its dividend policy. Not surprisingly, firms generally adopt dividend policies that best fit where they are currently in their life cycles. For instance, high-growth firms with great investment opportunities do not usually pay dividends, whereas stable firms with larger cash flows and fewer projects tend to pay more of their earnings out as dividends. Figure 10.7 looks at the typical path that dividend payout follows over a firm's life cycle.

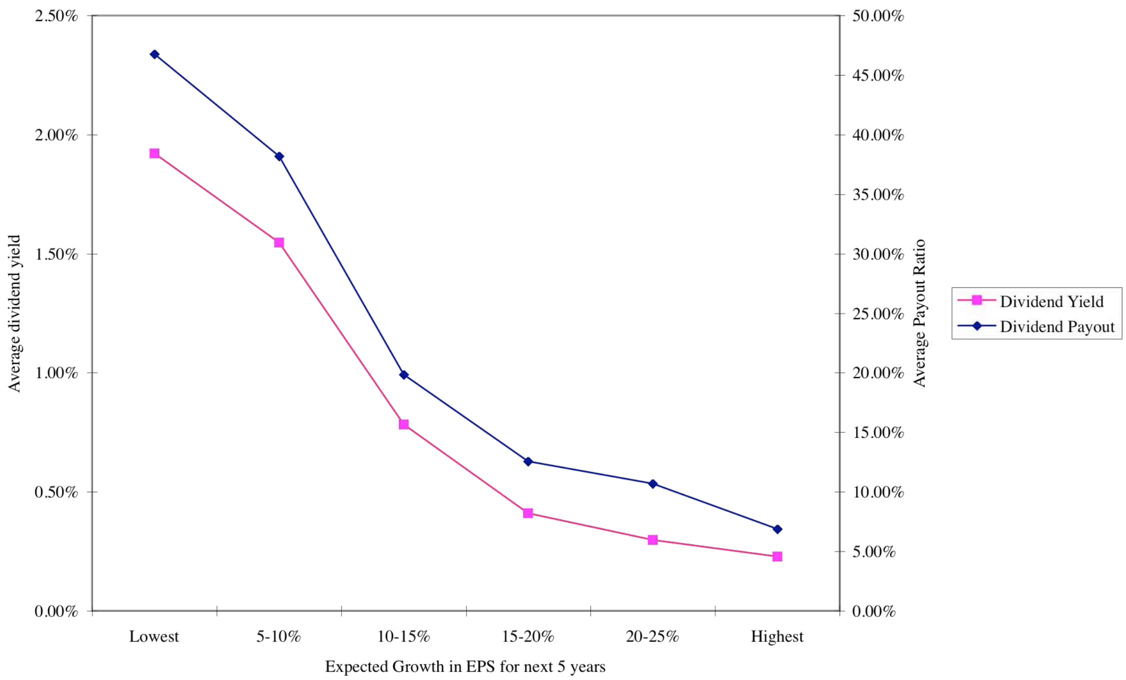
Figure 10.7: Life Cycle Analysis of Dividend Policy



External funding needs	High, but constrained by infrastructure	High, relative to firm value.	Moderates, relative to firm value.	Low, as projects dry up.	Low, as projects dry up.
Internal financing	Negative or low	Negative or low	Low, relative to funding needs	High, relative to funding needs	More than funding needs
Capacity to pay dividends	None	None	Very low	Increasing	High
Growth stage	Stage 1 Start-up	Stage 2 Rapid Expansion	Stage 3 High Growth	Stage 4 Mature Growth	Stage 5 Decline Years

This intuitive relationship between dividend policy and growth is emphasized when we look at the relationship between a firm's payout ratio and its expected growth rate. For instance, we classified firms on the New York Stock Exchange in January 2004 into six classes, based upon analyst estimates of expected growth rates in earnings per share for the next 5 years, and estimated the dividend payout ratios and dividend yields for each class; these are reported in Figure 10.8.

Figure 10.8: Dividend Yield and Payout Ratios - Growth Class



Source: Value Line Database

The firms with the highest expected growth rates pay the lowest dividends, both as a percent of earnings (payout ratio) and as a percent of price (dividend yield).[3]

10.3. ☞ **: Dividend Policy at Growth Firms**

Assume that you are following a growth firm, whose growth rate has begun easing. Which of the following would you most likely observe in terms of dividend policy at the firm?

a. An immediate increase of dividends to reflect the lower reinvestment needs.

b. No change in dividend policy, and an increase in the cash balance.

c. No change in dividend policy, and an increase in acquisitions of other firms

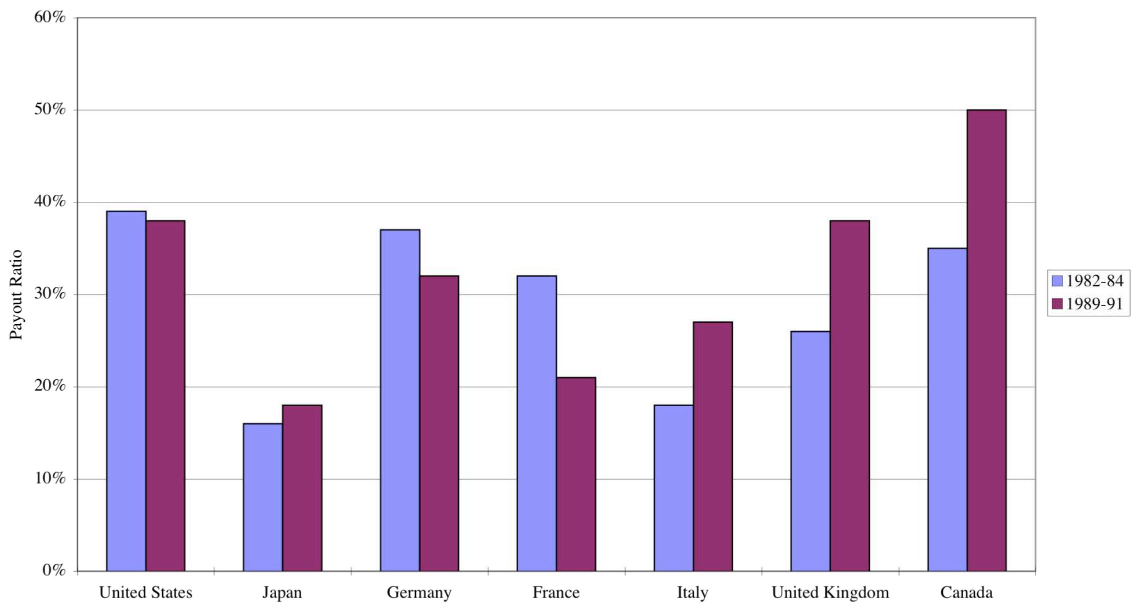
Explain.

[3] These are growth rates projected by Value Line for firms in April 1999.

Differences in Dividend Policy across Countries

Figures 10.5 to 10.8 showed several trends and patterns in dividend policies at U.S. companies.[4] They share some common features with firms in other countries, and there are some differences. As in the United States, dividends in other countries are sticky and follow earnings. However, there are differences in the magnitude of dividend payout ratios across countries. Figure 10.9 shows the proportion of earnings paid out in dividends in the G-7 countries in 1982-84 and again in 1989-91.

Figure 10.9: Dividend Payout Ratios in G-7 Countries, 1982-84 and 1989-91



[a]Source: Rajan and Zingales

These differences can be attributed to:

1. *Differences in Stage of Growth*: Just as higher growth companies tend to pay out less of their earnings in dividends (see Figure 10.8), countries with higher growth pay out less in dividends. For instance, Japan had much higher expected growth in 1982-84 than the other G-7 countries and paid out a much smaller percentage of its earnings as dividends.

2. *Differences in Tax Treatment*: Unlike the United States, where dividends are double taxed, some countries provide at least partial protection against the double taxation of

[4] Rajan, R. and L. Zingales, *What do we know about capital structure? Some Evidence from International Data*, Journal of Finance, 1995, v50, 1421-1460.

dividends. For instance, Germany taxes corporate retained earnings at a higher rate than corporate dividends.

3. Differences in Corporate Control: When there is a separation between ownership and management, as there is in many large publicly traded firms, and where stockholders have little control over managers, the dividends paid by firms will be lower. Managers, left to their own devices, have a much greater incentive to accumulate cash than do stockholders.

Not surprisingly, the dividend payout ratios of companies in emerging markets are much lower than the dividend payout ratios in the G-7 countries. The higher growth and relative power of incumbent management in these countries contribute to keeping these payout ratios low.

10.4. ☞: **Dividend policies and Stock Buyback Restrictions**

Some countries do not allow firms to buy back stock from their stockholders. Which of the following would you expect of dividend policies in these countries (relative to countries that don't restrict stock buybacks)?

a. Higher portion of earnings will be paid out in dividends; More volatile dividends;
b. Lower portion of earnings will be paid out in dividends; More volatile dividends
c. Higher portion of earnings will be paid out in dividends; Less volatile dividends;
d. Lower portion of earnings will be paid out in dividends; Less volatile dividends;

Explain

Illustration 10.1: Dividends, Dividend Yields and Payout Ratios

In the illustration that follows, we will examine the dollar dividends paid at Disney, Aracruz and Deutsche Bank between 2001 and 2003. Each year, we will also compute the dividend yield and dividend payout ratio for each firm.

	Deutsche Bank			*Disney*			*Aracruz*		
	2001	2002	2003	2001	2002	2003	2001	2002	2003
DPS	€ 1.30	€ 1.30	€ 1.30	$0.21	$0.21	$0.21	R$ 0.14	R$ 0.18	R$ 0.32
EPS	€ 2.44	€ 0.64	€ 0.27	$0.11	$0.60	$0.65	R$ 0.20	R$ 0.01	R$ 0.85
Stock Price	€ 79.40	€ 43.90	€ 65.70	$20.72	$16.31	$23.33	R$ 3.91	R$ 6.76	R$ 10.60
Dividend Yield	1.64%	2.96%	1.98%	1.01%	1.29%	0.90%	3.53%	2.69%	3.00%
Dividend Payout	53.28%	203.13%	481.48%	190.91%	35.00%	32.31%	69.01%	1818.44%	37.41%

Of the three companies, Aracruz had the highest dividend yield across the three years. Disney and Deutsche paid the same dividends per share each year, but the volatility in their stock prices and earnings made the payout ratios and dividend yields volatile. In fact, Deutsche maintained its dividends at 1.30 Euros per share in the face of declining earnings per share in 2002 and 2003, a testimonial to the stickiness of dividends.

As noted earlier in the book, Aracruz, like most Brazilian companies, maintains two classes of shares – voting share (called common and held by insiders) and non-voting shares (called preferred shares and held by outside investors). The dividend policies are different for the two classes, with preferred shares getting higher dividends. In fact, the failure to pay a mandated dividend to preferred stockholders (usually set at a payout ratio of 35%) can result in preferred stockholders getting some voting control of the firm. Effectively, this puts a floor on the dividend payout ratio.

When Are Dividends Irrelevant?

There is a school of thought that argues that what a firm pays in dividends is irrelevant and that stockholders are indifferent about receiving dividends. Like the capital structure irrelevance proposition, the dividend irrelevance argument has its roots in a paper crafted by Miller and Modigliani.[5]

The Underlying Assumptions

The underlying intuition for the dividend irrelevance proposition is simple. Firms that pay more dividends offer less price appreciation but must provide the same total return to stockholders, given their risk characteristics and the cash flows from their investment decisions. Thus, there are no taxes, or if dividends and capital gains are taxed at the same rate, investors should be indifferent to receiving their returns in dividends or price appreciation.

For this argument to work, in addition to assuming that there is no tax advantage or disadvantage associated with dividends, we also have to assume the following:

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[5] Miller, M. and F. Modigliani, 1961, *Dividend Policy, Growth and the Valuation of Shares*, Journal of Business, 411-433.

- There are no transactions costs associated with converting price appreciation into cash, by selling stock. If this were not true, investors who need cash urgently might prefer to receive dividends.
- Firms that pay too much in dividends can issue stock, again with no flotation or transactions costs, to take on good projects. There is also an implicit assumption that this stock is fairly priced.
- The investment decisions of the firm are unaffected by its dividend decisions, and the firm's operating cash flows are the same no matter which dividend policy is adopted.
- Managers of firms that pay too little in dividends do not waste the cash pursuing their own interests (i.e., managers with large free cash flows do not use them to take on bad projects).

Under these assumptions, neither the firms paying the dividends nor the stockholders receiving them will be adversely affected by firms paying either too little or too much in dividends.

10.5. ☞**: Dividend Irrelevance**

Based upon the Miller Modigliani assumptions, dividends are least likely to affect value for the following types of firms

a. Small companies with substantial investment needs.
b. Large companies with significant insider holdings.
c. Large companies with significant holdings by pension funds (which are tax exempt) and minimal investment needs.

Explain.

A Proof of Dividend Irrelevance

To provide a formal proof of irrelevance, assume that LongLast Corporation, an unlevered firm manufacturing furniture, has operating income after taxes of \$ 100 million, growing at 5% a year, and that its cost of capital is 10%. Further, assume that this firm has reinvestment needs of \$ 50 million, also growing at 5% a year, and that there are 105 million shares outstanding. Finally, assume that this firm pays out residual cash flows as dividends each year. The value of LongLast Corporation can be estimated as follows:

Free Cash Flow to the Firm = EBIT (1- tax rate) – Reinvestment needs

= $ 100 million - $ 50 million = $ 50 million

Value of the Firm = Free Cash Flow to Firm (1+g) / (WACC - g)

= $ 50 (1.05) / (.10 - .05) = $ 1050 million

Price per share = $ 1050 million / 105 million = $ 10.00

Based upon its cash flows, this firm could pay out $ 50 million in dividends.

Dividend per share = $ 50 million/105 million = $ 0.476

Total Value per Share = $ 10.00 + $ 0.48 = $10.476

The total value per share measures what stockholders gets in price and dividends from their stock holdings.

Scenario 1: LongLast doubles dividends

To examine how the dividend policy affects firm value, assume that LongLast Corporation is told by an investment banker that its stockholders would gain if the firm paid out $ 100 million in dividends, instead of $ 50 million. It now has to raise $ 50 million in new financing to cover its reinvestment needs. Assume that LongLast Corporation can issue new stock with *no issuance cost* to raise these funds. If it does so, the firm value will remain unchanged, since the value is determined not by the dividend paid but by the cash flows generated on the projects. Since the growth rate and the cost of capital are unaffected, we get:

Value of the Firm = $ 50 (1.05) / (.10 - .05) = $ 1050 million

The existing stockholders will receive a much larger dividend per share, since dividends have been doubled:

Dividends per share = $ 100 million/105 million shares = $ 0.953

In order to estimate the price per share at which the new stock will be issued, note that after the new stock issue of $ 50 million, the old stockholders in the firm will own only $1000 million of the total firm value of $ 1050 million.

Value of the Firm for existing stockholders after dividend payment = $ 1000 million

Price per share = $ 1000 million / 105 million = $ 9.523

The price per share is now lower than it was before the dividend increase, but it is exactly offset by the increase in dividends.

Value accruing to stockholder = $ 9.523 + $ 0.953 = $ 10.476

Thus, if the operating cash flows are unaffected by dividend policy, we can show that the firm value will be unaffected by dividend policy and that the average stockholder will be indifferent to dividend policy, since he or she receives the same total value (price + dividends) under any dividend payment.

Scenario 2: LongLast stops paying dividends

To consider an alternate scenario, assume that LongLast Corporation pays out no dividends and retains the residual \$50 million as a cash balance. The value of the firm to existing stockholders can then be computed as follows:

Value of Firm = Present Value of After-tax Operating CF + Cash Balance

= \$ 50 (1.05) / (.10 - .05) + \$ 50 million = \$1100 million

Value per share = \$ 1100 million / 105 million shares = \$10.48

Note that the total value per share remains at % 10.48. In fact, as shown in Table 10.1, the value per share remains \$10.48, no matter how much the firm pays in dividends.

Table 10.1: Value Per Share to Existing Stockholders from Different Dividend Policies

Value of Firm (Operating CF)	Dividends	Value to Existing Stockholders	Price per share	Dividends per share	Total Value per share
\$1,050	\$ -	\$1,100	\$ 10.48	\$ -	\$ 10.48
\$1,050	\$ 10.00	\$1,090	\$ 10.38	\$ 0.10	\$ 10.48
\$1,050	\$ 20.00	\$1,080	\$ 10.29	\$ 0.19	\$ 10.48
\$1,050	\$ 30.00	\$1,070	\$ 10.19	\$ 0.29	\$ 10.48
\$1,050	\$ 40.00	\$1,060	\$ 10.10	\$ 0.38	\$ 10.48
\$1,050	\$ 50.00	\$1,050	\$ 10.00	\$ 0.48	\$ 10.48
\$1,050	\$ 60.00	\$1,040	\$ 9.90	\$ 0.57	\$ 10.48
\$1,050	\$ 70.00	\$1,030	\$ 9.81	\$ 0.67	\$ 10.48
\$1,050	\$ 80.00	\$1,020	\$ 9.71	\$ 0.76	\$ 10.48
\$1,050	\$ 90.00	\$1,010	\$ 9.62	\$ 0.86	\$ 10.48
\$1,050	\$ 100.00	\$1,000	\$ 9.52	\$ 0.95	\$ 10.48

When LongLast Corporation pays less than \$ 50 million in dividends, the cash accrues in the firm and adds to its value. The increase in the stock price again is offset by the loss of cash flows from dividends. When it pays out more, the price decreases but is exactly offset by the increase in dividends per share.

Note, though, that the value per share remains unchanged because we assume that there are no tax differences to investors between dividends and capital gains, that firms can raise new capital with no issuance costs, and that firms do not change their investment policy. These assumptions eliminate the costs associated with paying either more in dividends or less.

Implications of Dividend Irrelevance

If dividends are, in fact, irrelevant, firms are spending a great deal of time pondering an issue about which their stockholders are indifferent. A number of strong implications emerge from this proposition. Among them, the value of equity in a firm should not change as its dividend policy changes. This does not imply that the price per share will be unaffected, however, since larger dividends should result in lower stock prices and more shares outstanding. In addition, in the long term, there should be no correlation between dividend policy and stock returns. Later in this chapter, we will examine some studies that have attempted to examine whether dividend policy is in fact irrelevant in practice.

The assumptions needed to arrive at the dividend irrelevance proposition may seem so onerous that many reject it without testing it. That would be a mistake, however, because the argument does contain a valuable message: Namely, a firm that has invested in bad projects cannot hope to resurrect its image with stockholders by offering them higher dividends. In fact, the correlation between dividend policy and total stock returns is weak, as we will see later in this chapter.

The "Dividends Are Bad" School

In the United States, dividends have historically been taxed at much higher rates than capital gains. Based upon this tax disadvantage, the second school of thought on dividends argued that dividend payments reduce the returns to stockholders after personal taxes. Stockholders, they posited, would respond by reducing the stock prices of the firms making these payments, relative to firms that do not pay dividends. Consequently, firms would be better off either retaining the money they would have paid out as dividends or repurchasing stock. In 2003, the basis for this argument was largely eliminated when the tax rate on dividends was reduced to match the tax rate on capital gains. In this section, we will consider both the history of tax-disadvantaged dividends and the potential effects of the tax law changes.[6]

The History of Dividend Taxation

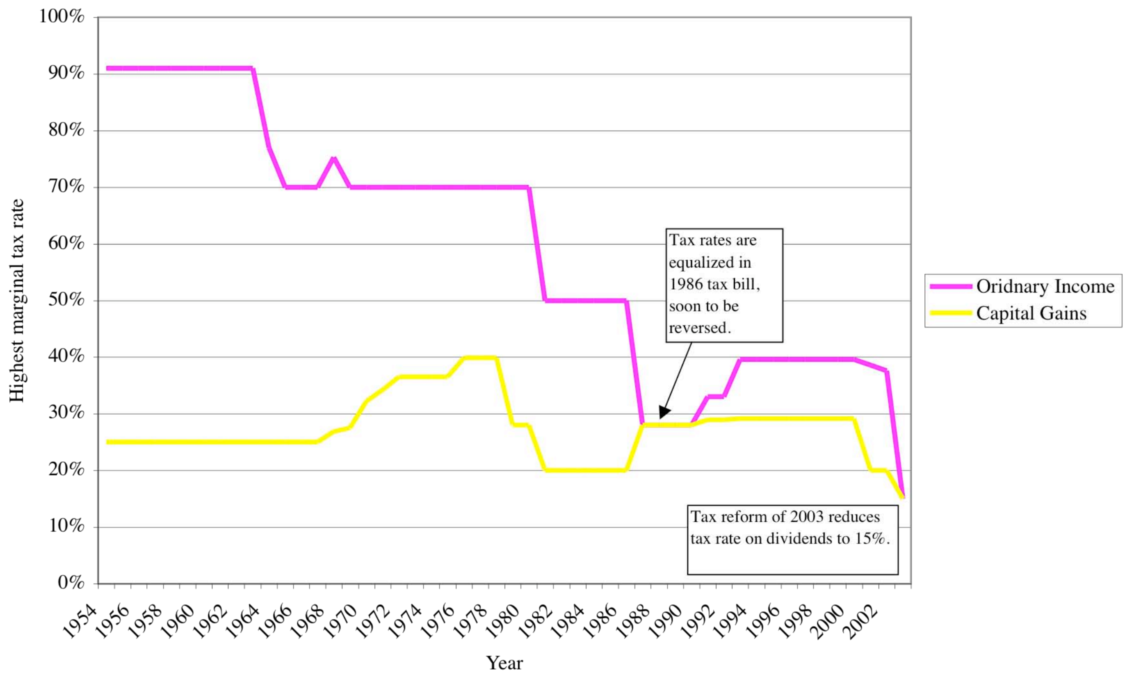
The tax treatment of dividends varies widely depending upon who receives the dividend. Individual investors are taxed at ordinary tax rates, corporations are sheltered from paying taxes on at least a portion of the dividends they receive and pension funds are not taxed at all.

Individuals

Since the inception of income taxes in the early part of the twentieth century in the United States, dividends received on investments have been treated as ordinary income, when received by individuals, and taxed at ordinary tax rates. In contrast, the price appreciation on an investment has been treated as capital gains and taxed at a different and much lower rate. Figure 10.10 graphs the highest marginal tax rate on dividends in the United States and the highest marginal capital gains tax rate since 1954 (when capital gains taxes were introduced).

[6] Adding to the uncertainty is the fact that the tax changes of 2003 are not permanent and are designed to sunset (disappear) in 2010. It is unclear whether the tax disadvantages of dividends have disappeared for the long term or only until 2010.

Figure 10.10: Ordinary Income and Capital Gains Tax Rates



Barring a brief period after the 1986 tax reform act, when dividends and capital gains were both taxed at 28%, the capital gains tax rate has been significantly lower than the ordinary tax rate in the United States. In 2003, the tax rate on dividends was dropped to 15% to match the tax rate on capital gains, thus nullifying the tax disadvantage of dividends.

There are two points worth making about this chart. The first is that these are the highest marginal tax rates and that most individuals are taxed at lower rates. In fact, some older and poorer investors may pay no taxes on income, if their income falls below the threshold for taxes. The second and related issue is that the capital gains taxes can be higher for some of these individuals than the ordinary tax rate they pay on dividends. Overall, though, wealthier individuals have more invested in stocks than poorer individuals, and it seems fair to conclude that individuals have collectively paid significant taxes on the income that they have received in dividends over the last few decades.

Institutional Investors

About two-thirds of all traded equities are held by institutional investors rather than individuals. These institutions include mutual funds, pension funds and corporations and dividends get taxed differently in the hands of each.

- Pension funds are tax-exempt. They are allowed to accumulate both dividends and capital gains without having to pay taxes. There are two reasons for this tax treatment. One is to encourage individuals to save for their retirement and to reward savings (as opposed to consumption). The other reason for this is that individuals will be taxed on the income they receive from their pension plans and that taxing pension plans would in effect tax the same income twice.
- Mutual funds are not directly taxed, but investors in mutual funds are taxed for their share of the dividends and capital gains generated by the funds. If high tax rate individuals invest in a mutual fund that invests in stocks that pay high dividends, these high dividends will be allocated to the individuals based on their holdings and taxed at their individual tax rates.
- Corporations are given special protection from taxation on dividends they receive on their holdings in other companies, with 70% of the dividends exempt from taxes[7]. In other words, a corporation with a 40% tax rate that receives $ 100 million in dividends will pay only $12 million in taxes. Here again, the reasoning is that dividends paid by these corporations to their stockholders will ultimately be taxed.

Tax Treatment of Dividends in other markets

Many countries have plans in place to protect investors from the double taxation of divided. There are two ways in which they can do this. One is to allow corporations to claim a full or partial tax deduction for dividends paid. The other is to give partial or full tax relief to individuals who receive dividends.

[7] The exemption increases as the proportion of the stock held increases. Thus, a corporation that owns 10% of another company's stock has 70% of dividends exempted. This rises to 80% if the company owns between 20 and 80% of the stock and to 100% if the company holds more than 80% of the outstanding stock.

Corporate Tax Relief

In some countries, corporations are allowed to claim a partial or full deduction for dividends paid. This brings their treatment into parity with the treatment of the interest paid on debt, which is entitled to a full deduction in most countries. Among the OECD countries, the Czech Republic and Iceland offer partial deductions for dividend payments made by companies but no country allows a full deduction. In a variation, Germany, until recently, applied a higher tax rate to income that was retained by firms than to income that was paid out in dividends. In effect, this gives a partial tax deduction to dividends.

Why don't more countries offer tax relief to corporations? There may be two factors. One is the presence of foreign investors in the stock who now also share in the tax windfall. The other is that investors in the stock may be tax exempt or pay no taxes, which effectively reduces the overall taxes paid on dividends to the treasury to zero.

Individual Tax Relief

There are far more countries that offer tax relief to individuals than to corporations. This tax relief can take several forms:

- *Tax Credit for taxes paid by corporation*: Individuals can be allowed to claim the taxes paid by the corporation as a tax credit when computing their own taxes. In the example earlier in the paper, where a company paid 30% of its income of $ 100 million as taxes and then paid its entire income as dividends to individuals with 40% tax rates the individuals would be allowed to claim a tax credit of $ 30 million against the taxes owed, thus reducing taxes paid to $ 10 million. In effect, this will mean that only individuals with marginal tax rates that exceed the corporate tax rate will be taxed on dividends. Australia, Finland, Mexico, Australia and New Zealand allow individuals to get a full credit for corporate taxes paid. Canada, France, the U.K and Turkey allow for partial tax credits.
- *Lower Tax Rate on dividends:* Dividends get taxed at a lower rate than other income to reflect the fact that it is paid out of after-tax income. In some countries, the tax rate on dividends is set equal to the capital gains tax rate. Korea, for instance, has a flat tax rate of 16.5% for dividend income.

In summary, it is far more common for countries to provide tax relief to investors than to corporations. Part of the reason for this is political. By focusing on individuals, you can direct the tax relief only towards domestic investors and only to those investors who pay taxes in the first place.

Timing of Tax Payments

When the 1986 tax law was signed into law, equalizing tax rates on ordinary income and capital gains, some believed that all the tax disadvantages of dividends had disappeared. Others noted that, even with the same tax rates, dividends carried a tax disadvantage because the investor had no choice as to when to report the dividend as income; taxes were due when the firm paid out the dividends. In contrast, investors retained discretionary power over when to recognize and pay taxes on capital gains, since such taxes were not due until the stock was sold. This timing option allowed the investor to reduce the tax liability in one of two ways. First, by taking capital gains in periods of low income or capital losses to offset against the gain, the investor could now reduce the taxes paid. Second, deferring a stock sale until an investor's death could result in tax savings. Since the tax rates on capital gains have decreased relative to the tax rates on dividends since, this timing option should make capital gains an even more attractive option now.

Assessing Investor tax preferences for dividends

As you can see from the discussion above, the tax rate on dividends can vary widely for different investors – individual, pension fund, mutual fund or corporation – receiving the dividends and even for the same investor on different investments. It is difficult therefore to look at a company's investor base and determine their preferences for dividends and capital gains. A simple way to measure the tax disadvantage associated with dividends is to measure the price change on the ex-dividend date and compare it to the actual dividend paid. The stock price on the ex-dividend day should drop to reflect the loss in dividends to those buying the stock after that day. It is not clear, however, whether the price drop will be equal to the dividends if dividends and capital gains are taxed at different rates.

To see the relationship between the price drop and the tax rates of the marginal investor, assume that investors in a firm acquired stock at some point in time at a price *P*, and that they are approaching an ex-dividend day, in which the dividend is known to be *D*. Assume that each investor in this firm can either sell the stock before the ex-dividend day at a price P_B or wait and sell it after the stock goes ex-dividend at a price P_A. Finally, assume that the tax rate on dividends is $\mathbf{t_o}$ and that the tax rate on capital gains is $\mathbf{t_{cg}}$**.** The cash flows the investor will receive from selling <u>before</u> the stock goes ex-dividend is –

$$CF_B = P_B - (P_B - P)\, t_{cg}$$

In this case, by selling before the ex-dividend day, the investor receives no dividend. If the sale occurs <u>after</u> the ex-dividend day, the cash flow is –

$$CF_A = P_A - (P_A - P)\, t_{cg} + D\,(1-t_o)$$

If the cash flow from selling before the ex-dividend day were greater than the cash flow from selling after, the investors would all sell before, resulting in a drop in the stock price. Similarly, if the cash flows from selling after the ex-dividend day were greater than the cash flows from selling before, every one would sell after, resulting in a price drop after the ex-dividend day. To prevent either scenario, the marginal investors in the stock have to be indifferent between selling before and after the ex-dividend day. This will occur only if the cash flows from selling before are equal to the cash flows from selling after:

$$P_B - (P_B - P)\, t_{cg} = P_A - (P_A - P)\, t_{cg} + D\,(1-t_o)$$

This can be simplified to yield the following ex-dividend day equality:

$$\frac{P_B - P_A}{D} = \frac{(1 - t_o)}{(1 - t_{cg})}$$

Thus, a necessary condition for the marginal investor to be indifferent between selling before and after the ex-dividend day is that the price drop on the ex-dividend day must reflect the investor's tax differential between dividends and capital gains.

Turning this equation around, we would argue that by observing a firm's stock price behavior on the ex-dividend day and relating it to the dividends paid by the firm, we can, in the long term, form some conclusions about the tax disadvantage the firm's stockholders attach to dividends. In particular:

If	*Tax Treatment of Dividends and Capital Gains*

$P_B - P_A = D$ Marginal investor is indifferent between dividends and capital gains

$P_B - P_A < D$ Marginal investor is taxed more heavily on dividends

$P_B - P_A > D$ Marginal investor is taxed more heavily on capital gains

While there are obvious measurement problems associated with this measure, it does provide some interesting insight into how investors view dividends.

The first study of ex-dividend day price behavior was completed by Elton and Gruber in 1970.[8] They examined the behavior of stock prices on ex-dividend days for stocks listed on the NYSE between 1966 and 1969. Based upon their finding that the price drop was only 78% of the dividends paid, Elton and Gruber concluded that dividends are taxed more heavily than capital gains. They also estimated the price change as a proportion of the dividend paid for firms in different dividend yield classes and reported that price drop is larger, relative to the dividend paid, for firms in the highest dividend yield classes than for firms in lower dividend yield classes. This difference is price drops, they argued, reflected the fact that investors in these firms are in lower tax brackets. Their conclusions were challenged, however, by some who argued, justifiably, that the investors trading on the stock on ex-dividend days are not the normal investors in the firm; rather, they are short-term, tax-exempt investors interested in capturing the difference between dividends and the price drops.

Implications

There can be no argument that dividends have historically been treated less favorably than capital gains by the tax authorities. In the United States, the double taxation of dividends, at least at the level of individual investors, should have created a strong disincentive to pay or to increase dividends. Other implications of the tax disadvantage argument include the following:

- Firms with an investor base composed primarily of individuals typically should have paid lower dividends than do firms with investor bases predominantly made up of tax-exempt institutions.

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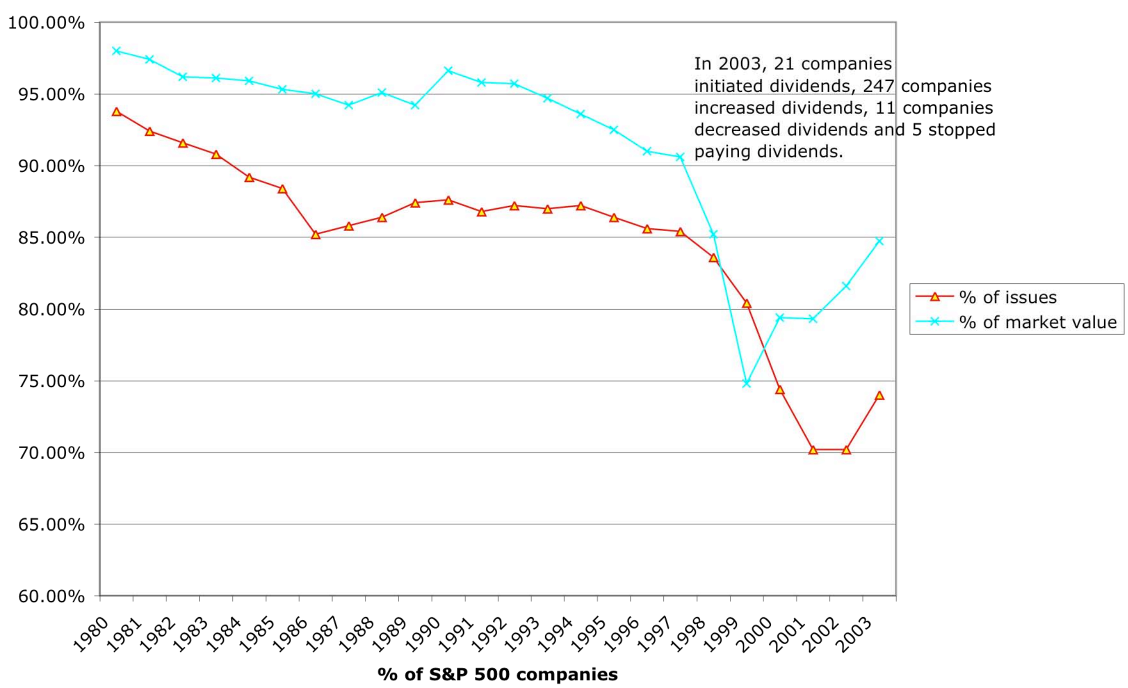
[8] Elton, E.J. and M.J. Gruber, 1970, *Marginal Stockholder Rates and the Clientele Effect*, Review of Economics and Statistics, v52, 68-74.

- The higher the income level (and hence the tax rates) of the investors holding stock in a firm, the lower the dividend paid out by the firm.
- As the tax disadvantage associated with dividends increased, the aggregate amount paid in dividends should have decreased. Conversely, if the tax disadvantage associated with dividends decreased, the aggregate amount paid in dividends should have increased.

The tax law changes of 2003 have clearly changed the terms of this debate. By reducing the tax rate on dividends, they have clearly made dividends more attractive at least to individual investors than they were prior to the change. We would expect companies to pay more dividends in response. While it is still early to test out this hypothesis, there is some evidence that companies are changing dividend policy in response to the tax law change. Technology companies like Microsoft that have never paid dividends before have initiated dividends. In figure 10.11, we look at the percent of S&P 500 companies that pay dividends by year and the dividends paid as a percent of the market capitalization of these companies from 1960 to 2003.

Figure 10.11: Dividends on S&P 500 Companies



There was an up tick in both the number of companies paying dividends in 2003 and the dividends paid, reversing a long decline in both statistics. It will be interesting to see whether this continues into the future.

In Practice: Dividend Policy for the next decade

As firms shift towards higher dividends, they may be put at risk because of volatile earnings. There are two ways in which they can alleviate the problem.

- One is to shift to a policy of *residual dividends*, where dividends paid are a function of the earnings in the year rather than a function of dividends last year. Note that the sticky dividend phenomenon in the US, where companies are reluctant to change their dollar dividends, is not a universal one. In countries like Brazil, companies target dividend payout ratios rather than dollar dividends and there is no reason why US companies cannot adopt a similar practice. A firm that targets a constant dividend payout ratio will pay more dividends when its earnings are high and less when its earnings are low, and the signaling effect of lower dividends will be mitigated if the payout policy is clearly stated up front.
- The other is to adopt a policy of regular dividends that will be based upon sustainable and predictable earnings and to supplement these with special dividends when earnings are high. In this form, the special dividends will take the place of stock buybacks.

In summary, you can expect both more dividends from companies and more creative dividend policies, if the dividend tax law stands. British Petroleum provided a preview of innovations to come by announcing that they would supplement their regular dividends with any extra cashflows generated if the oil price stayed above $ 30 a barrel, thus creating dividends that are tied more closely to their cashflows.

10.6. ☞**: Corporate Tax Status and Dividend Policy**

Corporations are exempt from paying taxes on 70% of the dividends they receive from their stockholdings in other companies, whereas they face a capital gains tax rate of 20%. If all the stock in your company is held by other companies, and the ordinary tax rate for companies is 36%,

a. dividends have a tax advantage relative to capital gains

b. capital gains have a tax advantage relative to dividends

c. dividends and capital gains are taxed at the same rate

Explain.

The "Dividends Are Good" School

Notwithstanding the tax disadvantages, firms continue to pay dividends and they typically view such payments positively. A third school of thought that argues dividends are good and can increase firm value. Some of the arguments used by this school are questionable, but some have a reasonable basis in fact. We consider both in this section.

Some Reasons for Paying Dividends that do not measure up

Some firms pay and increase dividends for the wrong reasons. We will consider two of those reasons in this section.

The Bird-in-the-Hand Fallacy

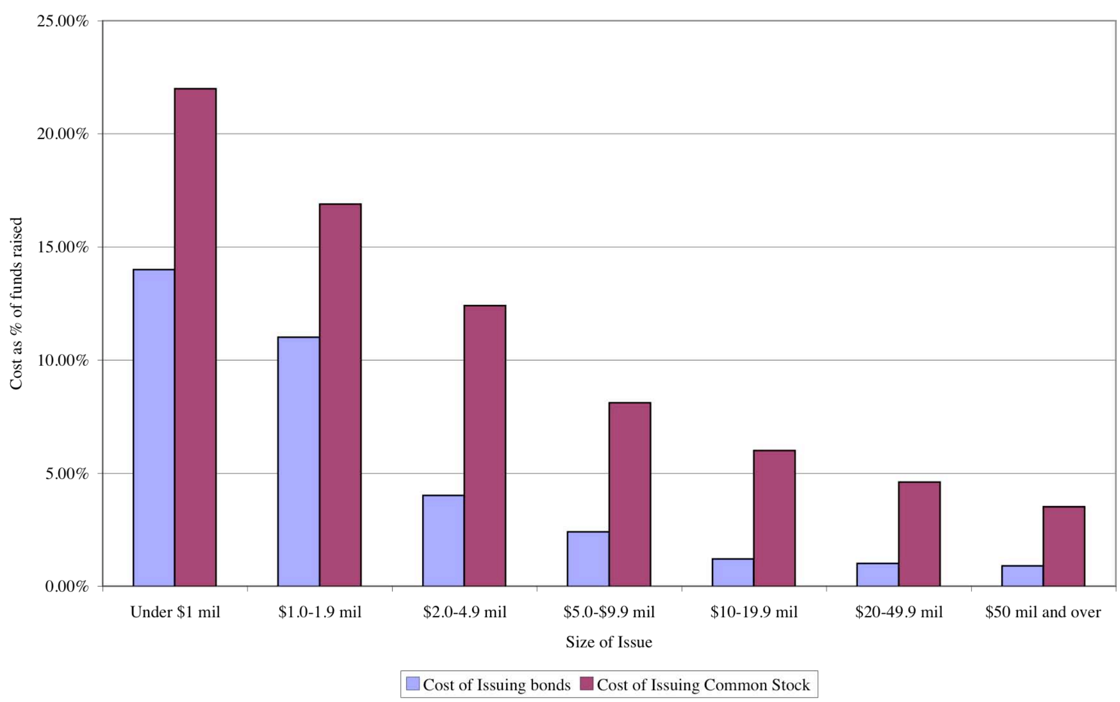
One reason given for the view that investors prefer dividends to capital gains is that dividends are certain, whereas capital gains are uncertain. Proponents of this view of dividend policy feel that risk averse investors will therefore prefer the former. This argument is flawed. The simplest counter-response is to point out that the choice is not between certain dividends today and uncertain capital gains at some unspecified point in the future, but between dividends today and an almost equivalent amount in price appreciation today. This comparison follows from our earlier discussion, where we noted that the stock price dropped by slightly less than the dividend on the ex-dividend day. By paying the dividend, the firm causes its stock price to drop today.

Another response to this argument is that a firm's value is determined by the cash flows from its projects. If a firm increases its dividends but its investment policy remains unchanged, it will have to replace the dividends with new stock issues. The investor who receives the higher dividend will therefore find himself or herself losing, in present value terms, an equivalent amount in price appreciation.

Temporary Excess Cash

In some cases, firms are tempted to pay or initiate dividends in years in which their operations generate excess cash. Although it is perfectly legitimate to return excess cash to stockholders, firms should also consider their own long-term investment needs. If the excess cash is a temporary phenomenon, resulting from having an unusually good year or a non-recurring action (such as the sale of an asset), and the firm expects cash shortfalls in future years, it may be better off retaining the cash to cover some or all these shortfalls. Another option is to pay the excess cash as a dividend in the current year and issue new stock when the cash shortfall occurs. This is not very practical because the substantial expense associated with new security issues makes this a costly strategy in the long term. Figure 10.12 summarizes the cost of issuing bonds and common stock, by size of issue in the United States.[9]

Figure 10.12: Issuance Costs for Stocks and Bonds

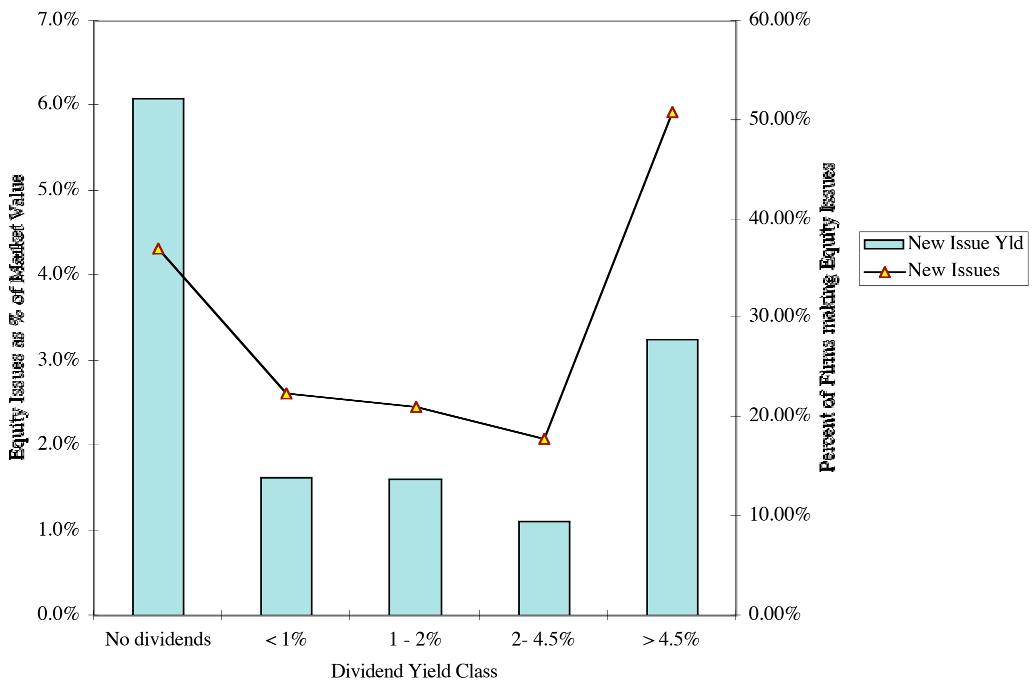


Source: Ibbotson, Sindelar and Ritter (1997)

[9] Ibbotson, R. G., J. L. Sindelar and J. R. Ritter. 1988, *Initial Public Offerings*, Journal of Applied Corporate Finance, v1(2), 37-45.

Since issuance costs increase as the size of the issue decreases and for common stock issues, small firms should be especially cautious about paying out temporary excess cash as dividends. This said, it is important to note that some companies do pay dividends and issue stock during the course of the same period, mostly out of a desire to maintain their dividends. Figure 10.13 reports new stock issues by firms as a percentage of firm value, classified by their dividend yields, in 1998.

Figure 21.11: Equity Issues by Dividend Class, United States - 1998



Source: Compustat database, 1998

While it is not surprising that stocks that pay no dividends are most likely to issue stock, it is surprising that firms in the highest dividend yield class also issue significant proportions of new stock (approximately half of all the firms in this class also make new stock issues). This suggests that many of these firms are paying dividends on the one hand and issuing stock on the other, creating significant issuance costs for their stockholders in the process.

Some Good Reasons for Paying Dividends

While the tax disadvantages of dividends are clear, especially for individual investors, there are some good reasons why firms that are paying dividends should not suspend them. First, there are investors who like to receive dividends, either because they pay no or very low taxes, or because they need the regular cash flows. Firms that have paid dividends over long periods are likely to have accumulated investors with these characteristics, and cutting or eliminating dividends would not be viewed favorably by this group.

Second, changes in dividends allow firms to signal to financial markets how confident they feel about future cash flows. Firms that are more confident about their future are therefore more likely to raise dividends; stock prices often increase in response. Cutting dividends is viewed by markets as a negative signal about future cashflows, and stock prices often decline in response. Third, firms can use dividends as a tool for altering their financing mix and moving closer to an optimal debt ratio. Finally, the commitment to pay dividends can help reduce the conflicts between stockholders and managers, by reducing the cash flows available to managers.

Some investors like dividends

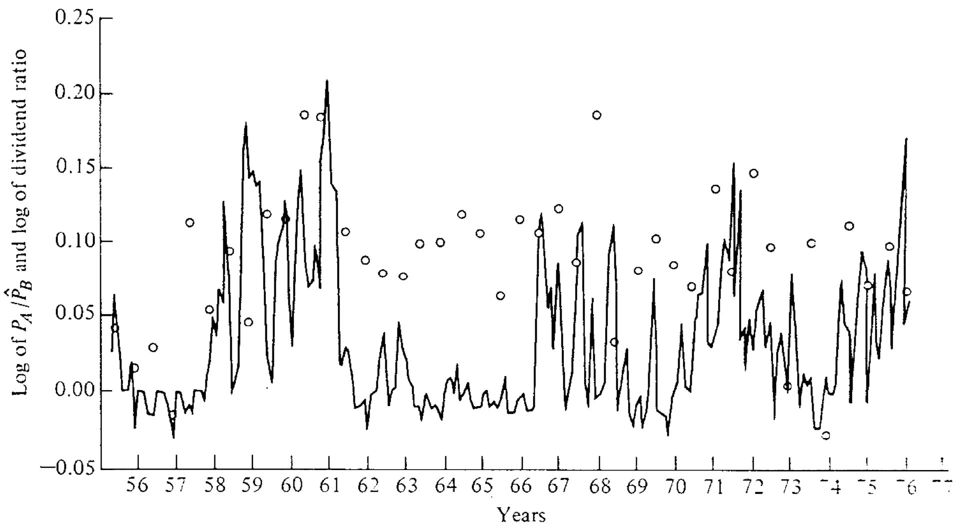
Many in the "dividends are bad" school of thought argue that rational investors should reject dividends due to their tax disadvantage. Whatever you might think of the merits of that argument, some investors have a strong preference for dividends and view large dividends positively. The most striking empirical evidence for this comes from studies of companies that have two classes of shares: one that pays cash dividends, and another that pays an equivalent amount of stock dividends; thus, investors are given a choice between dividends and capital gains.

John Long studied the price differential on Class A and B shares traded on Citizens Utility.[10] Class B shares paid a cash dividend, while Class A shares paid an equivalent stock dividend. Moreover, Class A shares could be converted at little or no cost to Class A shares at the option of its stockholders. Thus, an investor could choose to buy Class B shares to get cash dividends, or Class A shares to get an equivalent capital gain. During the period of this study, the tax advantage was clearly on the side of capital gains; thus, we would expect to find Class B shares selling at a discount on Class A

[10] Long, John B., Jr., 1978, *The Market Valuation Of Cash Dividends: A Case To Consider*, Journal of Financial Economics, 1978, v6(2/3), 235-264.

shares. The study found, surprisingly, that the Class B shares sold at a premium over Class A shares. Figure 10.14 reports the price differential between the two share classes over the period of the analysis.

Figure 10.14: Price Differential on Citizen's Utility Stock



Source: Long (1978)

While it may be tempting to attribute this phenomenon to the irrational behavior of investors, such is not the case. Not all investors like dividends — many feel its tax burden— but there are also many who view dividends positively. These investors may not be paying much in taxes and consequently do not care about the tax disadvantage associated with dividends. Or they might need and value the cash flow generated by the dividend payment. Why, you might ask, do they not sell stock to raise the cash flow they need? The transactions costs and the difficulty of breaking up small holdings[11] and selling unit shares may make selling small amounts of stock infeasible.

[11] Consider a stockholder who owns 100 shares trading at $ 20 per share, on which she receives a dividend of $0.50 per share. If the firm did not pay a dividend, the stockholder would have to sell 2.5 shares of stock to raise the $ 5 that would have come from the dividend.

Bailey extended Long's study to examine Canadian utility companies, which also offered dividend and capital-gains shares, and had similar findings.[12] Table 10.2 summarizes the price premium at which the dividend shares sold.

Table 10.2: Price Differential between Cash and Stock Dividend Shares

Company	*Premium on Cash Dividend Shares over Stock Dividend Shares*
Consolidated Bathurst	19.30%
Donfasco	13.30%
Dome Petroleum	0.30%
Imperial Oil	12.10%
Newfoundland Light & Power	1.80%
Royal Trustco	17.30%
Stelco	2.70%
TransAlta	1.10%
Average	**7.54%**

Source: Bailey (1988)

Note, once again, that on average the cash dividend shares sell at a premium of 7.5% over the stock dividend shares. We caution that while these findings do not indicate that all stockholders like dividends, they do indicate that the stockholders in these specific companies liked cash dividends so much that they were willing to overlook the tax disadvantage and pay a premium for shares that offered them.

The Clientele Effect

Stockholders examined in the studies described above clearly like cash dividends. At the other extreme are companies that pay no dividends, such as Microsoft, and whose stockholders seem perfectly content with that policy. Given the vast diversity of stockholders, it is not surprising that, over time, stockholders tend to invest in firms whose dividend policies match their preferences. Stockholders in high tax brackets who do not need the cash flow from dividend payments tend to invest in companies that pay low or no dividends. By contrast, stockholders in low tax brackets who need the cash from dividend payments, and tax-exempt institutions that need current cash flows, will usually invest in companies with high dividends. This clustering of stockholders in

[12] Bailey, W., 1988, *Canada's Dual Class Shares: Further Evidence On The Market Value Of Cash Dividends*, Journal of Finance, 1988, v43(5), 1143-1160

companies with dividend policies that match their preferences is called the **clientele effect**.

The existence of a clientele effect is supported by empirical evidence. One study looked at the portfolios of 914 investors to see whether their portfolios were affected by their tax brackets. The study found that older and poorer investors were more likely to hold high-dividend-paying stocks than were younger and wealthier investors.

In another study, dividend yields were regressed against the characteristics of the investor base of a company (including age, income and differential tax rates).[13]

$$\text{Dividend Yield}_t = a + b\,\beta_t + c\,\text{Age}_t + d\,\text{Income}_t + e\,\text{Differential Tax Rate}_t + \varepsilon_t$$

Variable	*Coefficient*	*Implies*
Constant	4.22%	
Beta Coefficient	-2.145	Higher beta stocks pay lower dividends.
Age/100	3.131	Firms with older investors pay higher dividends.
Income/1000	-3.726	Firms with wealthier investors pay lower dividends.
Differential Tax Rate	-2.849	If ordinary income is taxed at a higher rate than capital gains, the firm pays less dividends.

Source: Pettit (1977)

Not surprisingly, this study found that safer companies, with older and poorer investors, tended to pay more in dividends than companies with wealthier and younger investors. Overall, dividend yields decreased as the tax disadvantage of dividends increased.

10.7. ☞: **Dividend Clientele and Tax Exempt Investors**

Pension funds are exempt from paying taxes on either ordinary income or capital gains, and also have substantial ongoing cash flow needs. What types of stocks would you expect these funds to buy?

a. Stocks that pay high dividends

b. Stocks that pay no or low dividends

Explain.

[13] Pettit, R. R., 1977, *Taxes, Transactions Costs and the Clientele Effect of Dividends, Journal of Financial Economics*, v5, 419-436.

Consequences of the Clientele Effect

The existence of a clientele effect has some important implications. First, it suggests that firms get the investors they deserve, since the dividend policy of a firm attracts investors who like it. Second, it means that firms will have a difficult time changing an established dividend policy, even if it makes complete sense to do so. For instance, U.S. telephone companies have traditionally paid high dividends and acquired an investor base that liked these dividends. In the 1990s, many of these firms entered new businesses (entertainment, multi-media etc.), with much larger reinvestment needs and less stable cash flows. While the need to cut dividends in the face of the changing business mix might seem obvious, it was nevertheless a hard sell to stockholders, who had become used to the dividends.

The clientele effect also provides an alternative argument for the irrelevance of dividend policy, at least when it comes to valuation. In summary, if investors migrate to firms that pay the dividends that most closely match their needs, no firm's value should be affected by its dividend policy. Thus, a firm that pays no or low dividends should not be penalized for doing so, because its investors *do not want* dividends. Conversely, a firm that pays high dividends should not have a lower value, since its investors like dividends. This argument assumes that there are enough investors in each dividend clientele to allow firms to be fairly valued, no matter what their dividend policy.

Empirical Evidence on the Clientele Effect

Researchers have investigated whether the clientele effect is strong enough to separate the value of stocks from dividend policy. If there is a strong enough clientele effect, the returns on stocks should not be affected, over long periods, by the dividend payouts of the underlying firms. If there is a tax disadvantage associated with dividends, the returns on stocks that pay high dividends should be higher than the returns on stocks that pay low dividends, to compensate for the tax differences. Finally, if there is an overwhelming preference for dividends, these patterns should be reversed.

In their study of the clientele effect, Black and Scholes (1974) created 25 portfolios of NYSE stocks, classifying firms into five quintiles based upon dividend yield, and then subdivided each group into five additional groups based upon risk (beta) each year for 35 years, from 1931 to 1966.[14] When they regressed total returns on these portfolios against the dividend yields, the authors found no statistically significant relationship between the two. These findings were contested in a later study by Litzenberger and Ramaswamy (1979), who used updated dividend yields every month and examined whether the total returns in ex-dividend months were correlated with dividend yields.[15] They found a strong positive relationship between total returns and dividend yields, supporting the hypothesis that investors are averse to dividends. They also estimated that the implied tax differential between capital gains and dividends was approximately 23%. Miller and Scholes (1981) countered by arguing that this finding was contaminated by the stock price effects of dividend increases and decreases.[16] In response, they removed from the sample all cases in which the dividends were declared and paid in the same month and concluded that the implied tax differential was only 4%, which was not significantly different from zero.

In the interests of fairness, we should point out that most studies of the clientele effect have concluded that total returns and dividend yields are positively correlated. Although many of them contend that this is true because the implied tax differential between dividends and capital gains is significantly different from zero, there are alternative explanations for the phenomena. In particular, while one may disagree with Miller and Scholes' conclusions, their argument - that the higher returns on stocks that pay high dividends might have nothing to do with the tax disadvantages associated with dividends but may instead be a reflection of the price increases associated with unexpected dividend increases - has both a theoretical and an empirical basis, as discussed below.

10.8. ☞**: Dividend Clientele and Changing Dividend Policy**

Phone companies in the United States have for long had the following features - they are regulated, have stable earnings, low reinvestment needs and pay high dividends. Many of

[14] Black, F. and M. Scholes, 1974, The Effects of Dividend Yield and Dividend Policy on Common Stock Prices and Returns, Journal of Financial Economics, v1, 1-22.

[15] Litzenberger, R.H. and K. Ramaswamy, 1979, The Effect of Personal Taxes and Dividends on Capital Asset Prices: Theory and Empirical Evidence, Journal of Financial Economics, Vol 7, 163-196.

these phone companies are now considering entering the multimedia age and becoming entertainment companies, which requires more reinvestment and creates more volatility in earnings. If you were the CEO of the phone company, would you

a. announce an immediate cut in dividends as part of a major capital investment plan
b. continue to pay high dividends, and use new stock issues to finance the expansion
c. something else:

Explain.

Dividends operate as a information signal

Financial markets examine every action a firm takes for implications for future cash flows and firm value. When firms announce changes in dividend policy, they are conveying information to markets, whether they intend to or not.

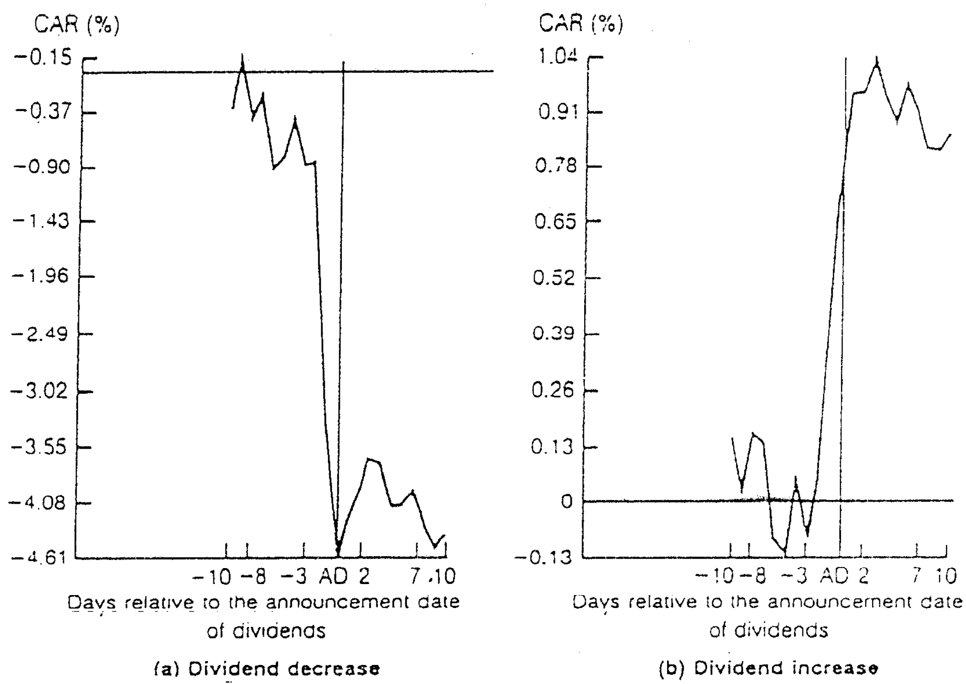
Financial markets tend to view announcements made by firms about their future prospects with a great deal of skepticism, since firms routinely make exaggerated claims. At the same time, some firms with good projects are under valued by markets. How do such firms convey information credibly to markets? Signaling theory suggests that these firms need to take actions that cannot be easily imitated by firms without good projects. Increasing dividends is viewed as one such action. By increasing dividends, firms create a cost to themselves, since they commit to paying these dividends in the long term. Their willingness to make this commitment indicates to investors that they believe they have the capacity to generate these cash flows in the long term. This positive signal should therefore lead investors to reevaluate the cash flows and firm values and increase the stock price.

Decreasing dividends is a negative signal, largely because firms are reluctant to cut dividends. Thus, when a firm take this action, markets see it as an indication that this firm is in substantial and long-term financial trouble. Consequently, such actions lead to a drop in stock prices.

[16] Miller, M. H. and M. S. Scholes, 1978, *Dividends And Taxes*, Journal of Financial Economics, v6(4), 333-364.

The empirical evidence concerning price reactions to dividend increases and decreases is consistent, at least on average, with this signaling theory. Figure 10.15 summarizes the average excess returns around dividend changes for firms.[17]

Figure 10.15: Excess Returns around Announcements of Dividend Changes



Source: Aharony and Swary

We should view this explanation for dividends increases and decreases cautiously, however. Although it is true that firms with good projects may use dividend increases to convey information to financial markets, given the substantial tax liability that increased dividends create for stockholders, is it the most efficient way? For smaller firms, which have relatively few signals available to them, the answer might be yes. For larger firms, which have many ways of conveying information to markets, dividends might not be the least expensive or the most effective signals. For instance, the information may be more effectively and economically conveyed through an analyst report on the company.

There is another reason for skepticism. An equally plausible story can be told about how an increase in dividends sends a negative signal to financial markets. Consider

[17] Aharony, J. and I. Swary, 1981, *Quarterly Dividends and Earnings Announcements and Stockholders'*

a firm that has never paid dividends in the past but has registered extraordinary growth and high returns on its projects. When this firm first starts paying dividends, its stockholders may consider this an indication that the firm's projects are neither as plentiful nor as lucrative as they used to be. However, Palepu and Healy find that the initiation of dividends does not signal a decline in earnings growth in a study of 151 firms from 1970 to 1979.[18]

10.9. ☞: **Dividends as Signals**

Silicon Electronics, a company with a history of not paying dividends, high earnings growth and reinvestment back into the company, announces that it will be initiating dividends. You would expect

a. the stock price to go up
b. the stock price to go down
c. the stock price to remain unchanged

Explain.

Dividend policy is a tool for changing financing mix

Dividend policy cannot be analyzed in a vacuum. Firms can use dividend policy as a tool to change their debt ratios, In chapter 9, we examined how firms that want to increase or decrease leverage can do so by changing their dividend policy: increasing dividends increases leverage over time, and decreasing dividends reduces leverage.

When dividends increase, stockholders sometimes get a bonus in the form of a wealth transfer from lenders to the firm. Lenders would rather have firms accumulate cash than pay it out as dividends. The payment of dividends takes cash out of the firm, and this cash could have been used to cover outstanding interest or principal payments. Not surprisingly, bond prices decline on the announcement of large increases in dividends. It is equity investors who gain from the loss in market value faced by bondholders. Bondholders, of course, try to protect themselves against this loss by restricting how much firms can pay out in dividends.

Returns: An Empirical Analysis, Journal of Finance, Vol 36, 1-12.

Dividends reduce managerial discretion/power

In examining debt policy, we noted that one reason for increasing debt levels was to induce managers to be more disciplined in their project choice. Implicit in this free cash flow argument is the assumption that cash accumulations, if left to the discretion of the managers of the firm, would be wasted on poor projects. If this is true, then forcing a firm to make a commitment to pay dividends would be an alternative to forcing managers to be disciplined in project choice and to reducing the cash that is available for discretionary uses. If this is the reason stockholders want managers to commit to paying larger dividends, then in firms where there is a clear separation between ownership and management, managers should pay larger dividends than in firms with substantial insider ownership and involvement in managerial decisions.

Managerial Interests and Dividend Policy

We have considered dividend policy in this chapter almost entirely from the perspective of equity investors in the firm. In reality, though, it is managers who set dividend policy and it should come as no surprise that there may be a potential for a conflict of interests between stockholders and managers.

The Source of the Conflict

In examining debt policy, we noted that one reason for taking on more debt was to induce managers to be more disciplined in their project choice. Implicit in this free cash flow argument is the assumption that cash accumulations, if left to the discretion of the managers of the firm, would be wasted on poor projects. If this is true, we can argue that forcing a firm to make a commitment to pay dividends provides an alternative to forcing managers to be disciplined in project choice and to reducing the cash that is available for discretionary uses.

If this is the reason stockholders want managers to commit to paying larger dividends, firms in which there is a clear separation between ownership and management,

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[18] Palepu, K and P. Healy, 1988, Earnings Information Conveyed by Dividend Initiations and Omissions, Journal of Financial Economics, v21, 149-175.

should pay larger dividends than should firms with substantial insider ownership and involvement in managerial decisions.

What do managers believe about dividend policy?

Given the pros and cons for paying dividends, and the lack of a consensus on the effect of dividends on value, it is worth considering what managers factor in when they make dividend decisions. Baker, Farrely and Edelman (1985) surveyed managers on their views on dividend policy and reported the level of agreement with a series of statements. Table 10.3 summarizes their findings –

Table 10.3: Management Beliefs about Dividend Policy

Statement of Management Beliefs	*Agree*	*No Opinion*	*Disagree*
1. A firm's dividend payout ratio affects the price of the stock.	61%	33%	6%
2. Dividend payments provide a signaling device of future prospects.	52%	41%	7%
3. The market uses divided announcements as information for assessing firm value.	43%	51%	6%
4. Investors have different perceptions of the relative riskiness of dividends and retained earnings.	56%	42%	2%
5. Investors are basically indifferent with regard to returns from dividends and capital gains.	6%	30%	64%
6. A stockholder is attracted to firms that have dividend policies appropriate to the stockholder's tax environment.	44%	49%	7%
7. Management should be responsive to shareholders' preferences regarding dividends.	41%	49%	10%

It is quite clear from this survey that, rightly or wrongly, managers believe, that their dividend payout ratios affect firm value and operate as signals of future prospects. They also operate under the presumption that investors choose firms with dividend policies that match their preferences and that management should be responsive to their needs.

In an updated and comprehensive survey[19] of dividend policy published in 2004, Brav, Graham, Harvey and Michaely conclude that management's focus is not on the level of dividends but on changes in these dividends. Indicating a shift from views in prior studies, many managers in this survey saw little gain from increasing dividends even in response to higher earnings and preferred stock buybacks instead. In fact, many managers in companies that paid dividends indicated regret the level of dividends paid by their firms, indicating that they would have set the dividend at a much lower level, if they had the choice. In contrast to the survey quoted in the last paragraph, managers also rejected the idea that dividends operate as useful financial signals, From the survey, the authors conclude that the rules of the game for dividends are the following: do not cut dividends, have a dividend policy similar to your peer group, preserve a good credit rating, maintain flexibility and do not take actions that reduce earnings per share.

10.10. ☞: **Corporate Governance and Dividend Policy**

In countries, where stockholders have little or no control over incumbent managers, you would expect dividends paid by companies

a. to be lower than dividends paid in other countries
b. to be higher than dividends paid in other countries
c. to be about the same as dividends paid in other countries

Conclusion

There are three schools of thought on dividend policy. The first is that dividends are neutral, and that they neither increase nor decrease value. Stockholders therefore are indifferent between receiving dividends and enjoying price appreciation. This view is based upon the assumptions that there are no tax disadvantages to investors associated with receiving dividends, relative to capital gains, and that firms can raise external capital for new investments without issuance costs.

The second view is that dividends destroy value for stockholders, because they are taxed at much higher rates than capital gains. The evidence for this tax disadvantage

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[19] Brav, A., J.R. Graham, C.R. Harvey and R. Michaely, *Payout Policy in the 21st Century*, 2004,, Working Paper, Duke University.

is strong both in the tax code and in markets, when we examine how stock prices change on ex-dividend days. On average, stock prices decline by less than the amount of the dividend, suggesting that stockholders in most firms consider dividends to be less attractive than equivalent capital gains.

The third school of thought makes the argument that dividends can be value increasing, at least for some firms. In particular, firms that have accumulated stockholders who prefer dividends to capital gains should continue to pay large and increasing dividends to keep their investor clientele happy. Furthermore, increasing dividends can operate as a positive signal to financial markets and allow a firm to change its financing mix over time. Finally, forcing firms to pay out dividends reduces the cash available to managers for new investments. If managers are not investing with the objective of maximizing stockholder wealth, this can make stockholders better off.

In summary, there is some truth to all these viewpoints, and it may be possible to develop a consensus around the points on which they agree. The reality is that dividend policy requires a trade-off between the additional tax liability it may create for firms and the potential signaling and free cash flow benefits of making the additional commitment to their stockholders. In some cases, the firm may choose not to increase or initiate dividends, because its stockholders are in high tax brackets and are particularly averse to dividends. In other cases, dividend increases may result.

Live Case Study

The Trade Off on Dividend Policy

Objective: To examine how much cash your firm has returned to its stockholders and in what form (dividends or stock buybacks), and to evaluate whether the trade off favors returning more or less.

Key Questions:

- Has this firm ever paid out dividends? If yes, is there a pattern to the dividends over time?
- Given this firm's characteristics today, do you think that this firm should be paying more dividends, less dividends or no dividends at all?

Framework for Analysis:

1. *Historical Dividend Policy*
    - How much has this company paid in dividends over the last few years?
    - How have these dividends related to earnings in these years?
2. *Firm Characteristics*
    - How easily can the firm convey information to financial markets? In other words, how necessary is it for them to use dividend policy as a signal?
    - Who are the marginal stockholdera in this firm? Do they like dividends or would they prefer stock buybacks?
    - How well can this firm forecast its future financing needs? How valuable is preserving flexibility to this firm?
    - Are there any significant bond covenants that you know of that restrict the firm's dividend policy?
    - How does this firm compare with other firms in the sector in terms of dividend policy?

Getting Information on dividend policy

You can get information about dividends paid back over time from the financial statements of the firm. (The statement of changes in cash flows is usually the best source.) To find typical dividend payout ratios and yields for the sector in which this firm operates examine the data set on industry averages on my web site.

Online sources of information:

http://www.stern.nyu.edu/~adamodar/cfin2E/project/data.htm

Problems

1. If Consolidated Power is priced at $50.00 with dividend, and its price falls to $46.50 when a dividend of $5.00 is paid, what is the implied marginal rate of personal taxes for its stockholders? Assume that the tax on capital gains is 40% of the personal income tax.

2. You are comparing the dividend policies of three dividend-paying utilities. You have collected the following information on the ex-dividend behavior of these firms.

	NE Gas	SE Bell	Western Electric
Price before	50	70	100
Price after	48	67	95
Dividends/share	4	4	5

If you were a tax-exempt investor, which company would you use to make "dividend arbitrage" profits? How would you go about doing so?

3. Southern Rail has just declared a dividend of $ 1. The average investor in Southern Rail faces an ordinary tax rate of 50%. While the capital gains rate is also 50%, it is believed that the investor gets the advantage of deferring this tax until future years (The effective capital gains rate will therefore be 50% discounted back to the present). If the price of the stock before the ex-dividend day is $10 and it drops to $9.20 by the end of the ex-dividend day, how many years is the average investor deferring capital gains taxes? (Assume that the opportunity cost used by the investor in evaluating future cashflows is 10%.)

4. LMN Corporation, a real estate corporation, is planning to pay a dividend of $0.50 per share. Most of the investors in LMN corporation are other corporations that pay 40% of their ordinary income and 28% of their capital gains as taxes. However, they are allowed to exempt 85% of the dividends they receive from taxes. If the shares are selling at $10 per share, how much would you expect the stock price to drop on the ex-dividend day?

5. UJ Gas is a utility that has followed a policy of increasing dividends every quarter by 5% over dividends in the prior year. The company announces that it will increase

quarterly dividends from $1.00 to $ 1.02 next quarter. What price reaction would you expect to the announcement? Why?

6. Microsoft Corporation, which has had a history of high growth and pays no dividends, announces that it will start paying dividends next quarter. How would you expect its stock price to react to the announcement? Why?

7. JC Automobiles is a small auto parts manufacturing firm, which has paid $1.00 in annual dividends each year for the last 5 years. It announces that dividends will increase to $ 1.25 next year. What would you expect the price reaction to be? Why? If your answer is different from the prior problem, explain the reasons for the difference.

8. Would your answer be different for the previous problem, if JC Automobiles were a large firm followed by 35 analysts? Why or why not?

9. WeeMart Corporation, a retailer of children's clothes, announces a cut in dividends following a year in which both revenues and earning dropped significantly. How would you expect its stock price to react? Explain.

10. RJR Nabisco, in response to stockholder pressure in 1996, announced a significant increase in dividends paid to stockholders, financed by the sale of some of its assets. What would you expect the stock price to do? Why?

11. RJR Nabsico also had $ 10 billion in bonds outstanding at the time of the dividend increase in problem 10. How would you expect Nabisco's bonds to react to the announcement? Why?

12. When firms increase dividends, stock prices tend to increase. One reason given for this price reaction is that dividends operate as a positive signal. What is the increase in dividends signaling to markets? Will markets always believe the signal? Why or why not?

CHAPTER 11

ANALYZING CASH RETURNED TO STOCKHOLDERS

Companies return cash to stockholders in the form of dividends, but over the last few years, they have also increasingly turned to stock buybacks as an alternative. Over the last few years, how much have companies returned to their stockholders, and how much could they have returned? As stockholders in these firms, would we want them to change their policies and return more or less than they are doing currently? In this chapter, we expand our definition of cash returned to stockholders to include stock buy backs. As we will document, firms in the United States have turned increasingly to buying back stock to either augment regular dividends, or, in some cases, to substitute for cash dividends.

Using this expanded measure of actual cash flows returned to stockholders, we consider two ways in which firms can analyze whether they are returning too little or too much to stockholders. In the first, we examine how much cash is left over after reinvestment needs have been met and debt payments made. We consider this cash flow to be the cash available for return to stockholders and compare it to the actual amount returned. We categorize firms into those that return more to stockholders than they have available in this cash flow, firms that return what they have available and firms that return less than they have available. We then examine the firms that consistently return more or less cash than they have available, and the consequences of these policies. For this part of the analysis, we bring in two factors – the quality of the firm's investments and the firm's plans to change its financing mix. We argue that firms that return less to their stockholders than they have available in free cash flows to equity are much more likely to be trusted with the cash if they have a track record of good investments. Firms that return more cash than they have available are on firm ground if they are trying to increase their debt ratios.

In the second approach to analyzing dividend policy, we consider how much comparable firms in the industry are paying as dividends. Many firms set their dividend policies by looking at their peer groups. We discuss this practice, and suggest some refinements in it to allow for the vast differences that often exist between firms in the same sector.

In the last part of this chapter, we look at how firms that decide they are paying too much or too little in dividends can change their dividend policies. Since firms tend to attract stockholders who like their existing dividend policies, and because dividends convey information to financial markets, changing dividends can have unintended and negative consequences. We suggest ways in which firms can manage a transition from a high dividend payout to a low dividend payout, or vice versa.

Cash Returned to Stockholders

In the last chapter, we considered the decision about how much to pay in dividends and three schools of thought about whether dividend policy affected firm value. Until the middle of the 1980s, dividends remained the primary mechanism for firms to return cash to stockholders. Starting in that period, we have seen firms increasingly turn to buying back their own stock, using either cash on hand or borrowed money, as a mechanism for returning cash to their stockholders.

The Effects of Buying Back Stock

Let us first consider the effect of a stock buyback on the firm doing the buyback. The stock buyback requires cash, just as a dividend would, and thus has the same effect on the assets of the firm – a reduction in the cash balance. Just as a dividend reduces the book value of the equity in the firm, a stock buyback reduces the book value of equity. Thus, if a firm with a book value of equity of $ 1 billion buys back $ 400 million in equity[1], the book value of equity will drop to $ 600 million. Both a dividend payment and a stock buyback reduce the overall market value of equity in the firm, but the way they affect the market value is different. The dividend reduces the market price, on the ex-dividend day and does not change the number of shares outstanding. A stock buyback reduces the number of shares outstanding and is often accompanied by a stock price increase. For instance, if a firm with 100 million shares outstanding trading at $ 10 per share buys back 10 million shares, the number of shares will decline to 90 million, but the

[1] The stock buyback is at market value. Thus, when the market value is significantly higher than the book value of equity, a buyback of stock will reduce the book value of equity disproportionately. For example, if the market value is five times the book value of equity, buying back 10% of the stock will reduce the book value of equity by 50%.

stock price may increase to $ 10.50. The total market value of equity after the buyback will be $ 945 million, a drop in value of 5.5%.

Unlike a dividend, which returns cash to all stockholders in a firm, a stock buyback returns cash selectively to those stockholders who choose to sell their stock to the firm. The remaining stockholders get no cash; they gain indirectly from the stock buyback if the stock price increases. Stockholders in the firm described above will find the value of their holdings increasing by 5%, after the stock buyback.

In Practice: How do you buy back stock?

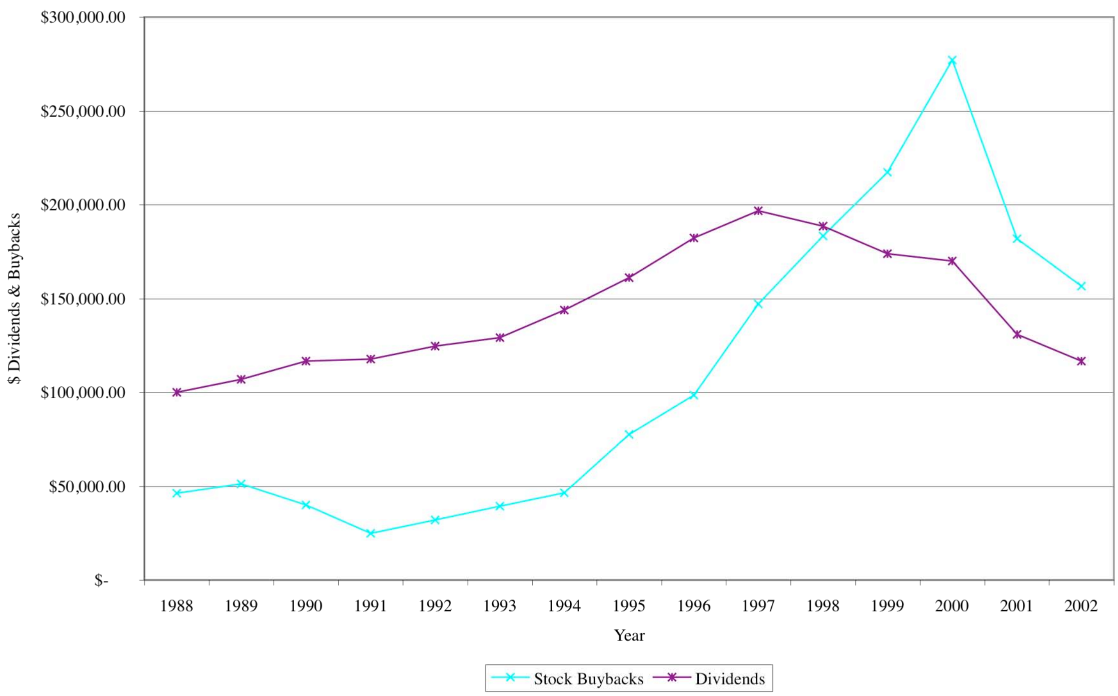
The process of repurchasing equity will depend largely upon whether the firm intends to repurchase stock in the open market, at the prevailing market price, or to make a more formal tender offer for its shares. There are three widely used approaches to buying back equity:

- Repurchase Tender Offers: In a repurchase tender offer, a firm specifies a price at which it will buy back shares, the number of shares it intends to repurchase, and the period of time for which it will keep the offer open, and invites stockholders to submit their shares for the repurchase. In many cases, firms retain the flexibility to withdraw the offer if an insufficient number of shares are submitted or to extend the offer beyond the originally specified time period. This approach is used primarily for large equity repurchases.
- Open Market Purchases: In the case of open market repurchases, firms buy shares in the market at the prevailing market price. While firms do not have to disclose publicly their intent to buy back shares in the market, they have to comply with SEC requirements to prevent price manipulation or insider trading. Finally, open market purchases can be spread out over much longer time periods than tender offers and are much more widely used for smaller repurchases. In terms of flexibility, an open market repurchase affords the firm much more freedom in deciding when to buy back shares and how many shares to repurchase.
- Privately Negotiated Repurchases: In privately negotiated repurchases, firms buy back shares from a large stockholder in the company at a negotiated price. This method is not as widely used as the first two and may be employed by managers or owners as a way of consolidating control and eliminating a troublesome stockholder.

The Magnitude of Stock Buybacks

In the last decade, more and more firms have used equity repurchases as an alternative to paying dividends. Figure 11.1 summarizes dividends paid and equity repurchases at U.S. corporations between 1989 and 2002.

Figure 11.1: Stock Buybacks and Dividends: Aggregate for US Firms - 1989-2002



Source: Compustat database (2003)

It is worth noting that while aggregate dividends at all US firms have grown at a rate of about 1.18% a year over this 10-year period, stock buybacks have grown 9.83% a year. In another interesting shift, the proportion of cash returned to stockholders in the form of stock buybacks has climbed from 32% in 1989 to about 57% in 2002. Stock buybacks, in the aggregate, exceeded dividends, in the aggregate, in 1999 for the first time in US corporate history. While the slowdown in the economy resulted in both dividends and stock buybacks decreasing in 2001 and 2002, buybacks still exceeded dividends in 2002.

This shift has been much less dramatic outside the United States. Firms in other countries are far less likely to use stock buybacks to return cash to stockholders for a number of reasons. First, dividends in the United States bear a much higher tax burden, relative to capital gains, than dividends paid in other countries. Many European countries, for instance, allow investors to claim a tax credit on dividends, for taxes paid by the firms paying these dividends. Stock buybacks, therefore, provide a much greater tax benefit to investors in the United States than they do to investors outside the United States, by shifting income from dividends to capital gains. Second, stock buybacks are prohibited or tightly constrained in many countries. Third, a strong reason for the increase in stock buybacks in the United States has been pressure from stockholders on managers to pay out idle cash. This pressure is far less in the weaker corporate governance systems that exist outside the United States.

For the rest of this section, we will be using "dividend policy" to mean not just what gets paid out in dividends but also the cash that is returned to stockholders in the form of stock buybacks.

Illustration 11.1: Dividends and Stock Buybacks: Disney, Aracruz and Deutsche Bank

In the table that follows, we consider how much the Disney, Aracruz and Deutsche Bank have returned to stockholders in dividends, and how much stock they have bought back each year between 1994 and 2003.

Table 11.1: Cash Returned to Stockholders: Disney, Aracruz and Deutsche Bank (in millions)

	Disney			*Aracruz*			*Deutsche Bank*		
Year	Dividends (in \$)	Equity Repurchases (in \$)	Cash to Equity	Dividends (in \$)	Equity Repurchases (in \$)	Cash to Equity	Dividends (in Eu)	Equity Repurchases (in Eu)	Cash to Equity
1994	\$153	\$571	\$724	\$80	\$0	\$80	\$400	\$0	\$400
1995	\$180	\$349	\$529	\$113	\$0	\$113	\$459	\$0	\$459
1996	\$271	\$462	\$733	\$27	\$0	\$27	\$460	\$0	\$460
1997	\$342	\$633	\$975	\$28	\$0	\$28	\$489	\$0	\$489
1998	\$412	\$30	\$442	\$24	\$26	\$51	\$600	\$0	\$600
1999	\$0	\$19	\$19	\$18	\$0	\$18	\$707	\$0	\$707
2000	\$434	\$166	\$600	\$58	\$23	\$81	\$801	\$0	\$801
2001	\$438	\$1,073	\$1,511	\$63	\$0	\$63	\$808	\$0	\$808
2002	\$428	\$0	\$428	\$74	\$2	\$76	\$808	\$0	\$808
2003	\$429	\$0	\$429	\$109	\$3	\$112	\$808	\$0	\$808

All three companies paid dividends over the ten-year period but there are interesting differences between the companies. Deutsche Bank has the steadiest dividend payment record as the total dividend paid increased from 400 million euros in 1994 to 808 million euros in 2003. Dividends were never cut during the entire period and have generally grown, though the amount paid has remained unchanged from 2001 to 2003. Disney has generally also increased its dividends over the ten-year period, with one naotable exception. In 1999, Disney did not pay dividends as its operating performance turned negative. Aracruz has had the most volatile history in terms of dividends paid, with dividends rising in 5 of the 10 years examined and falling in 4 of the 10 years.

Looking at stock buybacks, Disney has been the most active player buying stock in 8 out of the 10 years, with a buyback exceeding a billion dollars in 2001. Aracruz has bought back relatively small amounts of stock over the same period, mostly has treasury stock and Deutsche Bank has never bought back stock. These differences reflect the markets that these firms operate in. As noted earlier, companies in the United States have generally bought back more stock than their counterparts in other markets. Stock buybacks are rare in Brazil and were not allowed in Germany for much of the ten year period examined.

Reasons for Stock Buybacks

Firms that want to return substantial amounts of cash to their stockholders can either pay a large special dividend or buy back stock. There are several advantages to both the firm and its stockholders to using stock buybacks as an alternative to dividend payments. There are four significant advantages to the firm:

- Unlike regular dividends, which typically commit the firm to continue payment in future periods, equity repurchases are one-time returns of cash. Consequently, firms with excess cash that are uncertain about their ability to continue generating these cash flows in future periods should repurchase stocks rather than pay dividends. (They could also choose to pay special dividends, since these do not commit the firm to making similar payments in the future.)
- The decision to repurchase stock affords a firm much more flexibility to reverse itself and to spread the repurchases over a longer period than does a decision to pay an equivalent special dividend. In fact, there is substantial evidence that many firms that announce ambitious stock repurchases do reverse themselves and do not carry the plans through to completion.

- Equity repurchases may provide a way of increasing insider control in firms, since they reduce the number of shares outstanding. If the insiders do not tender their shares back, they will end up holding a larger proportion of the firm and, consequently, having greater control.
- Finally, equity repurchases may provide firms with a way of supporting their stock prices, when they are declining[2]. For instance, in the aftermath of the crash of 1987, many firms initiated stock buyback plans to keep stock prices from falling further.

There are two potential benefits that stockholders might perceive in stock buybacks:

- Equity repurchases may offer tax advantages to stockholders, since dividends are taxed at ordinary tax rates, while the price appreciation that results from equity repurchases is taxed at capital gains rates. Furthermore, stockholders have the option not to sell their shares back to the firm and therefore do not have to realize the capital gains in the period of the equity repurchases.
- Equity repurchases are much more selective in terms of paying out cash only to those stockholders who need it. This benefit flows from the voluntary nature of stock buybacks: those who need the cash can tender their shares back to the firm, while those who do not can continue to hold on to them.

In summary, equity repurchases allow firms to return cash to stockholders and still maintain flexibility for future periods.

Intuitively, we would expect stock prices to increase when companies announce that they will be buying back stock. Studies have looked at the effect on stock price of the announcement that a firm plans to buy back stock. There is strong evidence that stock prices increase in response. Lakonishok and Vermaelen examined a sample of 221 repurchase tender offers that occurred between 1962 and 1977, and at stock price changes in the 15 days around the announcement.[3] Table 11.2 summarizes the fraction of shares bought back in these tender offers and the change in stock price for two sub-periods: 1962-79 and 1980-86.

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[2] This will be true only if the price decline is not supported by a change in the fundamentals – drop in earnings, declining growth etc. If the price drop is justified, a stock buyback program can, at best, provide only temporary respite.

[3] Lakonishok, J. and T. Vermaelen, 1990, *Anomalous Price Behavior around Repurchase Tender Offers*, Journal of Finance, v45, 455-478

Table 11.2: Returns around Stock Repurchase Tender Offers

	1962-1979	1980-1986	1962-1986
Number of buybacks	131	90	221
Percentage of shares purchased	15.45%	16.82%	16.41%
Abnormal return to all stockholders	16.19%	11.52%	14.29%

On average, across the entire period, the announcement of a stock buyback increased stock value by 14.29%.

In Practice: Equity Repurchase and the Dilution Illusion

Some equity repurchases are motivated by the desire to reduce the number of shares outstanding and therefore increase the earnings per share. If we assume that the firm's price earnings ratio will remain unchanged, reducing the number of shares will usually lead to a higher price. This provides a simple rationale for many companies embarking on equity repurchases.

There is a problem with this reasoning, however. Although the reduction in the number of shares might increase earnings per share, the increase is usually caused by higher debt ratios and not by the stock buyback per se. In other words, a special dividend of the same amount would have resulted in the same returns to stockholders. Furthermore, the increase in debt ratios should increase the riskiness of the stock and lower the price earnings ratio. Whether a stock buyback will increase or decrease the price per share will depend on whether the firm is moving to its optimal debt ratio by repurchasing stock, in which case the price will increase, or moving away from it, in which case the price will drop.

To illustrate, assume that an all-equity financed firm in the specialty retailing business, with 100 shares outstanding, has $100 in earnings after taxes and a market value of $1,500. Assume that this firm borrows $300 and uses the proceeds to buy back 20 shares. As long as the after-tax interest expense on the borrowing is less than $ 20, this firm will report higher earnings per share after the repurchase. If the firm's tax rate is 50%, for instance, the effect on earnings per share is summarized in the table below for two scenarios: one where the interest expense is $ 30 and one where the interest expense is $ 55.

Effect of Stock Repurchase on Earnings per Share			
	Before Repurchase	*After Repurchase*	
		Interest Expense = $ 30	Interest Expense = $ 55
EBIT	$ 200	$200	$ 200
- Interest	$ 0	$ 30	$ 55
= Taxable Inc.	$ 200	$ 170	$ 145
- Taxes	$ 100	$ 85	$ 72.50
= Net Income	$ 100	$ 85	$ 72.50
# Shares	100	80	80
EPS	$ 1.00	$ 1.125	$ 0.91

If we assume that the price earnings ratio remains at 15, the price per share will change in proportion to the earnings per share. Realistically, however, we should expect to see a drop in the price earnings ratio, as the increase in debt makes the equity in the firm riskier. Whether the drop will be sufficient to offset or outweigh an increase in earnings per share will depend upon whether the firm has excess debt capacity and whether, by going to 20%, it is moving closer to its optimal debt ratio.

Choosing between Dividends and Equity Repurchases

Firms that plan to return cash to their stockholders can either pay them dividends or buy back stock. How do they choose? The choice will depend upon the following factors:

- *Sustainability and Stability of Excess Cash Flow:* Both equity repurchases and increased dividends are triggered by a firm's excess cash flows. If the excess cash flows are temporary or unstable, firms should repurchase stock; if they are stable and predictable, paying dividends provides a stronger signal of future project quality.
- *Stockholder Tax Preferences*: If stockholders are taxed at much higher rates on dividends than capital gains, they will be better off if the firm repurchases stock. If, on the other hand, stockholders prefer dividends, they will gain if the firm pays a special dividend.
- *Predictability of Future Investment Needs*: Firms that are uncertain about the magnitude of future investment opportunities should use equity repurchases as a way

of returning cash to stockholders. The flexibility that is gained will be useful, if they need cash flows in a future period to accept an attractive new investment.

- *Undervaluation of the Stock:* For two reasons, an equity repurchase makes even more sense when managers believe their stock to be undervalued. First, if the stock remains undervalued, the remaining stockholders will benefit if managers buy back stock at less than true value. The difference between the true value and the market price paid on the buyback will be accrue to those stockholders who do not sell their stock back. Second, the stock buyback may send a signal to financial markets that the stock is undervalued, and the market may react accordingly, by pushing up the price.
- *Management Compensation:* Managers often receive options on the stock of the companies that they manage. The prevalence and magnitude of such option-based compensation can affect whether firms use dividends or buy back stock. The payment of dividends reduces stock prices, while leaving the number of shares unchanged. The buying back of stock reduces the number of shares, and the share price usually increases on the buyback. Since options become less valuable as the stock price decreases, and more valuable as the stock price increases, managers with significant option positions may be more likely to buy back stock than pay dividends.

Bartov, Krinsky and Lee examined three of these determinants – undervaluation, management compensation and institutional investor holdings (as a proxy for stockholder tax preferences) – of whether firms buy back stock or pay dividends.[4] They looked at 150 firms announcing stock buyback programs between 1986 and 1992 and compared these firms to other firms in their industries that chose to increase dividends instead. Table 11.3 reports on the characteristics of the two groups.

Table 11.3: Characteristics of Firms Buying Back Stock versus those Increasing Dividends

	Firms buying back stock	*Firms increasing dividends*	*Difference is significant*
Book/Market	56.90%	51.70%	Yes
Options/shares	7.20%	6.30%	No

[4] Bartov, E., I. Krinsky and J. Lee, 1998, *Some Evidence on how Companies choose between Dividends and Stock Repurchases*, Journal of Applied Corporate Finance, v11, 89-96.

No of institutional holders	219.4	180	yes

While the option holdings of managers seemed to have had no statistical impact on whether firms bought back stock or increased dividends, firms buying back stock had higher book to market ratios than firms increasing dividends, and more institutional stockholders. The higher book to price ratio can be viewed as an indication that these firms are more likely to view themselves as under valued. The larger institutional holding might suggest a greater sensitivity to the tax advantage of stock buybacks.

11.1. ☞**: Stock Buybacks and Stock Price Effects**

For which of the following types of firms would a stock buyback be most likely to lead to a drop in the stock price?

a. Companies with a history of poor project choice

b. Companies which borrow money to buy back stock

c. Companies which are perceived to have great investment opportunities

Explain.

A Cash Flow Approach to Analyzing Dividend Policy

Given what firms are returning to their stockholders in the form of dividends or stock buybacks, how do we decide whether they are returning too much or too little? In the cash flow approach, we follow four steps. We first measure how much cash is available to be paid out to stockholders after meeting reinvestment needs and compare this amount to the amount actually returned to stockholders. We then have to consider how good existing and new investments in the firm are. Thirdly, based upon the cash payout and project quality, we consider whether firms should be accumulating more cash or less. Finally, we look at the relationship between dividend policy and debt policy.

Step 1: Measuring Cash Available to be returned to Stockholders

To estimate how much cash a firm can afford to return to its stockholders, we begin with the net income — the accounting measure of the stockholders' earnings during the period — and convert it to a cash flow by subtracting out a firm's reinvestment needs. First, any capital expenditures, defined broadly to include acquistions, are subtracted from the net income, since they represent cash outflows. Depreciation and amortization, on the other hand, are added back in because they are non-cash charges. The difference between capital expenditures and depreciation is referred to as *net capital expenditures* and is usually a function of the growth characteristics of the firm. High-growth firms tend to have high net capital expenditures relative to earnings, whereas low-growth firms may have low, and sometimes even negative, net capital expenditures.

Second, increases in working capital drain a firm's cash flows, while decreases in working capital increase the cash flows available to equity investors. Firms that are growing fast, in industries with high working capital requirements (retailing, for instance), typically have large increases in working capital. Since we are interested in the cash flow effects, we consider only changes in *non-cash working capital* in this analysis.

Finally, equity investors also have to consider the effect of changes in the levels of debt on their cash flows. Repaying the principal on existing debt represents a cash outflow, but the debt repayment may be fully or partially financed by the issue of new debt, which is a cash inflow. Again, netting the repayment of old debt against the new debt issues provides a measure of the cash flow effects of changes in debt.

Allowing for the cash flow effects of net capital expenditures, changes in working capital, and net changes in debt on equity investors, we can define the cash flows left over after these changes as the **free cash flow to equity (FCFE)**:

Free Cash Flow to Equity (FCFE) = Net Income
- (Capital Expenditures - Depreciation)
- (Change in Non-cash Working Capital)
+ (New Debt Issued - Debt Repayments)

This is the cash flow available to be paid out as dividends.

This calculation can be simplified if we assume that the net capital expenditures and working capital changes are financed using a fixed mix[5] of debt and equity. If δ is the proportion of the net capital expenditures and working capital changes that is raised from debt financing, the effect on cash flows to equity of these items can be represented as follows:

[5] The mix has to be fixed in book value terms. It can be varying in market value terms.

Equity Cash Flows associated with Capital Expenditure Needs = – (Capital Expenditures - Depreciation) (1 - δ)

Equity Cash Flows associated with Working Capital Needs = - (Δ Working Capital) (1-δ)

Accordingly, the cash flow available for equity investors after meeting capital expenditure and working capital needs is:

Free Cash Flow to Equity = Net Income
- (Capital Expenditures - Depreciation) (1 - δ)
- (Δ Working Capital) (1-δ)

Note that the net debt payment item is eliminated, because debt repayments are financed with new debt issues to keep the debt ratio fixed. It is particularly useful to assume that a specified proportion of net capital expenditures and working capital needs will be financed with debt if the target or optimal debt ratio of the firm is used to forecast the free cash flow to equity that will be available in future periods. Alternatively, in examining past periods, we can use the firm's average debt ratio over the period to arrive at approximate free cash flows to equity.

In Practice: Estimating the FCFE at a Financial Service Firm

The standard definition of free cash flows to equity is straightforward to put into practice for most manufacturing firms, since the net capital expenditures, non-cash working capital needs and debt ratio can be estimated from the financial statements. In contrast, the estimation of free cash flows to equity is difficult for financial service firms, due to several reasons. First, estimating net capital expenditures and non-cash working capital for a bank or insurance company is difficult to do, since all of the assets and liabilites are in the form of financial claims. Second, it is difficult to define short-term debt for financial service firms, again due to the complexity of their balance sheets.

To estimate the FCFE for a bank, we begin by categorizing the income earned into three categories - *net interest income* from taking deposits and lending them out a higher interest rate, *arbitrage income* from buying financial claims (at a lower price) and selling financial claims (of equivalent risk) at a higher price and *advisory and fee income* from providing financial advice and services to firms. For each of these sources of income, we traced the equity investment that would be needed:

Type of Income	*Net Investment Needed*
Net Interest Income	Net Loans - Total Deposits
Arbitrage Income	Investments in Financial Assets - Corresponding Financial Liabilities
Advisory Income	Training Expenses

(Net Loans = Total Loans - Bad Debt Provisions)

The first two categories of net investment can usually be obtained from the balance sheet, and changes in these net figures from year to year can be treated as the equivalent of net capital expenditures. While, in theory, training expenses should be capitalized and treated as tax-deductible capital expenditures, they are seldom shown in enough detail at most firms for this to be feasible.

Illustration 11.2: Estimating Free Cash Flows to Equity – Disney, Aracruz and Deutsche Bank

In Table 11.4, we estimate the free cash flows to equity for Disney from 1994 to 2003, using historical information from their financial statements.

Table 11.4: Estimates of Free Cashflows to Equity for Disney: 1994-2003

Year	*Net Income*	*Depreciation*	*Capital Expenditures*	*Change in non-cash WC*	*FCFE (before debt CF)*	*Net CF from Debt*	*FCFE (after Debt CF)*
1994	$1,110.40	$1,608.30	$1,026.11	$654.10	$1,038.49	$551.10	$1,589.59
1995	$1,380.10	$1,853.00	$896.50	($270.70)	$2,607.30	$14.20	$2,621.50
1996	$1,214.00	$3,944.00	$13,464.00	$617.00	($8,923.00)	$8,688.00	($235.00)
1997	$1,966.00	$4,958.00	$1,922.00	($174.00)	$5,176.00	($1,641.00)	$3,535.00
1998	$1,850.00	$3,323.00	$2,314.00	$939.00	$1,920.00	$618.00	$2,538.00
1999	$1,300.00	$3,779.00	$2,134.00	($363.00)	$3,308.00	($176.00)	$3,132.00
2000	$920.00	$2,195.00	$2,013.00	($1,184.00)	$2,286.00	($2,118.00)	$168.00
2001	($158.00)	$1,754.00	$1,795.00	$244.00	($443.00)	$77.00	($366.00)
2002	$1,236.00	$1,042.00	$1,086.00	$27.00	$1,165.00	$1,892.00	$3,057.00
2003	$1,267.00	$1,077.00	$1,049.00	($264.00)	$1,559.00	($1,145.00)	$414.00
Average	$1,208.55	$2,553.33	$2,769.96	$22.54	$969.38	$676.03	$1,645.41

The depreciation numbers also include amortization and the capital expenditures include acquisitions; the acquisition of Capital Cities/ABC is reflected in the large jump in capital expenditures in 1996 and in depreciation in the years after as goodwill was amortized. Increases in non-cash working capital, shown as positive numbers, represent a drain on the cash. In 1994, for example, non-cash working capital increased by $ 654.10 million, reducing the cash available for stockholders in that year by the same amount. Finally, the net cashflow from debt is the cash generated by the issuance of new debt, netted out against the cash outflow from the repayment of old debt. Again, using 1994 as an example, Disney issued $ 551.10 million more in new debt than it paid off on old debt, and this represents a cash inflow in that year.

We have computed two measures of free cashflow to equity, one before the net debt cashflow and one after. Using 1994 as an illustration, we compute each as follows:

FCFE before net Debt CF = Net Income + Depreciation – Capital Expenditures – Change in non-cash Working Capital = 1110.40 + 1608.30 – 1026.11 -654.10 = $ 1038.49 million

FCFE after net Debt CF = FCFE before net Debt CF + Net Debt Cashflow = 1038.49 + 551.10 = $1589.59 million

As Table 11.4 indicates, Disney had negative free cash flows to equity in 2 of the 10 years, in 1996 because of the Capital Cities acquisition and in 2001 because they reported a loss. The average annual FCFE before net debt issues over the period was $968 million and the average net debt issued over the period was $676 million, resulting in an annual FCFE after net debt issues of $1,645 million.

A similar estimation of FCFE was done for Aracruz from 1998 to 2003 in table 11.5, again using historical information:

Table 11.5: FCFE for Aracruz in US$ from 1998 to 2003

Year	*Net Income*	*Depreciation*	*Capital Expenditures*	*Change in non-cash WC*	*FCFE (before net Debt CF)*	*Net Debt Cashflow*	*FCFE (after net Debt CF)*
1998	$3.45	$152.80	$88.31	$76.06	($8.11)	$174.27	$166.16
1999	$90.77	$158.83	$56.47	$2.18	$190.95	($604.48)	($413.53)
2000	$201.71	$167.96	$219.37	$12.30	$138.00	($292.07)	($154.07)
2001	$18.11	$162.57	$421.49	($56.76)	($184.06)	$318.24	$134.19
2002	$111.91	$171.50	$260.70	($5.63)	$28.34	$36.35	$64.69
2003	$148.09	$162.57	$421.49	($7.47)	($103.37)	$531.20	$427.83
Average	$95.67	$162.70	$244.64	$3.45	$10.29	$27.25	$37.54

Between 1998 and 2003, Aracruz had big swings in net income and corresponding swings in FCFE, with FCFE being negative in 3 of the 6 years. The average annual FCFE before net debt cashflows was approximately 10 million dollars. The cashflows from debt add to the volatility, since Aracruz paid off large amounts of debt in 1999 and 2000 and raised large amounts of debt in 1998, 2001 and 2003. The average annual FCFE after net debt cashflows changes relatively little to 37.54 million dollars.

We can compute Aracruz's FCFE each year, using the approximation that we described in the last section. To do this, we first have to compute the net debt cashflows as percent of reinvestment needs over this period. Using the average values for debt cashflows, capital expenditures, depreciation and changes in non-cash working capital:

Average Debt Ratio = Net Debt Cashflow/ (Capital expenditures – Depreciation + Change in non-cash Working capital) = 27.25/(244.64-162.70+3.45) = 31.92%

The FCFE each year can then be estimated using the average debt ratio, instead of the actual net debt cashflows. Table 11.6 contains the estimates of FCFE each year using this approach for Aracruz:

Table 11.6: Approximate FCFE for Aracruz from 1998 to 2003

Year	*Net Income*	*(Capital Expenditures - Depreciation)*(1-DR)*	*Change in non-cash WC (1-DR)*	*FCFE*
1998	$3.45	-$43.91	$51.78	-$4.42
1999	$90.77	-$69.69	$1.48	$158.98
2000	$201.71	$35.00	$8.38	$158.34
2001	$18.11	$176.28	-$38.64	-$119.53
2002	$111.91	$60.73	-$3.83	$55.02
2003	$148.09	$176.28	-$5.09	-$23.11
Average	$95.67	$55.78	$2.35	$37.54

Note that the average FCFE between 1998 and 2003 remains the same at 37.54 million dollars a year when we use the approximation. The FCFE in each year is different, though, from the estimates in table 11.5, because we are smoothing out the effects of the cashflows from debt.

To estimate the FCFE for Deutsche Bank, we used the categories developed earlier for banks - *net interest income*, *arbitrage income* and *advisory and fee income* from providing financial advice and services to firms. To estimate the net investment made in 2003 for each source of income, and ignoring training expenses, we used the balance sheet numbers for 2002 and 2003. Table 11.7 reports these numbers.

Table 11.7: Deutsche Bank: 2002 and 2003 Financials

	2002	*2003*	*Change*
Interbank Assets	€ 25,691.00	€ 14,649.00	-€ 11,042.00
Net Loans	€ 167,303.00	€ 144,946.00	-€ 22,357.00

Security Purchases/Resell	€ 155,258.00	€ 185,215.00	€ 29,957.00
ST Investments	€ 318,681.00	€ 370,002.00	€ 51,321.00
LT Investments	€ 4,729.00	€ 2,569.00	-€ 2,160.00
Net Fixed Assets	€ 8,883.00	€ 5,786.00	-€ 3,097.00
Other Assets	€ 68,732.00	€ 73,751.00	€ 5,019.00
Total Non-Cash Assets	€ 749,277.00	€ 796,918.00	€ 47,641.00
Total Deposits	€ 327,625.00	€ 306,154.00	-€ 21,471.00
ST Borrowings	€ 125,842.00	€ 155,002.00	€ 29,160.00
LT Borrowing	€ 92,388.00	€ 82,018.00	-€ 10,370.00
ST Liabilities	€ 172,379.00	€ 222,838.00	€ 50,459.00
LT Liabilities	€ 10,130.00	€ 9,400.00	-€ 730.00
Liabilities	€ 728,364.00	€ 775,412.00	€ 47,048.00

We then categorized these changes into the "interest income" investments, "arbitrage income" investments and "other" investments, considering interbank investments as interest income investments.

Interest Income Investments = (Net Loans + Interbank Investments - Deposits)$_{2003}$ - (Net Loans + Interbank Investments - Deposits)$_{2002}$

Arbitrage Investments = (Short Term and Long Term Investments + Security Purchases - ST Borrowings - LT Borrowings - ST Liabilities - LT Liabilities)$_{2003}$ - (Short Term and Long Term Investments - ST Borrowings - LT Borrowings - ST Liabilities - LT Liabilities)$_{2002}$

Other Investments = (Net Fixed Assets + Other Assets)$_{2003}$ - (Net Fixed Assets + Other Assets)$_{2002}$

With these definitions, and based upon Deutsche's Bank's net income of 1,365 million Euro in 2003, we estimated the FCFE :

Net Income =	1365
- Interest Income Investments	-(-€ 11,928.00)
- Arbitrage Investments	- € 10,599.00
- Other Investments	- € 1,922.00
FCFE	= € 772.00

This analysis would suggest that Deutsche Bank had 772 million Euros available to be returned to stockholders in 2003.

11.2. ☞ **: Defining Free Cash Flows to Equity**

The reason that the net income is not the amount that a company can afford to pay out in dividends is because

a. Earnings are not cash flows
b. Some of the earnings have to be reinvested back in the firm to create growth
c. There may be cash inflows or outflows associated with the use of debt
d. All of the above

Explain.

Measuring the Payout Ratio

The conventional measure of dividend policy — the dividend payout ratio — gives us the value of dividends as a proportion of earnings. In contrast, our approach measures the total cash returned to stockholders as a proportion of the free cash flow to equity:

Dividend Payout Ratio = Dividends / Earnings

Cash to Stockholders to FCFE Ratio = (Dividends + Equity Repurchases) / FCFE

The ratio of cash returned to stockholders to FCFE shows how much of the cash available to be paid out to stockholders is actually returned to them in the form of dividends and stock buybacks. If this ratio, over time, is equal or close to 100%, the firm is paying out all that it can to its stockholders. If it is significantly less than 100%, the firm is paying out less than it can afford to and is using the difference to increase its cash balance or to invest in marketable securities. If it is significantly over 100%, the firm is paying out more than it can afford and is either drawing on an existing cash balance or issuing new securities (stocks or bonds).

Illustration 11.3: Comparing Dividend Payout Ratios to FCFE Payout Ratios: Disney and Aracruz

In the following analysis, we compare the dividend payout ratios to the cash to stockholders as a percent of FCFE for Disney and Aracruz. Table 11.8 shows both numbers for Disney from 1994 to 2003.

Table 11.8: Disney: Dividends as Percentage of Earnings and Cash Returned as Percentage of FCFE

Year	Net Income	Dividends	Payout Ratio	FCFE	Cash returned to Stockholders	Cash Returned/FCFE
1994	$1,110.40	$153.20	13.80%	$1,589.59	$723.90	45.54%
1995	$1,380.10	$180.00	13.04%	$2,621.50	$528.70	20.17%
1996	$1,214.00	$271.00	22.32%	($235.00)	$733.00	NA
1997	$1,966.00	$342.00	17.40%	$3,535.00	$975.00	27.58%
1998	$1,850.00	$412.00	22.27%	$2,538.00	$442.00	17.42%
1999	$1,300.00	$0.00	0.00%	$3,132.00	$19.00	0.61%
2000	$920.00	$434.00	47.17%	$168.00	$600.00	357.14%
2001	($158.00)	$438.00	NA	($366.00)	$1,511.00	NA
2002	$1,236.00	$428.00	34.63%	$3,057.00	$428.00	14.00%
2003	$1,267.00	$429.00	33.86%	$414.00	$429.00	103.62%
1994-2003	$12,085.50	$3,087.20	25.54%	$16,454.09	$6,389.60	38.83%

As you can see, Disney paid out 25.54% of its aggregate earnings as dividends over this period.[6] Over the same period, it returned 38.83% of its FCFE to its stockholders in the form of dividends and stock buybacks. Though the payout ratio gives us little information about the company, the cash returned as a percent of FCFE suggests that Disney accumulated cash during this period. Even if we ignore the cashflows generated by debt in estimating FCFE, Disney returned only 65.91% of its FCFE to its stockholders in the form of dividends and stock buybacks.

Table 11.9 shows dividend payout ratios and cash returned to stockholders as a percent of FCFE for Aracruz from 1998 to 2003.

Table 11.9: Aracruz – Dividends as Percentage of Earnings and Cash Returned as Percent of FCFE

Year	Net Income	Dividends	Payout Ratio	FCFE	Cash returned to Stockholders	Cash Returned/FCFE
1998	$3.45	$24.39	707.51%	$166.16	$50.79	30.57%
1999	$90.77	$18.20	20.05%	($413.53)	$18.20	NA
2000	$201.71	$57.96	28.74%	($154.07)	$80.68	NA
2001	$18.11	$63.17	348.87%	$134.19	$63.17	47.08%
2002	$111.91	$73.80	65.94%	$64.69	$75.98	117.45%
2003	$148.09	$109.31	73.81%	$427.83	$112.31	26.25%
1998-	$574.04	$346.83	60.42%	$225.27	$401.12	178.07%

[6] To compute the payout ratio over the entire period, we first aggregated earnings and dividends over the entire period and then divided the aggregate dividends by the aggregate earnings. This avoids the problems created by averaging ratios where outliers (very high ratios) are common.

2003						

As with Disney, the payout ratio and the cash returned as a percent of FCFE tell you different stories. While Aracruz paid out 60.42% of its aggregate earnings over the period as dividends, the total cash returned as a percent of aggregate FCFE was in excess of 100%. Some of the dividends were clearly funded using cash accumulated at the start of the period.

dividends.xls: This spreadsheet allows you to estimate the free cash flow to equity and the cash returned to stockholders for a period of up to 10 years.

divfcfe.xls: There is a dataset on the web that summarizes dividends, cash returned to stockholders and free cash flows to equity, by sector, in the United States.

Why Firms may pay out less than is available

For several reasons, many firms pay out less to stockholders, in the form of dividends and stock buybacks, than they have available in free cash flows to equity. The reasons vary from firm to firm and we list some below –

- The managers of a firm may gain by retaining cash rather than paying it out as a dividend. The desire for empire building may make increasing the size of the firm an objective on its own. Or, management may feel the need to build up a cash cushion to tide over periods when earnings may dip; in such periods, the cash cushion may reduce or obscure the earnings drop and may allow managers to remain in control.
- The firm may be unsure about its future financing needs and may choose to retain some cash to take on unexpected investments or meet unanticipated needs.
- The firm may have volatile earnings and may retain cash to help smooth out dividends over time.
- Bondholders may impose restrictions on cash payments to stockholders, which may prevent the firm from returning available cash flows to its stockholders.

11.3. ☞**: What happens to the FCFE that are not paid out?**

In 2003, Microsoft had free cash flows to equity of roughly $ 9 billion, paid no dividends and bought back no stock. Where would you expect to see the difference of $ 9 billion show up in Microsoft's financials?

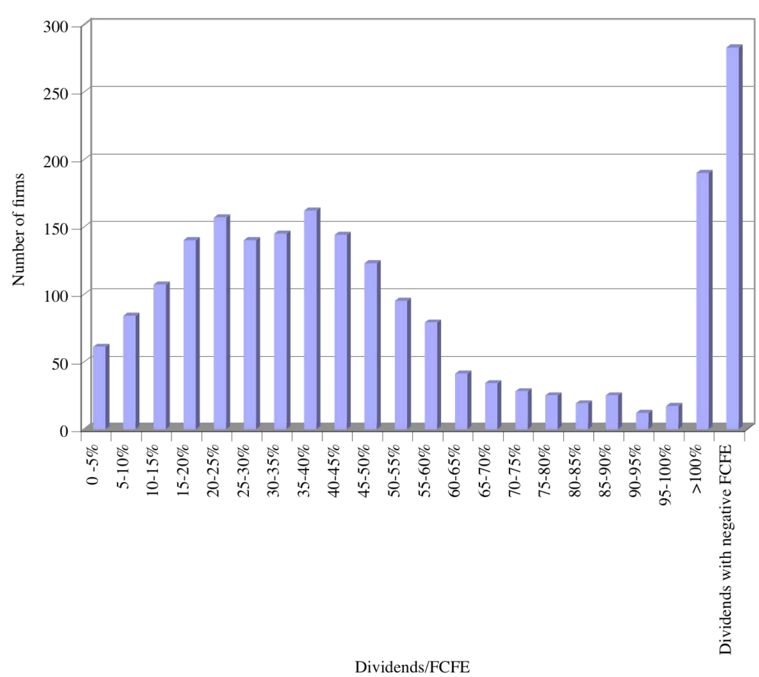
a. It will be invested in new projects
b. It will be in retained earnings, increasing the book value of equity
c. It will increase the cash balance of the company
d. None of the above

Explain.

Evidence on Dividends and FCFE

We can observe the tendency of firms to pay out less to stockholders than they have available in free cash flows to equity by examining cash returned to stockholders paid as a percentage of free cash flow to equity. In 2003, for instance, the median dividend to free cash flow to equity ratio across dividend paying firms listed in the United States was 60%. Figure 11.2 shows the distribution of cash returned as a percent of FCFE across all dividend-paying firms.

Figure 11.2: Dividends paid as % of FCFE



Source: Value Line, 2003

A percentage less than 100% means that the firm is paying out less in dividends than it has available in free cash flows and that it is generating surplus cash. For those firms that did not make net debt payments (debt payments in excess of new debt issues) during the period, this cash surplus appears as an increase in the cash balance. A percentage greater than 100% indicates that the firm is paying out more in dividends than it has available in cash flow. These firms have to finance these dividend payments either out of existing cash balances or by making new stock and debt issues. Note that there are almost 300 firms in this period that paid dividends even though they had negative free cashflows to equity. These firms will have to come up with enough funds, either from existing cash balances or new stock issues, to cover both the dividends and the cash deficit.

This spreadsheet allows you to estimate the free cash flows to equity for a firm over a period for up to 10 years and compare it to dividends paid.

Step 2: Assessing Project Quality

The alternative to returning cash to stockholders is reinvestment. Consequently, a firm's investment opportunities influence its dividend policy. Other things remaining equal, a firm with better projects typically has more flexibility in setting dividend policy and defending it against stockholder pressure for higher dividends. But how do we define a good project?

According to our analysis of investment decisions, a good project is one that earns at least the hurdle rate, which is the cost of equity, if cash flows are estimated on an equity basis, or the cost of capital if cash flows are measured on a pre-debt basis. In theory, we could estimate the expected cash flows on every project available to the firm and calculate the internal rates of return or net present value of each project to evaluate project quality. There are several practical problems with this, however. First, we have to be able to obtain the detailed cash flow estimates and hurdle rates for all available projects, which can daunting if the firm has dozens or even hundreds of projects. The second problem is that, even if these cash flows are available for existing projects, they will not be available for future projects.

As an alternative approach to measuring project quality, we can use one or more of the three measures we developed in chapter 5 to evaluate a firm's current project portfolio:

- Cash Flow Return on Investment (CFROI), which measures the real internal rate of return on existing investments, based upon expected cash flows and the remaining life of the investments, and compares it to the real cost of capital
- Accounting Return differentials, where we compare the accounting return on equity to the cost of equity and the accounting return on capital to the cost of capital.
- Economic value Added, which measures the excess return earned on capital invested in existing investments, and can be computed either on an equity or capital basis.

We did note the limitations of each of these approaches in chapter 5, but they still provide a measure of the quality of a firm's existing investments.

Using past project returns as a measure of future project quality can result in errors if a firm is making a transition from one stage in its growth cycle to the next, or if it is in the process of restructuring. In such situations, it is entirely possible that the expected returns on new projects will differ from past project returns. Consequently, it may be worthwhile scrutinizing past returns for trends that may carry over into the future. The average return on equity or capital for a firm will not reveal these trends very well, because they are slow to reflect the effects of new projects, especially for large firms. An alternative accounting return measure, which better captures year to year shifts, is the **marginal return on equity or capital**, which is defined as follows:

$$\text{Marginal Return on Equity}_t = \frac{\text{Net Income}_t - \text{Net Income}_{t-1}}{\text{Book Value of Equity}_t - \text{Book Value of Equity}_{t-1}}$$

$$\text{Marginal Return on Capital} = \frac{\text{EBIT}(1-t)_t - \text{EBIT}(1-t)_{t-1}}{\text{Book Value of Capital}_t - \text{Book Value of Capital}_{t-1}}$$

Although the marginal return on equity (capital) and the average return on equity (capital) will move in the same direction, the marginal returns typically change much more than do the average returns, the difference being a function of the size of the firm. These marginal returns can be used to compute the quality of the new projects added on by the firm.

The alternative to using accounting returns to measure the quality of a firm's projects is to look at how well or badly a firm's stock has done in financial markets. In chapter 4, we compared the returns earned by a stock to the returns earned on the market, after adjusting for risk. The risk-adjusted excess return that we estimated becomes a measure of whether a stock has under- or outperformed the market. A positive excess return would then be viewed as an indication that a firm has done better than expected, while a negative excess return would indicate that a firm has done worse than anticipated.

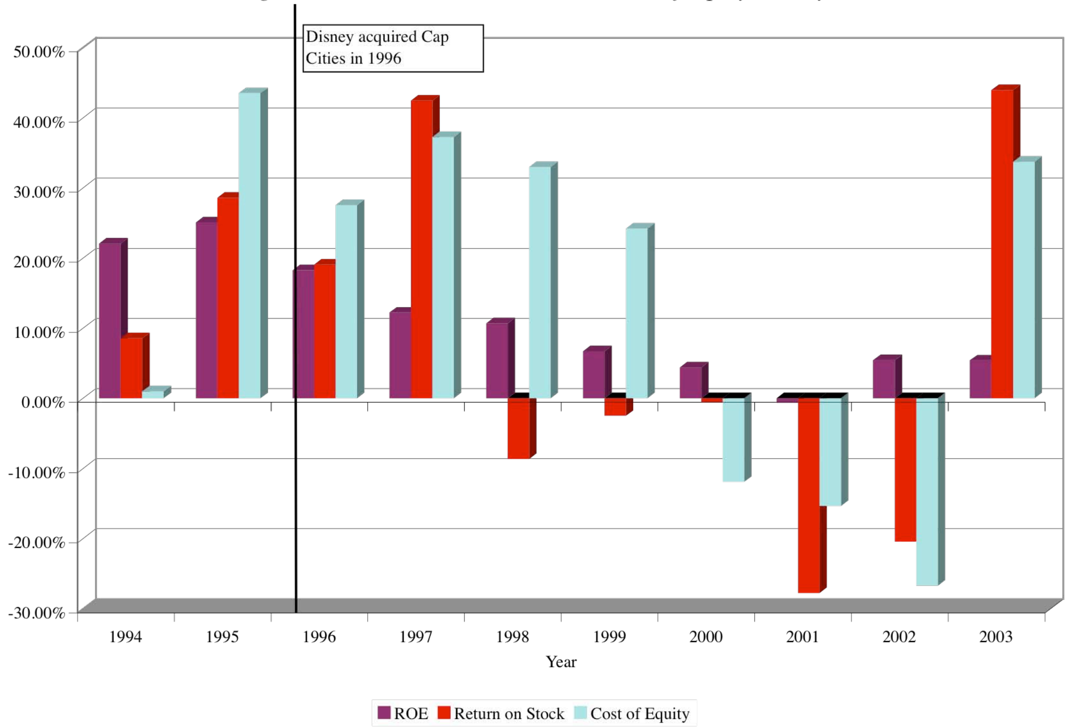
Finally, accounting income and stock returns may vary year to year, not only because of changes in project quality, but also because of fluctuations in the business cycles and interest rates. Consequently, the comparisons between returns and hurdle rates should be made over long enough periods, say five to ten years, to average out these other effects.

Illustration 11.4: Evaluating Project Quality at Disney and Aracruz

In illustration 5.9, we examined the quality of existing investments at Disney and Aracruz, using both accounting returns and economic value added. In the following analysis, we examine both accounting and market measures of return at Disney and Aracruz over the most recent time period, and compare them to the appropriate hurdle rates to evaluate the quality of the projects taken at each firm during the period. We begin with an analysis of Disney's accounting return on equity, the return from holding the stock, and the required return (given the beta and market performance during each year[7]) from 1994 to 2003 as shown in Figure 11.3.

[7] For instance, to estimate the expected return in 1998, we use the following:
Expected Return in 1998 = Riskfree rate at beginning of 1998 + Beta (Return on Market in 1998 – Riskfree Rate at the beginning of 1998)
An average beta of 1.20 was used over the entire period for Disney.

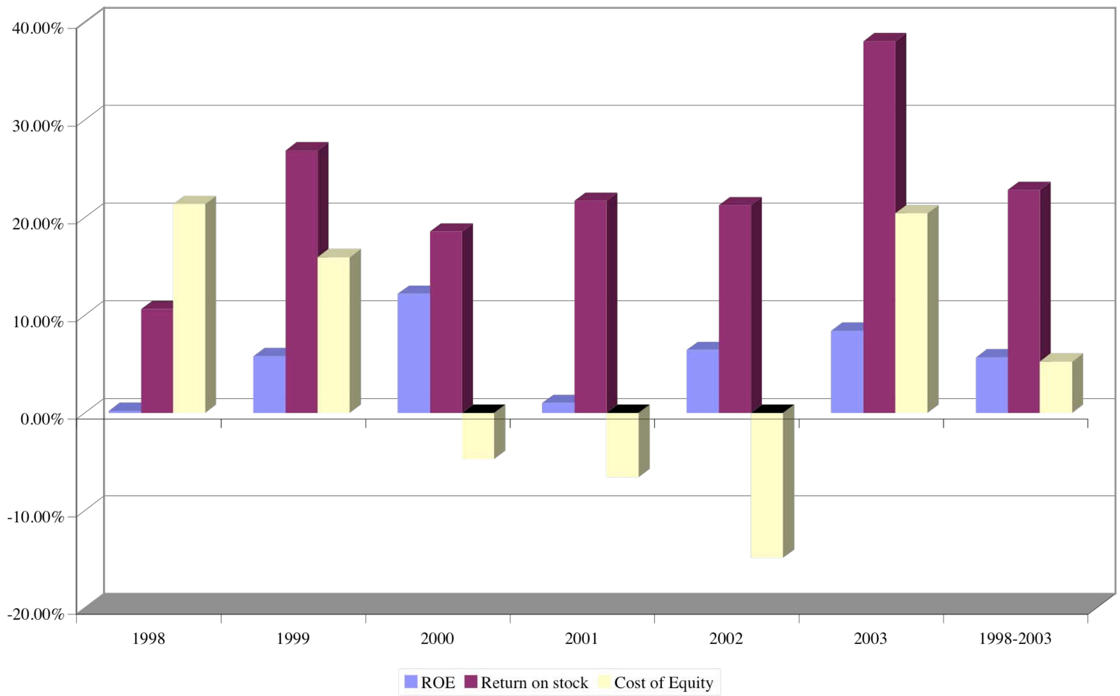
Figure 11.3: ROE, Return on Stock and Cost of Equity: Disney



As you can see, the verdict is not favorable to Disney, especially after the acquisition of Capital Cities in 1996. The return on equity for the firm, which exceeded 20% in the two years prior to the acquisition, plummeted in the years after to single digits. Accounting rules can be blamed partially for the decline immediately after the acquisition because the book value of equity at Disney jumped when it bought ABC. However, the continuing decline in return on equity in 1998 and 1998 cannot be attributed to the book value write and neither can the poor stock price performance between 1998 and 2001. It is clear that any promised synergy in this merger has not materialized over the following seven years. While there are individual years in which Disney project returns and stock returns exceed the required return, the average return on equity over the entire period is 7.50%, which is lower than the required rate of return of 14.62%. The average annual return from holding Disney stock is 8.27%, which is also lower than the required return. Based upon the company's performance over the last few years, that there is little to suggest that Disney's managers can be trusted with cash.

Repeating this analysis for Aracruz for the 1998-2003 time period yields different results. Figure 11.4 summarizes returns on equity, returns on the stock, and the required return at the firm for each year between 1998 and 2003.

Figure 11.4: ROE, Return on Stock and Cost of Equity: Aracruz



During this period, Aracruz earned an average return on equity of 5.68%, barely in excess of its cost of equity of 5.27% but an investor in its stock would have seen an average annual return of 22.84% over the same period. , Stockholders may be willing, at this stage, to accept the firm's contention that its projects are delivering sufficient returns, but a key question will how much these returns are dependent upon the price of paper/pulp holding up in future years. Looking at Aracruz's history, it is quite clear that much of the volatility in returns from year to year can be attributed to commodity price variation.

dividends.xls: This spreadsheet allows you to estimate the average return on equity and cost of equity for a firm for a period of up to 10 years.

11.4. ☞: **Historical, Average and Projected Returns on Capital**

You have been asked to judge the quality of the projects available at Super Meats, a meat processing company. It has earned an average return on capital of 10% over the last 5 years, but its marginal return on capital last year was 14%. The industry average return on capital is 12%, and it is expected that Super Meats will earn this return on its projects over the next 5 years. If the cost of capital is 12.5%, which of the following conclusions would you draw about Super Meat's projects

a. It invested in good projects over the last 5 years
b. It invested in good projects last year
c. It can expect to invest in good projects over the next 5 years

In terms of setting dividend policy, which of these conclusions matter the most?

In Practice: Dealing with Accounting Returns

Accounting rates of return, such as return on equity and capital, are subject to abuse and manipulation. For instance, decisions on how to account for acquisitions (purchase or pooling), choice of depreciation methods (accelerated versus straight line), and whether to expense or capitalize an item (research and development) can all affect reported income and book value. In addition, in any specific year, the return on equity and capital can be biased upwards or downwards depending upon whether the firm had an unusually good or bad year. To estimate a fairer measure of returns on existing projects, we would recommend the following:

1. Normalize the income, before computing returns on equity or capital. For Aracruz, in the analysis above, using the average income over the last 3 years, instead of the depressed income in 1996 provides returns on equity or capital that are much closer to the required returns.
2. Back out the effects of cosmetic earnings effects caused by accounting decisions, such as the one on pooling versus purchase. This is precisely why we should consider Disney's income prior to the amortization of the Capital Cities acquisition in computing returns on equity and capital.
3. If there are operating expenses designed to create future growth, rather than current income, capitalize those expenses and treat them as part of book value, while computing operating income, prior to those expenses. This is what we did with Bookscape, when we capitalized operating leases and treated them as part of the

capital base, and looked at earnings before interest, taxes and operating leases in computing return on capital.

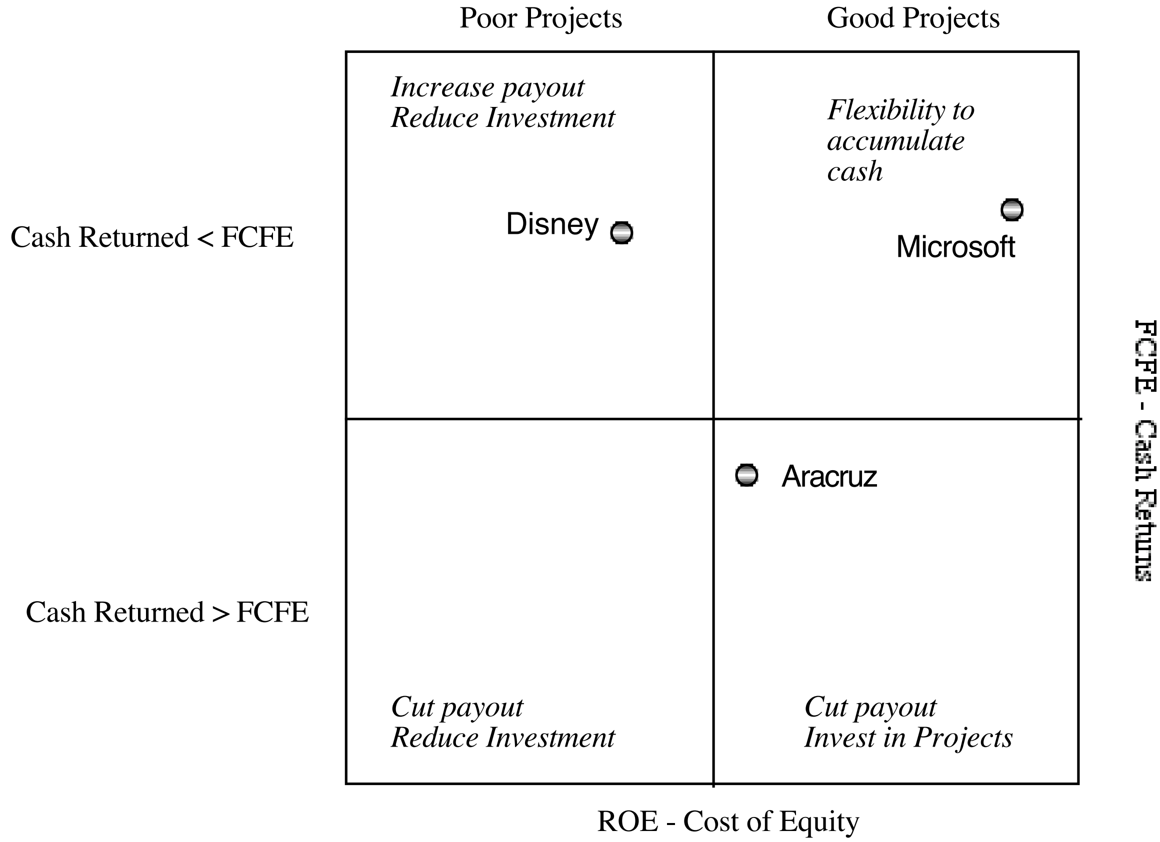
Step 3: Evaluating Dividend Policy

Once we have measured a firm's capacity to pay dividends and assessed its project quality, we can decide whether the firm should continue its existing policy of returning cash to stockholders, return more cash or return less. The assessment will depend upon how much of the free cash flow to equity is returned to stockholders each period, and on how good the firm's project opportunities are. There are four possible scenarios:

- *A firm may have good projects and may be paying out more (in dividends and stock buybacks) than its free cash flow to equity*: In this case, the firm is losing value in two ways. First, by paying too much in dividends, it is creating a cash shortfall that has to be met by issuing more securities. Second, the cash shortfall often creates capital rationing constraints; as a result, the firm may reject good projects it otherwise would have taken.
- *A firm may have good projects and may be paying out less than its free cash flow to equity as a dividend.* While it will accumulate cash as a consequence, the firm can legitimately argue that it will have good projects in the future in which it can invest the cash, though investors may wonder why it did not take the projects in the current period.
- *A firm may have poor projects and may be paying out less than its free cash flow to equity as a dividend.* This firm will also accumulate cash, but it will find itself under pressure from stockholders to distribute the cash, because of their concern that the cash will be used to finance poor projects.
- *A firm may have poor projects and may be paying out more than its free cash flow to equity as a dividend.* This firm first has to deal with its poor project choices, possibly by cutting back on those investments that make returns below the hurdle rate. Since the reduced capital expenditure will increase the free cash flow to equity, this may take care of the dividend problem. If it does not, the firm will have to cut dividends as well.

Figure 11.5 illustrates the possible combinations of cash payout and project quality.

Figure 11.5: Analyzing Dividend Policy



In this matrix, Aracruz, with its superior (albeit barely) project returns and its history of paying out more in dividends than it has available in free cash flows to equity falls in the quadrant where cutting dividends and redirecting the cash to projects seems to make the most sense. Disney, on the other hand, which pays less in dividends than it has available in free cash flows to equity and has a recent history of poor project returns, clearly will come under pressure to return more cash to its stockholders.

Note, though, that the pressure to pay dividends comes from the lack of trust in Disney's management rather than any greed on the part of stockholders. For a contrast, consider Microsoft, which had \$11.175 billion in free cashflows to equity inn 2003 and returned only \$857 million in dividends. The company's high return on equity (>25%) and superior stock price performance earned it the flexibility to pay out far less in cash than it generated, with little protest from stockholders.

While we might obtain estimates of return on equity and free cash flow to equity by looking at past data, the entire analysis should be forward looking. The objective is not to estimate return on equity on past projects, but to forecast expected returns on future investments. Only to the degree that past information is useful in making these forecasts is it an integral part of the analysis.

Consequences of Payout not matching FCFE

The consequences of the cash payout to stockholders not matching the free cash flows to equity can vary depending upon the quality of a firm's projects. In this section, we examine the consequences of paying out too little or too much for firms with good projects and for firms with bad projects. We also look at how managers in these firms may justify their payout policy, and how stockholders are likely to react to the justification.

A. Poor Projects and Low Payout

There are firms that invest in poor projects and accumulate cash by not returning the cash they have available to stockholders. We discuss stockholder reaction and management response to the dividend policy.

Consequences of Low Payout

When a firm pays out less than it can afford to in dividends, it accumulates cash. If a firm does not have good projects in which to invest this cash, it faces several possibilities: In the most benign case, the cash accumulates in the firm and is invested in financial assets. Assuming that these financial assets are fairly priced, the investments are zero net present value projects and should not negatively affect firm value. There is the possibility, however, that the firm may find itself the target of an acquisition, financed in part by its large holdings of liquid assets.

In the more damaging scenario, as the cash in the firm accumulates, the managers may be tempted to invest in projects that do not meet their hurdle rates, either to reduce the likelihood of a takeover or to earn higher returns than they would on financial assets.[8]

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[8] This is especially likely if the cash is invested in treasury bills or other low-risk low-return investments. On the surface, it may seem better for the firm to take on risky projects that earn, say 7%, than invest in T.Bills and make 3%, though this clearly does not make sense after adjusting for the risk.

These actions will lower the value of the firm. Another possibility is that the management may decide to use the cash to finance an acquisition. This hurts stockholders in the firm because some of their wealth is transferred to the stockholders of the acquired firms. The managers will claim that such acquisitions have strategic and synergistic benefits. The evidence[9] indicates, however, that most firms that have financed takeovers with large cash balances, acquired over years of paying low dividends while generating high free cash flows to equity, have reduced stockholder value.

Stockholder Reaction

Because of the negative consequences of building large cash balances, stockholders of firms that pay insufficient dividends and do not have "good" projects pressure managers to return more of the cash back to them. This is the basis for the free cash flow hypothesis, where dividends serve to reduce free cash flows available to managers and, by doing so, reduce the losses management actions can create for stockholders.

Management's Defense

Not surprisingly, managers of firms that pay out less in dividends than they can afford view this policy as being in the best long-term interests of the firm. They maintain that while the current project returns may be poor, future projects will both be more plentiful and have higher returns. Such arguments may be believable initially, but they become more difficult to sustain if the firm continues to earn poor returns on its projects. Managers may also claim that the cash accumulation is needed to meet demands arising from future contingencies. For instance, cyclical firms will often state that large cash balances are needed to tide them over the next recession. Again, while there is some truth to this view, the reasonableness of the cash balance must be compared to the experience of the firm in terms of cash requirements in prior recessions.

Finally, in some cases, managers will justify a firm's cash accumulation and low dividend payout based upon the behavior of comparable firms. Thus, a firm may claim that it is essentially matching the dividend policy of its closest competitors and that it has

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[9] See chapter 26.

to continue to do so to remain competitive. The argument that "every one else does it" cannot be used to justify a bad dividend policy, however.

Although all these justifications seem consistent with stockholder wealth maximization or the best long-term interests of the firm, they may really be smoke screens designed to hide the fact that this dividend policy serves managerial rather than stockholder interests. Maintaining large cash balances and low dividends provides managers with two advantages: it increases the funds that are directly under their control and thus increases their power to direct future investments; and it increases their margin for safety stabilizing earnings and protecting their jobs.

B. Good Projects and Low Payout

While the outcomes for stockholders in firms with poor projects and low dividend payout ratios range from neutral to terrible, the results may be more positive for firms that have a better selection of projects, and whose management have had a history of earning high returns for stockholders.

Consequences of Low Payout

The immediate consequence of paying out less in dividends than is available in free cash flow to equity is the same for firms with good projects as it is for firms with poor projects: the cash balance of the firm increases to reflect the cash surplus. The long term effects of cash accumulation are generally much less negative for these firms, however, for the following reasons:

- These firms have projects that earn returns greater than the hurdle rate, and it likely that the cash will be used productively in the long term.
- The high returns earned on internal projects reduces both the pressure and the incentive to invest the cash in poor projects or in acquisitions.
- Firms that earn high returns on their projects are much less likely to be targets of takeovers, reducing the threat of hostile acquisitions.

To summarize, firms that have a history of investing in good projects and that expect to continue to have such projects in the future may be able to sustain a policy of retaining cash rather than paying out dividends. In fact, they can actually create value in the long term by using this cash productively.

Stockholders Reaction

Stockholders are much less likely to feel a threat to their wealth in firms that have historically shown good judgment in picking projects. Consequently, they are more likely to agree when managers in those firms withhold cash rather than pay it out. While there is a solid basis for arguing that managers cannot be trusted with large cash balances, this proposition does not apply equally across all firms. The managers of some firms earn the trust of their stockholders because of their capacity to deliver extraordinary returns on both their projects and their stock over long periods of time. These managers will be generally have much more flexibility in determining dividend policy.

The notion that greedy stockholders force firms with great investments to return too much cash too quickly is not based in fact. Rather, stockholder pressure for dividends or stock repurchases is greatest in firms whose projects yield marginal or poor returns, and least in firms whose projects have high returns.

Management Responses

Managers in firms that have posted stellar records in project and stock returns clearly have a much easier time convincing stockholders of the desirability of withholding cash rather than paying it out. The most convincing argument for retaining funds for reinvestment is that the cash will be used productively in the future and earn excess returns for the stockholders. Not all stockholders will agree with this view, especially if they feel that future projects will be less attractive than past projects, as may occur if the industry in which the firm operates is maturing. For example, many specialty retail firms, such as the Limited, found themselves under pressure to return more cash to stockholders in the early 1990s as margins and growth rates in the business declined.

C. Poor Projects and High Payout

In many ways, the most troublesome combination of circumstances occurs when firms pay out much more in dividends than they can afford, and at the same time earn disappointing returns on their projects. These firms have problems with both their investment and their dividend policies, and the latter cannot be solved adequately without addressing the former.

Consequences of High Payout

When a firm pays out more in dividends than it has available in free cash flows to equity, it is creating a cash deficit that has to be funded by drawing on the firm's cash balance, by issuing stock to cover the shortfall, or by borrowing money to fund its dividends. If the firm uses its cash reserves, it will reduce equity and raise its debt ratio. If it issues new equity, the drawback is the issuance cost of the stock. By borrowing money, the firm increases its debt, while reducing equity and increasing its debt ratio.

Since the free cash flows to equity are after capital expenditures, this firm's real problem is not that it pays out too much in dividends, but that it invests too heavily in bad projects. Cutting back on these projects would therefore increase the free cash flow to equity and might eliminate the cash shortfall created by paying dividends.

Stockholder Reaction

The stockholders of a firm that pays more in dividends than it has available in free cash flow to equity faces a dilemma: On the one hand, they may want the firm to reduce its dividends to eliminate the need for additional borrowing or equity issues each year. On the other hand, the management's record in picking projects does not evoke much trust that the firm is using funds wisely, and it is likely that the funds saved by not paying the dividends will be used on other poor projects. Consequently, these firms will first have to solve their investment problems and then cut back on poor projects, which, in turn, will increase the free cash flow to equity. If the cash shortfall persists, the firm should then cut back on dividends.

It is therefore entirely possible, especially if the firm is underleveraged to begin with, that the stockholders will not push for lower dividends but will try to convince managers to improve project choice instead. It is also possible that they will encourage the firm to eliminate enough poor projects so that the free cash flow to equity covers the expected dividend payment.

Management Responses

The managers of firms with poor projects and dividends that exceed free cash flows to equity may not think that they have investment problems rather than dividend problems. They may also disagree that the most efficient way of dealing with these problems is to eliminate some of the capital expenditures. In general, their views will be the same as managers who have a poor investment track record. They will claim the period used to analyze project returns was not representative, it was an industry-wide problem that will pass, or the projects have long gestation periods.

Overall, it is unlikely that these managers will convince the stockholders of their good intentions on future projects. Consequently, there will be a strong push towards cutbacks in capital expenditures, especially if the firm is borrowing money to finance the dividends and does not have much excess debt capacity.

11.5. ☞: **Stockholder Pressure and Dividend Policy**

Which of the following companies would you expect to see under greatest pressure from its stockholders to buy back stock or pay large dividends? (All of the companies have costs of capital of 12%.)

a. A company with a historical return on capital of 25%, and a small cash balance
b. A company with a historical return on capital of 6%, and a small cash balance
c. A company with a historical return on capital of 25%, and a large cash balance
d. A company with a historical return on capital of 6%, and a large cash balance

The managers at the company argue that they need the cash to do acquisitions. Would this make it more or less likely that stockholders will push for stock buybacks?

a. More likely
b. Less likely

D. Good Projects and High Payout

The costs of trying to maintain unsustainable dividends are most evident in firms that have a selection of good projects to choose from. The cash that is paid out as dividends could well have been used to invest in some of these projects, leading to a much higher return for stockholders and higher stock prices for the firm.

Consequences of High Payout

When a firm pays out more in dividends than it has available in free cash flow to equity, it is creating a cash shortfall. If this firm also has good projects available but cannot invest in them because of capital rationing constraints, the firm is paying a hefty price for its dividend policy. Even if the projects are passed up for other reasons, the cash this firm is paying out as dividends would earn much better returns if left to accumulate in the firm.

Dividend payments also create a cash deficit that now has to be met by issuing new securities. Issuing new stock carries a potentially large issuance cost, which reduces firm value. But, if the firm issues new debt, it might become overleveraged, and this may reduce value.

Stockholder Reaction

The best course of action for stockholders is to insist that the firm pay out less in dividends and invest in better projects. If the firm has paid high dividends for an extended period of time and has acquired stockholders who value high dividends even more than they value the firm's long-term health, reducing dividends may be difficult. Even so, stockholders may be much more amenable to cutting dividends and reinvesting in the firm, if the firm has a ready supply of good projects at hand.

Management Responses

The managers of firms that have good projects, while paying out too much in dividends, have to figure out a way to cut dividends, while differentiating themselves from those firms that are cutting dividends due to declining earnings. The initial suspicion with which markets view dividend cuts can be overcome, at least partially, by providing markets with information about project quality at the time of the dividend cut. If the dividends have been paid for a long time, however, the firm may have stockholders who like the high dividends and may not particularly be interested in the projects that the firm has available. If this is the case, the initial reaction to the dividend cut, no matter how carefully packaged, will be negative. However, as disgruntled stockholders sell their holdings, the firm will acquire new stockholders who may be more willing to accept the lower dividend and higher investment policy.

11.6. ☞**: Dividend Policy and High Growth Firms**

High growth firms are often encouraged to start paying dividends to expand their stockholder base, since there are stockholders who will not or cannot hold stock that do not pay dividends. Do you agree with this rationale?

a. Yes

b. No
Explain.

Step 4: Interaction between Dividend Policy and Financing Policy

The analysis of dividend policy is further enriched — and complicated — if we bring in the firm's financing decisions as well. In Chapter 9, we noted that one of the ways a firm can increase leverage over time is by increasing dividends or repurchasing stock; at the same time, it can decrease leverage by cutting or not paying dividends. Thus, we cannot decide how much a firm should pay in dividends without determining whether it is under- or over-levered and whether or not it intends to close this leverage gap.

An underlevered firm may be able to pay more than its FCFE as dividend and may do so intentionally to increase its debt ratio. An overlevered firm, on the other hand, may have to pay less than its FCFE as dividends, because of its desire to reduce leverage. In some of the scenarios described above, leverage can be used to strengthen the suggested recommendations. For instance, an under-levered firm with poor projects and a cash flow surplus has an added incentive to raise dividends and to reevaluate investment policy, since it will be able to increase its leverage by doing so. In some cases, however, the imperatives of moving to an optimal debt ratio may act as a barrier to carrying out changes in dividend policy. Thus, an over-levered firm with poor projects and a cash flow surplus may find the cash better spent reducing debt rather than paying out dividends.

Illustration 11.5: Analyzing the Dividend Policy of Disney and Aracruz

Using the cash flow approach, described above, we are now in a position to analyze Disney's dividend policy. To do so, we will draw on three findings:

- Earlier, we compared the cash returned to stockholders by Disney between 1994 and 2003 to its free cash flows to equity. On average, Disney paid out 38.83% of its free cash flow to equity as dividends. In recent years, though, Disney has had significant operating problems, and its net income reflects these troubles.
- We then compared Disney's return on equity and stock to the required rate of return, and found that the company had under performed on both measures.
- Finally, in our analysis in chapter 8, we noted that Disney was slightly under levered, with an actual debt ratio of 21% and an optimal debt ratio of 30%.

Given its recent operating problems, we would recommend that Disney maintain its existing dividend payments for the next year. If the higher earnings that the company has reported in recent quarters are sustained, the free cash flows to equity will be higher than the dividend payments, In table 11.10, we forecast the free cashflows to equity for Disney over the next 5 years and compare it to existing dividend payments:

Table 11.10: Forecasted FCFE and Cash Available for Stock Buybacks: Disney

	Current	Expected Growth Rate	1	2	3	4	5
Net Income	$1,267	6.00%	$1,343	$1,424	$1,509	$1,600	$1,696
- (Cap Ex - Deprec'n) (1 - DR)	($20)		$9	$41	$79	$123	$174
- Change in Working Capital (1 - DR)	($185)		$22	$23	$24	$26	$28
FCFE	$1,471		$1,313	$1,359	$1,405	$1,450	$1,494
Expected Dividends	$429	0.00%	$429	$429	$429	$429	$429
Cash available for stock buybacks	$1,042		$884	$930	$976	$1,021	$1,065
Revenues	$27,061	6.00%	$28,685	$30,406	$32,230	$34,164	$36,214
Non-cash WC	$519		$31	$33	$35	$37	$39
Capital Expenditures	$1,049	10.00%	$1,154	$1,269	$1,396	$1,536	$1,689
Depreciation	$1,077	6.00%	$1,142	$1,210	$1,283	$1,360	$1,441

Note that we have assumed that revenues, net income and depreciation are expected to grow 6% a year for the next 5 years and that working capital remains at its existing percentage (1.92%) of revenues. We have also assumed that capital expenditures will grow faster (10%) over the next 5 years to compensate for reduced investment in prior years. Finally, we assumed that 30% of the net capital expenditures and working capital changes would be funded with debt, reflecting the optimal debt ratio we computed for Disney in chapter 8. Based upon these forecasts, and assuming that Disney maintains its existing dividend, Disney should have about $4.876 million in excess cash that it can return to its stockholders either as dividends or in the form of stock buybacks over the period.

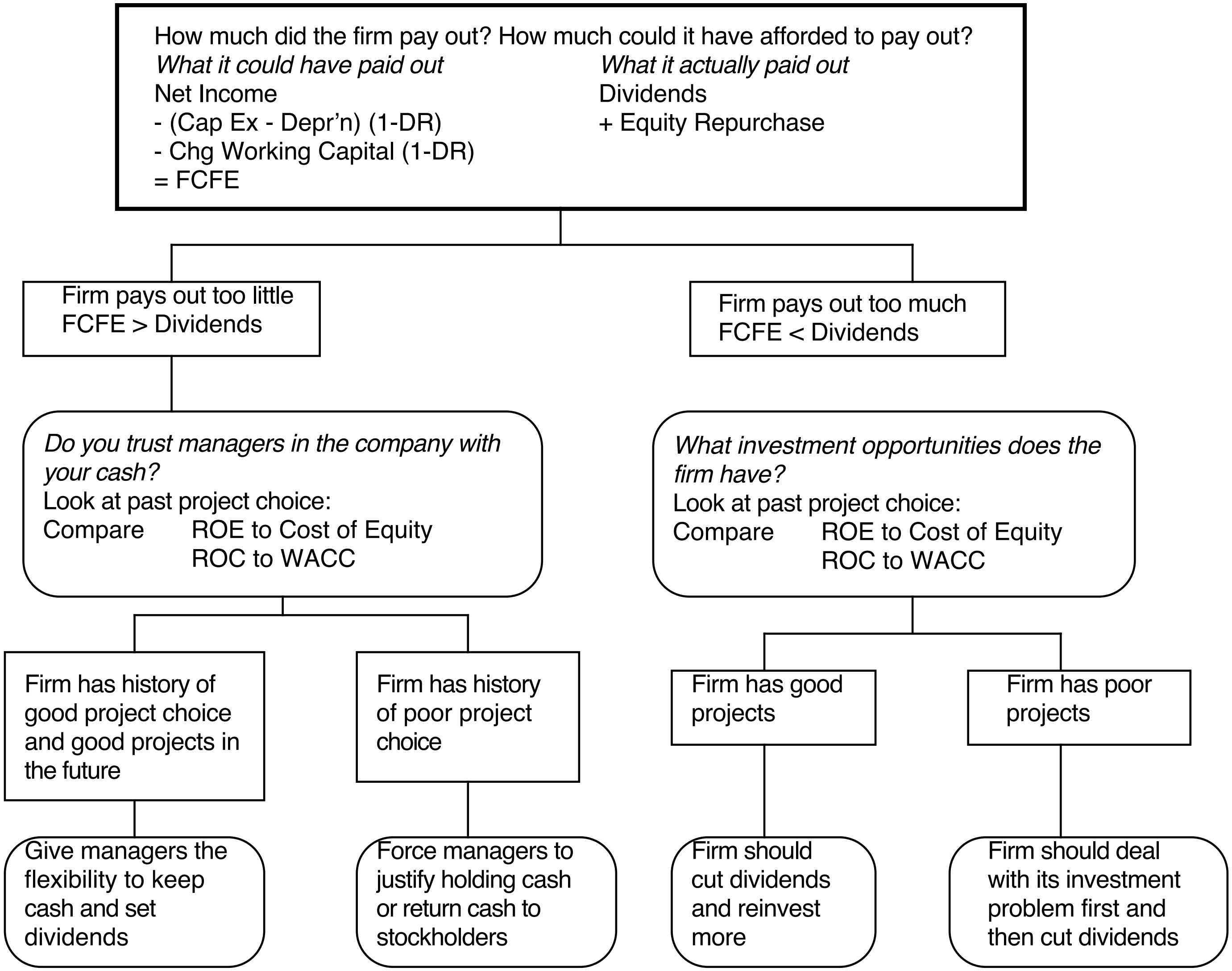
Examining Aracruz, we find that the firm is paying out more in dividends than it has available in free cashflows to equity. If you couple this finding with large investment needs, potentially good project returns and superior stock price performance, is seems clear that Aracruz will gain by cutting its dividends. In fact, this conclusion is strengthened when we forecast the free cashflows to equity for the next 5 years and compare them to the dividends being paid in Table 11.11;

Table 11.11: Expected FCFE and Cash Available for Dividends

	Current	*Expected Growth Rate*	*1*	*2*	*3*	*4*	*5*
Net Income	$148	5.00%	$155	$163	$171	$180	$189
- (Cap Ex - Deprec'n) (1 - DR)	$176		$120	$126	$133	$139	$146
- Change in Working Capital (1 - DR)	($5)		$5	$5	$6	$6	$6
FCFE	($23)		$30	$32	$33	$35	$37
Expected Dividends	$109	0.00%	$109	$109	$109	$109	$109
Cash available for stock buybacks			($79)	($78)	($76)	($74)	($73)
Revenues							
Non-cash WC	$1,003	5.00%	$1,053	$1,106	$1,161	$1,219	$1,280
Capital Expenditures	$150		$8	$8	$8	$9	$9
Depreciation	$421	5.00%	$347	$365	$383	$402	$422

In making these estimates, we assumed that revenues, net income, capital expenditures and depreciation will all grow 5% a year for the next 5 years and the non-cash working capital will remain at 15% of revenues. For capital expenditures, which have been volatile over the last few years, we used the average amount from 2000-03 as the base year number. If Aracruz maintains its existing dividends, the firm will find itself facing cash deficits in each of the next 5 years, aggregating to about $381 million. While the case for cutting dividends is strong, Aracruz has a potential problem because of its share structure, where the "preferred shares" held by outside investors get no voting rights but are compensated for with a larger dividend. Cutting dividends may violate the commitments given to preferred stockholders and trigger at least a partial loss of control. While there is no easy solution, it highlights a cost of trading off dividends for control.

Figure 11.4: A Framework for Analyzing Dividend Policy



A Comparable Firm Approach to Analyzing Dividend Policy

So far, we have examined the dividend policy of a firm by looking at its cash flows and the quality of its investments. There are managers who believe that their dividend policies are judged relative to those of their competitors. This "comparable-firm" approach to analyzing dividend policy is often used narrowly, by looking at only firms that are similar in size and business mix, for example. As we will illustrate, it can be used more broadly, by looking at the determinants of dividend policy across all firms in the market.

Using Firms in the Industry

In the simplest form of this approach, a firm's dividend yield and payout are compared to those of firms in its industry and judged to be adequate, excessive, or inadequate, accordingly. Thus, a utility stock with a dividend yield of 3.5% may be criticized for paying out an inadequate dividend if utility stocks, on average, have a much higher dividend yield. In contrast, a computer software firm that has a dividend yield of 1.0% may be viewed as paying too high a dividend, if software firms on average pay a much lower dividend.

While comparing a firm to comparable firms on dividend yield and payout may have some intuitive appeal, it can be misleading. First, it assumes that all firms within the same industry group have the same net capital expenditure and working capital needs. These assumptions may not be true, if firms are in different stages of the life cycle. Second, even if the firms are at the same stage in their life cycles, the entire industry may have a dividend policy that is unsustainable or sub-optimal. Third, it does not consider stock buybacks as an alternative to dividends. The third criticism can be mitigated when the approach is extended to compare cash returned to stockholders, rather than just dividends.

divfund.xls: There is a dataset on the web that summarizes the dividend yields and payout ratios, by sector, for U.S. companies.

Illustration 11.6: Analyzing Disney's Dividend Payout Using Comparable Firms

In comparing Disney's dividend policy to its peer group, we analyze the dividend yields and payout ratios of comparable firms in 2003, as shown in Table 11.12. We defined comparable firms as entertainment companies with a market capitalization in excess of $ 1 billion.

Table 11.12: Payout Ratios and Dividend Yields: Entertainment Companies

Company Name	*Dividend Yield*	*Dividend Payout*
Astral Media Inc. 'A'	0.00%	0.00%
Belo Corp. 'A'	1.34%	34.13%
CanWest Global Comm. Corp.	0.00%	0.00%
Cinram Intl Inc	0.00%	0.00%
Clear Channel	0.85%	35.29%
Cox Radio 'A' Inc	0.00%	0.00%
Cumulus Media Inc	0.00%	0.00%
Disney (Walt)	0.90%	32.31%
Emmis Communications	0.00%	0.00%
Entercom Comm. Corp	0.00%	0.00%
Fox Entmt Group Inc	0.00%	0.00%
Hearst-Argyle Television Inc	0.00%	0.00%
InterActiveCorp	0.00%	0.00%
Liberty Media 'A'	0.00%	0.00%
Lin TV Corp.	0.00%	0.00%
Metro Goldwyn Mayer	0.00%	0.00%
Pixar	0.00%	0.00%
Radio One INC.	0.00%	0.00%
Regal Entertainment Group	2.70%	66.57%
Sinclair Broadcast	0.00%	0.00%
Sirius Satellite	0.00%	0.00%
Time Warner	0.00%	0.00%
Univision Communic.	0.00%	0.00%
Viacom Inc. 'B'	0.56%	19.00%
Westwood One	0.00%	0.00%
XM Satellite `A'	0.00%	0.00%
Average	0.24%	7.20%

Source: Value Line Database

Of the 26 companies in this group, only 5 paid dividends. Relative to the other companies in this sector, Disney pays high dividends. The interesting question, though, is whether Disney should be setting dividend policy based upon entertainment firms, most of which are smaller and much less diversified than Disney, or upon large firms in other businesses which resemble it in terms of cashflows and risk.

For Deutsche Bank, we used large money-center European banks as comparable firms. Table 11.13 provides the listing of the firms, as well as their dividend yields and payout ratios.

Table 11.13: Payout Ratios and Dividend Yields: Home Improvement Products Retailers

Name	*Dividend Yield*	*Dividend Payout*
Banca Intesa Spa	1.57%	167.50%
Banco Bilbao Vizcaya Argenta	0.00%	0.00%
Banco Santander Central Hisp	0.00%	0.00%
Barclays Plc	3.38%	35.61%
Bnp Paribas	0.00%	0.00%
Deutsche Bank Ag -Reg	1.98%	481.48%
Erste Bank Der Oester Spark	0.99%	24.31%
Hbos Plc	2.85%	27.28%
Hsbc Holdings Plc	2.51%	39.94%
Lloyds Tsb Group Plc	7.18%	72.69%
Royal Bank Of Scotland Group	3.74%	38.73%
Sanpaolo Imi Spa	0.00%	0.00%
Societe Generale	0.00%	0.00%
Standard Chartered Plc	3.61%	46.35%
Unicredito Italiano Spa	0.00%	0.00%
Average	1.85%	62.26%

Source: Value Line Database

On both dividend yield and payout ratios, Deutsche Bank pays a much higher dividend than the typical European bank. It is interesting, though, that the British banks are the highest dividend payers in the group, with Lloyds maintaining a dividend yield of 7.18%.

For Aracruz, we did look at the average dividend yield and payout ratios of four sets of comparable firms – Latin American paper and pulp companies, emerging market paper and pulp companies, US paper and pulp companies and all paper and pulp companies listed globally. Table 11.14 summarizes these statistics.

Table 11.14: Dividend Yield and Payout Ratios for Paper and Pulp Companies

Group	*Dividend Yield*	*Dividend Payout*
Latin America	2.86%	41.34%
Emerging Market	2.03%	22.16%
US	1.14%	28.82%
All paper and pulp	1.75%	34.55%

Aracruz	3.00%	37.41%

Aracruz has a dividend yield and payout ratio similar to that of other Latin American paper and pulp companies, though it is higher than dividends paid out by paper companies listed elsewhere.

With all three companies, the dangers of basing dividend policy based upon comparable firms are clear. The “right’ amount to pay in dividends will depend heavily upon what we define “comparable’ to be. If managers are allowed to pick their peer group, it is easy to justify even the most irrational dividend policy,

11.7. ☞: **Peer Group Analysis**

Assume that you are advising a small high-growth bank, which is concerned about the fact that its dividend payout and yield are much lower than other banks. The CEO of the bank is concerned that investors will punish the bank for its dividend policy. What do you think?

a. I think that the bank will be punished for its errant dividend policy
b. I think that investors are sophisticated enough for the bank to be treated fairly
c. I think that the bank will not be punished for its low dividends as long as it tries to convey information to its investors about the quality of its projects and growth prospects.

Using the Market

The alternative to using only comparable firms in the same industry is to study the entire population of firms and to try to estimate the variables that cause differences in dividend payout across firms. We outlined some of the determinants of dividend policy in the last chapter, and we could try to arrive at more specific measures of each of these determinants. For instance,

- *Growth Opportunities*: Firms with greater growth opportunities should pay out less in dividends than firms without these opportunities. Consequently, dividend payout ratios (yields) and expected growth rates in earnings should be negatively correlated with each other.

- *Investment Needs*: Firms with larger investment needs (capital expenditures and working capital) should pay out less in dividends than firms without these needs. Dividend payout ratios and yields should be lower for firms with significant capital expenditure needs.
- *Insider Holdings*: As noted earlier in the chapter, firms where stockholders have less power are more likely to hold on to cash and not pay out dividends. Hence, dividend payout ratios and insider holdings should be negatively correlated with each other
- *Financial Leverage*: Firms with high debt ratios should pay lower dividends, because they have already pre-committed their cash flows to make debt payments. Therefore, dividend payout ratios and debt ratios should be negatively correlated with each other

Since there are multiple measures that can be used for each of these variables, we chose specific proxies – analyst estimates of growth in earnings for growth opportunities, capital expenditures as a percent of total assets for investment needs, percent of stock held by insiders for insider holdings and total debt as a percent of market capitalization as a measure of financial leverage. Using data from the end of 2003, we regressed dividend yields and payout ratios against all of these variables and arrived at the following regression equations (t statistics are in brackets below coefficients):

$$\underset{(20.41)}{PYT = 0.3889} - \underset{(3.42)}{0.738}\ CPXFR - \underset{(3.41)}{0.214}\ INS + \underset{(4.80)}{0.193}\ DFR - \underset{(8.12)}{0.747}\ EGR \qquad R^2 = 18.30\%$$

$$\underset{(22.78)}{YLD = 0.0205} - \underset{(5.87)}{0.058}\ CPXFR - \underset{(3.66)}{0.012}\ INS + \underset{(9.45)}{0.0200}\ DFR - \underset{(11.53)}{0.047}\ EGR \qquad R^2 = 28.5\%$$

Where,

PYT = Dividend Payout Ratio = Dividends/Net Income

YLD = Dividend Yield = Dividends/Current Price

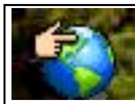
CPXFR = Capital Expenditures / Book Value of Total Assets

EGR = Expected growth rate in earnings over next 5 years (analyst estimates)

DFR = Debt / (Debt + Market Value of Equity)

INS = Insider holdings as a percent of outstanding stock

The regressions explain about 20-30% of the differences in dividend yields and payout across firms in the United States. The two strongest factors seem to be earnings growth and the debt ratio, with higher growth firms with lower debt ratios paying out less of their earnings as dividends and having lower dividend yields. While this contradicts our hypothesis that higher leverage should lead to lower payout, it is not difficult to explain. It can be attributed to the fact that firms with more stable earnings have higher debt ratios, and these firms can also afford to pay more dividends. In addition, firms with high insider holdings tend to pay out less in dividends than do firms with low insider holdings, and firms with high capital expenditures needs seem to pay less in dividends than firms without these needs.



divregr.xls: There is a dataset on the web that summarizes the results of regressing dividend yield and payout ratio against fundamentals for U.S. companies.

Illustration 11.7: Analyzing Dividend Payout Using The Cross Sectional Regrssion

To illustrate the applicability of the market regression in analyzing the dividend policy of Disney and Aracruz, we estimate the values of the independent variables in the regressions for the two firms, as shown in Table 11.15.

Table 11.15: Data for Cross-sectional Regressions

	Disney	*Aracruz ADR*
Insider Holdings	2.60%	20.00%
Capital Expenditures/Total Assets	2.10%	2%
Debt/ Capital	21.02%	31%
Expected growth in Earnings	8.00%	23%

Substituting into the regression equation for the dividend payout ratio, we predicted the following payout ratios for the two firms:

For Disney = 0.3889 - 0.738 (0.021)- 0.214 (0.026) + 0.193 (0.2102) - 0.747 (0.08) = 34.87%

For Aracruz ADR = 0.3889 - 0.738 (0.02)- 0.214 (0.20) + 0.193 (0.31) - 0.747 (0.23) = 21.71%

Substituting into the regression equation for the dividend yield, we predict the following dividend yields for the two firms:

For Disney = 0.0205 - 0.058 (0.021)- 0.012 (0.026) + 0.0200 (0.2102)- 0.047 (0.08)= 1.94%

For Aracruz ADR = 0.0205 - 0.058 (0.02)- 0.012 (0.20)+ 0.0200 (0.31)- 0.047 (0.23) = 1.22%

Based on this analysis, Disney with its dividend yield of 0.91% and a payout ratio of 32.31% is paying too little in dividends. Aracruz with a payout ratio of 37.41% and a dividend yield of 3% provides a mixed finding is paying too much in dividends, though the conclusion has to be tempered by the fact that the company is being compared to companies in the United States.

Managing Changes in Dividend Policy

In chapter 10, we noted the tendency on the part of investors to buy stocks with dividend policies that meet their specific needs. Thus, investors who want high current cash flows and do not care much about the tax consequences migrate to firms that pay high dividends; those who want price appreciation and are concerned about the tax differential hold stock in firms that pay low or no dividends. One consequence of this clientele effect is that changes in dividends, even if entirely justified by the cash flows, may not be well received by stockholders. In particular, a firm with high dividends that cuts its dividends drastically may find itself facing unhappy stockholders. At the other extreme, a firm with a history of not paying dividends that suddenly institutes a large dividend may also find that its stockholders are not pleased.

Is there a way in which firms can announce changes in dividend policy that minimizes the negative fall-out that is likely to occur? In this section, we will examine dividend changes and the market reaction to them and draw broader lessons for all firms that may plan to make such changes.

Empirical Evidence

Firms may cut dividends for several reasons; some clearly have negative implications for future cash flows and the current value of the firm, while others have more positive implications. In particular, the value of firms that cut dividends because of poor earnings and cash flows should drop, whereas the value of firms that cut dividends because of a dramatic improvement in project choice should increase. At the same time, financial markets tend to be skeptical of the latter claims, especially if the firm making the claims reports lower earnings and has a history of poor project returns. Thus, there is value to examining the actions at the time of dividend cuts and the announcements made by firms that cut dividends, to see if the market reaction changes as a consequence.

Woolridge and Ghosh looked at 408 firms that cut dividends, and the actions taken or information provided by these firms in conjunction with the dividend cuts. In particular, they examined three groups of companies: the first group announced an earnings decline or loss with the dividend cut; the second had made a prior announcement of earnings decline or loss; and the third made a simultaneous announcement of growth opportunities or higher earnings.[10] The results are summarized in Table 11.16.

Table 11.16: Excess Returns Around Dividend Cut Announcements

	Periods Around Announcement Date		
Category	*Prior Quarter*	*Announcement Period*	*Quarter After*
Simultaneous Announcement of Earnings Decline/Loss (N=176)	-7.23%	-8.17%	+1.80%
Prior Announcement of Earnings Decline or Loss (N = 208)	-7.58%	-5.52%	+1.07%
Simultaneous Announcement of Investment or Growth Opportunities (N=16)	-7.69%	-5.16%	+8.79%

We can draw several interesting conclusions from this study. First, the vast number of firms announcing dividend cuts did so in response to earnings declines (384) rather than in conjunction with investment or growth opportunities (16). The market

[10] Woolridge, J.R. and C. Ghosh, 1986, *Dividend Cuts: Do they always signal bad news?,* The Revolution in Corporate Finance, Blackwell.

seems to react negatively to all of them, however, suggesting that it does not attach much credibility to the firm's statements. The negative reaction to the dividend cut seems to persist in the case of the firms with the earnings declines, while it is reversed in the case of the firms with earnings increases or better investment opportunities.

Woolridge and Ghosh also found that firms that announced stock dividends or stock repurchases in conjunction with the dividend cuts fared much better than firms that did not. Finally, they noted the tendency across the entire sample for prices to correct themselves, at least partially, in the year following the dividend cut. This would suggest that markets tend to overreact to the initial dividend cut, and the price recovery can be attributed to the subsequent correction.

In an interesting case study, Soter, Brigham and Evanson looked at Florida Power & Light's dividend cut in 1994[11]. FPL was the first healthy utility in the United States to cut dividends by a significant amount (32%). At the same time as it cut dividends, FPL announced that it was buying back 10 million shares over the next 3 years, and emphasized that dividends would be linked more directly to earnings. On the day of the announcement, the stock price dropped 14%, but recovered this amount in the month after the announcement, and earned a return of 23.8% in the year after, significantly more than the S&P 500 over the period (11.2%) and other utilities (14.2%).

Lessons for Firms

There are several lessons for firms that plan to change dividend policy. First, no matter how good the reasons may be for a firm to cut dividends, it should expect markets to react negatively to the initial announcement for two reasons. The first reason is the well-founded skepticism with which markets greet any statement by the firm about dividend cuts. A second is that large dividend changes typically make the existing investor clientele unhappy. Although other stockholders may be happy with the new dividend policy, the transition will take time, during which stock prices fall. Second, if a firm has good reasons for cutting dividends, such as an increase in project availability, it

[11] Soter, D., E. Brigham and P. Evanson, 1996, *The Dividend Cut "Heard 'Round the World": The Case of FPL*, Journal of Applied Corporate Finance, v9, 4-15. This is also a Harvard Business School case study authored by Ben Esty.

will gain at least partial protection by providing information to markets about these projects.

In Practice: From Fixed to Residual Dividends – Some Ideas

In the United States and Western Europe, firms have locked themselves into a dance with investors where they institute dividends and are then committed to maintaining these dividends, in good times and in bad. In fact, much of what we observe in dividend policy from sticky dividends to the reluctance to increase dividends in the face of good news and to cut dividends in the face of bad news can be traced to this commitment. It is also this commitment that has led companies to increasingly shift to stock buybacks as an alternative to dividends.

Given the change in the tax law in 2003, there should be added incentive for companies to pay dividends now. It would help the cause if we can add flexibility to dividend policy, in effect allowing companies to adjust dividends to changing earnings. There are three ways in which we can do this:

a. Target a dividend payout ratio rather than a dollar dividend: This is the simplest way to make dividends a function of earnings and it mirrors what is already being done by companies in some markets.
b. Switch to a policy of paying out whatever is leftover as free cashflows to equity each year as dividends.
c. Set a fixed dividend based upon the predictable component of earnings and a contingent dividend that is tied to the extent to which earnings exceed the predictable component.

There may be some resistance on the part of investors to these changes but they will be overcome. There will be enough investors, however, who see the advantages of a flexible dividend policy and buy the stock of companies

Conclusion

We began this chapter by expanding our definition of cash returned to stockholder to include stock buybacks with dividends. Firms in the United States, especially, have turned to buying back stock and returning cash selectively to those investors who need it.

With this expanded definition of cash returned to stockholders, we first used a cash flow based approach to decide whether a firm is paying too much or too little to its stockholders. To form this judgment, we first estimate what the firm has available to pay out to its stockholders; we measure this cash flow by looking at the cash left over after reinvestment needs have been and debt has been serviced, and call it the free cash flow to equity. We then look at the quality of the firm's projects; firms with better projects get more leeway from equity investors to accumulate cash than firms with poor projects. We next consider the effect of wanting to increase or decrease the debt ratio on how much cash is returned to stockholders. Finally, we consider all three factors – the cash flow available for stockholders, the returns on existing investments and the need to increase or decrease debt ratios – in coming up with broad conclusions about dividend policy. Firms with a good track record in investing can pay out less in dividends than is available in cash flows, and not face significant pressure from stockholders to pay out more. When the managers of firms are not trusted by their stockholders to invest wisely, firms are much more likely to face pressure to return excess cash to stockholders.

We also analyzed a firm's dividend policy by looking at the dividend policies of comparable firms in the business. In this approach, a firm that is paying out less in dividends than comparable firms would be viewed as paying too little and one that is paying out more would be viewed as paying too much. We use both a narrow definition of comparable firms (firms in the same line of business), and a broader definition (all firms). We control for differences in risk and growth across firms, using a multiple regression.

We closed the chapter by looking at how firms that intend to change their dividend policy can minimize the side-costs of doing so. This is especially true when firms have to reduce their dividends to meet legitimate reinvestment needs. While the initial reaction to the announcement of a dividend cut is likely to be negative, firms can buffer some of the impact by providing information to markets about the investments that they plan to accept with the funds.

Live Case Study

A Framework for Analysing Dividends

Objective: To determine whether your firm should change its dividend policy, based upon an analysis of its investment opportunities and comparable firms.

Key Questions:

- How much could this firm have returned to its stockholders over the last few years? How much did it actually return?
- Given this dividend policy and the current cash balance of this firm, would you push the firm to change its dividend policy (return more or less cash to its owners)?
- How does this firm's dividend policy compare to those of its peer group and to the rest of the market?

Framework for Analysis:

1. *Cash Return to Stockholders*

- How much has the firm paid out in dividends each year for the last few years?
- How much stock has it bought back each year for the last few years?
- Cumulatively, how much cash has been returned to stockholders each year for the last few years?

2. *Affordable Dividends*
    - What were the free cash flows to equity that this firm had over the last few years?
    - What is the current cash balance for this firm?
3. *Management Trust*
    - How well have the managers of the firm picked investments, historically? (Look at the investment return section)
    - Is there any reason to believe that future investments of this firm will be different from the historical record?
4. *Changing Dividend Policy*
    - Given the relationship between dividends and free cash flows to equity, and the trust you have in the management of this firm, would you change this firm's dividend policy?

5. *Comparing to Sector and Market*
    - Relative to the sector to which this firm belongs, does it pay too much or too little in dividends? (Do a regression, if necessary)
    - Relative to the rest of the firms in the market, does it pay too much or too little in dividends? (Use the market regression, if necessary)

Getting Information on analyzing dividend policy

You can get the information that you need to estimate free cash flows to equity and returns on equity from past financials. You will also need a beta (see risk and return section) and a debt ratio (see risk and return section) to estimate the free cash flows to equity. Finally, you will need stock returns for your stock and the returns on a market index over the period of your analysis.

Online sources of information:

http://www.stern.nyu.edu/~adamodar/cfin2E/project/data.htm

Questions

1. Stock buybacks really do not return cash to stockholders, since only those who sell back stock receive the cash. Is this statement true or false? Explain.

2. In the last decade, we have seen an increase in the percent of cash returned to stockholders in the form of dividends. Why?

3. Lube Oil, a chain of automobile service stations, reports net income of $ 100 million, after depreciation of $ 50 million. The firm has capital expenditures of $ 80 million, and the non-cash working capital increased from $ 25 to $ 40 million. Estimate the firm's free cash flow to equity, assuming that the firm is all equity financed.

4. Lube Oil, in question 3, paid a dividend of $ 20 million, and bought back $ 25 million in stock. Estimate how much the cash balance of the firm changed during the year.

5. How would your answers to the last two problems change if you were told that Lube Oil started the year with $120 million in debt and ended the year with $ 135 million?

6. Now assume that Lube Oil, in questions 3-5, has a return on equity of 5% and a cost of equity of 10%. As a stockholder in Lube Oil, would you want the firm to change its dividend policy. Why or why not?

7. Tech Products reported a net loss of $ 80 million for the latest financial year. In addition, the firm reported a net capital expenditure of $ 70 million, and a change in non-cash working capital of $ 10 million. Finally, the firm had $ 10 million in debt at the start of the year that it paid off during the year. Estimate the free cash flow to equity.

8. Tech Products, from problem 7, pays a dividend of $ 40 million. Assuming that the firm started the period with no cash, how did it raise the funding for the dividend payment?

9. New Age Telecomm is a young, high-growth telecommunications firm. It pays no dividends, though the average dividend payout for other firms in the telecommunications sector is 40%. Is New Age paying too little in dividends? Why or why not?

10. The following is a regression of dividend payout ratios on the risk and ln(market capitalization: in millions) of chemical firms:

Dividend Payout ratio = 0.14 + 0.05 (ln (Market Capitalization)) – 0.1 (Beta)

Harman Chemicals has a market capitalization of $ 1.5 billion and a beta of 1.2. It pays out 22% of its earnings as dividends. How does this dividend payout compare to the industry?

Problems

1. JLChem Corporation, a chemical manufacturing firm with changing investment opportunities, is considering a major change in dividend policy. It currently has 50 million shares outstanding and pays an annual dividend of $2 per share. The firm current and projected income statement are provided below (in millions):

	Current	*Projected for next year*
EBITDA	1200	1350
- Depreciation	200	250
EBIT	1000	1100
- Interest Expense	200	200
EBT	800	900
- Taxes	320	360
Net Income	480	540

The firm's current capital expenditure is $ 500 million. It is considering five projects for the next year:

Project	Investment	Beta	IRR (using cashflows to equity)
A	$190 mil	0.6	12.0%
B	$200 mil	0.8	12.0%
C	$200 mil	1.0	14.5%
D	$200 mil	1.2	15.0%
E	$100 mil	1.5	20.0%

The firm's current beta is 1.0, and the current T. Bill rate is 5.5%. The firm expects working capital to increase $50 million both this year and next. The firm plans to finance its net capital expenditures and working capital needs with 30% debt.

a. What is the firm's current payout ratio?

b. What proportion of its current free cash flow to equity is it paying out as dividends?

c. What would your projected capital expenditure be for next year (i.e Which of the five projects would you accept and why)?

d. How much cash will the company have available to pay out as dividends next year? (What is the maximum amount the company can pay out as dividends?)

e. Would you pay out this maximum amount as dividends? Why or why not? What other considerations would you bring to this decision?

f. JKL Corporation currently has a cash balance of $100 million (after paying the current year's dividends). If it pays out $125 million as dividends next year, what will its projected cash balance be at the end of the next year?

2. GL Corporation, a retail firm, is making a decision on how much it should pay out to its stockholders. It has $100 million in investible funds. The following information is provided about the firm:

(a) It has 100 million shares outstanding, each share selling for $15. The beta of the stock is 1.25 and the riskfree rate is 8%. The expected return on the market is 16%.

(b) The firm has $ 500 million of debt outstanding. The marginal interest rate on the debt is 12%.

(c) The corporation's tax rate is 50%.

(e) The firm has the following investment projects:

Project	Investment Requirement	After-Tax Return on capital
A	15 million	27%
B	10 million	20%
C	25 million	16%
D	20 million	14%
E	30 million	12%

The firm plans to finance all its investment needs at its current debt ratio.

(i) Should the company return money to its stockholders?

(ii) If so, how much should be returned to stockholders?

3. InTech Corporation, a computer software firm which has never paid dividends before, is considering whether it should start doing so. This firm has a cost of equity of 22% and a cost of debt of 10% (the tax rate is 40%). The firm has $100 million in debt outstanding and 50 million shares outstanding, selling for $10 per share. The firm currently has net

income of $90 million and depreciation charges of $10 million. It also has the following projects available:

Project	Initial Investment	Annual EBIT	Annual Depreciation	Lifetime	Salvage
1	$10 million	$ 1 mil	$500,000	5 years	$2.5 mil
2	$40 million	$ 5 mil	$ 1 million	10 years	$10 mil
3	$50 million	$ 5 mil	$ 1 million	10 years	$10 mil

The firm plans to finances its future capital investment needs using 20% debt.

a. Which of these projects should the firm accept?

b. How much (if any) should the firm pay out as dividends?

4. LimeAde Corporation, a large soft drink manufacturing firm, is faced with the decision of how much to pay out as dividends to its stockholders. It expects to have a net income of $ 1000 (after depreciation of $500), and it has the following projects:

Project	Initial Investment	Beta	IRR (to equity investors)
A	$ 500	2.0	21%
B	$600	1.5	20%
C	$ 500	1.0	12%

The firm's beta is 1.5 and the current risk-free rate is 6%. The firm plans to finance net capital expenditures (cap ex -depreciation) and working capital with 20% debt. The firm also has current revenues of $5000, which it expects to grow at 8 %. Working capital will be maintained at 25% of revenues. How much should the firm return to its stockholders as a dividend?

5. NoLone Corporation, an all-equity manufacturing firm, has net income of $100 million currently and expects this number to grow at 10% a year for the next three years. The firm's working capital increased by $10 million this year and is expected to increase by the same dollar amount each of the next three years. The depreciation is $50 million and is expected to grow 8% a year for the next three years. Finally, the firm plans to invest $60 million in capital expenditure for each of the next three years. The firm pays 60% of its earnings as dividends each year. RYBR has a cash balance currently of $50. Assuming

that the cash does not earn any interest, how much would you expect to have as a cash balance at the end of the third year?

6. Boston Turkey is a publicly traded firm, with the following income statement and balance sheet from its most recent financial year:

Income Statement

Revenues	$ 1,000,000
- Expenses	$ 400,000
- Depreciation	$ 100,000
EBIT	$ 500,000
- Interest Expense	$ 100,000
Taxable Income	$ 400,000
- Tax	$ 160,000
Net Income	$ 240,000

Balance Sheet

Assets		*Liabilities*	
Property, Plant & Equipment	$ 1,500,000	Accounts Payable	$ 500,000
Land & Buildings	$ 500,000	Long Term Debt	$ 1,000,000
Current Assets	$ 1,000,000	Equity (100,000 shares)	$ 1,500,000
Total	$ 3,000,000	Total	$ 3,000,000

Boston Turkey expects its revenues to grow 10% next year and its expenses to remain at 40% of revenues. The depreciation and interest expenses will remain unchanged at $100,000 next year. The working capital, as a percentage of revenue, will also remain unchanged next year.

The managers of Boston Turkey claim to have several projects available to choose from next year, in whichthey plan to invest the funds from operations, and they suggest that the firm really should not be paying dividends. The projects have the following characteristics:

Project	Equity Investment	Expected Annual CF to Equity	Beta
A	$ 100,000	12,500	1.00
B	$ 100,000	14,000	1.50
C	$ 50,000	8,000	1.80

D	$ 50,000	12,000	2.00

The treasury bill rate is 3%, and the treasury bond rate is 6.25%. The firm plans to finance 40% of its future net capital expenditures (Cap Ex - Depreciation) and working capital needs with debt.

a. How much can the company afford to pay in dividends next year?

b. Now assume that the firm actually pays out $1.00 per share in dividends next year. The current cash balance of the firm is $150,000. How much will the cash balance of the firm be at the end of next year, after the payment of the dividend?

7. Z-Tec Corporation, a firm providing Internet services, reported net income of $ 10 million in the most recent year, while making $ 25 million in capital expenditures (depreciation was $ 5 million). The firm had no working capital needs and uses no debt.

a. Can the firm afford to pay out dividends right now? Why or why not?

b. Assuming net income grows 40% a year and that net capital expenditures grow 10% a year, when will the firm be in a position to pay dividends?

8. You are analyzing the dividend policy of Conrail, a major railroad, and you have collected the following information from the last 5 years –

Year	Net Income	Capital Expenditure	Depreciation	Non-cash Working Capital	Dividends
1991	$ 240	$ 314	$ 307	$ 35	$ 70
1992	$ 282	$ 466	$ 295	$ (110)	$ 80
1993	$ 320	$ 566	$ 284	$ 215	$ 95
1994	$ 375	$ 490	$ 278	$ 175	$ 110
1995	$ 441	$ 494	$ 293	$ 250	$ 124

The average debt ratio during this period was 40% and the total non-cash working capital at the end of 1990 was $ 10 million.

a. Estimate how much Conrail could have paid in dividends during this period.

b. If the average return on equity during the period was 13.5%, and Conrail had a beta of 1.25, what conclusions would you draw about Conrail's dividend policy? (The average T.Bond rate during the period was 7%, and the average return on the market was 12.5% during the period)

9. Assume now that you have been asked to forecast cash flows that you will have available to repurchase stock and pay dividends during the next 5 years for Conrail (from problem 8). In making these forecasts, you can assume the following –

- Net Income is anticipated to grow 10% a year from 1995 levels for the next 5 years
- Capital expenditures and depreciation are expected to grow 8% a year from 1995 levels
- The revenues in 1995 were $ 3.75 billion, and are expected to grow 5% each year for the next 5 years. The working capital as a percent of revenues is expected to remain at 1995 levels
- The proportion of net capital expenditures and depreciation that will be financed with debt will drop to 30%

a. Estimate how much cash Conrail will have available to pay dividends or repurchase stocks over the next 5 years.

b. How will the perceived uncertainty associated with these cash flows affect your decision on dividends and equity repurchases?

10. Cracker Barrel, which operates restauarants and gift stores, is reexamining its policy of paying minimal dividends. In 1995, Cracker Barrel reported net income of $ 66 million; it had capital expenditures of $ 150 million in that year and claimed depreciation of only $ 50 million. The working capital in 1995 was $ 43 million on sales of $ 783 million. Looking forward, Cracker Barrel expects the following:

- Net Income is expected to grow 17% a year for the next 5 years
- During the 5 years, capital expenditures are expected to grow 10% a year and depreciation is expected to grow 15% a year
- The working capital as a percent of revenues is expected to remain at 1995 levels, and revenues are expected to grow 10% a year during the period
- The company has not used debt to finance its net capital expenditures and does not plan to use any for the next 5 years

a. Estimate how much cash Cracker Barrel would have available to pay out to its stockholders over the next 5 years

b. How would your answer change, if the firm plans to increase its leverage by borrowing 25% of its net capital expenditure and working capital needs?

11. Assume that Cracker Barrel, from problem 10, wants to continue with its policy of not paying dividends. You are the CEO of Cracker Barrel and have been confronted by dissident stockholders, demanding to know why you are not paying out your FCFE (estimated in the previous problem) to your stockholders. How would you defend your decision? How receptive will stockholders be to your defense? Would it make any difference that Cracker Barrel has earned a return on equity of 25% over the previous five years, and that its beta is only 1.2?

12. Manpower Corporation, which provides non-government emplyments services in the United States, reported net income of $ 128 million in 1995. It had capital expenditures of $ 50 million and depreciation of $ 24 million in 1995, and its working capital was $ 500 million (on revenues of $ 5 billion). The firm has a debt ratio of 10%, and plans to maintain this debt ratio.

a. Estimate how much Manpower Corporation will have available to pay out as dividends next year.

b. The current cash balance is $ 143 million. If Manpower Corporation is expected to pay $ 12 million in dividends next year and repurchase no stock, estimate the expected cash balance at the end of the next year.

13. How would your answers to the previous problem change if Manpower Corporation in problem 12 plans to pay off its outstanding debt of $ 100 million next year and become a debt-free company?

14. You are an institutional investor and have the collected the following information on five maritime firms in order to assess their dividend policies:

Company	*FCFE*	*Dividends Paid*	*ROE*	*Beta*
Alexander & Brown	$ 55	$ 35	8%	0.80
American President	$ 60	$ 12	14.5%	1.30
OMI Corporation	- $ 15	$ 5	4.0%	1.25
Overseas Shipholding	$ 20	$ 12	1.5 %	0.90
Sea Containers	- $ 5	$ 8	14%	1.05

The average riskfree rate during the period was 7% and the average return on the market was 12%.

a. Assess which of these firms you would pressure to pay more in dividends.

b. Which of the firms would you encourage to pay less in dividends?

c. How would you modify this analysis to reflect your expectations about the future of the entire sector?

15. You are analyzing the dividend policy of Black and Decker, a manufacturer of tools and appliances. The following table summarizes the dividend payout ratios, yields and expected growth rates of other firms in the waste disposal business.

Company	*Payout Ratio*	*Dividend Yield*	*Ex. Growth*
Fedders Corporation	11%	1.2%	11.0%
Maytag Corporation	37%	2.8%	23.0%
National Presto	67%	4.9%	13.5%
Toro Corporation	15%	1.5%	16.5%
Whirlpool Corp.	30%	2.5%	20.5%
Black & Decker	24%	1.3%	23.0%

a. Compare Black and Decker's dividend policy to those of its peers, using the average dividend payout ratios and yields.

b. Do the same comparison, controlling for differences in expected growth.

16. The following regression was run using all NYSE firms in 1995

YIELD = 0.0478 - 0.0157 BETA + 0.0000008 MKTCAP + 0.6797 DBTRATIO + 0.0002 ROE - 0.09 NCEX/TA $\qquad R^2 = 12.88\%$

where BETA = Beta of the stock

MKTCAP = Market Value of Equity + Book Value of Debt

DBTRATIO = Book Value of Debt / MKTCAP

ROE = Return on Equity in 1994

NCEX/TA = (Capital Expenditures - Depreciation) / Total Assets

The corresponding values for Black and Decker, in 1995, were as follows:

Beta = 1.30

MKTCAP = $ 5,500 million

DBTRATIO = 35%

ROE = 14.5%

NCEX/TA = 4.00%

Black and Decker had a dividend yield of 1.3% and a dividend payout ratio of 24% in 1995.

a. Estimate the dividend yield for Allwaste, based upon the regression.

b. Why might your answer be different, using this approach, than the answer to the prior question, where you used only the comparable firms?

17. Handy and Harman, a leading fabricator of precious metal alloys, pays out only 23% of its earnings as dividends. The average dividend payout ratio for metal fabricating firms is 45%. The average growth rate in earnings for the entire sector is 10% (Handy and Harman is expected to grow 23%). Should Handy and Harman pay more in dividends just to get closer to the average payout ratio? Why or why not?

CHAPTER 12

VALUATION: PRINCIPLES AND PRACTICE

In this chapter, we look at how to value a firm and its equity, given what we now know about investment, financing and dividend decisions. We will consider two approaches to valuation. The first and most fundamental approach to valuing a firm is *discounted cash flow valuation*, which extends the present value principles that we developed to analyze projects to value a firm. The value of any firm is determined by four factors – its capacity to generate cash flows from assets in place, the expected growth rate of these cash flows, the length of time it will take for the firm to reach stable growth, and the cost of capital. Consequently, to increase the value of a firm, we have to change one or more of these variables.

The second way of valuing a firm or its equity is to based the value on how the market is valuing similar or comparable firms; this approach is called *relative valuation*. This approach can yield values that are different from a discounted cashflow valuation and we will look at some of the reasons why these differences may occur.

In a departure from the previous chapters, we will take the perspective of investors in financial markets in estimating value. Investors assess the value of a firm's stock in order to decide whether to buy the stock or, if they already own it, whether to continue to it.

Discounted Cash Flow Valuation

In discounted cash flow valuation, we estimate the value of any asset by discounting the expected cash flows on that asset at a rate that reflects their riskiness. In a sense, we measure the intrinsic value of an asset. The value of any asset is a function of the cash flows generated by that asset, the life of the asset, the expected growth in the cash flows and the riskiness associated with them. In other words, it is the present value of the expected cash flows on that asset.

$$\text{Value of Asset} = \sum_{t=1}^{t=N} \frac{E(\text{Cash Flow}_t)}{(1+r)^t}$$

where the asset has a life of N years and r is the discount rate that reflects both the riskiness of the cash flows and financing mix used to acquire the asset. If we view a firm as a portfolio of assets, this equation can be extended to value a firm, using cash flows to the firm over its life and a discount rate that reflects the collective risk of the firm's assets.

This process is complicated by the fact that while some of the assets of a firm have already been created, and thus are assets-in-place, a significant component of firm value reflects expectations about future investments. Thus, we not only need to measure the cash flows from current investments, but we also must estimate the expected value from future investments. In the sections that follow, we will introduce the discounted cash flow model in steps. We begin by discussing two different ways of approaching valuation – equity and firm valuation – and then move on to consider how best to estimate the inputs into valuation models, and then consider how to go from the value of a firm to the value of equity per share.

Equity Valuation versus Firm Valuation

There are two paths to discounted cash flow valuation -- the first is to value just the equity stake in the business; the second is to value the entire firm, including equity and any other claimholders in the firm (bondholders, preferred stockholders, etc.). While both approaches discount expected cash flows, the relevant cash flows and discount rates are different for each.

> ***Value of Equity:*** This is the value of the equity stake in a business; in the context of a publicly traded firm, it is the value of the common stock in the firm.

The value of equity is obtained by discounting expected cash flows to equity — i.e., the residual cash flows after meeting all expenses, tax obligations, and interest and principal payments — at the cost of equity — i.e., the rate of return required by equity investors in the firm.

$$\text{Value of Equity} = \sum_{t=1}^{t=n} \frac{\text{CF to Equity}_t}{(1+k_e)^t}$$

where

CF to Equity$_t$ = Expected Cash flow to Equity in period t

k_e = Cost of Equity

The dividend discount model is a specialized case of equity valuation, where the value of a stock is the present value of expected future dividends.

The value of the firm is obtained by discounting expected cash flows to the firm, i.e., residual cash flows after meeting all operating expenses and taxes, but prior to debt payments — at the weighted average cost of capital — i.e., the cost of the different components of financing used by the firm, weighted by their market value proportions.

> ***Value of Firm:*** The value of the firm is the value of all investors who have claims on the firm; thus, it includes lenders and debt-holders, who have fixed claims and equity investors, who have residual claims.

$$\text{Value of Firm} = \sum_{t=1}^{t=n} \frac{\text{CF to Firm}_t}{(1+\text{WACC})^t}$$

where

CF to Firm_t = Expected Cash flow to Firm in period t

WACC = Weighted Average Cost of Capital

While the two approaches use different definitions of cash flow and discount rates, they will yield consistent estimates of value as long as the same set of assumptions is applied for both. It is important to avoid mismatching cash flows and discount rates, since discounting cash flows to equity at the weighted average cost of capital will lead to an upwardly biased estimate of the value of equity, while discounting cash flows to the firm at the cost of equity will yield a downward biased estimate of the value of the firm.

12.1. ☞: **Firm Valuation and Leverage**

It is often argued that equity valuation requires more assumptions than firm valuation, because cash flows to equity require explicit assumptions about changes in leverage whereas cash flows to the firm are pre-debt cash flows and do not require assumptions about leverage. Is this true?

a. Yes

b. No

Explain.

Choosing the Right Valuation Model

All discounted cash flow models ultimately boil down to estimating four inputs - current cashflows, an expected growth rate in these cashflows, a point in time when the firm will be growing a rate it can sustain forever and a discount rate to use in discounting these cashflows. In this section, we will examine the choices available in terms of each of these inputs.

In terms of cashflows, there are three choices - dividends or free cashflows to equity for equity valuation models, and free cashflows to the firm for firm valuation models. Discounting dividends usually provides the most conservative estimate of value for the equity in any firm, since most firms pay less in dividends than they can afford to. In the dividend policy section, we noted that the free cash flow to equity, i.e., the cash flow left over after meeting all investment needs and making debt payments, is the amount that a firm can pay in dividends. The value of equity, based upon the free cash flow to equity, will therefore yield a more realistic estimate of value for equity, especially in the context of a takeover. Even if a firm is not the target of a takeover, it can be argued that the value of equity has to reflect the possibility of a takeover, and hence the expected free cash flows to equity. The choice between free cash flows to equity and free cash flows to the firm is really a choice between equity and firm valuation. Done consistently, both approaches should yield the same values for the equity in a business. As a practical concern, however, cash flows to equity are after net debt issues or payments and become much more difficult to estimate when financial leverage is changing over time, whereas cashflows to the firm are pre-debt cash flows and are unaffected by changes in the leverage. Ease of use dictates that firm valuation will be more straightforward under this scenario.

While we can estimate any of these cashflows from the most recent financial statements, the challenge in valuation is in estimating these cashflows in future years. In most valuations, this takes the form of an expected growth rate in earnings that is then used to forecast earnings and cash flows in future periods. The growth rates estimated should be consistent with our definition of cashflows. When forecasting cashflows to equity, we will generally forecast growth in net income or earnings per share that are measures of equity earnings. When forecasting cashflows to the firm, the growth rate that matters is the growth rate in operating earnings. [1]

The choice of discount rates will be dictated by the choice in cash flows. If the cash flow that is being discounted is dividends or free cash flows to equity, the appropriate discount rate is the cost of equity. If the cash flow being discounted is the cash flow to the firm, the discount rate has to be the cost of capital.

The final choice that all discounted cash flow models have to make relates to expected growth patterns. Since firms have infinite lives, the way in which we apply closure is to estimate a terminal value at a point in time and dispense with estimating cash flows beyond that point. To do this in the context of discounted cash flow valuation, we have to assume that the growth rate in cash flows beyond this point in time are constant forever, an assumption that we refer to as "stable" growth. If we do this, the present value of these cash flows can be estimated as the present value of a growing perpetuity. There are three questions that every valuation then has to answer:

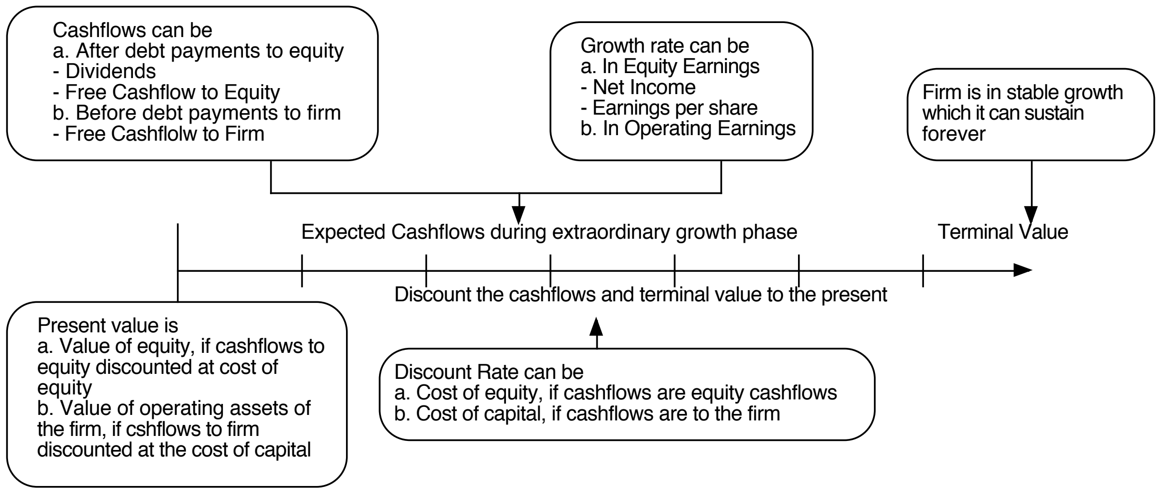
1. How long in the future will a company be able to grow at a rate higher than the stable growth rate?
2. How high will the growth rate be during the high growth period and what pattern will it follow?
3. What will happen to the firm's fundamentals (risk, cash flow patterns etc.) as the expected growth rate changes?

At the risk of being simplistic, we can broadly classify growth patterns into three categories - firms which are in stable growth already, firms which expect to maintain a 'constant" high growth rate for a period and then drop abruptly to stable growth and firms which will have high growth for a specified period and then grow through a transition phase to reach stable growth at a point in time in the future. As a practical point, it is important that as the growth rate changes, the firm's risk and cash flow characteristics change as well. In general, as expected growth declines towards stable growth, firms should see their risk approach the "average" and reinvestment needs decline. These

[1] We should generally become much more conservative in our growth estimates as we move up the income statements. Generally, growth in earnings per share will be lower than the growth in net income, and growth in net income will be lower than the growth in operating income.

choices are summarized in Figure 12.1. We will now examine each of these valuation models in more detail in the next section.

Figure 12.1: The Ingredients in a Valuation



model.xls: This spreadsheet allows you to pick the right discounted cash flow valuation model for your needs, given the characteristics of the business that you are valuing.

In Practice: What Is A Stable Growth Rate?

Determining when your firm will be in stable growth is difficult to do without first defining what we mean by a stable growth rate. There are two insights to keep in mind when estimating a "stable" growth rate. First, since the growth rate in the firm's cashflows is expected to last forever, the firm's other measures of performance (including revenues, earnings and reinvestment) can be expected to grow at the same rate. Consider the long-term consequences of a firm whose earnings grow 6% a year forever, while its dividends grow at 8%. Over time, the dividends will exceed earnings. Similarly, if a firm's earnings grow at a faster rate than its dividends in the long term, the payout ratio will converge towards zero, which is also not a steady state. The second issue relates to what growth rate is reasonable as a 'stable' growth rate. Again, the assumption that this growth rate will last forever establishes rigorous constraints on "reasonableness". A firm cannot in the long term grow at a rate significantly greater than the growth rate in the economy in which it operates. Thus, a firm that grows at 8% forever in an economy growing at 4% will eventually become larger than the economy. In practical terms, the stable growth rate cannot be larger than the nominal (real) growth rate in the economy in which the firm operates, if the valuation is done in nominal (real) terms.

Can a stable growth rate be much lower than the growth rate in the economy? There are no logical or mathematical limits on the downside. Firms that have stable growth rates much lower than the growth rate in the economy will become smaller in proportion to the economy over time. Since there is no economic basis for arguing that this cannot happen, there is no reason to prevent analysts from using a stable growth rate much lower than the nominal growth rate in the economy. In fact, the stable growth rate can be a negative number. Using a negative stable growth rate will ensure that your firm peaks in your last year of high growth and becomes smaller each year after that.

There is one rule of thumb that works well in setting a cap on the stable growth rate. The stable growth rate should generally not exceed the riskfree rate used in a valuation. Why should the two be related? The riskfree rate can be decomposed into an expected inflation rate and an expected real interest rate. If we assume that the real growth rate of an economy will be equal to the real interest rate in the long term, the riskfree rate becomes a proxy for the nominal growth rate in the economy.

12.2 ☞: **Cyclical firms and Constant Growth Rates**

Models that are built on the assumption of an expected constant growth rate over time cannot be used for cyclical firms, whose earnings growth is likely to be very volatile over time - high during economic booms, and very low or negative during recessions.

a. True

b. False

Explain.

Estimation in DCF Models

While all discounted cashflow models require the same four ingredients – cashflows, a discount rate, a period of high growth and a growth rate during the period, there are different estimation challenges we face with each model. In this section, we will begin by estimating these inputs to the simplest of the three models, the dividend discount model, and then extend the discussion to cashflow to equity and firm valuation models.

I. Dividend Discount Models

When an investor buys stock, he generally expects to get two types of cash flows - dividends during the holding period and an expected price at the end of the holding period. Since this expected price is itself determined by future dividends, the value of a stock is the present value of just expected dividends. The dividend discount model is therefore the most direct and the most conservative way of valuing a stock since it counts only those cashflows that are actually paid out.

Setting up the Model

In it's most general form, the value of a stock in the dividend discount model is the present value of the expected dividends on the stock in perpetuity.

$$\text{Value per share of stock} = \sum_{t=1}^{t=\infty} \frac{\text{Expected Dividends in period t}}{(1+\text{Cost of Equity})^t}$$

Since we cannot estimate dividends in perpetuity, we generally allow for a period where dividends can grow at extraordinary rates but we allow for closure in the model by assuming that the growth rate will decline to a stable rate that can be sustained forever at some point in time in the future. By assuming stable growth at some point in time in the future, we can stop estimating dividends and estimate what we think the stock will be worth at the end of the extraordinary growth period.

> ***Terminal Value:*** This is the expected price of a stock (or equity) at the end of a specified holding period.

$$\text{Value}_0 = \sum_{t=1}^{t=n} \frac{\text{E(Dividends)}_t}{(1+r)^t} + \frac{\text{Terminal Value}_n}{(1+r)^n} \text{ where Terminal Value}_n = \frac{\text{E(Dividends)}_{n+1}}{(r_n - g_n)}$$

where r is the cost of equity and g_n is the expected growth rate in dividends in perpetuity after year n.[2] Note that it is possible for a firm to already be in stable growth, in which case this model collapses into itls simplest form:

Value of a stock in stable growth = Expected Dividends next year/ (Cost of equity – g_n)

This model is called the Gordon Growth model and is a special case of the dividend discount model. It can be used only for firms that are already in stable growth.[3]

Estimating Model Inputs

Breaking down the general version of the dividend discount model, there are four basic components. The first is the length of the high growth period, during which the firm can sustain extraordinary growth. The second is the expected dividends each year during the high growth period. The third is the cost of equity that stockholders will demand for holding the stock, based upon their assessments of risk. The final input is the expected price at the end of the high growth period – the terminal value. In this section, we will consider the challenges associated with estimating each of these components.

a. Length of High-Growth Period

The question of how long a firm will be able to sustain high growth is perhaps the most difficult of all to answer in a valuation, but two points are worth keeping in mind. One is that it is not a question of whether but when; all firms will ultimately be stable growth firms, because high growth makes firms larger, and the firm's size will eventually become a barrier to further high growth. The second is that high growth in valuation, at least high growth that creates value, comes from firms earning high returns on their marginal investments. Using the terminology that we have used before in investment analysis, it comes from firms having a return on equity (capital) that is well in excess of the cost of equity (capital). Thus, when we assume that a

> ***High Growth Period:*** This is a period during which a company's earnings or cash flows are expected to grow at a rate much higher than the overall growth rate of the economy.

[2] The cost of equity can be different for the high growth and stable growth periods. Hence, r_n is the cost of equity for the stable growth period.

[3] When the Gordon Growth model is used to value high growth companies, it is entirely possible that g>r and the model will yield a negative value. The problem is not with the model but in its msapplication to a high growth firm.

firm will experience high growth for the next 5 or 10 years, we are also implicitly assuming that it will earn excess returns (over and above the cost of equity or capital) during that period. In a competitive market, these excess returns will eventually draw in new competitors, and the excess returns will disappear.

We should look at three factors when considering how long a firm will be able to maintain high growth.

1. *Size of the firm*: Smaller firms are much more likely to earn excess returns and maintain these excess returns than otherwise similar larger firms. This is so because they have more room to grow and a larger potential market. When looking at the size of the firm, we should look not only at its current market share, but also at the potential growth in the total market for its products or services. Thus, Microsoft may have a large market share of the computer software market, but it may be able to grow in spite of it because the entire software market is growing. On the other hand, Boeing dominates the market for commercial airliners, but we do not expect the overall market for airliners to increase substantially. Boeing, therefore, is far more constrained in terms of future growth.
2. *Existing growth rate and excess returns:* Although the returns we would like to estimate are the marginal returns on new investments, there is a high correlation between the returns on current investments and these marginal returns. Thus, a firm earning excess returns of 20% on its current investments is far more likely to have large positive excess returns and a long growth period than a firm currently earning excess returns of 2%. There are cases where this rule will not work, such as in new industries going through major restructuring.
3. *Magnitude and Sustainability of Competitive Advantages*: This is perhaps the most critical determinant of the length of the high growth period. If there are significant barriers to entry and sustainable competitive advantages, firms can maintain high growth for longer periods. If, on the other hand, there are no or minor barriers to entry, or if the firm's existing competitive advantages are fading, we should be far more conservative about allowing for long growth periods. The quality of existing

management also influences growth. Some top managers[4] have the capacity to make the strategic choices that increase competitive advantages and create new ones.

Again, the sensitivity of value to changes in the length of the high growth period can always be estimated. While some analysts use growth periods greater than 10 years, the combination of high growth rates and long growth periods creates a potent mix in terms of increasing the size of the firm, in many cases well beyond the realm of what is reasonable. Looking back, there are very few firms that have been able to grow at high rates for more than 10 years.

Illustration 12.1: Length of High Growth Period

To assess how long high growth will last at Disney, Aracruz and Deutsche Bank, we assessed their standings on each of the above characteristics in Table 12.1:

Table 12.1: Assessment of Length of High Growth Period

	Disney	*Aracruz*	*Deutsche Bank*
Firm Size/Market Size	Firm is one of the largest players in the entertainment and theme park businesses but the businesses are redefining themselves and expanding.	Firm has a small market share of the paper/pulp business, but the business is mature.	Firm has a significant market share of a mature business.
Current Excess Returns	Firm is earning less than its cost of capital, and has done so for last few years	Returns on capital are largely a function of paper/pulp prices but, on average, have been less than the cost of capital.	Firm has a return on equity that has lagged its cost of equity in recent years.
Competitive Advantages	Has some of the most recognized brand names in the world. Knows more about operating theme parks than any other firm in the world. Has skilled animation studio staff.	Cost advantages because of access to Brazilian rainforests. Has invested in newer, updated plants and has skilled workforce.	Has an edge in the commercial banking business in Germany but this advantage is dissipating in the EU.
Length of High Growth period	10 years, entirely because of its strong competitive advantages (which have been wasted over the last few years) but the excess returns are likely to be	5 years, largely due to access to cheap raw material.	5 years, mostly to allow firms to recover to pre-downturn levels.

[4] Jack Welch at GE and Robert Goizueta at Coca Cola are good examples of CEOs who made a profound difference in the growth of their firms.

	small.		

What about Bookscape? The single biggest competitive advantage possessed by the firm is its long-term lease, at favorable terms, in a superb location in New York City. It is unlikely that the firm will be able to replicate this advantage elsewhere. Adding to this the fact that this is a private firm leads us to conclude that there will be no high growth period.

12.3. ☞: **Length of High Growth Period and Barriers to Entry**

Assume that you are analyzing two firms, both of which are enjoying high growth. The first firm is Earthlink Network, an internet service provider, which operates in an environment with few barriers to entry and extraordinary competition. The second firm is Biogen, a biotechnology firm which is enjoying growth from two drugs to which it owns patents for the next decade. Assuming that both firms are well managed, which of the two firms would you expect to have a longer high growth period?

a. Earthlink Network
b. Biogen
c. Both are well managed and should have the same high growth period

b. Expected Dividends during High Growth Period

The first step in estimating expected dividends during the high growth period is to estimate the expected earnings for each year. This can be done in one of two ways – you can apply an expected growth rate to current earnings or you can begin by estimating future revenues first and then estimate net profit margins in each year. The first approach is easier but the second approach provides for more flexibility since margins can change over time. The resulting expected earnings are paired with estimated dividend payout ratios in each period, which may change over the high growth period. This may seem like an awkward procedure, since expected dividends could well be estimated using the current dividends and applying a dividend growth rate, but it is used for two reasons. First, most analyst projections for growth are stated in

Historical Growth Rate (in Earnings): This is the growth rate over the past few periods in earnings - it can be calculated either by averaging the year-specific growth rates (arithmetic average) or by estimating at the compounded growth rate over the whole period.

terms of revenues and earnings rather than dividends. Second, separating earnings forecasts from dividend payout provides more flexibility in terms of changing dividend payout ratios as earnings growth rates change. In particular, it allows us to raise dividend payout ratios as earnings growth rates decline.

The growth rate in earnings can be estimated using one of three approaches. The first is to look at the past and measuring the historical growth rate in earnings over previous years. In measuring earnings growth, we will have to consider both how far back to go in time and whether to use arithmetic average or geometric average growth rates. In general, geometric growth rates yield more meaningful values than arithmetic average growth rates. The second is to look at estimates made by others following the same stock. In fact, growth estimates made by equity research analysts following a stock are public information and are easily accessible.[5] The third is to consider fundamentals and to estimate a growth rate based upon a firm's investment policy. In particular, the growth in earnings per share of a firm can be written as the product of two variables – the percentage of the earnings per share that is retained in the firm to generate future growth (retention ratio) and a the return earned on equity in these new investments:

Expected Growth Rate = Retention Ratio * Return on Equity

Thus, a firm with a return on equity of 20% and a retention ratio of 70% should have earnings growth of 14% a year. Reverting back to our discussion of dividend policy in chapter 10, note that the retention ratio and the payout ratio are two sides of the same coin:

Retention Ratio = 1 – Payout Ratio

Since the retention ratio cannot exceed 100%, the expected growth in earnings per share in the long term for a firm cannot exceed its return on equity.

Assuming that we can obtain all three estimates of the growth rate in earnings for a firm, which one should we use in valuing a company? Historical growth should be weighted the least, because earnings are volatile and past growth has generally not been

[5] I/B/E/S, First Call and Zacks all track equity research analyst forecasts continuously and the consensus estimate across all analysts is publicly available.

highly correlated with future growth.[6] Analyst estimates are useful signposts of what the investment community thinks about a company and could include information that is not be in the financial statements. In particular, it could reflect changes in both the company's management and strategic plans. However, trusting analysts, no matter how well informed they may be, to come up with the most important input in a valuation is not prudent. Ultimately, the fundamental growth equation offers the most promise because it relates growth back to what the firm does and also constrains us to pay for growth (by requiring firms to reinvest) as we estimate value.

12.4. ☞: **Differences in Growth Rates**

The growth rates from historical earnings, analyst projections and fundamentals can often be very different. These differences can be best explained by:

a. As firms become larger, the differences between growth rates will increase.
b. Analysts are biased towards making optimistic estimates of growth
c. The inputs used to estimate fundamental growth reflect what happened last year rather than what we expect will happen in the future.
d. All of the above

Illustration 12.2: Growth in Earnings per share: Deutsche Bank

In 2003, Deutsche Bank reported net income of \$1,365 million on a book value of equity of \$29,991 million at the end of 2002. The resulting return on equity for the firm is 4.55%:

Return on Equity = Net Income$_{2003}$/ Book Value of Equity$_{2002}$ = 1365/29,991 = 4.55%

This is lower than the cost of equity for the firm, which is 8.76%, and the average return on equity for European banks, which is 11.26%. In the four quarters ended in March 2004, Deutsche Bank paid out dividends per share of 1.50 Euros on earnings per share of 4.33 Euros. The resulting retention ratio is 65.36%.

Retention Ratio = 1 – Dividends per share/ Earnings per share = 1 – 1.50/4.33 = 65.36%

[6] One of the most famous studies of growth was titled "Higgledy Piggledy Growth" (Little, I.M.D., 1962, *Higgledy Piggledy Growth*, Institute of Statistics, Oxford.) precisely because earnings growth was so difficult to predict based upon history.

If Deutsche maintains its existing return on equity and retention ratio for the long term, its expected growth rate will be anemic.

Expected Growth Rate $_{\text{Existing Fundamentals}}$ = Retention Ratio * ROE = .6536*.0455 = 2.97%

For the next five years, we will assume that the return on equity will improve to the industry average of 11.26% while the retention ratio will stay unchanged at 65.36%. The expected growth in earnings per share is 7.36%.

Expected Growth Rate $_{\text{Modified Fundamentals}}$ = .6536 * .1126 = .0736

c. Cost of Equity

The dividends and terminal price should be discounted back at a rate that reflects the risk in the investment to stockholders to arrive at the current value. In chapter 4, we argued that the only risk that diversified investors see in a stock is market risk and that this risk can be measured with a beta (in the capital asset pricing model) or multiple betas (in the arbitrage pricing or multi-factor models). The same reasoning applies here. In fact, the costs of equity that we estimated for Disney, Deutsche Bank and Aracruz in chapter 4 will be the costs of equity that will be used if we were valuing stock in these companies using a dividend discount model. The only point that relates specifically to valuation is that high-growth firms tend to have higher betas than do low-growth firms. Building on this premise, it is important that, as we change growth rates over time, we also adjust risk accordingly. Thus, when a firm goes from high growth to low growth, its beta should be moved towards one to reflect the lower growth.

d. Terminal Value

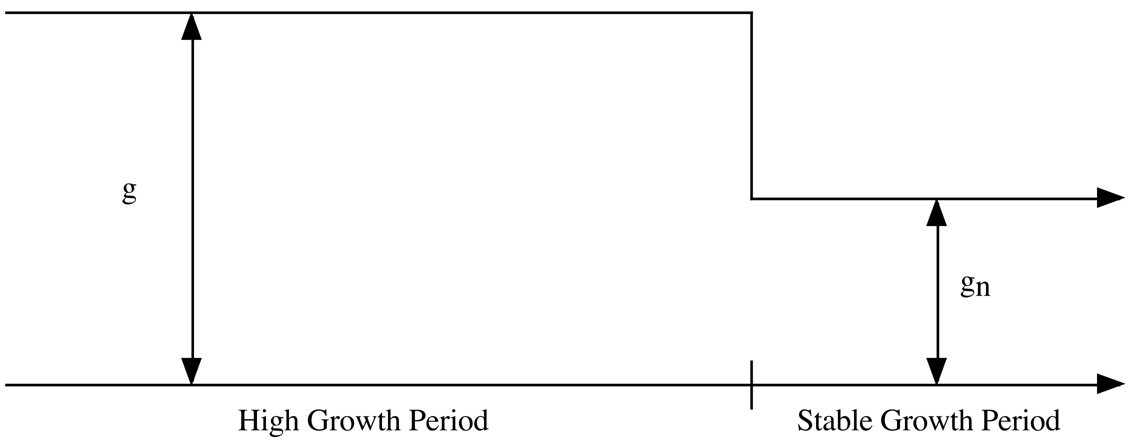
The last component of the model is the value that you attach to the equity at the end of a period of high growth. This value is estimated from expected dividends in the first time period following the high-growth period, the cost of equity in the stable phase, and the expected stable growth rate in dividends as follows:

$$\text{Value of Equity in year n} = \frac{\text{Expected Dividends}_{n+1}}{r_n - g_n}$$

where r_n is the cost of equity in the stable growth period and g_n is the expected growth rate in dividends beyond year n (forever).

Before you estimate terminal value, you need to map out a path for the earnings growth during the high growth phase to move towards the stable growth rate. The simplest assumption to make is that your earnings growth rate is constant for the high growth period, after which the growth rate drops to the stable level, as shown in Figure 12.2.

Figure 12.2: Two-Stage Growth Model



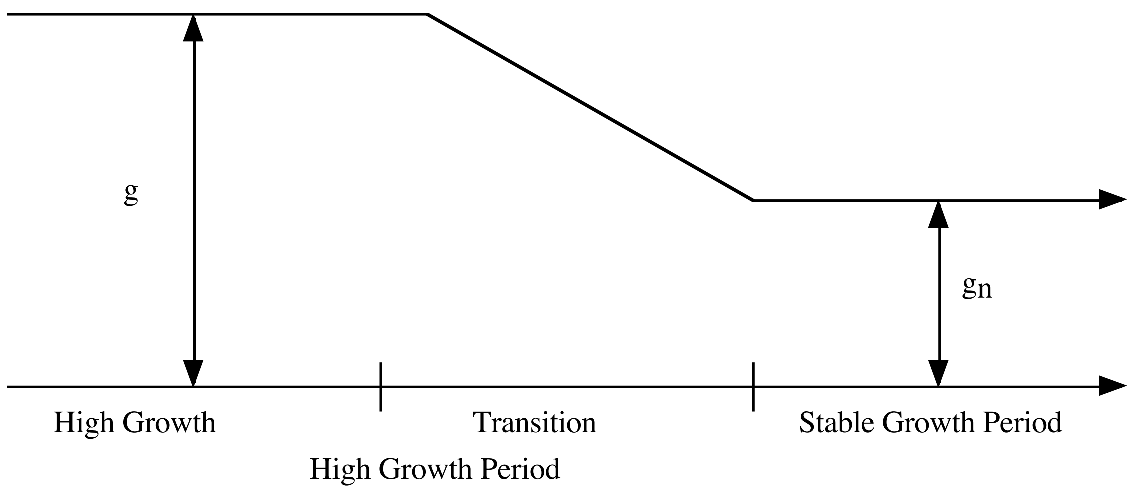
This is a two-stage model, and its limitation is obvious. It assumes that the growth rate is high during the initial period and is transformed overnight to a lower, stable rate at the end of the period. While these sudden transformations in growth can happen, it is much more realistic to assume that the shift from high growth to stable growth happens gradually over time. The assumption that the growth rate drops precipitously from its level in the initial phase to a stable rate also implies that this model is more appropriate for firms with modest growth rates in the initial phase. For instance, it is more reasonable to assume that a firm growing at 12% in the high growth period will see its growth rate drop to 4%, than it is for a firm growing at 40% in the high-growth period. If we assume that the growth rate and payout ratio are fixed for the high growth period, the present value of the dividends during the high growth period can be estimated as follows:[7]

$$\text{PV of High - growth dividends}_0 = \frac{\text{Dividends}_0 * (1+g) * \left(1 - \frac{(1+g)^n}{(1+r)^n}\right)}{r - g}$$

[7] Unlike the stable growth model equation, this one can be used even if the expected growth rate exceeds the discount rate. While this makes the denominator negative, it will also result in a negative numerator, and the net effect will be positive. The only condition when it will not work if g=r, but the PV of dividends in that case will just be the product of the number of years of growth and dividends today since the growth and the discounting effects each year will cancel out.

A more general formulation would allow for growth during the high growth period, followed by a gradual reduction to stable growth over a transition period, as illustrated in figure 12.3:

Figure 12.3: High Growth followed by transition



This model allows for growth rates and payout ratios to change gradually during the transition period.

Whatever path you devise to get your firm to stable growth, it is not just the growth rate that should change in stable growth. The other characteristics of the firm should also change to reflect the stable growth rates.

- The cost of equity should be more reflective of that of a mature firm. If it is being estimated using a beta, that beta should be closer to one in stable growth even though it can take on very high or very low values in high growth.
- The dividend payout ratio, which is usually low or zero for high growth firms, should increase as the firm becomes a stable growth firm. In fact, drawing on the fundamental growth equation from the last section, we can estimate the payout ratio in stable growth:

  Dividend Payout Ratio = 1 – Retention Ratio = 1 – Expected growth rate/ ROE

  If we expect the stable growth rate to be 4% and the return on equity in stable growth to be 12%, the payout ratio in stable growth will be 66.67% (1- 4/12).
- The return on equity in stable growth, if used to estimate the payout ratio, should be also reflective of a stable growth firm. The most conservative estimate to make in stable

growth is that the return on equity will be equal to the cost of equity, thus denying the firm the possibility of excess returns in perpetuity. If this is too rigid a framework, you can assume that the return on equity will converge on an industry average in the stable growth phase.

If there is a transition period for growth, as in figure 12.3, the betas and payout ratios should adjust in the transition period, as the growth rate changes.

12.5. ☞: **Terminal Value and Present Value**

The bulk of the present value in most discounted cash flow valuations comes from the terminal value. Therefore, it is reasonable to conclude that the assumptions about growth during the high growth period do not affect value as much as assumptions about the terminal value.

a. True

b. False

Explain.

Closing Thoughts on the Dividend Discount Model

Many analysts view the dividend discount model as outmoded but it is a useful starting point in valuing all companies and may be the only choice in valuing companies where estimating cashflows is not feasible. As we noted in chapter 11, estimating free cashflows for financial service companies is often difficult to do both because the line between operating and capital expenses is a fuzzy one and because working capital, defined broadly, could include just about all of the balance sheet. While we can arrive at approximations of cashflows by making assumptions about capital expenditures, we are often left in the uncomfortable position of assuming that dividends represent free cashflows to equity for these firms. Even for firms where we can estimate free cash flows to equity with reasonable precision, the dividend discount model allows us to estimate a "floor value" in most cases since firms tend to pay out less in dividends than they have available in free cashflows to equity.

It is often argued that the dividend discount model cannot be used to value high growth companies that pay little in dividends. That is true only if we use the inflexible version of the model where future dividends are estimated by growing current dividends.

In our more flexible version, where both payout ratios and earnings growth can change over time, the dividend discount model can be extended to cover all types of firms.

There is one final point worth making in this section. We can estimate the value of equity on a per share basis by using dividends per share or we can obtain the aggregate value of equity using total dividends paid. The two approaches will yield the same results, if there are no management options, warrants or convertible bonds outstanding. If there are equity options, issued by the firm, that are outstanding, it is safest to value the equity on an aggregate basis. We will consider how best to deal with equity options in arriving at a value per share later in this chapter.

12.6. ☞: **Payout Ratios and Expected Growth**

The dividend discount model cannot be used to value stock in a company with high growth, which does not pay dividends.

a. True

b. False

Explain.

This file on the web contains, by sector, the industry averages for returns on capital, retention ratios, debt equity ratios and interest rates.

Illustration 12.3: Valuing equity using the Dividend Discount Model: Deutsche Bank

In illustration 12.2, we estimated the annual growth rate for the next 5 years at Deutsche Bank to be 7.36%, based upon an estimated ROE of 11.26% and a retention ratio of 65.36%. In 2003, the earnings per share at Deutsche Bank were 4.33 Euros, and the dividend per share was 1.50 Euros. Our earlier analysis of the risk at Deutsche Bank provided us with an estimate of beta of 0.98, which used in conjunction with the Euro riskfree rate of 4.05% and a risk premium of 4.82%, yielded a cost of equity of 8.76% (see illustration 4.11).

Based upon these inputs, we estimate the expected earnings per share and dividends per share for the next 5 years, and the present value of these dividends in table 12.2:

Table 12.2: Present Value of Expected Dividends for High Growth Period

Year	EPS	Payout Ratio	DPS	PV at 8.76%
1	€4.65	34.64%	€1.61	€1.48
2	€4.99	34.64%	€1.73	€1.46
3	€5.36	34.64%	€1.86	€1.44
4	€5.75	34.64%	€1.99	€1.42
5	€6.18	34.64%	€2.14	€1.41
Present value of expected dividends =				€7.22

Note that we could have arrived at the same present value, using the short cut described earlier (since the payout ratio and the cost of equity remain unchanged for the high growth period):

$$\text{PV of High - growth dividends}_0 = \frac{1.50 * (1.0736) * \left(1 - \frac{(1.0736)^5}{(1.0876)^5}\right)}{.0876 - .0736} = 7.22$$

At the end of year 5, we will assume that Deutsche Bank's earnings growth will drop to 4% and stay at that level in perpetuity. In keeping with the assumption of stable growth, we will also assume that

- The beta will rise marginally to 1, resulting in a slightly higher cost of equity of 8.87%.

Cost of Equity = Riskfree Rate + Beta * Risk Premium = 4.05%+ 4.82% = 8.87%

- The return on equity will drop to the cost of equity of 8.87%, thus preventing excess returns from being earned in perpetuity.
- The payout ratio will adjust to reflect the stable period growth rate and return on equity.

Stable Period Payout Ratio = 1 – g/ ROE = 1- .04/.0887 = .5490 or 54.9%

The expected dividends in year 6 is calculated using this payout ratio:

Expected Dividends in year 6 = Expected EPS_6 * Stable period payout ratio

=€6.18 (1.04) * .549 = €3.5263

The value per share at the end of the fifth year can be estimated using these inputs:

Terminal Value per share = Expected Dividends in year 6/ (Cost of equity – g)

= €3.5263/(.0887 - .04) = €72.41

The present value of the terminal value is computed using the high growth period cost of equity:

Present value of terminal value = Terminal Value/ $(1+r)^n$ = 72.41/1.0876^5 = 47.59

The total value per share is the sum of this value and the present value of the expected dividends in the high growth period:

Value per share = PV of expected dividends in high growth + PV of terminal value

= €7.22 + €47.59 = €54.80

The market price of Deutsche Bank at the time of this valuation was 66 Euros per share. Based upon out assumptions, Deutsche Bank looks over valued.

II. Free Cashflow to Equity Models

In Chapter 11, while developing a framework for analyzing dividend policy we estimated the free cash flow to equity as the cash flow that the firm can afford to pay out as dividends, and contrasted it with the actual dividends. We noted that many firms do not pay out their FCFE as dividends; thus, the dividend discount model may not capture their true capacity to generate cash flows for stockholders. A more appropriate model is the free cash flow to equity model.

Setting up the Model

The FCFE is the residual cash flow left over after meeting interest and principal payments and providing for capital expenditures to maintain existing assets and to create new assets for future growth. The free cash flow to equity is measured as follows:

FCFE = Net Income + Depreciation - Capital Expenditures - Δ Working Capital - Principal Repayments + New Debt Issues

where Δ Working Capital is the change in non-cash working capital.

In the special case where the capital expenditures and the working capital are expected to be financed at the target debt ratio δ, and principal repayments are made from new debt issues, the FCFE is measured as follows:

FCFE = Net Income + (1-δ) (Capital Expenditures - Depreciation) + (1-δ) Δ Working Capital

There is one more way in which we can present the free cash flow to equity. If we define the portion of the net income that equity investors reinvest back into the firm as the equity reinvestment rate, we can state the FCFE as a function of this rate.

Equity Reinvestment Rate

$$= \frac{(\text{Capital Expenditures - Depreciation} + \Delta \text{ Working Capital})(1-\delta)}{\text{Net Income}}$$

FCFE = Net Income (1 – Equity Reinvestment Rate)

Once we estimate the FCFE, the general version of the FCFE model resembles the dividend discount model, with FCFE replacing dividends in the equation:

Value of the Stock = PV of FCFE during high growth + PV of terminal price

$$\text{Value}_0 = \sum_{t=1}^{t=n} \frac{E(\text{FCFE})_t}{(1+r)^t} + \frac{\text{Terminal Value}_n}{(1+r)^n} \text{ where Terminal Value}_n = \frac{E(\text{FCFE})_{n+1}}{(r_n - g_n)}$$

where the expected free cashflows to equity are estimated each year for the high growth period, r is the cost of equity and g_n is the stable growth rate.

There is one key difference between the two models, though. While the dividends can never be less than zero, the free cashflows to equity can be negative. This can occur even if earnings are positive, if the firm has substantial working capital and capital expenditure needs. In fact, the expected free cashflows to equity for many small, high growth firms will be negative at least in the early years, when reinvestment needs are high, but will become positive as the growth rates and reinvestment needs decrease.

In Practice: Estimating Capital Expenditure and Working Capital Needs

Two components go into estimating reinvestments. The first is net capital expenditures, which is the difference between capital expenditures and depreciation. While these numbers can easily be obtained for the current year for any firm in the United States[8], they should be used with the following caveats:

1. Firms seldom have smooth capital expenditure streams. Firms can go through periods when capital expenditures are very high, followed by periods of relatively light capital expenditures. Consequently, when estimating the capital expenditures to use

for forecasting future cash flows, we should look at capital expenditures over time and normalize them by taking an average or we should look at industry norms.

2. If we define capital expenditures are expenditures designed to generate benefits over many years, research and development expenses are really capital expenditures. Consequently, R&D expenses need to be treated as capital expenditures, and the research asset that is created as a consequence needs to be amortized, with the amortization showing up as part of depreciation.[9]
3. Finally, in estimating capital expenditures, we should not distinguish between internal investments (which are usually categorized as capital expenditures in cash flow statements) and external investments (which are acquisitions). The capital expenditures of a firm, therefore, need to include acquisitions. Since firms seldom make acquisitions every year, and each acquisition has a different price tag, the point about normalizing capital expenditures applies even more strongly to this item.

The second component of reinvestment is the cash that needs to be set aside for working capital needs. As in the chapters on investment analysis, we define working capital needs as non-cash working capital, and the cash flow effect is the period-to-period change in this number. Again, while we can estimate this change for any year using financial statements, it has to be used with caution. Changes in non-cash working capital are volatile, with big increases in some years followed by big decreases in the following years. To ensure that the projections are not the result of an unusual base year, we tie the changes in working capital to expected changes in revenues or costs of goods sold at the firm over time. For instance, we use the non-cash working capital as a percent of revenues, in conjunction with expected revenue changes each period, to estimate projected changes in non-cash working capital. As a final point, non-cash working capital can be negative, which can translate into positive cash flows from working capital as

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[8] It is actually surprisingly difficult to obtain the capital expenditure numbers even for large, publicly traded firms in some markets outside the United States. Accounting standards, in these markets, often allow firms to lump investments together and report them in the aggregate.

[9] Capitalizing R&D is a three-step process. First, you need to specify, on average, how long it takes for research to pay off (amortizable life). Second, you have to collect R&D expenses from the past for an equivalent period. Third, the past R&D expenses have to be written off (straight line) over the amortizable life.

revenue increases. It is prudent, when this occurs, to set non-cash working capital needs to zero[10].

Estimating Model Inputs

Just as in the dividend discount model, there are four basic inputs needed for this model to be usable. First, the *length of the high growth period* is defined. Second, the *free cash flow to equity* each period during the growth period is specified; this means that net capital expenditures, working capital needs and the debt financing mix are all estimated for the high growth period. Third, the *rate of return* stockholders will demand for holding the stock is estimated. Finally, the *terminal value of equity at the end of the high growth period* is calculated, based upon the estimates of stable growth, the free cash flows to equity and required return after the high growth ends. Of the four inputs, the length of the high growth period and the rate of return required by stockholders are the same for the dividend discount and FCFE valuation models. On the other two, the differences in the other two inputs are minor but still worth emphasizing.

a. Estimating FCFE during High Growth Period

As in the dividend discount model, we start with the earnings per share and estimate expected growth in earnings. Thus, the entire discussion about earnings growth in the dividend discount model applies here as well. The only difference is in the estimation of fundamental growth. When estimating fundamental growth in the dividend discount model, we used the retention ratio and the return on equity to estimate the expected growth in earnings. When estimating fundamental growth in the FCFE valuation model, it is more consistent to use the equity reinvestment rate that we defined in the last section and the return on equity to estimate expected growth:

Expected Growth in Net Income = Equity Reinvestment Rate * Return on Equity

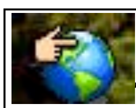
Unlike the retention ratio, which cannot exceed 100% or be less than 0%, the equity reinvestment rate can be negative (if capital expenditures drop below depreciation) or greater than 100%. If the equity reinvestment rate is negative and is expected to remain so for the foreseeable future, the expected growth in earnings will be negative. If the

[10] While it is entirely possible that firms can generate positive cash flows from working capital decreasing

equity reinvestment rate is greater than 100%, the net income can grow at a rate higher than the return on equity though the firm will have to issue new stock to fund the reinvestment.[11]

Once the earnings are estimated, the net capital expenditures, working capital needs, and debt financing needs have to be specified in order to arrive at the FCFE. Just as the dividend payout ratio was adjusted to reflect changes in expected growth, the net capital expenditure and working capital needs should change as the growth rate changes. In particular, high growth companies will have relatively higher net capital expenditures and working capital needs. In other words, the equity reinvestment rate will generally be high in high growth and decline as the growth rate declines. A similar point can be made about leverage. High growth, high risk firms generally do not use much leverage to finance investment needs; as the growth tapers off, however, the firm will be much more willing to use debt, suggesting that debt ratios will increase as growth rates drop.

There is one final point worth making about equity valuations. Since the net income includes both income from operations and income from cash and marketable securities, we have two choices when it comes to equity valuations. The first and easier, albeit less precise one, is to discount the total free cashflow to equity (including the income from cash holdings) at a cost of equity that is adjusted to reflect the cash holdings.[12] The present value of equity will then incorporate the cash holdings of the company. The second and more precise way is to discount the net income, without including the interest income from cash, at a cost of equity that reflects only the operations of the firm and then to add the cash and marketable securities on to this present value at the end.


This file on the web contains, by sector, the industry averages for net capital expenditures and working capital as a percent of revenues.

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for short periods, it is dangerous to assume that this can occur forever.

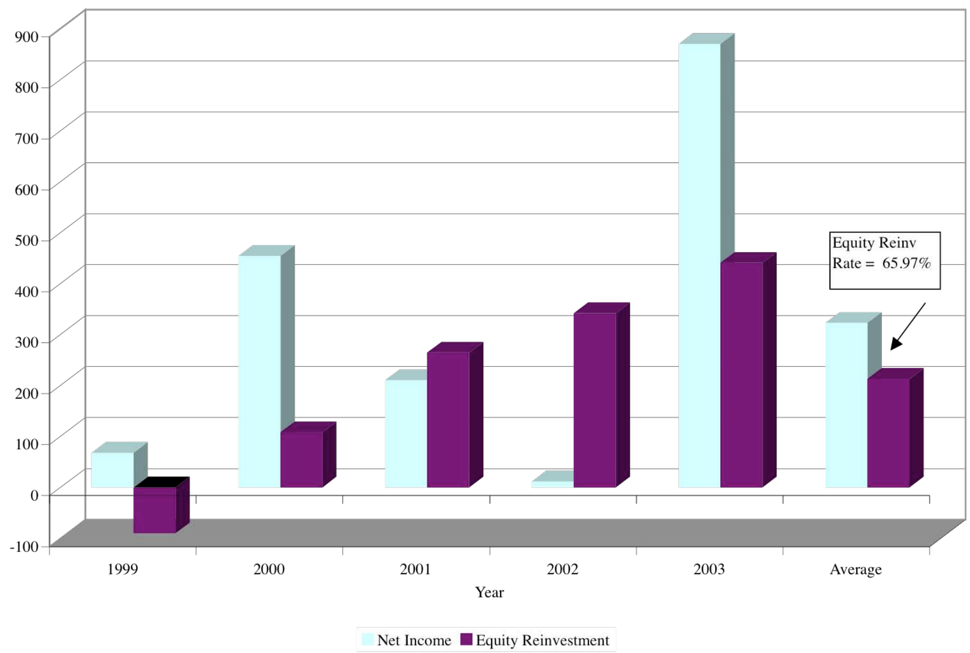
[11] If the equity reinvestment rate exceeds 100%, the net income of the firm is insuffuicient to cover the equity reinvestment needs of the firm. Fresh equity will have to be issued to fund the difference. This will increase the number of shares outstanding.

[12] The beta for equity will be based upon an unlevered beta, adjusted for the cash holdings of the company. In other words, if the company is 20% cash and 80% operations, the unlevered beta will be estimated attaching a 20% weight to cash and a beta of zero for cash.

Illustration 12.4: Estimating Growth Rate in Net Income

Like many manufacturing firms, Aracruz has volatile reinvestment outlays and the cashflows from debt swing wildly from year to year. In figure 12.4, we report on net income and equity reinvestment (capital expenditures – depreciation + change in non-cash working capital – net cashflow from debt) each year from 1999 to 2003:

Figure 12.4: Equity Reinvestment and Net Income at Aracruz- 1999 to 2003



Rather than base the equity reinvestment rate on the most recent year's numbers, we will use the average values for each of the variables over the entire period to compute a "normalized" equity reinvestment rate:

Normalized Equity Reinvestment Rate = Average Equity Reinvestment$_{99\text{-}03}$/ Average Net Income$_{99\text{-}03}$ = 213.17/323.12 = 65.97%

To estimate the return on equity, we look at only the portion of the net income that comes from operations (ignoring the income from cash and marketable securities) and divide by the book value of equity net of cash and marketable securities. This non-cash ROE is a cleaner measure of the returns on equity in operating assets.

Non-cash ROE = (Net Income – After-tax Interest income on cash)$_{2003}$/ (BV of Equity – Cash)$_{2002}$

Aracruz had net income of $148.09 million in 2003, interest income before taxes of $43.04 million and faced a tax rate of 34%. The book value of equity at the end of 2002 was $1760.58 million, of which cash represented $273.93 million.

Non-cash $ROE_{Aracruz}$ = (148.09 – 43.04(1-.34))/ (1760.58-273.93) = .0805 or 8.05%

The expected growth in net income can be computed as the product of the non-cash ROE and the equity reinvestment rate.

Expected Growth in Net Income = Equity Reinvestment Rate * Non-cash ROE

= 65.97% * 8.05% = 5.31%

Based upon fundamentals, we would expect Aracruz's net income to grow 5.31% a year.

In Practice: Paths to a Higher ROE

The expected growth rate in earnings per share and net income are dependent upon the return on equity that a firm makes on its new investments. The higher the return one equity, the higher the expected growth rate in earnings. But how do firms generate higher returns on equity? Algebraically, the return on equity can be decomposed into a return on capital and a leverage effect:

Return on Equity = Return on capital + D/E (Return on capital – Cost of debt (1-tax rate))

where,

Return on capital = EBIT (1-tax rate)/ (Book value of debt + Book value of equity)

D/E = Book value of debt/ Book value of equity

The second term in the equation reflects the influence of debt. To the extent that a firm can earn a return on capital that exceeds the after-tax cost of debt, its return on equity will increase as it uses more debt. A firm with a return on capital of 12%, a debt to equity ratio of 0.5 and an after-tax cost of debt of 4% will have a return on equity of 16%. Lest firms view this as a free lunch, we should hasten to point out that using more debt will also increase the firm's beta and cost of equity and the value of equity may very well decrease with higher borrowing, even though the return on equity and expected growth rate may be higher.

b. Estimating Terminal Value

As with the dividend discount model, the terminal value in the FCFE model is determined by the stable growth rate and the cost of equity. The difference between this model and the dividend discount model lies primarily in the cash flow used to calculate the terminal price: the latter uses expected dividends in the period after the high growth period, whereas the former uses the free cash flow to equity in that period:

$$\text{Terminal value of equity}_n = \frac{\text{FCFE}_{n+1}}{r - g_n}$$

In estimating that cash flow, the net capital expenditures and working capital needs should be consistent with the definition of stability. The simplest way to ensure this is to estimate an equity reinvestment rate from the stable period return on equity:

Equity Reinvestment rate in stable growth = Stable growth rate/ Stable period ROE

This is exactly the same equation we used to compute the retention ratio in stable growth in the dividend discount model.

Many analysts assume that stable growth firms have capital expenditures that offset depreciation and no working capital requirements. This will yield a equity reinvestment rate of zero which is consistent only with a stable growth rate of zero. Using a stable growth rate of 3 or 4% while allowing for no reinvestment essentially allows your firm to grow without paying for the growth and will yield too high a value for the firm.

Reconciling FCFE and Dividend Discount Model Valuations

The FCFE discounted cash flow model can be viewed as an alternative to the dividend discount model. Since the two approaches sometimes provide different estimates of value, however, it is worth a comparison.

There are two conditions under which the value obtained from using the FCFE in discounted cash flow valuation will be the same as the value obtained from using the dividend discount model. The first is obvious: when the dividends are equal to the FCFE, the value will be the same. The second is more subtle: when the FCFE is greater than dividends, but the excess cash (FCFE - Dividends) is invested in projects with a net present value of zero, the values will also be similar. For instance, investing in financial assets that are fairly priced should yield a net present value of zero.[13]

More often, the two models will provide different estimates of value. First, when the FCFE is greater than the dividend and the excess cash either earns below-market returns or is invested in negative net present value projects, the value from the FCFE model will be greater than the value from the dividend discount model. This is not uncommon. There are numerous case studies of firms that having accumulated large cash balances by paying out low dividends relative to FCFE, have chosen to use this cash to finance unwise takeovers (the price paid is greater than the value received). Second, the payment of smaller dividends than the firm can afford lowers debt-equity ratios; accordingly, the firm may become underleveraged, reducing its value.

In those cases where dividends are greater than FCFE, the firm will have to issue new shares or borrow money to pay these dividends leading to at least three negative consequences for value are possible. One is the flotation cost on these security issues, which can be substantial for equity issues. Second, if the firm borrows the money to pay the dividends, the firm may become overleveraged (relative to the optimal), leading to a loss in value. Finally, paying too much in dividends can lead to capital rationing constraints, whereby good projects are rejected, resulting in a loss of wealth.

When the two models yield different values, two questions remain: (1) What does the difference between the two models tell us? (2) Which of the two models is the appropriate one to use in evaluating the market price? In most cases, the value from the FCFE model will exceed the value from the dividend discount model. The difference between the value obtained from the FCFE model and the value obtained from the dividend discount model can be considered one component of the value of controlling a firm – that is, it measures the value of controlling dividend policy. In a hostile takeover, the bidder can expect to control the firm and change the dividend policy (to reflect FCFE), thus capturing the higher FCFE value. In the more infrequent case —the value from the dividend discount model exceeds the value from the FCFE — the difference has

[13] Mechanically, this will work out only if you keep track of the cash build up in the dividend discount model and add it to the terminal value. If you do not do this, you will under value your firm with the dividend discount model.

less economic meaning but can be considered a warning on the sustainability of expected dividends.

As for which of the two values is more appropriate for evaluating the market price, the answer lies in the openness of the market for corporate control. If there is a significant probability that a firm can be taken over or its management changed, the market price will reflect that likelihood; in that case, the value from the FCFE model would be a more appropriate benchmark. As changes in corporate control become more difficult, either because of a firm's size and/or legal or market restrictions on takeovers, the value from the dividend discount model will provide a more appropriate benchmark for comparison.

12.7. ☞**: FCFE and DDM Value**

Most firms can be valued using FCFE and DDM valuation models. Which of the following statements would you most agree with on the relationship between these two values?

a. The FCFE value will always be higher than the DDM value
b. The FCFE value will usually be higher than the DDM value
c. The DDM value will usually be higher than the FCFE value
d. The DDM value will generally be equal to the FCFE value

Illustration 12.5: FCFE Valuation: Aracruz

To value Aracruz, using the FCFE model, we will use the expected growth in net income that we estimated in illustration 12.4 and value the equity in operating assets first and then add on the value of cash and other non-operating assets. We will also value the company in U.S. dollars, rather than Brazilian real, because the firm generates so much of its cashflows in dollars. Summarizing the basic information that we will be using:

- The net income for the firm in 2003 was \$148.09 million but \$28.41 million of this income represented income from financial assets.[14] The net income from non-operating assets is \$119.68 million.

[14] The pre-tax income from financial assets was \$43.04 million. We used a 34% tax rate to arrive at

- In 2003, capital expenditures amounted to \$ 228.82 million, depreciation was \$191.51 million and non-cash working capital increased by \$10.89 million. The net cashflow from debt was \$531.20 million, resulting in a large negative equity reinvestment in that year.

  Equity Reinvestment Rate$_{2003}$ = (228.82 – 191.51 + 10.89 -531.20)/ 119.68 = -403.58%

  We will use the average equity reinvestment rate of 65.97%, based upon the average values from 199-2003, that we computed in illustration 12.4 as the equity reinvestment rate for the next 5 years. In conjunction, with the non-cash return on equity of 8.05% that we computed in that illustration, we estimate an expected growth rate of 5.31% a year for the next 5 years.
- In illustration 4.7, we estimated a beta for equity of 0.7576 for the paper business that Aracruz.[15] With a nominal U.S. dollar riskfree rate of 4% and an equity risk premium of 12.49% for Brazil (also estimated in chapter 4), we arrive at a dollar cost of equity of 13.46%

  Cost of equity = 4% + 0.7576 (12.49%) = 13.46%

  After year 5, we will assume that the beta will remain at 0.7576 and that the equity risk premium will decline to 8.66%.[16] The resulting cost of equity is 10.56%.

  Cost of equity in stable growth = 4% + 0.7576 (8.66%) = 10.56%
- After year 5, we will assume that the growth in net income will drop to the inflation rate (in U.S. dollar terms) of 2% and that the return on equity will rise to 10.56% (which is also the cost of equity). The equity reinvestment rate in stable growth can then be estimated as follows:

  Equity Reinvestment Rate$_{\text{Stable Growth}}$ = Expected Growth Rate/ Return on Equity

  = 2%/10.56% = 18.94%

To value the equity in Aracruz, we begin by estimating the free cashflows to equity from operations in table 12.3:

[15] We used the equity beta of just the operating asssets in this valuation. If we had chosen to include the cash from financial holdings as part of net income, we would have used Aracruz's consolidated equity beta of 0.7040.

[16] We halved the country risk premium from 7.67% to 3.84%. We are assuming that as Brazil grows, it will become a less risky country to invest in.

Table 12.3: Expected FCFE at Aracruz – Years 1-5

	1	*2*	*3*	*4*	*5*
Net Income (non-cash)	$126.04	$132.74	$139.79	$147.21	$155.03
Equity Reinvestment Rate	65.97%	65.97%	65.97%	65.97%	65.97%
FCFE	$42.89	$45.17	$47.57	$50.09	$52.75
Present Value at 13.46%	$37.80	$35.09	$32.56	$30.23	$28.05

FCFE = Net Income (1- Reinvestment Rate)

To estimate the terminal value of equity, we first estimate the free cashflow to equity in year 6:

FCFE in year 6 = Net Income in year 6 (1- Equity Reinvestment Rate$_{\text{Stable Growth}}$)

= 155.03 (1.02) (1- .1894) = $128.18 million

The terminal value is then computed using the stable period cost of equity of 10.56%:

Terminal value of equity = 128.18/(.1056-.02) = $1497.98 million

The current value of equity is the sum of the present values of the expected cashflows in table 12.3, the present value of the terminal value of equity and the value of cash and non-operating assets today:

Present Value of FCFEs in high growth phase =	$163.73
+ Present Value of Terminal Equity Value = $1497.98/1.1346^5$ =	$796.55
Value of equity in operating assets =	$960.28
+ Value of Cash and Marketable Securities =	$352.28
Value of equity in firm =	$1,312.56

Dividing by the 859.59 million shares outstanding yields a value per share of $1.53. Converted into Brazilian Real at the exchange rate of 3.15 BR/$ prevailing at the time of this valuation, we get a value per share of 4.81 BR per share, well below the market price of 7.50 BR/share.

In Practice: Reconciling your value with the market price

When you value a company and arrive at a number very different from the market price, as we have with both Aracruz and Deutsche Bank, there are three possible explanations. The first is that we are mistaken in our assumptions and that our valuations are wrong while the market is right. Without resorting to the dogma of efficient markets, this is a reasonable place to start since this is the most likely scenario. The second is that the market is wrong and that we are right, in which case we have to decide whether we have enough confidence in our valuations to act on them. If we find a company to be under valued, this would require buying and holding the stock. If the stock is over valued, we would have to sell short. The problem, though, is that there is no guarantee that markets, even if they are wrong, will correct their mistakes in the near future. In other words, a stock that is over valued can become even more over valued and a stock that is under valued may stay undervalued for years, wreaking havoc on our portfolio. This also makes selling short a much riskier strategy since we generally can do so only for a few months.

One way to measure market expectations is to solve for a growth rate that will yield the market price. In the Aracruz valuation, for instance, we would need an expected growth rate of 19.50% in earnings over the next 5 years to justify the current market price. This is called an implied growth rate and can be compared to the estimate of growth we used in the valuation of 5.31%.

III. Free Cashflow to the Firm Models

The dividend discount and FCFE models are models for valuing the equity in a firm directly. The alternative is to value the entire business and then to use this value to arrive at a value for the equity. That is precisely what we try and do in firm valuation models where we focus on the operating assets of the firm and the cashflows that they generate.

Setting up the Model

The cash flow to the firm can be measured in two ways. One is to add up the cash flows to all of the different claim holders in the firm. Thus, the cash flows to equity investors (which take the form of dividends or stock buybacks) are added to the cash flows to debt holders (interest and net debt payments) to arrive at the cash flow to the firm. The other approach to estimating cash flow to the firm, which should yield equivalent results, is to estimate the cash flows to the firm prior to debt payments, but after reinvestment needs have been met:

Earnings before interest and taxes (1 - tax rate)

– (Capital Expenditures - Depreciation)

– Change in Non-cash Working Capital

= Free Cash Flow to the Firm

The difference between capital expenditures and depreciation (net capital expenditures) and the increase in non-cash working capital represent the reinvestment made by the firm to generate future growth. Another way of presenting the same equation is to add the net capital expenditures and the change in working capital, and state that value as a percentage of the after-tax operating income. This ratio of reinvestment to after-tax operating income is called the **reinvestment rate**, and the free cash flow to the firm can be written as:

$$\text{Reinvestment Rate} = \frac{(\text{Capital Expenditures - Depreciation} + \Delta \text{ Working Capital}))}{\text{EBIT } (1 - \text{tax rate})}$$

Free Cash Flow to the Firm = EBIT (1-t) (1 – Reinvestment Rate)

Note that the reinvestment rate can exceed 100%[17], if the firm has substantial reinvestment needs. If that occurs, the free cash flow to a firm will be negative even though after-tax operating income is positive. The cash flow to the firm is often termed an unlevered cash flow, because it is unaffected by debt payments or the tax benefits[18] flowing from these payments.

As with the dividends and the FCFE, the value of the operating assets of a firm can be written as the present value of the expected cashflows during the high growth period and a terminal value at the end of the period:

$$\text{Value}_0 = \sum_{t=1}^{t=n} \frac{E(\text{FCFF})_t}{(1+r)^t} + \frac{\text{Terminal Value}_n}{(1+r)^n} \text{ where Terminal Value}_n = \frac{E(\text{FCFF})_{n+1}}{(r_n - g_n)}$$

where r is the cost of capital and g_n is the expected growth rate in perpetuity.

[17] In practical terms, this firm will need external financing, either from debt or equity or both, to cover the excess reinvestment.

[18] If you are wondering where the tax benefits from interest payments, which are real cash benefits, show up, it is in the discount rate, when we compute the after-tax cost of debt. If we add this tax benefit as a cash flow to the free cash flow to the firm, we will double count the tax benefit.

Estimating Model Inputs

As with the dividend discount and the FCFE discount models, there are four basic components that go into the value of the operating assets of the firm – a period of high growth, the free cashflows to the firm during that period, the cost of capital to use as a discount rate and the terminal value for the operating assets of the firm. We have additional steps we need to take to get to the value of equity per share. In particular, we have to incorporate the value of non-operating assets, subtract out debt and then consider the effect of options outstanding on the equity of the firm.

a. Estimating FCFF during High Growth Period

We base our estimate of a firm's value on expected future cash flows, not current cash flows. It is the forecasts of earnings, net capital expenditures and working capital that will yield these expected cash flows. One of the most significant inputs into any valuation is the expected growth rate in operating income. As with the growth rates we estimated for dividends and net income, the variables that determine expected growth are simple. The expected growth in operating income is a product of a firm's reinvestment rate, i.e., the proportion of the after-tax operating income that is invested in net capital expenditures and non-cash working capital, and the quality of these reinvestments, measured as the after-tax return on the capital invested.

Expected $\text{Growth}_{\text{EBIT}}$ = Reinvestment Rate * Return on Capital

where,

$$\text{Reinvestment Rate} = \frac{\text{Capital Expenditure - Depreciation} + \Delta \text{ Non-cash WC}}{\text{EBIT (1 - tax rate)}}$$

Return on Capital = EBIT (1-t) / (Book value of Debt + Book value of equity)

Both measures should be forward looking, and the return on capital should represent the expected return on capital on future investments. In the rest of this section, we will consider how best to estimate the reinvestment rate and the return on capital.

The reinvestment rate is often measured using a firm's past history on reinvestment. Although this is a good place to start, it is not necessarily the best estimate of the future reinvestment rate. A firm's reinvestment rate can ebb and flow, especially in firms that invest in relatively few large projects or acquisitions. For these firms, looking at an average reinvestment rate over time may be a better measure of the future. In addition, as firms grow and mature, their reinvestment needs (and rates) tend to decrease. For firms that have expanded significantly over the last few years, the historical reinvestment rate is likely to be higher than the expected future reinvestment rate. For these firms, industry averages for reinvestment rates may provide a better indication of the future than using numbers from the past. Finally, it is important that we continue treating R&D expenses and operating lease expenses consistently. The R&D expenses, in particular, need to be categorized as part of capital expenditures for purposes of measuring the reinvestment rate.

The return on capital is often based upon the firm's return on capital on existing investments, where the book value of capital is assumed to measure the capital invested in these investments. Implicitly, we assume that the current accounting return on capital is a good measure of the true returns earned on existing investments, and that this return is a good proxy for returns that will be made on future investments. This assumption, of course, is open to question if the book value of capital is not a good measure of the capital invested in existing projects and/or if the operating income is mis-measured or volatile. Given these concerns, we should consider not only a firm's current return on capital, but also any trends in this return as well as the industry average return on capital. If the current return on capital for a firm is significantly higher than the industry average, the forecasted return on capital should be set lower than the current return to reflect the erosion that is likely to occur as competition responds.

Finally, any firm that earns a return on capital greater than its cost of capital is earning an excess return. These excess returns are the result of a firm's competitive advantages or barriers to entry into the industry. High excess returns locked in for very long periods imply that this firm has a permanent competitive advantage.

In Practice: After-tax Operating Income

The income statement for a firm provides a measure of the operating income of the firm in the form of the earnings before interest and taxes (EBIT) and a tax rate in the form of an effective tax rate. Since the operating income we would like to estimate is before capital and financing expenses, we have to make at least three adjustments to the accounting operating income:

- The first adjustment is for financing expenses that accountants treat as operating expenses. The most significant example is operating leases. Since these lease payments constitute firm commitments into the future, they are tax deductible, and the failure to make lease payments can result in bankruptcy, we treat these expenses as financial expenses. The adjustment, which we describe in detail in chapter 4, results in an increase in both the operating income and the debt outstanding at the firm.
- The second adjustment is to correct for the incidence of one-time or irregular income and expenses. Any expense (or income) that is truly a one-time expense (or income) should be removed from the operating income and should not be used in forecasting future operating income. While this would seem to indicate that all extraordinary charges should be expunged from operating income, there are some extraordinary charges that seem to occur at regular intervals – say once every four or five years. Such expenses should be viewed as "irregular" rather than extraordinary expenses and should be built into forecasts. The easiest way to do this is to annualize the expense. Put simply, this would mean taking one-fifth of any expense that occurs once every five years, and computing the income based on this apportioned expense.

As for the tax rate, the effective tax rates reported by most firms are much lower than the marginal tax rates. As with the operating income, we should look at the reasons for the difference and see if these firms can maintain their lower tax rates. If they cannot, it is prudent to shift to marginal tax rates in computing future after-tax operating income.

Illustration 12.6: Estimating Growth Rate in Operating Income - Disney

We begin by estimating the reinvestment rate and return on capital for Disney in 2003, using the numbers from the latest financial statements. We did convert operating leases into debt and adjusted the operating income and capital expenditure accordingly.[19]

Reinvestment Rate_{2003} = (Cap Ex – Depreciation + Chg in non-cash WC)/ EBIT (1-t)

[19]The book value of debt is augmented by the $1,753 million in present value of operating lease commitments. The unadjusted operating income for Disney was $2,713 million. The operating lease adjustment adds the inputed interest expense on the PV of operating leases to the operating income (5.25% of $1753 million= $92 million), the current year's operating lease expense to capital expenditures ($556 million) and the depreciation on the leased asset to depreciation ($195 million).

= (1735 – 1253 + 454)/(2805(1-.373)) = 53.18%

Return on capital$_{2003}$ = EBIT (1-t)$_{2003}$/ (BV of Debt$_{2002}$ + BV of Equity$_{2002}$)

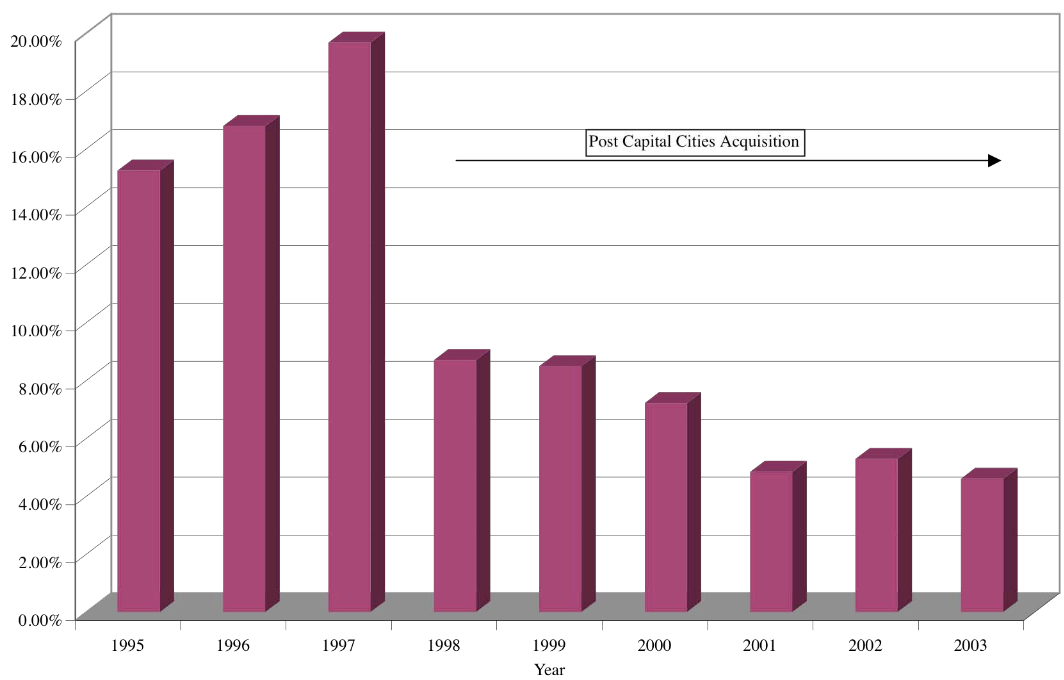
= 2805 (1-.373)/ (15,883+23,879) = 4.42%

If Disney maintains its 2003 reinvestment rate and return on capital for the next few years, its growth rate will be only 2.35%.

Expected Growth Rate from existing fundamentals = 53.18% * 4.42% = 2.35%

To make our estimates for the future, we look at Disney's returns on capital and reinvestment rates from 1995 to 2003 in Figure 12.5:

Figure 12.5: Return on Capital - Disney



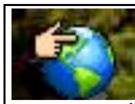
Note the dramatic drop in the return on capital after the Capital Cities acquisition from more than 19% in 1997 to less than 10% in 1998.[20] While this may sound optimistic, we will assume that Disney will be able to earn a return on capital of 12% on its new investments and that the reinvestment rate will be 60% for the immediate future.[21] The expected growth in operating income over this period will be 7.20%.

[20] Part of this drop can be explained by accounting factors; the acquisition of Capital Cities increased the book value of equity and debt substantially.

[21] We are, however, leaving the return on capital on existing investments at 4.55% since improving those returns will be much more difficult to do.

Expected Growth Rate in operating income = Return on capital * Reinvestment Rate

$$= 12\% * .60 = 7.20\%$$



fundgrEB.xls: There is a dataset on the web that summarizes reinvestment rates and return on capital by industry group in the United States for the most recent quarter.

b. Estimating Cost of Capital

Unlike equity valuation models, where the cost of equity is used to discount cashflows to equity, the cost of capital is used to discount cashflows to the firm. The cost of capital is a composite cost of financing that includes the costs of both debt and equity and their relative weights in the financing structure:

$$\text{Cost of Capital} = k_{equity}\,(\text{Equity}/(\text{Debt}+\text{Equity})) + k_{debt}\,(\text{Debt}/(\text{Debt} + \text{Equity}))$$

where the cost of equity represents the rate of return required by equity investors in the firm, and the cost of debt measures the current cost of borrowing, adjusted for the tax benefits of borrowing. The weights on debt and equity have to be market value weights. We discussed the cost of capital estimation extensively earlier in this book, in the context of both investment analysis and capital structure. We will consider each of the inputs in the model, in the context of valuing a firm.

The cost of equity, as we have defined it through this book, is a function of the non-diversifiable risk in an investment, which, in turn, is measured by a beta (in the single factor model) or betas (in the multiple factor models). We argued that the beta(s) are better measured by looking at the average beta(s) of other firms in the business, i.e, bottom-up estimates, and reflecting a firm's current business mix and leverage. This argument is augmented, when we value companies, by the fact that a firm's expected business mix and financial leverage can change over time, and its beta will change with both. As the beta changes, the cost of equity will also change, from year to year.

Just as the cost of equity can change over time as a firm's exposure to market risk changes, so too can the cost of debt, as its exposure to default risk changes. The default risk of a firm can be expected to change for two reasons. One is that the firm's size will change as we project earnings further into the future; the volatility in these earnings is also likely to change over time. The second reason is that changes occur in financial leverage. If we expect a firm's financial leverage to change over time, it will affect its capacity to service debt and hence its cost of borrowing. The after-tax cost of debt can also change as a consequence of expected changes in the tax rate over time.

As a firm changes its leverage, the weights attached to equity and debt in the cost of capital computation will change. Should a firm's leverage be changed over the forecast period? The answer to this depends upon two factors. The first is whether the firm is initially under or over levered. If it is at its appropriate leverage, there is a far smaller need to change leverage in the future. The second is the views of the firm's management and the degree to which they are responsive to the firm's stockholders. Thus, if the management of a firm is firmly entrenched and steadfast in its opposition to debt, an under levered firm will stay under levered over time. In an environment where stockholder have more power, there will eventually be pressure on this firm to increase its leverage toward its optimal level.

Illustration 12.7: Cost of capital - Disney

Recapping the inputs we used to estimate the cost of capital in Disney, we will make the following assumptions:

- The beta for the first 5 years will be the bottom-up beta of 1.2456 that we estimated in illustration 4.5. In conjunction with a riskfree rate of 4% and market risk premium of 4.82%, this yields a cost of equity of 10%.

Cost of Equity = Riskfree Rate + Beta * Risk Premium = 4% + 1.2456(4.82%) = 10%

- The cost of debt for Disney for the first 5 years, based upon its rating of BBB+, is 5.25%. Using Disney's tax rate of 37.30% gives us an after-tax cost of debt of 3.29%:

After-tax cost of debt = 5.25% (1-.373) = 3.29%

- The current market debt ratio of 21% debt, estimated in illustration 4.15 will be used as the debt ratio for the first 5 years of the valuation. Keep in mind that this debt ratio is computed using the market value of debt (inclusive of operating leases) of $14,668 million and a market value of equity of $55,101 million.

The cost of capital for Disney, at least for the first 5 years of the valuation, is 8.59%.

Cost of capital = Cost of Equity (E/(D+E))) + After-tax cost of debt (D/(D+E))

$$= 10\% (.79) + 3.29\% (.21) = 8.59\%$$

12.8. ☞**: Firm Valuation and Leverage**

A standard critique of the use of cost of capital in firm valuation is that it assumes that leverage stays stable over time (through the weights in the cost of capital). Is this true?

a. Yes

b. No

wacc.xls: This dataset summarizes the costs of capital for firms in the United States, categorized by industry group.

c. Estimating Terminal Value

The approach most consistent with a discounted cash flow model assumes that cash flows, beyond the terminal year, will grow at a constant rate forever, in which case the terminal value can be estimated as follows:

$$\text{Terminal value}_n = \text{Free Cashflow to Firm}_{n+1} / (\text{Cost of Capital}_{n+1} - g_n)$$

where the cost of capital and the growth rate in the model are sustainable forever. We can use the relationship between growth and reinvestment rates that we noted earlier to estimate the reinvestment rate in stable growth:

$$\text{Reinvestment Rate in stable growth} = \text{Stable growth rate} / \text{ROC}_n$$

where the ROC_n is the return on capital that the firm can sustain in stable growth. This reinvestment rate can then be used to generate the free cash flow to the firm in the first year of stable growth:

$$\text{Terminal Value} = \frac{\text{EBIT}_{n+1}(1-t)\left(1 - \frac{g_n}{\text{ROC}_n}\right)}{(\text{Cost of Capital}_n - g_n)}$$

In the special case where ROC is equal to the cost of capital, this estimate simplifies to become the following:

$$\text{Terminal Value}_{\text{ROC=WACC}} = \frac{\text{EBIT}_{n+1}(1-t)}{\text{Cost of Capital}_n}$$

Thus, in every discounted cash flow valuation, there are two critical assumptions we need to make on stable growth. The first relates to when the firm that we are valuing will become a stable growth firm, if it is not one already. The second relates to what the characteristics of the firm will be in stable growth, in terms of return on capital and cost of capital. We examined the first question earlier in this chapter when we looked at the dividend discount model. Let us consider the second question now.

As firms move from high growth to stable growth, we need to give them the characteristics of stable growth firms. A firm in stable growth will be different from that same firm in high growth on a number of dimensions. For instance,

- As we noted with equity valuation models, high growth firms tend to be *more exposed to market risk* (and have higher betas) than stable growth firms. Thus, although it might be reasonable to assume a beta of 1.8 in high growth, it is important that the beta be lowered, if not to one, at least toward one in stable growth[22].
- High growth firms tend to have *high returns on capital and earn excess returns*. In stable growth, it becomes much more difficult to sustain excess returns. There are some who believe that the only assumption sustainable in stable growth is a zero excess return assumption; the return on capital is set equal to the cost of capital. While we agree, in principle, with this view, it is difficult in practice to assume that all investments, including those in existing assets, will suddenly lose the capacity to earn excess returns. Since it is possible for entire industries to earn excess returns over long periods, we believe that assuming a firm's return on capital will move towards its industry average yields more reasonable estimates of value.
- Finally, high growth firms tend to *use less debt* than stable growth firms. As firms mature, their debt capacity increases. The question whether the debt ratio for a firm should be moved towards its optimal cannot be answered without looking at the incumbent managers' power, relative to their stockholders, and their views about debt. If managers are willing to change their debt ratios, and stockholders retain some power, it is reasonable to assume that the debt ratio will move to the optimal level in stable growth; if not, it is safer to leave the debt ratio at existing levels.

12.9. ☞: **Net Capital Expenditures, FCFE and Stable Growth**

Assume that you are valuing a high-growth firm with high risk (beta) and large reinvestment needs (high reinvestment rate). You assume the firm will be in stable growth after 5 years, but you leave the risk and reinvestment rate at high growth levels. Will you under value or over value this firm?

a. Under value the firm

b. Over value the firm

Illustration 12.8: Stable Growth Inputs and Transition Period - Disney

We will assume that Disney will be in stable growth after year 10. In its stable growth phase, we will assume the following:

- The beta for the stock will drop to one, reflecting Disney's status as a mature company. This will lower the cost of equity for the firm to 8.82%.

  Cost of Equity = Riskfree Rate + Beta * Risk Premium = 4% + 4.82% = 8.82%

- The debt ratio for Disney will rise to 30%. This is the optimal we computed for Disney in chapter 8 and we are assuming that investor pressure will be the impetus for this change. Since we assume that the cost of debt remains unchanged at 5.25%, this will result in a cost of capital of 7.16%

  Cost of capital = 8.82% (.70) + 5.25% (1-.373) (.30) = 7.16%

- The return on capital for Disney will drop from its high growth period level of 12% to a stable growth return of 10%. This is still higher than the cost of capital of 7.16% but the competitive advantages that Disney has are unlikely to dissipate completely by the end of the 10^{th} year.

- The expected growth rate in stable growth will be 4%. In conjunction with the return on capital of 10%, this yields a stable period reinvestment rate of 40%:

  Reinvestment Rate = Growth Rate / Return on Capital = 4% /10% = 40%

The values of all of these inputs adjust gradually during the transition period, from years 6 to 10, from high growth levels to stable growth values.

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[22] As a rule of thumb, betas above 1.2 or below 0.8 are inconsistent with stable growth firms. Two-thirds of all US firms have betas that fall within this range.

c. From Operating Asset Value to Firm Value

The operating income is the income from operating assets, and the cost of capital measures the cost of financing these assets. When the operating cash flows are discounted to the present, we value the operating assets of the firm. Firms, however, often have significant amounts of cash and marketable securities on their books. The value of these assets should be added to the value of the operating assets to arrive at firm value.

Cash and marketable securities can easily be incorporated into firm value, whereas other non-operating assets are more difficult to value. Consider, for instance, minority holdings in other firms and subsidiaries, where income statements are not consolidated[23]. If we consider only the reported income[24] from these holdings, we will miss a significant portion of the value of the holdings. The most accurate way to incorporate these holdings into firm value is to value each subsidiary or firm in which there are holdings and assign a proportional share of this value to the firm. If a firm owns more than 50% of a subsidiary, accounting standards in the U.S. require that the firm fully consolidate the income and assets of the subsidiary into its own. The portion of the equity that does not belong to the firm is shown as minority interest on the balance sheet and should be subtracted out to get to the value of the equity in the firm.[25]

There is one final asset to consider. Firms with defined pension liabilities sometimes accumulate pension fund assets in excess of these liabilities. While the excess does belong to the owners of the firm, they face a tax liability if they claim it. The conservative rule would be to assume that the social and tax costs of reclaiming the excess pension funds are so large that few firms would ever even attempt to do it.

Illustration 12.9: Value of Non-Operating Assets at Disney

At the end of 2003, Disney reported holding $1,583 million in cash and marketable securities. In addition, Disney reported a book value of $1.849 million for

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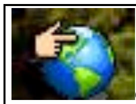
[23] When income statements are consolidated, the entire operating income of the subsidiary is shown in the income statement of the parent firm. Firms do not have to prepare consolidated financial statements if they hold minority stakes in firms and take a passive role in their management.

[24] When firms hold minority, passive interests in other firms, they report only the portion of the dividends they receive from these investments.

[25] Optimally, we would like to subtract out the market value of the minority interests rather than the book value which is reported in the balance sheet.

minority investments in other companies, primarily in non-US Disney theme parks.[26] In the absence of detailed financial statements for these investments, we will assume that the book value is roughly equal to the market value. Note that we consider the rest of the assets on Disney's balance sheet including the $6.2 billion it shows in capitalized television and film costs and $19.7 billion it shows in goodwill and intangibles to be operating assets that we have already captured in the cashflows.[27]

Finally, Disney consolidates its holdings in a few subsidiaries where it owns less than 100%. The portion of the equity in these subsidiaries that does not belong to Disney is shown on the balance sheet as a liability (minority interests) of $428 million. As with its holdings in other companies, we will assume that this is also the estimated market value and subtract it from firm value to arrive at the value of equity in Disney.



cash.xls: There is a dataset on the web that summarizes the value of cash and marketable securities by industry group in the United States for the most recent quarter.

d. From Firm Value to Equity Value

The general rule that you should use is that the debt you subtract from the value of the firm should be at least equal to the debt that you use to compute the cost of capital. Thus, if you decide to convert operating leases to debt to compute the cost of capital, you should subtract out the debt value of operating leases from the value of operating assets to estimate the value of equity. If the firm you are valuing has preferred stock, you would use the market value of the stock (if it is traded) or estimate a market value[28] (if it is not) and deduct it from firm value to get to the value of common equity.

There may be other claims on the firm that do not show up in debt for purposes of computing cost of capital but that you should subtract out from firm value.

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[26] Disney owns 39% of Euro Disney and 43% of the proposed Hong Kong Disney park. It also owns 37.5% of the A&E network and 39.6% of E! Television.

[27] Adding these on to the present value of the cashflows would represent double counting.

[28] Estimating market value for preferred stock is relatively simple. Preferred stock generally is perpetual and the estimated market value of the preferred stock is therefore:

$$\text{Value of preferred stock} = \frac{\text{Preferred Dividend}}{\text{Cost of preferred stock}}$$

The cost of preferred stock should be higher than the pre-tax cost of debt, since debt has a prior claim on the cash flows and assets of the firm.

- *Expected liabilities on lawsuits*: You could be analyzing a firm that is the defendant in a lawsuit, where it potentially could have to pay tens of millions of dollars in damages. You should estimate the probability that this will occur and use this probability to estimate the expected liability. Thus, if there is a 10% chance that you could lose a case that you are defending and the expected damage award is $1 billion, you would reduce the value of the firm by $100 million (probability * expected damages). If the expected liability is not expected to occur until several years from now, you would compute the present value of the payment.
- *Unfunded Pension and Health Care Obligations*: If a firm has significantly under funded a pension or a health plan, it will need to set aside cash in future years to meet these obligations. While it would not be considered debt for cost of capital purposes, it should be subtracted from firm value to arrive at equity value.
- *Deferred Tax Liability*: The deferred tax liability that shows up on the financial statements of many firms reflects the fact that firms often use strategies that reduce their taxes in the current year while increasing their taxes in the future years. Of the three items listed here, this one is the least clearly defined, since it is not clear when or even whether the obligation will come due. Ignoring it, though, may be foolhardy, since the firm could find itself making these tax payments in the future. The most sensible way of dealing with this item is to consider it an obligation, but one that will come due only when the firm's growth rate moderates. Thus, if you expect your firm to be in stable growth in 10 years, you would discount the deferred tax liability back ten years and deduct this amount from the firm value to get to equity value.

e. From Equity Value to Equity Value per share

Once the value of the firm, inclusive of non-operating assets, has been estimated, we generally subtract the value of the outstanding debt to arrive at the value of equity and then divide the value of equity by the number of shares outstanding to estimate the value per share. This approach works only when common stock is the only equity outstanding. When there are warrants and employee options outstanding, the estimated value of these options has to be subtracted from the value of the equity, before we divide by the number of shares outstanding. The same procedure applies when the firm has convertible bonds outstanding, since these conversion options represent claims on equity, as well.

While the approach described above will provide the precise value, there are two short cuts available. One is to divide the value of equity by the fully diluted[29] number of shares outstanding rather than by the actual number. This approach will underestimate the value of the equity, because it fails to consider the cash proceeds from option exercise. The other shortcut, which is called the *treasury stock approach*, adds the expected proceeds from the exercise of the options (exercise price multiplied by the number of options outstanding) to the numerator before dividing by the number of shares outstanding. While this approach will yield a more reasonable estimate than the first one, it does not include the time value of the options outstanding. Thus, it tends to overstate the value of the common stock.

warrants.xls: This spreadsheet allows you to value the options outstanding in a firm, allowing for the dilution effect.

Illustration 12.10: Value of Equity Options

Disney has granted considerable numbers of options to its managers. At the end of 2003, there were 219 million options outstanding, with a weighted average exercise price of \$26.44 and weighted average life of 6 years. Using the current stock price of \$26.91, an estimated standard deviation[30] of 40, a dividend yield of 1.21%. a riskfree rate of 4% and an option pricing model, we estimate the value of these equity options to \$2.129 billion.[31] The value we have estimated for the options above are probably too high, since we assume that all the options are exercisable. In fact, a significant proportion of these options (about 50%) are not vested[32] yet, and this fact will reduce their estimated value. We will also assume that these options, when exercised, will generate a tax benefit to the firm equal to 37.3% of their value:

After-tax value of equity options = 2129 (1-.373) = \$1334.67 million

[29] We assume that all options will be exercised, and compute the number of shares that will be outstanding in that event.

[30] We used the historical standard deviation in Boeing's stock price to estimate this number.

[31] The option pricing model used is the Black-Scholes model. It is described in more detail in the appendix.

[32] When options are not vested, they cannot be exercised. Firms, when providing options to their employees, firms often require that they continue as employees for a set period before they can exercise these options.

Reconciling Equity and Firm Valuations

This model, unlike the dividend discount model or the FCFE model, values the firm rather than equity. The value of equity, however, can be extracted from the value of the firm by subtracting out the market value of outstanding debt. Since this model can be viewed as an alternative way of valuing equity, two questions arise - Why value the firm rather than equity? Will the values for equity obtained from the firm valuation approach be consistent with the values obtained from the equity valuation approaches described in the previous chapter?

The advantage of using the firm valuation approach is that cashflows relating to debt do not have to be considered explicitly, since the FCFF is a pre-debt cashflow, while they have to be taken into account in estimating FCFE. In cases where the leverage is expected to change significantly over time, this is a significant saving, since estimating new debt issues and debt repayments when leverage is changing can become increasingly messy the further into the future you go. The firm valuation approach does, however, require information about debt ratios and interest rates to estimate the weighted average cost of capital.

<u>The value for equity obtained from the firm valuation and equity valuation approaches will be the same if you make consistent assumptions about financial leverage.</u> Getting them to converge in practice is much more difficult. Let us begin with the simplest case – a no-growth, perpetual firm. Assume that the firm has \$166.67 million in earnings before interest and taxes and a tax rate of 40%. Assume that the firm has equity with a market value of \$600 million, with a cost of equity of 13.87%, and debt of \$400 million, with a pre-tax cost of debt of 7%. The firm's cost of capital can be estimated:

$$\text{Cost of capital} = (13.87\%)\left(\frac{600}{1000}\right) + (7\%)(1 - 0.4)\left(\frac{400}{1000}\right) = 10\%$$

$$\text{Value of the firm} = \frac{\text{EBIT}(1 - t)}{\text{Cost of capital}} = \frac{166.67(1 - 0.4)}{0.10} = \$1{,}000$$

Note that the firm has no reinvestment and no growth. We can value equity in this firm by subtracting out the value of debt.

Value of equity = Value of firm – Value of debt = \$ 1,000 - \$400 = \$ 600 million

Now let us value the equity directly by estimating the net income:

Net Income = (EBIT – Pre-tax cost of debt * Debt) (1-t) = (166.67 - 0.07*400) (1-0.4) = 83.202 million

The value of equity can be obtained by discounting this net income at the cost of equity:

$$\text{Value of equity} = \frac{\text{Net Income}}{\text{Cost of equity}} = \frac{83.202}{0.1387} = \$\,600\text{ million}$$

Even this simple example works because of the following assumptions that we made implicitly or explicitly during the valuation.

1. The values for debt and equity used to compute the cost of capital were equal to the values that we obtained in the valuation. Notwithstanding the circularity in reasoning – you need the cost of capital to obtain the values in the first place – it indicates that a cost of capital based upon market value weights will not yield the same value for equity as an equity valuation model, if the firm is not fairly priced in the first place.
2. There are no extraordinary or non-operating items that affect net income but not operating income. Thus, to get from operating to net income, all we do is subtract out interest expenses and taxes.
3. The interest expenses are equal to the pre-tax cost of debt multiplied by the market value of debt. If a firm has old debt on its books, with interest expenses that are different from this value, the two approaches will diverge.

If there is expected growth, the potential for inconsistency multiplies. You have to ensure that you borrow enough money to fund new investments to keep your debt ratio at a level consistent with what you are assuming when you compute the cost of capital.

fcffvsfcfe.xls: This spreadsheet allows you to compare the equity values obtained using FCFF and FCFE models.

Illustration 12.11: FCFF Valuation: Disney

To value Disney, we will consider all of the numbers that we have estimated already in this section. Recapping those estimates:

- The operating income in 2003, before taxes and adjusted for operating leases, is \$2,805 million. While this represents a significant come back from the doldrums of 2002, it is still lower than the operating income in the 1990s and results in an after-tax return on capital of only 4.42% (assuming a tax rate of 37.30%).

- For years 1 through 5, we will assume that Disney will be able to raise its return on capital on new investments to 12% and that the reinvestment rate will be 60%. (See illustration 12.6). This will result in an expected growth rate of 7.20% a year.
- For years 1 through 5, we will assume that Disney will maintain its existing debt ratio of 21% and its current cost of capital of 8.59% (see illustration 12.7).
- The assumptions for stable growth (after year 10) and for the transition period are listed in illustration 12.8.

In table 12.4, we estimate the after-tax operating income, reinvestment and free cashflow to the firm each year for the next 10 years:

Table 12.4: Estimated Free Cashflows to the Firm - Disney

Year	*Expected Growth*	*EBIT*	*EBIT (1-t)*	*Reinvestment Rate*	*Reinvestment*	*FCFF*
Current		$2,805				
1	6.38%	$2,984	$1,871	53.18%	$994.92	$876.06
2	6.38%	$3,174	$1,990	53.18%	$1,058.41	$931.96
3	6.38%	$3,377	$2,117	53.18%	$1,125.94	$991.43
4	6.38%	$3,592	$2,252	53.18%	$1,197.79	$1,054.70
5	6.38%	$3,822	$2,396	53.18%	$1,274.23	$1,122.00
6	5.90%	$4,047	$2,538	50.54%	$1,282.59	$1,255.13
7	5.43%	$4,267	$2,675	47.91%	$1,281.71	$1,393.77
8	4.95%	$4,478	$2,808	45.27%	$1,271.19	$1,536.80
9	4.48%	$4,679	$2,934	42.64%	$1,250.78	$1,682.90
10	4.00%	$4,866	$3,051	40.00%	$1,220.41	$1,830.62

In table 12.5, we estimate the present value of the free cashflows to the firm using the cost of capital Since the beta and debt ratio change each year from year 6 to 10, the cost of capital also changes each year.

Table 12.5: Present Value of Free Cashflows to Firm – Disney

Year	*Cost of capital*	*FCFF*	*PV of FCFF*
1	8.59%	$876.06	$806.74
2	8.59%	$931.96	$790.31
3	8.59%	$991.43	$774.21
4	8.59%	$1,054.70	$758.45
5	8.59%	$1,122.00	$743.00
6	8.31%	$1,255.13	$767.42
7	8.02%	$1,393.77	$788.91
8	7.73%	$1,536.80	$807.42
9	7.45%	$1,682.90	$822.90

10	7.16%	$1,830.62	$835.31
PV of cashflows during high growth =			$7,894.66

To compute the present value of the cashflows in years 6 through 10, we have to use the compounded cost of capital over the previous years. To illustrate, the present value of $1536.80 million in cashflows in year 8 is:

$$\text{Present value of cashflow in year 8} = \frac{1536.80}{(1.0859)^5(1.0831)(1.0802)(1.0773)}$$

The final piece of the valuation is the terminal value. To estimate the terminal value, at the end of year 10, we estimate the free cashflow to the firm in year 11:

$FCFF_{11} = EBIT_{11}$ (1-t) (1- Reinvestment $Rate_{Stable\ Growth}$)/

= 4866 (1.04) (1-.40) = $1,903.84 million

Terminal Value = $FCFF_{11}$/ (Cost of $capital_{Stable\ Growth}$ – g)

= 1903.84/ (.0716 - .04) = $60,219.11 million

The value of the firm is the sum of the present values of the cashflows during the high growth period, the present value of the terminal value and the value of the non-operating assets that we estimated in illustration 12.9.

PV of cashflows during the high growth phase =$ 7,894.66

$$\text{PV of terminal value} = \frac{60{,}219.11}{(1.0859)^5(1.0831)(1.0802)(1.0773)(1.0745)(1.0716)} = \$\ 27{,}477.81$$

+ Cash and Marketable Securities =$ 1,583.00

+ Non-operating Assets (Holdings in other companies) =$ 1,849.00

Value of the firm =$ 38,804.48

Subtracting out the market value of debt (including operating leases) of $14,668.22 million and the value of the equity options (estimated to be worth $1,334.67 million in illustration 12.10) yields the value of the common stock:

Value of equity in common stock = Value of firm – Debt – Equity Options

= $38,804.48 - $14,668.22 - $1334.67 = $ 22,801.59

Dividing by the number of shares outstanding (2047.60 million), we arrive at a value per share o $11.14, well below the market price of $ 26.91 at the time of this valuation.

12.10. ☞: **Net Capital Expenditures and Value**

In the valuation above, we assumed that the reinvestment rate would be 40% in perpetuity to sustain the 4% stable growth rate. What would the terminal value have been if, instead, we had assumed that the reinvestment rate was zero, while continuing to use a stable growth rate of 4%?

In Practice: Adjusted Present Value (APV)

In chapter 8, we presented the adjusted present value approach to estimate the optimal debt ratio for a firm. In that approach, we begin with the value of the firm without debt. As we add debt to the firm, we consider the net effect on value by considering both the benefits and the costs of borrowing. To do this, we assume that the primary benefit of borrowing is a tax benefit and that the most significant cost of borrowing is the added risk of bankruptcy.

The first step in this approach is the estimation of the value of the unlevered firm. This can be accomplished by valuing the firm as if it had no debt, i.e., by discounting the expected free cash flow to the firm at the unlevered cost of equity. In the special case where cash flows grow at a constant rate in perpetuity, the value of the firm is easily computed.

$$\text{Value of Unlevered Firm} = \frac{\text{FCFF}_o(1+\text{g})}{\rho_u - \text{g}}$$

where $FCFF_0$ is the current after-tax operating cash flow to the firm, ρ_u is the unlevered cost of equity and g is the expected growth rate. In the more general case, you can value the firm using any set of growth assumptions you believe are reasonable for the firm.

The second step in this approach is the calculation of the expected tax benefit from a given level of debt. This tax benefit is a function of the tax rate of the firm and is discounted at the cost of debt to reflect the riskiness of this cash flow. If the tax savings are viewed as a perpetuity,

$$\begin{aligned} &= \frac{(\text{Tax Rate})(\text{Cost of Debt})(\text{Debt})}{\text{Cost of Debt}} \\ \text{Value of Tax Benefits} &= (\text{Tax Rate})(\text{Debt}) \\ &= t_c D \end{aligned}$$

The tax rate used here is the firm's marginal tax rate and it is assumed to stay constant over time. If we anticipate the tax rate changing over time, we can still compute the present value of tax benefits over time, but we cannot use the perpetual growth equation cited above.

The third step is to evaluate the effect of the given level of debt on the default risk of the firm and on expected bankruptcy costs. In theory, at least, this requires the estimation of the probability of default with the additional debt and the direct and indirect cost of bankruptcy. If π_a is the probability of default after the additional debt and BC is the present value of the bankruptcy cost, the present value of expected bankruptcy cost can be estimated.

$$\text{PV of Expected Bankruptcy cost} \begin{aligned} &= (\text{Probability of Bankruptcy})(\text{PV of Bankruptcy Cost}) \\ &= \pi_a BC \end{aligned}$$

This step of the adjusted present value approach poses the most significant estimation problem, since neither the probability of bankruptcy nor the bankruptcy cost can be estimated directly.

In theory, the APV approach and the cost of capital approach will yield the same values for a firm if consistent assumptions are made about financial leverage. The difficulties associated with estimating the expected bankruptcy cost, though, often lead many to use an abbreviated version of the APV model, where the tax benefits are added to the unlevered firm value and bankruptcy costs are ignored. This approach will over value firms.

Valuing Private Businesses

All of the principles that we have developed for valuation apply to private companies as well. In other words, the value of a private company is the present value of the expected cashflows that you would expect that company to generate over time, discounted back at a rate that reflects the riskiness of the cashflows. The differences that exist are primarily in the estimation of the cashflows and the discount rates:

- When estimating cashflows, we should keep in mind that while accounting standards may not be adhered to consistently in publicly traded firms, they can diverge dramatically in private firms. In small, private businesses, we should reconstruct financial statements rather than trust the earnings numbers that are reported. There are also two common problems that arise in private firm accounting that we have to correct for. The first is the failure on the part of many owners to attach a cost to the time that they spend running their businesses. Thus, the owner of a store who spends most of every day stocking the store shelves, manning the cash register and completing the accounting will often not show a salary associated with these activities in her income statement, resulting in overstated earnings. The second is the intermingling of personal and business expenses that is endemic in many private businesses. When re-estimating earnings, we have to strip the personal expenses out of the analysis.

- When estimating discount rates for publicly traded firms, we hewed to two basic principles. With equity, we argued that the only risk that matters is the risk that cannot be diversified away by marginal investors, who we assumed were well diversified. With debt, the cost of debt was based upon a bond rating and the default spread associated with that rating. With private firms, both these assumptions will come under assault. First, the owner of a private business is almost never diversified and has his or her entire wealth often tied up in the firm's assets. That is why we developed the concept of a total beta for private firms in chapter 4, where we scaled the beta of the firm up to reflect all risk and not just non-diversifiable risk. Second, private businesses usually have to borrow from the local bank and do not have the luxury of accessing the bond market. Consequently, they may well find themselves facing a higher cost of debt than otherwise similar publicly traded firms.
- The final issue relates back to terminal value. With publicly traded firms, we assume that firms have infinite lives and use this assumption, in conjunction with stable growth, to estimate a terminal value. Private businesses, especially smaller ones, often have finite lives since they are much more dependent upon the owner/founder for their existence.

With more conservative estimates of cashflows, higher discount rates to reflect the exposure to total risk and finite life assumptions, it should come as no surprise that the values we attach to private firms are lower than those that we would attach to otherwise similar publicly traded firms. This also suggests that private firms that have the option of becoming publicly traded will generally succumb to that temptation even though the owners might not like the oversight and loss of control that comes with this transition.

Illustration 12.12: Valuing a Private Business: Bookscape

To value Bookscape, we will use the operating income of $2 million that the firm had in its most recent year as a starting point. Adjusting for the operating lease commitments that the firm has, we arrive at an adjusted operating income of $2,368.88 million.[33] To estimate the cost of capital, we draw on the estimates of total beta and the assumption that the firm's debt to capital ratio would resemble the industry average of 16.90% that we made in chapter 4 (see illustration 4.16):

Cost of capital = Cost of equity (D/(D+E)) + After-tax cost of debt (D/(D+E))

= 13.93% (.831) + 5.50% (1-.4) (.169) = .1214 or 12.14%

The total beta for Bookscape is 2.06 and we will continue to use the 40% tax rate for the firm.

In chapter 5, we estimated a return on capital for Bookscape of 12.68% and we will assume that the firm will continue to generate this return on capital for the next 40 years, while growing its earnings at 4% a year. The resulting reinvestment rate is 31.54%:

Reinvestment rate = Growth rate/ Return on capital = 4%/12.68% = 31.54%

The present value of the cashflows, assuming perpetual growth, can be computed as follows:

Value of operating assets = 2,368.88 (1-.40)(1-.3154)/(.1214-.04)	= $12.483 million
Value of cash holdings	= $ 2.500 million
Value of the firm	= $ 14.939 million
- Value of debt (operating leases)	= $ 6.707 million
Value of equity	= $ 8.231 million

If we wanted to be conservative, and assume that the cashflows will continue for only 40 years, the value of the operating assets drops marginally to $12.3 million.

In Practice: Illiquidity Discounts in Private Firm Valuation

[33] In illustration 4.15, we estimated the present value of the operating lease commitments at Bookscape to be $6.7 million. To adjust the operating income, we add back the imputed interest expense on this debt,

If you buy stock in a publicly traded firm and change your mind and decide to sell, you face modest transactions costs. If you buy a private business and change your mind, it is far more difficult to reverse your decision. As a consequence, many analysts valuing private businesses apply an illiquidity discount that ranges from 20 to 40% of the value to arrive at a final value. While the size of the discount is large, there is surprisingly little thought that seems to go into the magnitude of the discount. In fact, it is almost entirely based on studies of restricted stock issued by publicly traded firms. These stock are placed with investors who are restricted from trading on the stock for 2 years after the issue and the price on the issue can be compared to the market price of the traded shares of the company to get a sense of the discount that investors demand for the enforced illiquidity. Since there are relatively few restricted stock issues, the sample sizes tend to be small and involve companies that may have other problems raising fresh funds.

While we concede the necessity of an illiquidity discounts in the valuation of private businesses, the discount should be adjusted to reflect the characteristics of the firm in question, Other things remaining equal, we would expect smaller firms with less liquid assets and in poorer financial health to have much larger illiquidity discounts attached to their values. One way to make this adjustment is to take a deeper look at the restricted stock issues for which we have data and look at reasons for the differences in discounts across stocks.[34] Another way is to view the bid-ask spread as the illiquidity discount on publicly traded companies and extend an analysis of the determinants of bid-ask spreads to come up with a reasonable measure of the bid-ask spread or illiquidity discount of a private business.[35]

Value Enhancement

In a discounted cashflow valuation, the value of a firm is the function of four key inputs – the cashflows from existing investments, the expected growth rate in these cashflows for the high growth period, the length of time before the company becomes a

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obtained by multiplying the pre-tax cost of borrowing (5.5%) by the present value of the operating leases (6.7 m))

[34] Silber did this in a 1989 study, where he found that the discount tended to be larger for companies with smaller revenues and negative earnings.

[35] See Investment Valuation (John Wiley and Sons) for more details.

stable growth company and the cost of capital. Put simply, to enhance the value of a firm, we have to change one or more of these inputs:

a. *Increase cashflows from existing assets*: There are a number of ways in which we can increase cashflows from assets. First, we can use assets more efficiently, cutting costs and improving productivity. If we succeed, we should see higher operating margins and profits. Second, we can, within the bounds of the law, reduce the taxes we pay on operating income through good tax planning. Third, we can reduce maintenance capital expenditures and investments in working capital – inventory and accounts receivable – thus increasing the cash left over after these outflows.
b. *Increase the growth rate during the high growth period*: Within the structure that we used in the last section, there are only two ways of increasing growth. We can reinvest more in internal investments and acquisitions or we can try to earn higher returns on the capital that we invest in new investments. To the extent that we can do both, we can increase the expected growth rate. One point to keep in mind, though, is that increasing the reinvestment rate will almost always increase the growth rate but it will not increase value, if the return on capital on new investments lags the cost of capital.
c. *Increase the length of the high growth period*: It is not growth per se that creates value but excess returns. Since excess returns and the capacity to continue earning them comes from the competitive advantages possessed by a firm, a firm has to either create new competitive advantages – brand name, economies of scale and legal restrictions on competition all come to mind – or augment existing ones.
d. *Reduce the cost of capital*: In chapter 8, we considered how changing the mix of debt and equity may reduce the cost of capital, and in chapter 9, we considered how matching your debt to your assets can reduce your default risk and reduce your overall cost of financing. Holding all else constant, reducing the cost of capital will increase firm value.

Which one of these four approaches you choose will depend upon where the firm you are analyzing or advising is in its growth cycle. For large mature firms, with little or no growth potential, it is cashflows from existing assets and the cost of capital that offer the most promise for value enhancement. For smaller, risky, high growth firms, it is likely to be changing the growth rate and the growth period that generate the biggest increases in value.

Illustration 12.13: Value Enhancement at Disney

In illustration 12.11, we valued Disney at $11.14 a share. In the process, though, we assumed that there would be no significant improvement in the return on capital that Disney earns on its existing assets, which at 4.42% is well below the cost of capital of 8.59%. To examine how much the value per share could be enhanced at Disney if it were run differently, we made the following changes:

- We assumed that the current after-tax operating income would increase to $3,417 million, which would be 8.59% of the book value of capital. This, in effect, would ensure that existing investments do not destroy value.
- We also assumed that the return on capital on new investments would increase to 15% from the 12% used in the status quo valuation. This is closer to the return that Disney used to make prior to its acquisition of Capital Cities. We kept the reinvestment rate unchanged at 53.18%. The resulting growth rate in operating income (for the first 5 years) is 7.98% a year.
- We assumed that the firm would increase its debt ratio immediately to 30%, which is its current optimal debt ratio (from chapter 8). As a result the cost of capital will drop to 8.40%.

Keeping the assumptions about stable growth unchanged, we estimate significantly higher cashflows for the firm for the high growth period in table 12.6.

Table 12.6: Expected Free Cashflows to the Firm- Disney

Year	*Expected Growth*	*EBIT*	*EBIT (1-t)*	*Reinvestment Rate*	*Reinvestment*	*FCFF*	*Cost of capital*	*PV of FCFF*
Current		$5,327						
1	7.98%	$5,752	$3,606	53.18%	$1,918	$1,688	8.40%	$1,558
2	7.98%	$6,211	$3,894	53.18%	$2,071	$1,823	8.40%	$1,551
3	7.98%	$6,706	$4,205	53.18%	$2,236	$1,969	8.40%	$1,545
4	7.98%	$7,241	$4,540	53.18%	$2,414	$2,126	8.40%	$1,539
5	7.98%	$7,819	$4,902	53.18%	$2,607	$2,295	8.40%	$1,533
6	7.18%	$8,380	$5,254	50.54%	$2,656	$2,599	8.16%	$1,605
7	6.39%	$8,915	$5,590	47.91%	$2,678	$2,912	7.91%	$1,667
8	5.59%	$9,414	$5,902	45.27%	$2,672	$3,230	7.66%	$1,717

9	4.80%	$9,865	$6,185	42.64%	$2,637	$3,548	7.41%	$1,756
10	4.00%	$10,260	$6,433	40.00%	$2,573	$3,860	7.16%	$1,783

The terminal value is also pushed up, as a result of the higher growth in the high growth period:

Terminal value = $FCFF_{11}$/(Cost of capital – g) = 6433 (1.04)/(.0716-.04) = $126,967 mil

The value of the firm and the value per share can now be estimated:

Present Value of FCFF in high growth phase =	$16,254.91
+ Present Value of Terminal Value of Firm =	$58,645.39
+ Value of Cash, Marketable Securities & Non-operating assets =	$3,432.00
Value of Firm =	$78,332.30
- Market Value of outstanding debt =	$14,648.80
- Value of Equity in Options =	$1,334.67
Value of Equity in Common Stock =	$62,348.84
Market Value of Equity/share =	$30.45

Disney's value per share increases from $11.14 per share in illustration 12.11 to $30.45 a share, when we make the changes to the way it is managed.[36]

In Practice: The Value of Control

The notion that control is worth 15% or 20% or some fixed percent of every firm's value is deeply embedded in valuation practice and it is not true. The value of control is the difference between two values – the value of the firm run by its existing management (status quo) and the value of the same firm run optimally.

Value of control = Optimal value for firm – Status quo value

Thus, a firm that takes poor investments and funds them with a sub-optimal mix of debt and equity will be worth more if it takes better investments and funds them with the right mix of debt and equity. In general, the worse managed a firm is the greater the value of control. This view of the world has wide ramifications in corporate finance and valuation:

- In a hostile acquisition, which is usually motivated by the desire to change the way that a firm is run, you should be willing to pay a premium that at best is equal to the

[36] You may wonder why the dollar debt does not change even though the firm is moving to a 30% debt raito. In reality, it will increase but the number of shares will decrease when Disney recapitalizes. The net effect is that the value per share will be close to our estimated value.

value of control. You would rather pay less, to preserve some of the benefits for yourself (rather than give them to target company stockholders).

- In companies with voting and non-voting shares, the difference in value should be a function of the value of control. If the value of control is high and there is a high likelihood of control changing, the value of the voting shares will increase relative to non-voting shares.

In the Disney valuation above, the value of control can be estimated by comparing the value of Disney, run optimally, with the status quo valuation done earlier in the chapter.

Value of control$_{\text{Disney}}$ = Optimal value – Status quo value = \$30.45 - \$11.14 = \$19.31

The fact that Disney trades at \$26.91 can be an indication that the market thinks that there will be significant changes in the way the firm is run in the near future, though it is unclear whether these changes will occur voluntarily or through hostile actions.

Relative Valuation

In discounted cash flow valuation, the objective is to find the value of assets, given their cash flow, growth and risk characteristics. In relative valuation, the objective is to value assets, based upon how similar assets are currently priced in the market. In this section, we consider why and how asset prices have to be standardized before being compared to similar assets, and how to control for differences across comparable firms.

Standardized Values and Multiples

To compare the values of "similar" assets in the market, we need to standardize the values in some way. They can be standardized relative to the earnings they generate, to the book value or replacement value of the assets themselves, or to the revenues that they generate. We discuss each method next.

1. Earnings Multiples

One of the more intuitive ways to think of the value of any asset is as a multiple of the earnings it generates. When buying a stock, it is common to look at the price paid as a multiple of the earnings per share generated by the company. This **price/earnings ratio** can be estimated using current earnings per share, which is called a **trailing PE**, or an expected earnings per share in the next year, called a **forward PE**. When buying a business, as opposed to just the equity in the business, it is common to examine the value of the firm as a multiple of the operating income or the earnings before interest, taxes, depreciation and amortization (EBITDA). While, as a buyer of the equity or the firm, a lower multiple is better than a higher one, these multiples will be affected by the growth potential and risk of the business being acquired.

2. Book Value or Replacement Value Multiples

While markets provide one estimate of the value of a business, accountants often provide a very different estimate of the same business. The accounting estimate of book value is determined by accounting rules and is heavily influenced by the original price paid for the asset and any accounting adjustments (such as depreciation) made since. Investors often look at the relationship between the price they pay for a stock and the book value of equity (or net worth) as a measure of how over- or undervalued a stock is; the **price/book value** ratio that emerges can vary widely across industries, depending again upon the growth potential and the quality of the investments in each. When valuing businesses, we estimate this ratio using the value of the firm and the book value of all assets (rather than just the equity). For those who believe that book value is not a good measure of the true value of the assets, an alternative is to use the replacement cost of the assets; the ratio of the value of the firm to replacement cost is called[37].

3. Revenue Multiples

Both earnings and book value are accounting measures and are determined by accounting rules and principles. An alternative approach, which is far less affected by these factors, is to use the ratio of the value of an asset to the revenues it generates. For equity investors, this ratio is the **price/sales ratio (PS)**, where the market value per share is divided by the revenues generated per share. For firm value, this ratio can be modified as the **value/sales ratio (VS)**, where the numerator becomes the total value of the firm. This ratio, again, varies widely across sectors, largely as a function of the profit margins in each. The advantage of using revenue multiples, however, is that it becomes far easier

[37] See Chung and Pruitt for a simple approximation of Tobin's Q.

to compare firms in different markets, with different accounting systems at work, than it is to compare earnings or book value multiples.

Determinants of Multiples

One reason commonly given for the use of these multiples to value equity and firms is that they require far fewer assumptions than does discounted cash flow valuation. We believe this is a misconception. The difference between discounted cash flow valuation and relative valuation is that the assumptions we make are explicit in the former and remain implicit in the latter. It is important that we know what the variables are that cause multiples to change, since these are the variables we have to control for when comparing these multiples across firms.

To look under the hood, so to speak, of equity and firm value multiples, we will go back to fairly simple discounted cash flow models for equity and firm value and use them to derive our multiples. Thus, the simplest discounted cash flow model for equity, which is a stable growth dividend discount model, would suggest that the value of equity is:

$$\text{Value of Equity} = P_0 = \frac{DPS_1}{k_e - g_n}$$

where DPS_1 is the expected dividend in the next year, k_e is the cost of equity and g_n is the expected stable growth rate. Dividing both sides by the earnings, we obtain the discounted cash flow equation specifying the PE ratio for a stable growth firm:

$$\frac{P_0}{EPS_0} = PE = \frac{\text{Payout Ratio} * (1 + g_n)}{k_e - g_n}$$

Dividing both sides by the book value of equity, we can estimate the price/book value ratio for a stable growth firm:

$$\frac{P_0}{BV_0} = PBV = \frac{ROE * \text{Payout Ratio} * (1 + g_n)}{k_e - g_n}$$

where ROE is the return on equity. Dividing by the Sales per share, the price/sales ratio for a stable growth firm can be estimated as a function of its profit margin, payout ratio, profit margin, and expected growth.

$$\frac{P_0}{Sales_0} = PS = \frac{\text{Net Profit Margin} * \text{Payout Ratio} * (1 + g_n)}{k_e - g_n}$$

We can do a similar analysis from the perspective of firm valuation[38]. The value of a firm in stable growth can be written as:

$$\text{Value of Firm} = V_0 = \frac{FCFF_1}{k_c - g_n}$$

Dividing both sides by the expected free cash flow to the firm yields the Value/FCFF multiple for a stable growth firm:

$$\frac{V_0}{FCFF_1} = \frac{1}{k_c - g_n}$$

Since the free cash flow the firm is the after-tax operating income netted against the net capital expenditures and working capital needs of the firm, the multiples of EBIT, after-tax EBIT and EBITDA can also be estimated similarly. The value/EBITDA multiple, for instance, can be written as follows:

$$\frac{\text{Value}}{\text{EBITDA}} = \frac{(1 - t)}{k_c - g} + \frac{\text{Depr (t)/EBITDA}}{k_c - g} - \frac{\text{CEx/EBITDA}}{k_c - g} - \frac{\Delta \text{ Working Capital/EBITDA}}{k_c - g}$$

The point of this analysis is not to suggest that we go back to using discounted cash flow valuation but to understand the variables that may cause these multiples to vary across firms in the same sector. If we ignore these variables, we might conclude that a stock with a PE of 8 is cheaper than one with a PE of 12, when the true reason may be that the latter has higher expected growth or we might decide that a stock with a P/BV ratio of 0.7 is cheaper than one with a P/BV ratio of 1.5, when the true reason may be that the latter has a much higher return on equity. Table 12.7 lists the multiples that are widely used and the variables that determine each; the variable that, in our view, is the most significant determinant is highlighted for each multiple. This variable is what we would call the *companion variable* for this multiple, i.e., the one variable we need to know in order to use this multiple to find under or over valued assets.

[38] In practice, cash and marketable securities are subtracted from firm value to arrive at what is called enterprise value. All the multiples in the following section can be written in terms of enterprise value, and the determinants remain unchanged.

Table 12.7: Multiples and Companion Variables (in italics)

Multiple	*Determining Variables*
Price/Earnings Ratio	*Growth*, Payout, Risk
Price/Book Value Ratio	Growth, Payout, Risk, *ROE*
Price/Sales Ratio	Growth, Payout, Risk, *Net Margin*
Value/EBIT Value/EBIT (1-t) Value/EBITDA	Growth, *Net Capital Expenditure needs*, Leverage, Risk
Value/Sales	Growth, Net Capital Expenditure needs, Leverage, Risk, *Operating Margin*
Value/Book Capital	Growth, Leverage, Risk and *ROC*

eqmult.xls: This spreadsheet allows you to estimate the equity multiples for a firm, given its fundamentals.

firmmult.xls: This spreadsheet allows you to estimate the firm value multiples for a firm, given its fundamentals.

The Use of Comparable Firms

When we use multiples, we tend to use them in conjunction with "comparable" firms to determine the value of a firm or its equity. This analysis begins with two choices - the multiple that will be used in the analysis and the group of firms that will comprise the comparable firms. The multiple is computed for each of the comparable firms, and the average is computed. To evaluate an individual firm, we then compare its multiple to the average computed; if it is significantly different, we make a subjective judgment about whether the firm's individual characteristics (growth, risk or cash flows) may explain the difference. Thus, a firm may have a PE ratio of 22 in a sector where the average PE is only 15, but the analyst may conclude that this difference can be justified because the firm has higher growth potential than the average firm in the industry. If, in the analysts' judgment, the difference on the multiple cannot be explained by the variables listed in Table 12.7, the firm will be viewed as over valued (if its multiple is higher than the average) or undervalued (if its multiple is lower than the average). Choosing comparable firms, and adequately controlling for differences across these comparable firms, then become critical steps in this process. In this section, we will consider both these decisions.

1. Choosing Comparables

The first step in relative valuation is usually the selection of comparable firms. A comparable firm is one with cash flows, growth potential, and risk similar to the firm being valued. It would be ideal if we could value a firm by looking at how an exactly identical firm - in terms of risk, growth and cash flows - is priced. In most analyses, however, analysts define comparable firms to be other firms in the firm's business or businesses. If there are enough firms in the industry to allow for it, this list is pruned further using other criteria; for instance, only firms of similar size may be considered. The implicit assumption being made here is that firms in the same sector have similar risk, growth, and cash flow profiles and therefore can be compared with much more legitimacy.

This approach becomes more difficult to apply when there are relatively few firms in a sector. In most markets outside the United States, the number of publicly traded firms in a particular sector, especially if it is defined narrowly, is small. It is also difficult to find comparable firms if differences in risk, growth and cash flow profiles across firms within a sector are large. Thus, there may be hundreds of computer software companies listed in the United States, but the differences across these firms are also large. The tradeoff is therefore a simple one. Defining a industry more broadly increases the number of comparable firms, but it also results in a more diverse group.

2. Controlling for Differences across Firms

In Table 12.7, we listed the variables that determined each multiple. Since it is impossible to find firms identical to the one being valued, we have to find ways of controlling for differences across firms on these variables. The process of controlling for the variables can range from very simple approaches, which modify the multiples to take into account differences on one key variable, to more complex approaches that allow for differences on more than one variable.

a. Simple Adjustments

Let us start with the simple approaches. In this case, we modify the multiple to take into account the most important variable determining it. Thus, the PE ratio is divided by the expected growth rate in EPS for a company to determine a growth-adjusted PE ratio or the **PEG ratio**. Similarly, the PBV ratio is divided by the ROE to find a **Value Ratio**, and the price sales ratio is divided by the net margin. These modified ratios are then compared across companies in a sector. The implicit assumption we make is that these firms are comparable on all the other measures of value, besides the one being controlled for.

Illustration 12.14: Comparing PE ratios and growth rates across firms: Entertainment companies

To value Disney, we look at the PE ratios and expected growth rates in EPS over the next 5 years, based on consensus estimates from analysts, for all entertainment companies where data is available on PE ratios and analyst estimates of expected growth in earnings over the next 5 years. Table 12.8 lists the firms and PE ratios.

Table 12.8: Entertainment firms – PE Ratios and Growth Rates – 2004

Company Name	*Ticker Symbol*	*PE*	*Expected Growth Rate*	*PEG*
Point 360	PTSX	10.62	5.00%	2.12
Fox Entmt Group Inc	FOX	22.03	14.46%	1.52
Belo Corp. 'A'	BLC	25.65	16.00%	1.60
Hearst-Argyle Television Inc	HTV	26.72	12.90%	2.07
Journal Communications Inc.	JRN	27.94	10.00%	2.79
Saga Communic. 'A'	SGA	28.42	19.00%	1.50
Viacom Inc. 'B'	VIA/B	29.38	13.50%	2.18
Pixar	PIXR	29.80	16.50%	1.81
Disney (Walt)	DIS	29.87	12.00%	2.49
Westwood One	WON	32.59	19.50%	1.67
World Wrestling Ent.	WWE	33.52	20.00%	1.68
Cox Radio 'A' Inc	CXR	33.76	18.70%	1.81
Beasley Broadcast Group Inc	BBGI	34.06	15.23%	2.24
Entercom Comm. Corp	ETM	36.11	15.43%	2.34
Liberty Corp.	LC	37.54	19.50%	1.92
Ballantyne of Omaha Inc	BTNE	55.17	17.10%	3.23
Regent Communications Inc	RGCI	57.84	22.67%	2.55
Emmis Communications	EMMS	74.89	16.50%	4.54
Cumulus Media Inc	CMLS	94.35	23.30%	4.05

Univision Communic.	UVN	122.76	24.50%	5.01
Salem Communications Corp	SALM	145.67	28.75%	5.07
Average for sector		47.08	17.17%	2.74

Source: Value Line

This simple view of multiples leads us to conclude that Disney should trade at 47.08 times earnings, since that is the average for similar publicly traded firms. The resulting value for the equity would be:

Value of Equity = Disney net income in 2003* Average PE ratio for sector

= $1,267 million * 47.08 = $59,650 million

In this valuation, we assume that Disney has a growth rate similar to the average for the sector. One way of bringing growth into the comparison is to compute the PEG ratio, which is reported in the last column. Based on the average PEG ratio of 2.79 for the sector and the analyst estimate of growth in earnings of 12% for the next 5 years, we obtain the following value for the equity in Disney:

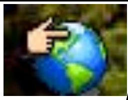
Value of Equity = $ 1,267 million * 2.79 * 12 = $ 41,692 million

While this may seem like an easy adjustment to resolve the problem of differences across firms, the conclusion holds only if these firms are of equivalent risk. Implicitly, this approach assumes a linear relationship[39] between growth rates and PE.

12.11. ☞: **Underlying Assumptions in Comparable Valuation**

Assume that you are reading an equity research report where a buy recommendation for a company is being based upon the fact that its PE ratio is lower than the average for the industry. Implicitly, what is the underlying assumption or assumptions being made by this analyst?

a. The sector itself is, on average, fairly priced
b. The earnings of the firms in the group are being measured consistently
c. The firms in the group are all of equivalent risk
d. The firms in the group are all at the same stage in the growth cycle
e. The firms in the group are of equivalent risk and have similar cash flow patterns
f. All of the above



pe.xls: There is a dataset on the web that summarizes PE ratios and PEG ratios by industry group in the United States for the most recent quarter.

b. Adjusting for more than one variable

When firms differ on more than one variable, it becomes difficult to modify the multiples to account for the differences across firms. We can run regressions of the multiples against the variables and then use these regressions to find predicted values for each firm. This approach works reasonably well when the number of comparable firms is large and the relationship between the multiple and the variables is stable. When these conditions do not hold, a few outliers can cause the coefficients to change dramatically and make the predictions much less reliable.

Illustration 12.15: Price to Book Value Ratios and Return on Equity: European Banks

Table 12.9 lists price/book value ratios of European banks and reports on their returns on equity and risk levels (measured using the standard deviation in stock prices over the previous 5 years):

Table 12.9: European Banks: Price to Book Value Ratio – 2003

Name	*PBV Ratio*	*Return on Equity*	*Standard Deviation*
Bayerische Hypo-Und Vereinsb	0.80	-1.66%	49.06%
Commerzbank Ag	1.09	-6.72%	36.21%
Deutsche Bank Ag -Reg	1.23	1.32%	35.79%
Banca Intesa Spa	1.66	1.56%	34.14%
Bnp Paribas	1.72	12.46%	31.03%
Banco Santander Central Hisp	1.86	11.06%	28.36%
Sanpaolo Imi Spa	1.96	8.55%	26.64%
Banco Bilbao Vizcaya Argenta	1.98	11.17%	18.62%
Societe Generale	2.04	9.71%	22.55%
Royal Bank Of Scotland Group	2.09	20.22%	18.35%
Hbos Plc	2.15	22.45%	21.95%
Barclays Plc	2.23	21.16%	20.73%
Unicredito Italiano Spa	2.30	14.86%	13.79%

[39] Only by assuming a linear relationship can we compare the PEG ratio of a 10% growth firm to a 20% growth firm.

Kredietbank Sa Luxembourgeoi	2.46	17.74%	12.38%
Erste Bank Der Oester Spark	2.53	10.28%	21.91%
Standard Chartered Plc	2.59	20.18%	19.93%
Hsbc Holdings Plc	2.94	18.50%	19.66%
Lloyds Tsb Group Plc	3.33	32.84%	18.66%
Sector Average	2.05	12.54%	24.99%

Source: Bloomberg

Since these firms differ on both risk and return on equity, we run a regression of PBV ratios on both variables:

$$\underset{(5.56)}{PBV = 2.27} \quad + \quad \underset{(3.32)}{3.63\ ROE} \quad \underset{(2.32)}{-2.68\ \text{Standard Deviation}} \qquad R^2 = 79.48\%$$

Firms with higher return on equity and lower standard deviations trade at much higher price to book ratios. The numbers in brackets are t-statistics and suggest that the relationships between PBV ratios and both variables in the regression are statistically significant. The R-squared indicates the percentage of the differences in PBV ratios that is explained by the independent variables. Finally, the regression[40] itself can be used to get predicted PBV ratios for the companies in the list. Thus, the predicted PBV ratio for Deutsche Bank, based upon its return on equity of 1.32% and its standard deviation of 35.79%, would be 1.36.

Predicted $PBV_{\text{Deutsche Bank}}$ = 2.27 + 3.63 (.0132) – 2..68 (.3579) = 1.36

Since the actual PBV ratio for Deutsche Bank at the time of the analysis was 1.23, this would suggest that the stock is undervalued by roughly 10%.

pbv.xls: There is a dataset on the web that summarizes price to book ratios and returns on equity by industry group in the United States for the most recent quarter.

ps.xls: There is a dataset on the web that summarizes price to sales ratios and margins by industry group in the United States for the most recent quarter.

[40] Both approaches described above assume that the relationship between a multiple and the variables driving value are linear. Since this is not always true, we might have to run non-linear versions of these regressions.

3. Expanding the Range of Comparable Firms

Searching for comparable firms within the sector in which a firm operates is fairly restrictive, especially when there are relatively few firms in the sector or when a firm operates in more than one sector. Since the definition of a comparable firm is not one that is in the same business but one that has the same growth, risk and cash flow characteristics as the firm being analyzed, we need not restrict our choice of comparable firms to those in the same industry. A software firm should be comparable to an automobile firm, if we can control for differences in the fundamentals.

The regression introduced in the previous section allows us to control for differences on those variables that we believe cause multiples to vary across firms. Based upon the variables listed in Table 12.7, we should be able to regress PE, PBV and PS ratios against the variables that should affect them:

Price Earnings = f (Growth, Payout ratios, Risk)

Price to Book Value = f (Growth, Payout ratios, Risk, ROE)

Price to Sales = f (Growth, Payout ratios, Risk, Margin)

It is, however, possible that the proxies that we use for risk (beta), growth (expected growth rate), and cash flow (payout) may be imperfect and that the relationship may not be linear. To deal with these limitations, we can add more variables to the regression - e.g., the size of the firm may operate as a good proxy for risk - and use transformations of the variables to allow for non-linear relationships.

We ran these regressions[41] for PE, PBV, and PS ratios across publicly listed firms in the United States in January 2004 against analyst estimates of expected growth in earnings per share and other financial indicators from the most recent year. The sample, which had more than 7000 firms in it, yielded the regressions reported below. These regressions can then be used to get predicted PE, PBV, and PS ratios for each firm, which, in turn, can be compared to the actual multiples to find under and over valued firms.

PE = 9.475 + 0.814 Expected growth + 0.06 Payout + 6.283 Beta (R2 = 22.1%)

PBV= 0.140 ROE + 0.599 Beta + 0.08 Expected Growth +.002 Payout (R2= 47.1%)

PS= 0.04 Expected Growth +0.011 Payout + 0.549 Beta + 0.234 Net Margin (R^2= 71.0%)

The first advantage of this approach over the "subjective" comparison across firms in the same sector, described in the previous section, is that it does quantify, based upon actual market data, the degree to which higher growth or risk should affect the multiples. It is true that these estimates can be noisy, but noise is a reflection of the reality that many analysts choose not to face when they make subjective judgments. Second, by looking at all firms in the market, this approach allows us to make more meaningful comparisons of firms that operate in industries with relatively few firms. Third, it allows us to examine whether all firms in an industry are under- or overvalued, by estimating their values relative to other firms in the market.

Illustration 12.16: Applying Market Regression to Estimate Multiples - Disney

We will use the results of the market regression summarized above to estimate the appropriate value for Disney. Consider the regression for the PE ratio:

PE = 9.475 + 0.814 Expected growth + 0.06 Payout + 6.283 Beta

The corresponding values for Disney are as follows:

Expected Growth rate = 12.00% (Analyst consensus estimate for EPS growth)

Payout Ratio = 32.31%

Beta = 1.2456

The estimated price earnings ratio for Disney is:

PS = 9.475 + 0.814 (12) + 0.06 (32.31) + 6.283 (1.2456) = 29.01

Since Disney trades at an actual PE ratio of 29.87, it is slightly overvalued, relative to the market, by about 3%.

multregr.xls: This dataset summarizes the latest regression of multiples against fundamentals for the United States for the most recent quarter.

[41] We ran the regression using absolute values for the independent variables and both with intercepts and without intercepts. .If the intercept is negative, we have reported the regression without the intercept.

Reconciling Different Valuations

The two approaches to valuation – discounted cash flow valuation and relative valuation – yield different values for Disney[42]. In fact, Disney is significantly overvalued using a discounted cashflow model but is closer to being fairly valued using relative valuation models. Even within relative valuation, we arrive at different estimates of value, depending upon which multiple we use and what firms we based the relative valuation on.

The differences in value between discounted cash flow valuation and relative valuation come from different views of market efficiency, or put more precisely, market inefficiency. In discounted cash flow valuation, we assume that markets make mistakes, that they correct these mistakes over time, and that these mistakes can often occur across entire sectors or even the entire market. In relative valuation, we assume that while markets make mistakes on individual stocks, they are correct on average. In other words, when we value Disney relative to other entertainment companies, we are assuming that the market has priced these companies correctly, on average, even though it might have made mistakes in the pricing of each of them individually. Thus, a stock may be over valued on a discounted cash flow basis but under valued on a relative basis, if the firms used in the relative valuation are all overpriced by the market. The reverse would occur, if an entire sector or market were underpriced.

To conclude, we suggest the following broad guidelines on gauging value using different approaches:

- The discounted cash flow models are built on the implicit assumption of long time horizons, giving markets time to correct their errors.
- When using relative valuation, it is dangerous to base valuations on multiples where the differences across firms cannot be explained well using financial fundamentals – growth, risk, and cash flow patterns. One of the advantages of using the regression approach described in the later part of this chapter is that the R-squared and t-statistics from the regressions yield a tangible estimate of the strength (or weakness) of this relationship.

12.12. ☞: **Valuing an Initial Public Offering**

If you were an investment banker, pricing an initial public offering, would you primarily use discounted cash flow valuation, relative valuation or a combination of the two?

a. Relative valuation, because the buyers of the IPO will look at comparables
b. Discounted cash flow valuation, because it reflects intrinsic value
c. The higher of the two values, since it is my job to get the highest price I can for my client
d. None of the above

Explain.

Conclusion

There are two basic approaches to valuation. The first is discounted cash flow valuation, where the value of any asset is estimated by computing the present value of the expected cash flows on it. The actual process of estimation, in either case, generally requires four inputs –

- the length of the period for which a firm or asset can be expected to generate growth greater than the stable growth rate (which is constrained to be close to the growth rate of the economy in which the firm operates),
- the cash flows during the high growth period,
- the terminal value at the end of the high growth period and
- a discount rate.

The expected growth potential will vary across firms, with some firms already growing at a stable growth rate and others for which the expectation, at least, is that growth will last for some period into the future. We can value the operating assets of a firm by discounting cashflows before debt payments, but after reinvestments, at the cost of capital. Adding the value of cash and non-operating assets give us firm value, and subtracting out debt yields the value of equity. We can also value equity directly by discounting cash flows after debt payments and reinvestment needs at the cost of equity.

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[42] Kaplan and Ruback (1995) examine valuations in acquisitions and find that discounted cash flow models better explain prices paid than relative valuation models.

The other approach to valuation is relative valuation, where the value of any asset is estimated by looking at how "similar" assets are priced in the market. The key steps in this approach are defining "comparable" firms or assets and choosing a standardized measure of value (usually value as a multiple of earnings, cash flows or book value) to compare the firms. To compare multiples across companies, we have to control for differences in growth, risk and cash flows, just as we would have in discounted cash flow valuation.

Live Case Study
Valuation

Objective: To value your firm, based upon its existing management, and your expectations for the future.

Key Questions:

- What type of cash flow (dividends, FCFE or FCFF) would you choose to discount for this firm?
- What growth pattern would you pick for this firm? How long will high growth last?
- What is your estimate of value of equity in this firm? How does this compare to the market value?

Framework for Analysis:

1. *Cash Flow Estimation*
    - What is this firm's accounting operating income? Would you adjust it for your valuation?
    - What is your firm's effective tax rate? What is its marginal tax rate? Which would you use in your valuation?
    - How much did your firm reinvest last year in internal investments, acquisitions, R&D and working capital?

2. *Growth Pattern Choice*
    - How fast have this company's earnings grown historically?
    - How fast do analysts expect this company's earnings to grow in the future?
    - What do the fundamentals suggest about earnings growth at this company? (How much is being reinvested and at what rate of return?)
    - If there is anticipated high growth, what are the barriers to entry that will allow this high growth to continue? For how long?
3. *Valuation*
    - What is the value of the operating assets of the firm, based upon a discounted cash flow model?
    - Does the firm have cash and non-operating assets and what is their value?

- Are there equity options outstanding (management options, convertible bonds) and how much are they worth?
- What is the value of equity per share?

4. *Relative Valuation*

- What multiple would you use to value the firm or its equity?
- What industry does the firm belong to, and what are the comparable firms?
- How does your firm's valuation (in multiple terms) compare to those of the other firms in the industry?
- What value would you assign your firm (or its equity), given how comparable firms are valued?

Getting Information for valuation

Most of the information that you need for valuation come from your current or past financial statements. You will also need a beta (see risk and return section) and a debt ratio (see risk and return section) to estimate the free cash flows to equity. You can get analyst estimates of growth in several sources including Zacks and I/B/E/S.

Online sources of information:

http://www.stern.nyu.edu/~adamodar/cfin2E/project/data.htm

Problems

1. Vernon Enterprises has current after-tax operating income of $ 100 million and a cost of capital of 10%. The firm earns a return on capital equal to its cost of capital.

   a. If we assume that the firm is in stable growth, growing 5% a year forever, estimate the firm's reinvestment rate.

   b. Given this reinvestment rate, estimate the value of the firm.

   c. What is the value of the firm, if you assume a zero reinvestment rate and no growth?

2. Assume, in the previous example with Vernon Enterprises, that the firm will earn a return on capital of 15% in perpetuity.

   a. If we assume that the firm is in stable growth, growing 5% a year forever, estimate the firm's reinvestment rate.

   b. Given this reinvestment rate, estimate the value of the firm.

3. Cello Inc. is a manufacturer of pianos. It earned an after-tax return on capital of 10% last year and expects to maintain this next year. If the current years after-tax operating income is $ 100 million and the firm reinvests 50% of this income back, estimate the free cash flow to the firm next year.(After-tax Operating Income = EBIT (1-t)]

4. Cell Phone Inc. is a cellular firm that reported net income of $50 million in the most recent financial year. The firm had $ 1 billion in debt, on which it reported interest expenses of $ 100 million in the most recent financial year. The firm had depreciation of $ 100 million for the year, and capital expenditures were 200% of depreciation. The firm has a cost of capital of 11%. Assuming that there is no working capital requirement, and a constant growth rate of 4% in perpetuity, estimate the value of the firm.

5. Netsoft is a company that manufactures networking software. In the current year, the firm reported operating earnings before interest and taxes of $ 200 million (Operating earnings does not include interest income), and these earnings are expected to grow 4% a year in perpetuity. In addition, the firm has a cash balance of $ 250 million on which it earned interest income of $ 20 million. The unlevered beta for other networking software

firm is 1.20, and these firms, have, on average, cash balances of 10% of firm value. If Netsoft has a debt ratio of 15%, a tax rate of 40%, a return on capital of 10% on operating assets, and a cost of debt of 10%, estimate the value of the firm. [The riskfree rate is 6% and you can assume a market risk premium of 5.5%.]

6. Gemco Jewellers earned $ 5 million in after-tax operating income in the most recent year. The firm also had capital expenditures of $ 4 million and depreciation of $ 2 million during the year, and the non-cash working capital at the end of the year was $ 10 million.

a. Assuming that the firm's operating income will grow 20% next year, and that all other items (capital expenditures, depreciation and non-cash working capital) will grow at the same rate, estimate the free cash flow to the firm next year.

b. If the firm can grow at 20% for the next 5 years, estimate the present value of the free cash flows to the firm over that period. You can assume a cost of capital of 12%.

c. After year 5, the firm's capital expenditures will decline to 125% of revenues, and the growth rate will drop to 5% (in both operating income and non-cash working capital). In addition, the cost of capital will decline to 10%. Estimate the terminal value of the firm at the end of year 5.

d. Estimate the total value of the operating assets of the firm.

7. Now assume that Gemco Jewellers has $ 10 million in cash and non-operating assets and that the firm has $ 15 million in outstanding debt.

a. Estimate the value of equity in the firm.

b. If the firm has 5 million shares outstanding, estimate the value of equity per share.

c. How would your answer to (b) change if you learn that the firm has 1 million options oustanding, with an exercise price of $ 5 and 5 years to maturity. (The estimated value per option is $ 7)

8. Union Pacific Railroad reported net income of $770 million in 1993, after interest expenses of $320 million. (The corporate tax rate was 36%). It reported depreciation of $960 million in that year, and capital spending was $1.2 billion. The firm also had $4 billion in debt outstanding on the books, rated AA (carrying a yield to maturity of 8%), trading at par (up from $3.8 billion at the end of 1992). The beta of the stock is 1.05, and

there were 200 million shares outstanding (trading at $60 per share), with a book value of $ 5 billion. Union Pacific paid 40% of its earnings as dividends and working capital requirements are negligible. (The treasury bond rate is 7%.)

a. Estimate the free cash flow to the firm in 1993.

b. Estimate the value of the firm at the end of 1993.

c. Estimate the value of equity at the end of 1993, and the value per share

9. Lockheed Corporation, one of the largest defense contractors in the US, reported EBITDA of $1290 million in 1993, prior to interest expenses of $215 million and depreciation charges of $400 million. Capital Expenditures in 1993 amounted to $450 million, and working capital was 7% of revenues (which were $13,500 million). The firm had debt outstanding of $3.068 billion (in book value terms), trading at a market value of $3.2 billion, and yielding a pre-tax interest rate of 8%. There were 62 million shares outstanding, trading at $64 per share, and the most recent beta is 1.10. The tax rate for the firm is 40%. (The treasury bond rate is 7%)

The firm expects revenues, earnings, capital expenditures and depreciation to grow at 9.5% a year from 1994 to 1998, after which the growth rate is expected to drop to 4%. (Capital spending will offset depreciation in the steady state period.) The company also plans to lower its debt/equity ratio to 50% for the steady state (which will result in the pre-tax interest rate dropping to 7.5%).

a. Estimate the value of the firm.

b. Estimate the value of the equity in the firm, and the value per share.

10. In the face of disappointing earnings results and increasingly assertive institutional stockholders, Eastman Kodak was considering the sale of its health division, which earned $560 million in earnings before interest and taxes in 1993, on revenues of $5.285 billion. The expected growth in earnings was expected to moderate to 6% between 1994 and 1998, and to 4% after that. Capital expenditures in the health division amounted to $420 million in 1993, while depreciation was $350 million. Both are expected to grow 4% a year in the long term. Working capital requirements are negligible.

The average beta of firms competing with Eastman Kodak's health division is 1.15. While Eastman Kodak has a debt ratio (D/(D+E)) of 50%, the health division can sustain a debt ratio (D/(D+E)) of only 20%, which is similar to the average debt ratio of firms competing in the health sector. At this level of debt, the health division can expect to pay 7.5% on its debt, before taxes. (The tax rate is 40%, and the treasury bond rate is 7%.)

a. Estimate the cost of capital for the division.

b. Estimate the value of the division.

11. You have been asked to value Alcoa and have come up with the following inputs.

- The stock has a beta of 0.90, estimated over the last 5 years. During this period, the firm had an average debt/equity ratio of 20% and an average cash balance of 15%.
- The firm's current market value of equity is 1.6 billion and its current market value of debt is $800 million. The current cash balance is $ 500 million.
- The firm earned earnings before interest and taxes of $ 450 million, which includes the interest income on the current cash balance of $ 50 million. The firm's tax rate is 40%.
- The firm is in stable growth, and its earnings from operations are expected to grow 5% a year. The net capital expenditures next year are expected to be $ 90 million.

Estimate the value of the non-cash assets of the firm, its total value, and the value of its equity.

12. You are analyzing a valuation done on a stable firm by a well-known analyst. Based upon the expected free cash flow to firm, next year, of $30 million, and an expected growth rate of 5%, the analyst has estimated a value of $750 million. However, he has made the mistake of using the book values of debt and equity in his calculation. While you do not know the book value weights he used, you know that the firm has a cost of equity of 12%, and an after-tax cost of debt of 6%. You also know that the market value of equity is three times the book value of equity, while the market value of debt is equal to the book value of debt. Estimate the correct value for the firm.

13. You have been asked to value Office Help Inc., a private firm providing office support services in the New York area.

- The firm reported pre-tax operating income of $ 10 million in its most recent financial year on revenues of $ 100 million. In the most recent financial year, you note that the owners of the business did not pay themselves a salary. You believe that a fair salary for their services would be $ 1.5 million a year.

- The cost of capital for comparable firms that are publicly traded is 9%. (You can assume that this firm will have similar leverage and cost of capital).
- The firm is in stable growth and expects to grow 5% a year in perpetuity. The tax rate is 40%.

While the average illiquidity discount applied to private firms is 30%, you have run a regression and arrived at the following estimate for the discount:

Illiquidity Discount = 0.30 – 0.04 (ln (Revenues in millions))

Estimate the value of Office Help for sale in a private transaction (to an individual).

14. National City Corporation, a bank holding company, reported earnings per share of $2.40 in 1993, and paid dividends per share of $1.06. The earnings had grown 7.5% a year over the prior five years, and were expected to grow 6% a year in the long term (starting in 1994). The stock had a beta of 1.05 and traded for ten times earnings. The treasury bond rate was 7%.

a. Estimate the P/E Ratio for National City Corporation.

b. What long term growth rate is implied in the firm's current PE ratio?

15. The following were the P/E ratios of firms in the aerospace/defense industry at the end of December, 1998, with additional data on expected growth and risk:

Company	*P/E Ratio*	*Expected Growth*	*Beta*	*Payout*
Boeing	17.3	3.5%	1.10	28%
General Dynamics	15.5	11.5%	1.25	40%
General Motors - Hughes	16.5	13.0%	0.85	41%
Grumman	11.4	10.5%	0.80	37%
Lockheed Corporation	10.2	9.5%	0.85	37%
Logicon	12.4	14.0%	0.85	11%
Loral Corporation	13.3	16.5%	0.75	23%
Martin Marietta	11.0	8.0%	0.85	22%
McDonnell Douglas	22.6	13.0%	1.15	37%

Northrop	9.5	9.0%	1.05	47%
Raytheon	12.1	9.5%	0.75	28%
Rockwell	13.9	11.5%	1.00	38%
Thiokol	8.7	5.5%	0.95	15%
United Industrial	10.4	4.5%	0.70	50%

a. Estimate the average and median P/E ratios. What, if anything, would these averages tell you?

b. An analyst concludes that Thiokol is undervalued, because its P/E ratio is lower than the industry average. Under what conditions is this statement true? Would you agree with it here?

c. Using the PEG ratio, assess whether Thiokol is under valued. What are you assuming about the relationship between value and growth, when you use PEG ratios?

c. Using a regression, control for differences across firms on risk, growth, and payout. Specify how you would use this regression to spot under and overvalued stocks. What are the limitations of this approach?

16. NCH Corporation, which markets cleaning chemicals, insecticides and other products, paid dividends of $2.00 per share in 1993 on earnings of $4.00 per share. The book value of equity per share was $40.00, and earnings are expected to grow 6% a year in the long term. The stock has a beta of 0.85, and sells for $60 per share. The treasury bond rate is 7%.

a. Based upon these inputs, estimate the price/book value ratio for NCH.

b. How much would the return on equity have to increase to justify the price/book value ratio at which NCH sells for currently?

17. You are trying to estimate a price per share on an initial public offering of a company involved in environmental waste disposal. The company has a book value per share of $20 and earned $3.50 per share in the most recent time period. While it does not pay dividends, the capital expenditures per share were $2.50 higher than depreciation per share in the most recent period, and the firm uses no debt financing. Analysts project that

earnings for the company will grow 25% a year for the next five years. You have data on other companies in the environment waste disposal business:

Company	*Price*	*BV/Share*	*EPS*	*DPS*	*Beta*	*Exp.Growth*
Air & Water	$9.60	$8.48	$0.40	$0.00	1.65	10.5%
Allwaste	$5.40	$3.10	$0.25	$0.00	1.10	18.5%
Browning Ferris	$29.00	$11.50	$1.45	$0.68	1.25	11.0%
Chemical Waste	$9.40	$3.75	$0.45	$0.15	1.15	2.5%
Groundwater	$15.00	$14.45	$0.65	$0.00	1.00	3.0%
Intn'l Tech.	$3.30	$3.35	$0.16	$0.00	1.10	11.0%
Ionics Inc.	$48.00	$31.00	$2.20	$0.00	1.00	14.5%
Laidlaw Inc.	$6.30	$5.85	$0.40	$0.12	1.15	8.5%
OHM Corp.	$16.00	$5.65	$0.60	$0.00	1.15	9.50%
Rollins	$5.10	$3.65	$0.05	$0.00	1.30	1.0%
Safety-Kleen	$14.00	$9.25	$0.80	$0.36	1.15	6.50%

The average debt/equity ratio of these firms is 20%, and the tax rate is 40%.

a. Estimate the average price/book value ratio for these comparable firms. Would you use this average P/BV ratio to price the initial public offering.

b. What subjective adjustments would you make to the price/book value ratio for this firm and why?

18. Longs Drug, a large U.S. drugstore chain operating primarily in Northern California, had sales per share of $122 in 1993, on which it reported earnings per share of $2.45 and paid a dividend per share of $1.12. The company is expected to grow 6% in the long term, and has a beta of 0.90. The current T.Bond rate is 7%.

a. Estimate the appropriate price/sales multiple for Longs Drug.

b. The stock is currently trading for $34 per share. Assuming the growth rate is estimated correctly, what would the profit margin need to be to justify this price per share.

19. You have been asked to assess whether Walgreen Company, a drugstore chain, is correctly priced relative to its competitors in the drugstore industry at the end of 1993.

The following are the price/sales ratios, profit margins, and other relative details of the firms in the drugstore industry.

Company	*P/S Ratio*	*Profit Margin*	*Payout*	*Expected Growth*	*Beta*
Arbor Drugs	0.42	3.40%	18%	14.0%	1.05
Big B Inc.	0.30	1.90%	14%	23.5%	0.70
Drug Empor.	0.10	0.60%	0%	27.5%	0.90
Fay's Inc.	0.15	1.30%	37%	11.5%	0.90
Genovese	0.18	1.70%	26%	10.5%	0.80
Longs Drug	0.30	2.00%	46%	6.0%	0.90
Perry Drugs	0.12	1.30%	0%	12.5%	1.10
Rite Aid	0.33	3.20%	37%	10.5%	0.90
Walgreen	*0.60*	*2.70%*	*31%*	*13.5%*	*1.15*

Based entirely on a subjective analysis, do you think that Walgreen is overpriced because its price/sales ratio is the highest in the industry? If it is not, how would you rationalize its value?

20. Time Warner is considering a sale of its publishing division. The division had earnings before interest, taxes and depreciation of $ 550 million in the most recent year (depreciation was $ 150 million), growing at an estimated 5% a year (You can assume that depreciation grows at the same rate). The return on capital in the division is 15%, and the corporate tax rate is 40%. If the cost of capital for the division is 9%, estimate the following:

a. Value/FCFF multiple

b. Value/EBIT multiple

c. Value/EBITDA multiple

BASIC STATISTICS

The problem that we face today is not that we have too little information but too much. Making sense of large and often contradictory information is part of what we are called upon to do when analyzing companies. Basic statistics can make this job easier. In this appendix, we consider the most fundamental tools that we have available in data analysis.

Summarizing Data

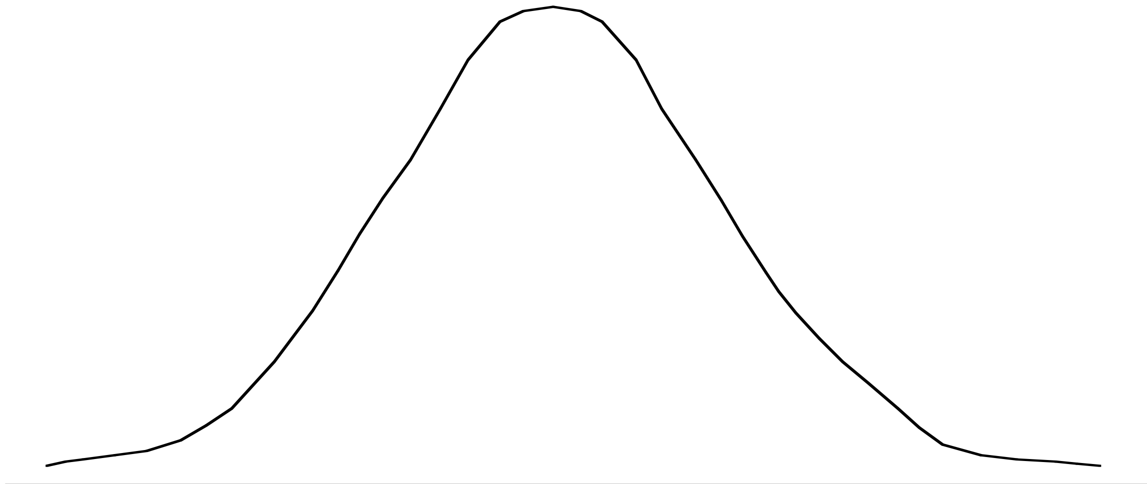
Large amounts of data are often compressed into more easily assimilated summaries, which provide the user with a sense of the content, without overwhelming him or her with too many numbers. There a number of ways in which data can be presented. We will consider two here – one is to present the data in a distribution and the other is to provide summary statistics that capture key aspects of the data.

Data Distributions

When presented with thousands of pieces of information, you can break the numbers down into individual values (or ranges of values) and provides the number of individual data items that take on each value or range of values. This is called a frequency distribution. If the data can only take on specific values, as is the case when we record the number of goals scored in a soccer game, it is called a discrete distribution. When the data can take on any value within the range, as is the case with income or market capitalization, it is called a continuous distribution.

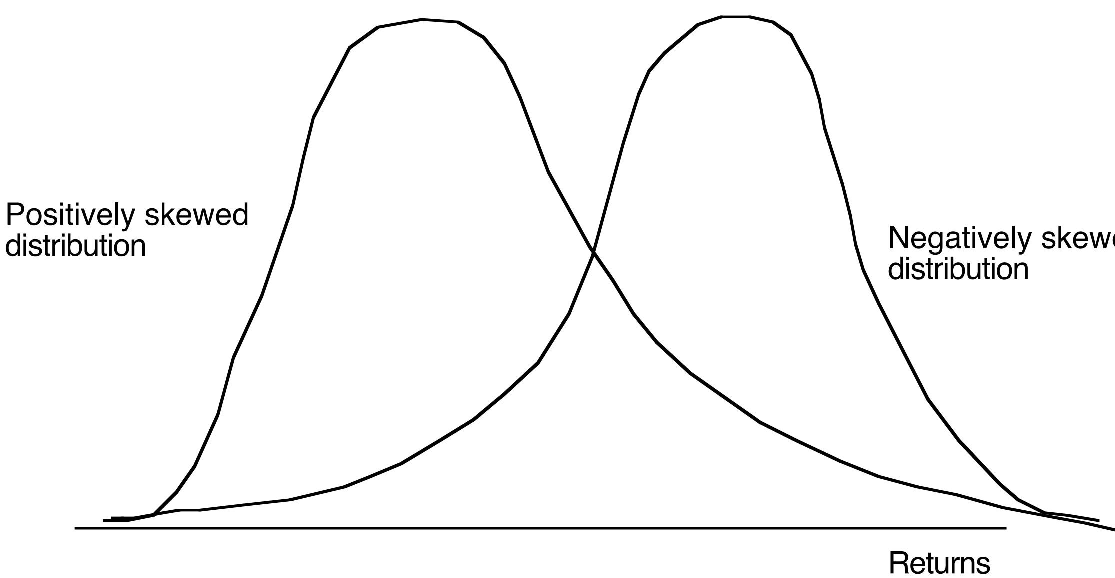
The advantage of a presenting the data in a distribution is two fold. One is that you can summarize even the largest data sets into one distribution and get a measure of what values occur most frequently and the range of high and low values. The second is that the distribution can resemble one of the many common distributions about which we know a great deal in statistics. Consider, for instance, the distribution that we tend to draw on the most in analysis: the normal distribution, illustrated in figure 1.

Figure 1: Normal Distribution



A normal distribution is symmetric, has a peak centered around the middle of the distribution and tails that are no fat and stretch to include infinite positive or negative values. Figure 2 illustrates positively and negatively skewed distributions.

Figure 2: Skewed Distributions



Summary Statistics

The simplest way to measure the key characteristics of a data set is to estimate the summary statistics for the data. For a data series, X_1, X_2, X_3, ...X_n, where n is the number of observations in the series, the most widely used summary statistics are as follows –

- The mean (μ), which is the average of all of the observations in the data series

$$Mean = \mu_X = \sum_{j=1}^{j=n} X_j$$

- The median, which is the mid-point of the series; half the data in the series is higher than the median and half is lower
- The variance, which is a measure of the spread in the distribution around the mean, and is calculated by first summing up the squared deviations from the mean, and then dividing by either the number of observations (if the data represents the entire population) or by this number, reduced by one (if the data represents a sample)

$$\text{Variance} = \sigma_X^2 = \sum_{j=1}^{j=n} (X_j - \mu)^2$$

The standard deviation is the square root of the variance.

The mean and the standard deviation are the called the first two moments of any data distribution. A normal distribution can be entirely described by just these two moments; in other words, the mean and the standard deviation of a normal distribution suffice to completely characterize it. If a distribution is not symmetric, it is considered to be skewed and the skewness is the moment that describes both the direction and the magnitude of the skewness.

Looking for Relationships in the Data

When there are two series of data, there are a number of statistical measures that can be used to capture how the two series move together over time.

Correlations and Covariances

The two most widely used measures of how two variables move together (or do not) are the correlation and the covariance. For two data series, X (X_1, X_2,.) and Y(Y,Y...), the covariance provides a non-standardized measure of the degree to which they move together, and is estimated by taking the product of the deviations from the mean for each variable in each period.

$$\text{Covariance} = \sigma_{XY} = \sum_{j=1}^{j=n} (X_j - \mu_X)\ (Y_j - \mu_Y)$$

The sign on the covariance indicates the type of relationship that the two variables have. A positive sign indicates that they move together and a negative that they move in opposite directions. While the covariance increases with the strength of the relationship, it is still relatively difficult to draw judgments on the strength of the relationship between two variables by looking at the covariance, since it is not standardized.

The correlation is the standardized measure of the relationship between two variables. It can be computed from the covariance –

$$\text{Correlation} = \rho_{XY} = \sigma_{XY} / \sigma_X \sigma_Y = \frac{\sum_{j=1}^{j=n} (X_j - \mu_X)\,(Y_j - \mu_Y)}{\sqrt{\sum_{j=1}^{j=n} (X_j - \mu_X)^2}\sqrt{\sum_{j=1}^{j=n} (Y_j - \mu_Y)^2}}$$

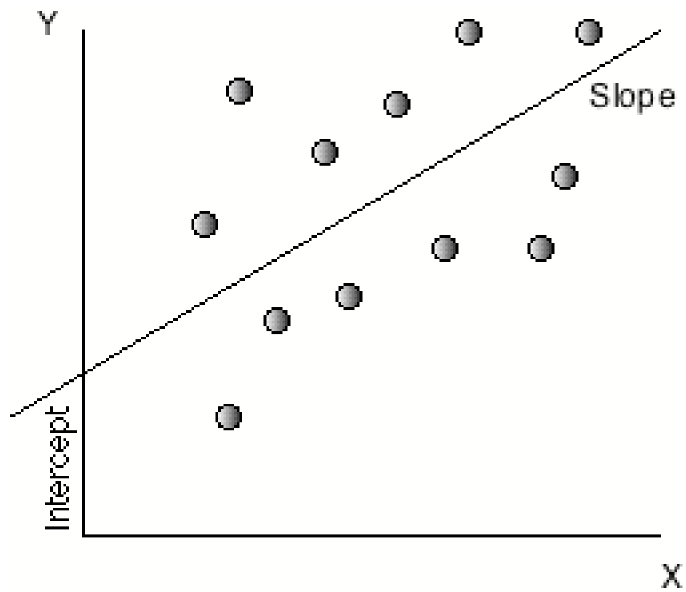
The correlation can never be greater than 1 or less than minus 1. A correlation close to zero indicates that the two variables are unrelated. A positive correlation indicates that the two variables move together, and the relationship is stronger the closer the correlation gets to one. A negative correlation indicates the two variables move in opposite directions, and that relationship also gets stronger the closer the correlation gets to minus 1. Two variables that are perfectly positvely correlated (r=1) essentially move in perfect proportion in the same direction, while two assets which are perfectly negatively correlated move in perfect proportion in opposite directions.

Regressions

A simple regression is an extension of the correlation/covariance concept. It attempts to explain one variable, which is called the dependent variable, using the other variable, called the independent variable.

Scatter Plots and Regression Lines

Keeping with statistical tradition, let Y be the dependent variable and X be the independent variable. If the two variables are plotted against each other, with each pair of observations representing a point on the graph, you have a scatter plot, with Y on the vertical axis and X on the horizontal axis.



In a regression, we attempt to fit a line through the points that best fits the . In its simplest form, this is accomplished by finding a line that minimizes the sum of the squared deviations of the points from the line. Consequently, it is called ordinary least squares (OLS) regression. When such a line is fit, two parameters emerge – one is the point at which the line cuts through the Y-axis, called the intercept of the regression, and the other is the slope of the regression line.

$$Y = a + b X$$

The slope (b) of the regression measures both the direction and the magnitude of the relationship between the dependent variable (Y) and the independent variable (X). When the two variables are positively correlated, the slope will also be positive, whereas when the two variables are negatively correlated, the slope will be negative. The magnitude of the slope of the regression can be read as follows - for every unit increase in the dependent variable (X), the independent variable will change by b (slope).

Estimating Regression Parameters

While there are statistical packages that allow us to input data and get the regression parameters as output, it is worth looking at how they are estimated in the first place. The slope of the regression line is a logical extension of the covariance concept introduced in the last section. In fact, the close linkage between the slope of the regression and the correlation/covariance should not be surprising since the slope is estimated using the covariance –

$$\text{Slope of the Regression} = b = \frac{\text{Covariance}_{YX}}{\text{Variance of X}} = \frac{\sigma_{YX}}{\sigma_X^2}$$

The intercept (a) of the regression can be read in a number of ways. One interpretation is that it is the value that Y will have when X is zero. Another is more straightforward, and is based upon how it is calculated. It is the difference between the average value of Y, and the slope adjusted value of X.

$$\text{Intercept of the Regression} = a = \mu_Y - b^* (\mu_X)$$

Regression parameters are always estimated with some error or statistical noise, partly because the relationship between the variables is not perfect and partly because we estimate them from samples of data. This noise is captured in a couple of statistics. One is the R-squared of the regression, which measures the proportion of the variability in the independent variable (Y) that is explained by the dependent variable (X). It is a direct function of the correlation between the variables –

$$\text{R - squared of the Regression} = \text{Correlation}_{YX}^2 = \rho_{YX}^2 = \frac{b^2 \sigma_X^2}{\sigma_Y^2}$$

An R-squared value closer to one indicates a strong relationship between the two variables, though the relationship may be either positive or negative. Another measure of noise in a regression is the standard error, which measures the "spread' around each of the two parameters estimated- the intercept and the slope. Each parameter has an associated standard error, which is calculated from the data –

$$\text{Standard Error of Intercept} = \text{SE}_a = \sqrt{\frac{\left(\sum_{j=1}^{j=n} X_j^2\right)\left(\sum_{j=1}^{j=n} (Y_j - bX_j)^2\right)}{(n-1)\sum_{j=1}^{j=n} (X_j - \mu_X)^2}}$$

$$\text{Standard Error of Slope} = \text{SE}_b = \sqrt{\frac{\left(\sum_{j=1}^{j=n} (Y_j - bX_j)^2\right)}{(n-1)\sum_{j=1}^{j=n} (X_j - \mu_X)^2}}$$

If we make the additional assumption that the intercept and slope estimates are normally distributed, the parameter estimate and the standard error can be combined to get a "t statistic" that measures whether the relationship is statistically significant.

$$\text{T statistic for intercept} = a/SE_a$$

$$\text{T statistic from slope} = b/SE_b$$

For samples with more than 120 observations, a t statistic greater than 1.66 indicates that the variable is significantly different from zero with 95% certainty, while a statistic greater than 2.36 indicates the same with 99% certainty. For smaller samples, the t statistic has to be larger to have statistical significance.[1]

Using Regressions

While regressions mirror correlation coefficients and covariances in showing the strength of the relationship between two variables, they also serve another useful purpose. The regression equation described in the last section can be used to estimate predicted values for the dependent variable, based upon assumed or actual values for the independent variable. In other words, for any given Y, we can estimate what X should be:

$$X = a + B\ (Y)$$

How good are these predictions? That will depend entirely upon the strength of the relationship measured in

From Simple to Multiple Regressions

The regression that measures the relationship between two variables becomes a multiple regression when it is extended to include more than one independent variables (X1,X2,X3,X4..) in trying to explain the dependent variable Y. While the graphical presentation becomes more difficult, the multiple regression yields output that is an extension of the simple regression.

$$Y = a + b\,X1 \;\; + c\,X2 + dX3 \; + eX4$$

The R-squared still measures the strength of the relationship, but an additional R-squared statistic called the adjusted R squared is computed to counter the bias that will induce the R-squared to keep increasing as more independent variables are added to the regression. If there are k independent variables in the regression, the adjusted R squared is computed as follows –

[1] The actual values that t statistics need to take on can be found in a table for the t distribution, which is reproduced at the end of this book as an appendix.

$$\text{R squared} = \frac{\left(\sum_{j=1}^{j=n} (Y_j - bX_j)^2\right)}{\text{n - 1}}$$

$$\text{Adjusted R squared} = \frac{\left(\sum_{j=1}^{j=n} (Y_j - bX_j)^2\right)}{\text{n - k}}$$

Multiple regressions are powerful weapons that allow us to examine the determinants of any variable.

Regression Assumptions and Constraints

Both the simple and multiple regressions that we have described in this section also assume linear relationships between the dependent and independent variables. If the relationship is not linear, we have two choices. One is to transform the variables, by taking the square, square root or natural log (for example) of the values and hope that the relationship between the transformed variables is more linear. The other is run non-linear regressions that attempt to fit a curve through the data.

There are implicit statistical assumptions behind every multiple regression that we ignore at our own peril. For the coefficients on the individual independent variables to make sense, the independent variable needs to be uncorrelated with each other, a condition that is often very difficult to meet. When independent variables are correlated with each other, the statistical hazard that is created is called multicollinearity. In its presence, the coefficients on independent variables can take on unexpected signs (positive instead of negative, for instance) and unpredictable values.

There are simple diagnostic statistics that allow us to measure how far the data that we are using in a regression may be deviating from our ideal. If these statistics send out warning signals, we ignore them at our own peril.

Conclusion

In the course of trying to make sense of large amounts of contradictory data, there are useful statistical tools that we can draw on. While we have looked at the only most basic ones in this chapter, there are far more sophisticated and powerful tools that we can draw on.

FINANCIAL STATEMENTS

Financial statements provide the fundamental information that we use to analyze and answer valuation questions. It is important, therefore, that we understand the principles governing these statements by looking at four questions:

- How valuable are the assets of a firm? The assets of a firm can come in several forms – assets with long lives such as land and buildings, assets with shorter lives such inventory, and intangible assets that still produce revenues for the firm such as patents and trademarks.
- How did the firm raise the funds to finance these assets? In acquiring these assets, firms can use the funds of the owners (equity) or borrowed money (debt), and the mix is likely to change as the assets age.
- How profitable are these assets? A good investment, we argued, is one that makes a return greater than the hurdle rate. To evaluate whether the investments that a firm has already made are good investments, we need to estimate what returns we are making on these investments.

We will look at the way accountants would answer these questions, and why the answers might be different when doing valuation. Some of these differences can be traced to the differences in objectives – accountants try to measure the current standing and immediate past performance of a firm, whereas valuation is much more forward looking.

The Basic Accounting Statements

There are three basic accounting statements that summarize information about a firm. The first is the **balance sheet**, shown in Figure 3.1, which summarizes the assets owned by a firm, the value of these assets and the mix of financing, debt and equity, used to finance these assets at a point in time.

Figure 1: The Balance Sheet

Assets		Liabilities	
Long Lived Real Assets	Fixed Assets	Current Liabilties	Short-term liabilities of the firm
Short-lived Assets	Current Assets	Debt	Debt obligations of firm
Investments in securities & assets of other firms	Financial Investments	Other Liabilities	Other long-term obligations
Assets which are not physical, like patents & trademarks	Intangible Assets	Equity	Equity investment in firm

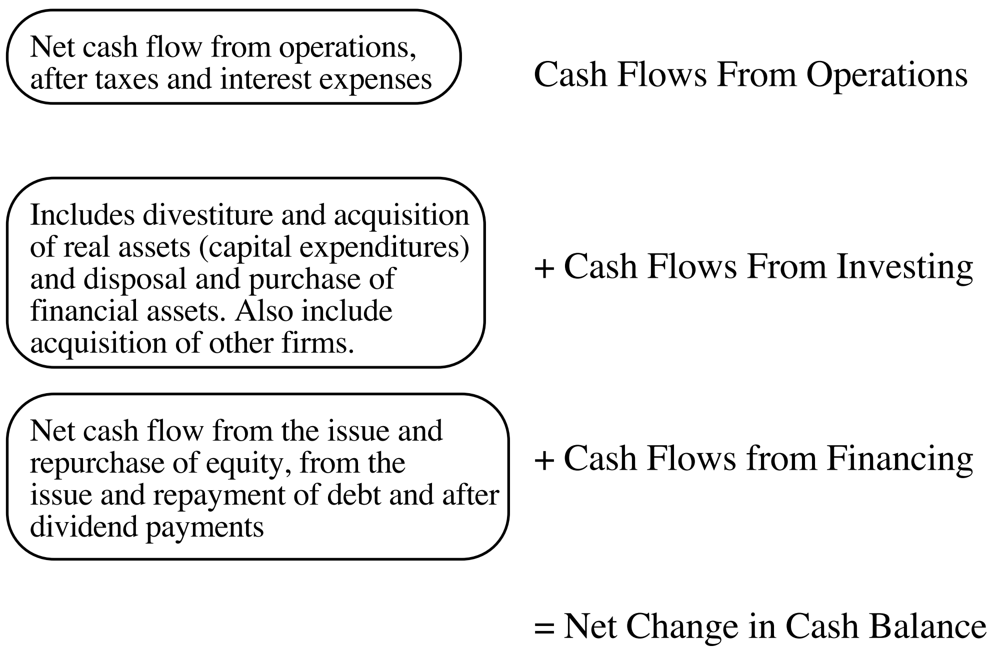
The next is the **income statement**, shown in Figure 3.2, which provides information on the revenues and expenses of the firm, and the resulting income made by the firm, during a period. The period can be a quarter (if it is a quarterly income statement) or a year (if it is an annual report).

Figure 2: Income Statement

Gross revenues from sale of products or services	Revenues
Expenses associates with generating revenues	- Operating Expenses
Operating income for the period	= Operating Income
Expenses associated with borrowing and other financing	- Financial Expenses
Taxes due on taxable income	- Taxes
Earnings to Common & Preferred Equity for Current Period	= Net Income before extraordinary items
Profits and Losses not associated with operations	- (+) Extraordinary Losses (Profits)
Profits or losses associated with changes in accounting rules	- Income Changes Associated with Accounting Changes
Dividends paid to preferred stockholders	- Preferred Dividends
	= Net Income to Common Stockholders

Finally, there is the **statement of cash flows**, shown in figure 3.3, which specifies the sources and uses of cash of the firm from operating, investing and financing activities, during a period.

Figure 3: Statement of Cash Flows



The statement of cash flows can be viewed as an attempt to explain how much the cash flows during a period were, and why the cash balance changed during the period.

Asset Measurement and Valuation

When analyzing any firm, we would like to know the types of assets that it owns, the values of these assets and the degree of uncertainty about these values. Accounting statements do a reasonably good job of categorizing the assets owned by a firm, a partial job of assessing the values of these assets and a poor job of reporting uncertainty about asset values. In this section, we will begin by looking at the accounting principles underlying asset categorization and measurement, and the limitations of financial statements in providing relevant information about assets.

Accounting Principles Underlying Asset Measurement

An asset is any resource that has the potential to either generate future cash inflows or reduce future cash outflows. While that is a general definition broad enough to cover almost any kind of asset, accountants add a caveat that for a resource to be an asset.

A firm has to have acquired it in a prior transaction and be able to quantify future benefits with reasonable precision. The accounting view of asset value is to a great extent grounded in the notion of **historical cost**, which is the original cost of the asset, adjusted upwards for improvements made to the asset since purchase and downwards for the loss in value associated with the aging of the asset. This historical cost is called the **book value**. While the generally accepted accounting principles for valuing an asset vary across different kinds of assets, three principles underlie the way assets are valued in accounting statements.

- *An Abiding Belief in Book Value as the Best Estimate of Value*: Accounting estimates of asset value begin with the book value. Unless a substantial reason is given to do otherwise, accountants view the historical cost as the best estimate of the value of an asset.
- *A Distrust of Market or Estimated Value:* When a current market value exists for an asset that is different from the book value, accounting convention seems to view this market value with suspicion. The market price of an asset is often viewed as both much too volatile and too easily manipulated to be used as an estimate of value for an asset. This suspicion runs even deeper when values are is estimated for an asset based upon expected future cash flows.
- *A Preference for under estimating value rather than over estimating it*: When there is more than one approach to valuing an asset, accounting convention takes the view that the more conservative (lower) estimate of value should be used rather than the less conservative (higher) estimate of value. Thus, when both market and book value are available for an asset, accounting rules often require that you use the lesser of the two numbers.

Measuring Asset Value

The financial statement in which accountants summarize and report asset value is the balance sheet. To examine how asset value is measured, let us begin with the way assets are categorized in the balance sheet. First, there are the **fixed assets**, which include the long-term assets of the firm, such as plant, equipment, land and buildings. Next, we have the short-term assets of the firm, including inventory (including raw materials, work in progress and finished goods), receivables (summarizing moneys owed to the firm) and cash; these are categorized as **current assets**. We then have investments in the assets and securities of other firms, which are generally categorized as financial investments. Finally, we have what is loosely categorized as **intangible assets**. These include assets, such as patents and trademarks that presumably will create future earnings and cash flows, and also uniquely accounting assets such as goodwill that arise because of acquisitions made by the firm.

Fixed Assets

Generally accepted accounting principles (GAAP) in the United States require the valuation of fixed assets at historical cost, adjusted for any estimated gain and loss in value from improvements and the aging, respectively, of these assets. While in theory the adjustments for aging should reflect the loss of earning power of the asset as it ages, in practice they are much more a product of accounting rules and convention, and these adjustments are called **depreciation**. Depreciation methods can very broadly be categorized into **straight line** (where the loss in asset value is assumed to be the same every year over its lifetime) and **accelerated** (where the asset loses more value in the earlier years and less in the later years). [While tax rules, at least in the United States, have restricted the freedom that firms have on their choice of asset life and depreciation methods, firms continue to have a significant amount of flexibility on these decisions for reporting purposes. Thus, the depreciation that is reported in the annual reports may not, and generally is not, the same depreciation that is used in the tax statements.

Current Assets

Current assets include inventory, cash and accounts receivables. It is in this category that accountants are most amenable to the use of market value, especially in valuing marketable securities.

- Accounts receivable represent money owed by entities to the firm on the sale of products on credit. The accounting convention is for accounts receivable to be recorded as the amount owed to the firm, based upon the billing at the time of the credit sale. The only major valuation and accounting issue is when the firm has to recognize accounts receivable that are not collectible. Firms can set aside a portion of their income to cover expected **bad debts** from credit sales, and accounts receivable will be reduced by this reserve. Alternatively, the bad debts can be recognized as they occur and the firm can reduce the accounts receivable accordingly. There is the danger, however, that absent a decisive declaration of a bad debt, firms may continue to show as accounts receivable amounts that they know are unlikely to be ever collected.

- Cash is one of the few assets for which accountants and financial analysts should agree on value. The value of a cash balance should not be open to estimation error. Having said this, we should note that fewer and fewer companies actually hold cash in the conventional sense (as currency or as demand deposits in banks). Firms often invest the cash in interest-bearing accounts or in treasuries, so as to earn a return on their investments. In either case, market value can deviate from book value, especially if the investments are long term. While there is no real default risk in either of these investments, interest rate movements can affect their value.
- Three basis approaches to valuing inventory are allowed by GAAP: FIFO, LIFO and Weighted Average.

  (a) First-in, First-out (FIFO): Under **FIFO**, the cost of goods sold is based upon the cost of material bought earliest in the period, while the cost of inventory is based upon the cost of material bought latest in the year. This results in inventory being valued close to the current replacement cost.

  (b) Last-in, First-out (LIFO): Under **LIFO**, the cost of goods sold is based upon the cost of material bought latest in the period, while the cost of inventory is based upon the cost of material bought earliest in the year. This results in finished goods being valued close to the current production cost.

  (c) Weighted Average: Under the weighted average approach, both inventory and the cost of goods sold are based upon the average cost of all materials bought during the period. When inventory turns over rapidly, this approach will more closely resemble FIFO than LIFO.

  Firms often adopt the LIFO approach for its tax benefits during periods of high inflation. The cost of goods sold is then higher because it is based upon prices paid towards to the end of the accounting period. This, in turn, will reduce the reported taxable income and net income, while increasing cash flows. Given the income and cash flow effects of inventory valuation methods, it is often difficult to compare the inventory values of firms that use different methods. There is, however, one way of adjusting for these differences. Firms that choose the LIFO approach to value inventories have to specify in a footnote the difference in inventory valuation between FIFO and LIFO, and this difference is termed the **LIFO reserve**. It can be used to adjust the beginning and ending inventories, and consequently the cost of goods sold, and to restate income based upon FIFO valuation.

Investments (Financial) and Marketable Securities

In the category of investments and marketable securities, accountants consider investments made by firms in the securities or assets of other firms, and other marketable securities including treasury bills or bonds. The way in which these assets are valued depends upon the way the investment is categorized and the motive behind the investment. In general, an investment in the securities of another firm can be categorized as a **minority, passive investment**; a **minority, active investment**; or a **majority, active investment**. The accounting rules vary depending upon the categorization.

Minority, Passive Investments

If the securities or assets owned in another firm represent less than 20% of the overall ownership of that firm, an investment is treated as a minority, passive investment. These investments have an acquisition value, which represents what the firm originally paid for the securities and often a market value. Accounting principles require that these assets be sub-categorized into one of three groups: investments that will be held to maturity, investments that are available for sale and trading investments. The valuation principles vary for each.

- For investments that will be held to maturity, the valuation is at historical cost or book value, and interest or dividends from this investment are shown in the income statement under net interest expenses
- For investments that are available for sale, the valuation is at market value, but the unrealized gains or losses are shown as part of the equity in the balance sheet and not

in the income statement. Thus, unrealized losses reduce the book value of the equity in the firm, and unrealized gains increase the book value of equity.

- For trading investments, the valuation is at market value and the unrealized gains and losses are shown in the income statement.

Firms are allowed an element of discretion in the way they classify investments and, subsequently, in the way they value these assets. This classification ensures that firms such as investment banks, whose assets are primarily securities held in other firms for purposes of trading, revalue the bulk of these assets at market levels each period. This is called **marking-to-market** and provides one of the few instances in which market value trumps book value in accounting statements.

Minority, Active Investments

If the securities or assets owned in another firm represent between 20% and 50% of the overall ownership of that firm, an investment is treated as a **minority, active investment**. While these investments have an initial acquisition value, a proportional share (based upon ownership proportion) of the net income and losses made by the firm in which the investment was made, is used to adjust the acquisition cost. In addition, the dividends received from the investment reduce the acquisition cost. This approach to valuing investments is called the **equity approach**. The market value of these investments is not considered until the investment is liquidated, at which point the gain or loss from the sale, relative to the adjusted acquisition cost is shown as part of the earnings under extraordinary items in that period.

Majority, Active Investments

If the securities or assets owned in another firm represent more than 50% of the overall ownership of that firm, an investment is treated as a **majority active investment**[1]. In this case, the investment is no longer shown as a financial investment but is instead replaced by the assets and liabilities of the firm in which the investment was made. This approach leads to a **consolidation** of the balance sheets of the two firms, where the assets and liabilities of the two firms are merged and presented as one balance sheet. The share of the firm that is owned by other investors is shown as a **minority interest** on the liability side of the balance sheet. A similar consolidation occurs in the financial statements of the other firm as well. The statement of cash flows reflects the cumulated cash inflows and outflows of the combined firm. This is in contrast to the equity approach, used for minority active investments, in which only the dividends received on the investment are shown as a cash inflow in the cash flow statement. Here again, the market value of this investment is not considered until the ownership stake is liquidated. At that point, the difference between the market price and the net value of the equity stake in the firm is treated as a gain or loss for the period.

Intangible Assets

Intangible assets include a wide array of assets ranging from patents and trademarks to goodwill. The accounting standards vary across intangible assets.

1. Patents and Trademarks

Patents and trademarks are valued differently depending on whether they are generated internally or acquired. When patents and trademarks are generated from internal sources, such as research, the costs incurred in developing the asset are expensed in that period even though the asset might have a life of several accounting periods. Thus, the intangible asset is not usually valued in the balance sheet of the firm. In contrast, when an intangible asset is acquired from an external party, it is treated as an asset.

Intangible assets have to be amortized over their expected lives, with a maximum amortization period of 40 years. The standard practice is to use straight-line amortization. For tax purposes, however, firms are not allowed to amortize goodwill or other intangible assets with no specific lifetime.

2. Goodwill

Intangible assets are sometimes the by-products of acquisitions. When a firm acquires another firm, the purchase price is first allocated to tangible assets and then allocated to any intangible assets such as patents or trade names. Any residual becomes

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[1] Firms have evaded the requirements of consolidation by keeping their share of ownership in other firms below 50%.

goodwill. While accounting principles suggest that goodwill captures the value of any intangibles that are not specifically identifiable, it is really a reflection of the difference between the market value of the firm owning the assets and the book value of assets. This approach is called **purchase accounting** and it creates an intangible asset (goodwill) which has to be amortized over 40 years. Firms, which do not want to see this charge against their earnings, often use an alternative approach called **pooling accounting**, in which the purchase price never shows up in the balance sheet. Instead, the book values of the two companies involved in the merger are aggregated to create the consolidated balance of the combined firm.[2]

Measuring Financing Mix

The second set of questions that we would like to answer and accounting statements to shed some light on relates to the current value and subsequently the mixture of debt and equity used by the firm. The bulk of the information about these questions is provided on the liability side of the balance sheet and the footnotes.

Accounting Principles Underlying Liability and Equity Measurement

Just as with the measurement of asset value, the accounting categorization of liabilities and equity is governed by a set of fairly rigid principles. The first is a *strict categorization of financing into either a liability or equity* based upon the nature of the obligation. For an obligation to be recognized as a liability, it must meet three requirements:

- It must be expected to lead to a future cash outflow or the loss of a future cash inflow at some specified or determinable date,
- The firm cannot avoid the obligation.
- The transaction giving rise to the obligation has happened already.

In keeping with the earlier principle of conservatism in estimating asset value, accountants recognize as liabilities only cash flow obligations that cannot be avoided.

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[2] The Financial Accounting Standards Board (FASB) was considering eliminating the use of pooling and reducing the amortization period for goodwill in purchase accounting to 20 years at the time this book went to print.

The second principle is that the value of both liabilities and equity in a firm are *better estimated using historical costs* with accounting adjustments, rather than with expected future cash flows or market value. The process by which accountants measure the value of liabilities and equities is inextricably linked to the way they value assets. Since assets are primarily valued at historical cost or at book value, both debt and equity also get measured primarily at book value. In the section that follows, we will examine the accounting measurement of both liabilities and equity.

Measuring the Value of Liabilities and Equities

Accountants categorize liabilities into current liabilities, long term debt and long term liabilities that are neither debt nor equity. Next, we will examine the way they measure each of these.

Current Liabilities

Current liabilities include all obligations that the firm has coming due in the next accounting period. These generally include:

- Accounts Payable – representing credit received from suppliers and other vendors to the firm. The value of accounts payable represents the amounts due to these creditors. For this item, book and market value should be similar.
- Short term borrowing – representing short term loans (due in less than a year) taken to finance the operations or current asset needs of the business. Here again, the value shown represents the amounts due on such loans, and the book and market value should be similar, unless the default risk of the firm has changed dramatically since it borrowed the money.
- Short term portion of long term borrowing – representing the portion of the long term debt or bonds that is coming due in the next year. Here again, the value shown is the actual amount due on these loans, and market and book value should converge as the due date approaches.
- Other short-term liabilities – which is a catch-all component for any other short term liabilities that the firm might have, including wages due to its employees and taxes due to the government.

Of all the items on the liability side of the balance sheet, absent outright fraud, current liabilities should be the one for which the accounting estimates of book value and financial estimates of market value are the closest.

Long Term Debt

Long-term debt for firms can take one of two forms. It can be a long-term loan from a bank or other financial institution or it can be a long-term bond issued to financial markets, in which case the creditors are the investors in the bond. Accountants measure the value of long term debt by looking at the present value of payments due on the loan or bond at the time of the borrowing. For bank loans, this will be equal to the nominal value of the loan. With bonds, however, there are three possibilities: When bonds are issued at par value, for instance, the value of the long-term debt is generally measured in terms of the nominal obligation created, in terms of principal (face value) due on the borrowing. When bonds are issued at a premium or a discount on par value, the bonds are recorded at the issue price, but the premium or discount to the face value is amortized over the life of the bond. As an extreme example, companies that issue zero coupon debt have to record the debt at the issue price, which will be significantly below the principal (face value) due at maturity. The difference between the issue price and the face value is amortized each period and is treated as a non-cash interest expense that is tax deductible.

In all these cases, the book value of debt is unaffected by changes in interest rates during the life of the loan or bond. Note that as market interest rates rise (fall), the present value of the loan obligations should decrease (increase). This updated market value for debt is not shown on the balance sheet. If debt is retired prior to maturity, the difference between book value and the amount paid at retirement is treated as an extraordinary gain or loss in the income statement.

Finally, companies which have long-term debt denominated in non-domestic currencies have to adjust the book value of debt for changes in exchange rates. Since exchange rate changes reflect underlying changes in interest rates, it does imply that this debt is likely to be valued much nearer to market value than is debt in the home currency.

Other Long Term Liabilities

Firms often have long term obligations that are not captured in the long term debt item. These include obligations to lessors on assets that firms have leased, to employees in the form of pension fund and health care benefits yet to be paid, and to the government in the form of taxes deferred. In the last two decades, accountants have increasingly moved towards quantifying these liabilities and showing them as long term liabilities.

1. Leases

There are two ways of accounting for leases. In an **operating lease**, the lessor (or owner) transfers only the right to use the property to the lessee. At the end of the lease period, the lessee returns the property to the lessor. Since the lessee does not assume the risk of ownership, the lease expense is treated as an operating expense in the income statement and the lease does not affect the balance sheet. In a **capital lease**, the lessee assumes some of the risks of ownership and enjoys some of the benefits. Consequently, the lease, when signed, is recognized both as an asset and as a liability (for the lease payments) on the balance sheet. The firm gets to claim depreciation each year on the asset and also deducts the interest expense component of the lease payment each year. In general, capital leases recognize expenses sooner than equivalent operating leases.

Since firms prefer to keep leases off the books and sometimes to defer expenses they have a strong incentive to report all leases as operating leases. Consequently the Financial Accounting Standards Board has ruled that a lease should be treated as a capital lease if it meets any one of the following four conditions.

(a) The lease life exceeds 75% of the life of the asset.

(b) There is a transfer of ownership to the lessee at the end of the lease term.

(c) There is an option to purchase the asset at a "bargain price" at the end of the lease term.

(d) The present value of the lease payments, discounted at an appropriate discount rate, exceeds 90% of the fair market value of the asset.

The lessor uses the same criteria for determining whether the lease is a capital or operating lease and accounts for it accordingly. If it is a capital lease, the lessor records the present value of future cash flows as revenue and recognizes expenses. The lease receivable is also shown as an asset on the balance sheet and the interest revenue is recognized over the term of the lease as paid.

From a tax standpoint, the lessor can claim the tax benefits of the leased asset only if it is an operating lease, though the revenue code uses slightly different criteria[3] for determining whether the lease is an operating lease.

2. Employee Benefits

Employers provide pension and health care benefits to their employees. In many cases, the obligations created by these benefits are extensive and a failure by the firm to adequately fund these obligations needs to be revealed in financial statements.

a. Pension Plans

In a pension plan, the firm agrees to provide certain benefits to its employees, either by specifying a 'defined contribution' (wherein a fixed contribution is made to the plan each year by the employer, without any promises as to the benefits which will be delivered in the plan) or a 'defined benefit' (wherein the employer promises to pay a certain benefit to the employee). In the latter case, the employer has to put sufficient money into the plan each period to meet the defined benefits.

Under a defined contribution plan, the firm meets its obligation once it has made the pre-specified contribution to the plan. Under a defined-benefit plan, the firm's obligations are much more difficult to estimate, since they will be determined by a number of variables including the benefits that employees are entitled to, the prior contributions made by the employer, the returns the plan have earned, and the rate of return that the employer expects to make on current contributions. As these variables change, the value of the pension fund assets can be greater than, less than or equal to pension fund liabilities (which is the present value of promised benefits). A pension fund whose assets exceed its liabilities is an over-funded plan, whereas one whose assets are

[3] The requirements for an operating lease in the revenue code are as follows - (a) the property can be used by someone other than the lessee at the end of the lease term, (b) the lessee cannot buy the asset using a bargain purchase option, (c) the lessor has at least 20% of its capital at risk, (d) the lessor has a positive cash flow from the lease independent of tax benefits and (e) the lessee does not have an investment in the lease.

less than its liabilities is an under-funded plan and disclosures to that effect have to be included in financial statements, generally in the footnotes.

When a pension fund is over-funded, the firm has several options. It can withdraw the excess assets from the fund, it can discontinue contributions to the plan, or it can continue to make contributions on the assumption that the over-funding is a transitory phenomenon that could well disappear by the next period. When a fund is under-funded, the firm has a liability, though accounting standards require that firms reveal only the excess of accumulated[4] pension fund liabilities over pension fund assets on the balance sheet.

b. Health Care Benefits

A firm can provide health care benefits in one of two ways: by making a fixed contribution to a health care plan, without promising specific benefits (analogous to a defined contribution plan), or by promising specific health benefits and setting aside the funds to provide these benefits (analogous to a defined benefit plan). The accounting for health care benefits is very similar to the accounting for pension obligations. The key difference between the two is that firms do not have to report[5] the excess of their health care obligations over the health care fund assets as a liability on the balance sheet, though a footnote to that effect has to be added to the financial statement.

3. Deferred Taxes

Firms often use different methods of accounting for tax and financial reporting purposes, leading to a question of how tax liabilities should be reported. Since accelerated depreciation and favorable inventory valuation methods for tax accounting purposes lead to a deferral of taxes, the taxes on the income reported in the financial statements will generally be much greater than the actual tax paid. The same principles of matching expenses to income that underlie accrual accounting suggest that the 'deferred income tax' be recognized in the financial statements. Thus a company which pays taxes

[4] The accumulated pension fund liability does not take into account the projected benefit obligation, where actuarial estimates of future benefits are made. Consequently, it is much smaller than the total pension liabilities.

[5] While companies might not have to report the excess of their health care obligations over assets as a liability, some firms choose to do so anyway.

of $55,000 on its taxable income based upon its tax accounting, and which would have paid taxes of $75,000 on the income reported in its financial statements, will be forced to recognize the difference ($20,000) as deferred taxes in liabilities. Since the deferred taxes will be paid in later years, they will be recognized as paid.

It is worth noting that companies that actually pay more in taxes than the taxes they report in the financial statements create an asset on the balance sheet called a **deferred tax asset**. This reflects the fact that the firm's earnings in future periods will be greater as the firm is given credit for the deferred taxes.

The question of whether the deferred tax liability is really a liability is an interesting one. Firms do not owe the amount categorized as deferred taxes to any entity, and treating it as a liability makes the firm look more risky than it really is. On the other hand, the firm will eventually have to pay its deferred taxes, and treating it as a liability seems to be the conservative thing to do.

Preferred Stock

When a company issues preferred stock, it generally creates an obligation to pay a fixed dividend on the stock. Accounting rules have conventionally not viewed preferred stock as debt because the failure to meet preferred dividends does not result in bankruptcy. At the same time, the fact the preferred dividends are cumulative makes them more onerous than common equity. Thus, preferred stock is viewed in accounting as a hybrid security, sharing some characteristics with equity and some with debt.

Preferred stock is valued on the balance sheet at its original issue price, with any cumulated unpaid dividends added on. Convertible preferred stock is treated similarly, but it is treated as equity on conversion.

Equity

The accounting measure of equity is a historical cost measure. The value of equity shown on the balance sheet reflects the original proceeds received by the firm when it issued the equity, augmented by any earnings made since (or reduced by losses, if any) and reduced by any dividends paid out during the period. While these three items go into what we can call the book value of equity, a few other items also end up in this estimate.

1. When companies buy back stock for short periods, with the intent of reissuing the stock or using it to cover option exercises, they are allowed to show the repurchased stock as treasury stock, which reduces the book value of equity. Firms are not allowed to keep treasury stock on the books for extended periods and have to reduce their book value of equity by the value of repurchased stock in the case of actions such as stock buybacks. Since these buybacks occur at the current market price, they can result in significant reductions in the book value of equity.
2. Firms that have significant losses over extended periods or carry out massive stock buybacks can end up with negative book values of equity.
3. Relating back to our discussion of marketable securities, any unrealized gain or loss in marketable securities that are classified as available-for-sale is shown as an increase or decrease in the book value of equity in the balance sheet.

As part of their financial statements, firms provide a summary of changes in shareholders equity during the period, where all the changes that occurred to the accounting (book value) measure of equity value are summarized.

Accounting rules still do not seem to have come to grips with the effect of warrants and equity options (such as those granted by many firms to management) on the book value of equity. If warrants are issued to financial markets, the proceeds from this issue will show up as part of the book value of equity. In the far more prevalent case where options are given or granted to management, there is no effect on the book value of equity. When the options are exercised, the cash inflows from the exercise do ultimately show up in the book value of equity and there is a corresponding increase in the number of shares outstanding. The same point can be made about convertible bonds, which are treated as debt until conversion, at which point they become part of equity. In partial defense of accountants, we must note that the effect of options outstanding is often revealed when earnings and book value are computed on a per share basis. Here, the computation is made on two bases, the first on the current number of shares outstanding (primary shares outstanding) and the second on the number of shares outstanding after all options have been exercised (fully diluted shares outstanding).

As a final point on equity, accounting rules still seem to consider preferred stock, with its fixed dividend, as equity or near-equity, largely because of the fact that preferred dividends can be deferred or cumulated without the risk of default. To the extent that there can still be a loss of control in the firm (as opposed to bankruptcy), we would argue that preferred stock shares almost as many characteristics with unsecured debt as it does with equity.

Measuring Earnings and Profitability

How profitable is a firm? What did it earn on the assets that it invested in? These are the fundamental questions we would like financial statements to answer. Accountants use the income statement to provide information about a firm's operating activities over a specific time period. In terms of our description of the firm, the income statement is designed to measure the earnings from assets in place. In this section, we will examine the principles underlying earnings and return measurement in accounting, and the methods that they are put into practice.

Accounting Principles Underlying Measurement of Earnings and Profitability

Two primary principles underlie the measurement of accounting earnings and profitability. The first is the principle of **accrual accounting**. In accrual accounting, the revenue from selling a good or service is recognized in the period in which the good is sold or the service is performed (in whole or substantially). A corresponding effort is made on the expense side to match[6] expenses to revenues. This is in contrast to **cash accounting**, where revenues are recognized when payment is received and expenses are recorded when they are paid.

The second principle is the categorization of expenses into operating, financing and capital expenses. **Operating expenses** are expenses that, at least in theory, provide benefits only for the current period; the cost of labor and materials expended to create products that are sold in the current period is a good example. **Financing expenses** are expenses arising from the non-equity financing used to raise capital for the business; the most common example is interest expenses. **Capital expenses** are expenses that are

[6] If a cost (such as an administrative cost) cannot be easily linked with a particular revenues, it is usually recognized as an expense in the period in which it is consumed.

expected to generate benefits over multiple periods; for instance, the cost of buying land and buildings is treated as a capital expense.

Operating expenses are subtracted from revenues in the current period to arrive at a measure of operating earnings from the firm. Financing expenses are subtracted from operating earnings to estimate earnings to equity investors or net income. Capital expenses are written off over their useful life (in terms of generating benefits) as depreciation or amortization.

Measuring Accounting Earnings and Profitability

Since income can be generated from a number of different sources, generally accepted accounting principles (GAAP) require that income statements be classified into four sections: income from continuing operations, income from discontinued operations, extraordinary gains or losses and adjustments for changes in accounting principles.

Generally accepted accounting principles require the recognition of revenues when the service for which the firm is getting paid has been performed in full or substantially and for which it has received in return either cash or a receivable that is both observable and measurable. Expenses linked directly to the production of revenues (like labor and materials) are recognized in the same period in which revenues are recognized. Any expenses that are not directly linked to the production of revenues are recognized in the period in which the firm consumes the services.

While accrual accounting is straightforward in firms that produce goods and sell them, there are special cases where accrual accounting can be complicated by the nature of the product or service being offered. For instance, firms that enter into long term contracts with their customers, for instance, are allowed to recognize revenue on the basis of the percentage of the contract that is completed. As the revenue is recognized on a percentage of completion basis, a corresponding proportion of the expense is also recognized. When there is considerable uncertainty about the capacity of the buyer of a good or service to pay for a service, the firm providing the good or service may recognize the income only when it collects portions of the selling price under the installment method.

Reverting back to our discussion of the difference between capital and operating expenses, operating expenses should reflect only those expenses that create revenues in the current period. In practice, however, a number of expenses are classified as operating expenses that do not seem to meet this test. The first is depreciation and amortization. While the notion that capital expenditures should be written off over multiple periods is reasonable, the accounting depreciation that is computed on the original historical cost often bears little resemblance to the actual economical depreciation. The second expense is research and development expenses, which accounting standards in the United States classify as operating expenses, but which clearly provide benefits over multiple periods. The rationale used for this classification is that the benefits cannot be counted on or easily quantified.

Much of financial analysis is built around the expected future earnings of a firm, and many of these forecasts start with the current earnings. It is therefore important that we know how much of these earnings come from the ongoing operations of the firm, and how much can be attributed to unusual or extraordinary events that are unlikely to recur on a regular basis. From that standpoint, it is useful that firms categorize expenses into operating and nonrecurring expenses, since it is the earnings prior to extraordinary items that should be used in forecasting. Nonrecurring items include the following:

1. *Unusual or Infrequent items*, such as gains or losses from the divestiture of an asset or division and write-offs or restructuring costs. Companies sometimes include such items as part of operating expenses. As an example, Boeing in 1997 took a write-off of $1,400 million to adjust the value of assets it acquired in its acquisition of McDonnell Douglas, and it showed this as part of operating expenses.
2. *Extraordinary items*, which are defined as events that are unusual in nature, infrequent in occurrence and material in impact. Examples include the accounting gain associated with refinancing high coupon debt with lower coupon debt, and gains or losses from marketable securities that are held by the firm.
3. *Losses associated with discontinued operations*, which measure both the loss from the phase out period and the estimated loss on the sale of the operations. To qualify, however, the operations have to be separable separated from the firm.

4. *Gains or losses associated with accounting changes,* which measure earnings changes created by accounting changes made voluntarily by the firm (such as a change in inventory valuation and change in reporting period) and accounting changes mandated by new accounting standards.

Measures of Profitability

While the income statement allows us to estimate how profitable a firm is in absolute terms, it is just as important that we gauge the profitability of the firm in comparison terms or percentage returns. Two basic gauges measure profitability. One examines the profitability relative to the capital employed to get a rate of return on investment. This can be done either from the viewpoint of just the equity investors, or by looking at the entire firm. Another examines profitability relative to sales, by estimating a profit margin.

I. Return on Assets (ROA) & Return on Capital (ROC)

The *return on assets* (ROA) of a firm measures its operating efficiency in generating profits from its assets, prior to the effects of financing.

$$\text{ROA} = \frac{\text{EBIT}\,(1 - \text{tax rate})}{\text{Total Assets}}$$

Earnings before interest and taxes (EBIT) is the accounting measure of operating income from the income statement and total assets refers to the assets as measured using accounting rules, i.e., using book value for most assets. Alternatively, return on assets can be written as:

$$\text{ROA} = \frac{\text{Net Income} + \text{Interest Expenses}\,(1 - \text{tax rate})}{\text{Total Assets}}$$

By separating the financing effects from the operating effects, the return on assets provides a cleaner measure of the true return on these assets.

ROA can also be computed on a pre-tax basis with no loss of generality, by using the earnings before interest and taxes (EBIT), and not adjusting for taxes -

$$\text{Pre - tax ROA} = \frac{\text{EBIT}}{\text{Total Assets}}$$

This measure is useful if the firm or division is being evaluated for purchase by an acquirer with a different tax rate or structure.

A more useful measure of return relates the operating income to the capital invested in the firm, where capital is defined as the sum of the book value of debt and equity. This is the *return on capital* (ROC). When a substantial portion of the liabilities is either current (such as accounts payable) or non-interest bearing, this approach provides a better measure of the true return earned on capital employed in the business.

$$\text{After - Tax ROC} = \frac{\text{EBIT}(1 - t)}{\text{BV of Debt} + \text{BV of Equity}}$$

$$\text{Pre - Tax ROC} = \frac{\text{EBIT}}{\text{BV of Debt} + \text{BV of Equity}}$$

Decomposing Return on Capital

The *return on capital* of a firm can be written as a function of its operating profit margin and its capital turnover ratio.

$$\text{After - Tax ROC} = \frac{\text{EBIT}(1 - t)}{\text{BV of Capital}} = \frac{\text{EBIT}(1 - t)}{\text{Sales}} \text{ X } \frac{\text{Sales}}{\text{BV of Capital}}$$
$$= \text{After - Tax Operating Margin} \ * \ \text{Capital Turnover Ratio}$$

$$\text{Pre - Tax ROC} = \text{Pre - Tax Operating Margin} \ * \ \text{Capital Turnover Ratio}$$

Thus, a firm can arrive at a high ROC by either increasing its profit margin or more efficiently utilizing its capital to increase sales. There are likely to be competitive constraints and technological constraints on increasing sales, but firms still have some freedom within these constraints to choose the mix of profit margin and capital turnover that maximizes their ROC. The return on capital varies widely across firms in different businesses, largely as a consequence of differences in profit margins and capital turnover ratios.

II. Return on Equity

While the return on capital measures the profitability of the overall firm, the *return on equity* (ROE) examines profitability from the perspective of the equity investor by relating profits to the equity investor (net profit after taxes and interest expenses) to the book value of the equity investment.

$$\text{ROE} = \frac{\text{Net Income}}{\text{Book Value of Common Equity}}$$

Since preferred stockholders have a different type of claim on the firm than do common stockholders, the net income should be estimated after preferred dividends and the book value of common equity should not include the book value of preferred stock. This can be accomplished by using net income after preferred dividends in the numerator and the book value of common equity in the denominator.

Summary

Financial statements remain the primary source of information for most investors and analysts. There are differences, however, in how accounting and financial analysis approach answering a number of key questions about the firm. We examine these differences in this chapter.

The first question that we examined related to the nature and the value of the assets owned by a firm. Categorizing assets into investments already made (assets in place) and investments yet to be made (growth assets), we argued that accounting statements provide a substantial amount of historical information about the former and very little about the latter. The focus on the original price of assets in place (book value) in accounting statements can lead to significant differences between the stated value of these assets and their market value. With growth assets, accounting rules result in low or no values for assets generated by internal research.

The second issue that we examined was the measurement of profitability. The two principles that seem to govern how profits are measured are accrual accounting – revenues and expenses are shown in the period where transactions occur rather than when the cash is received or paid – and the categorization of expenses into operating, financing and capital expenses. Operating and financing expenses are shown in income statements. Capital expenditures take the form of depreciation and amortization and are spread over several time periods. Accounting standards miscategorize operating leases and research and development expenses as operating expenses (when the former should be categorized as financing expenses and the latter as capital expenses).

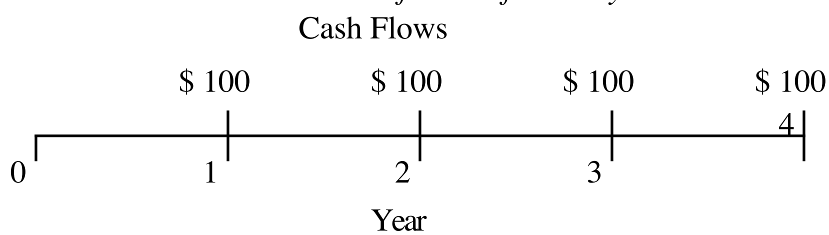
TIME VALUE OF MONEY

The simplest tools in finance are often the most powerful. Present value is a concept that is intuitively appealing, simple to compute, and has a wide range of applications. It is useful in decision making ranging from simple personal decisions - buying a house, saving for a child's education and estimating income in retirement, — to more complex corporate financial decisions - picking projects in which to invest as well as the right financing mix for these projects.

Time Lines and Notation

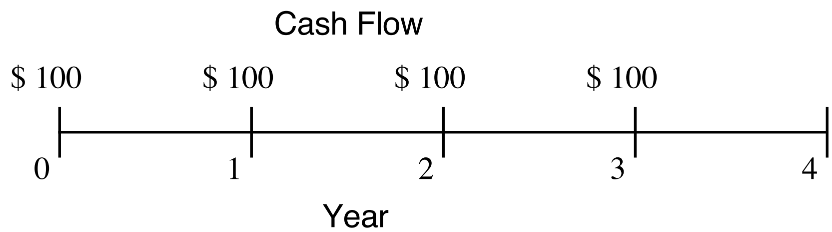
Dealing with cash flows that are at different points in time is made easier using a *time line* that shows both the timing and the amount of each cash flow in a stream. Thus, a cash flow stream of $100 at the end of each of the next 4 years can be depicted on a time line like the one depicted in Figure 1.

Figure 1: A Time Line for Cash Flows: $ 100 in Cash Flows Received at the End of Each of Next 4 years



In the figure, *0* refers to right now. A cash flow that occurs at time 0 is therefore already in present value terms and does not need to be adjusted for time value. A distinction must be made here between a period of time and a point in time. The portion of the time line between 0 and 1 refers to period 1, which, in this example, is the first year. The cash flow that occurs at the point in time "1" refers to the cash flow that occurs at the end of period 1. Finally, the discount rate, which is 10% in this example, is specified for each period on the time line and may be different for each period. Had the cash flows been at the beginning of each year instead of at the end of each year, the time line would have been redrawn as it appears in Figure 2.

Figure 2: A Time Line for Cash Flows: $ 100 in Cash Received at the Beginning of Each Year for Next 4 years



Note that in present value terms, a cash flow that occurs at the beginning of year 2 is the equivalent of a cash flow that occurs at the end of year 1.

Cash flows can be either positive or negative; positive cash flows are called cash inflows and negative cash flows are called cash outflows. For notational purposes, we will assume the following for the chapter that follows:

Notation	*Stands for*
PV	Present Value
FV	Future Value
Cf_t	Cash flow at the end of period t
A	Annuity – Constant cash flows over several periods
r	Discount rate
g	Expected growth rate in cash flows
n	Number of years over which cash flows are received or paid

The Intuitive Basis for Present Value

There are three reasons why a cash flow in the future is worth less than a similar cash flow today.

(1) Individuals prefer present consumption to future consumption. People would have to be offered more in the future to give up present consumption. If the preference for current consumption is strong, individuals will have to be offered much more in terms of future consumption to give up current consumption, a trade-off that is captured by a high "real" rate of return or discount rate. Conversely, when the preference for current consumption is weaker, individuals will settle for much less in terms of future consumption and, by extension, a low real rate of return or discount rate.

(2) When there is monetary inflation, the value of currency decreases over time. The greater the inflation, the greater the difference in value between a cash flow today and the same cash flow in the future.

(3) A promised cash flow might not be delivered for a number of reasons: the promisor might default on the payment, the promisee might not be around to receive payment; or some other contingency might intervene to prevent the promised payment or to reduce it.. Any uncertainty (risk) associated with the cash flow in the future reduces the value of the cashflow.

The process by which future cash flows are adjusted to reflect these factors is called discounting, and the magnitude of these factors is reflected in the discount rate. The discount rate incorporates all of the above mentioned factors. In fact, the discount rate can be viewed as a composite of the expected real return (reflecting consumption preferences in the aggregate over the investing population), the expected inflation rate (to capture the deterioration in the purchasing power of the cash flow) and the uncertainty associated with the cash flow. Models to measure this uncertainty and capture it in the discount rate are examined in Chapters 6 and 7.

The Mechanics of Time Value

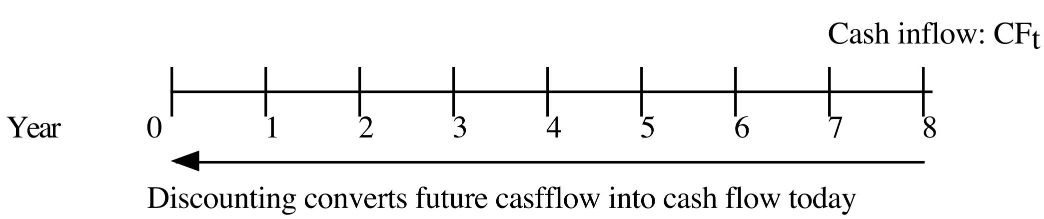
The process of discounting future cash flows converts them into cash flows in present value terms. Conversely, the process of compounding converts present cash flows into future cash flows.

There are five types of cash flows - simple cash flows, annuities, growing annuities, perpetuities and growing perpetuities — which we discuss below.

Simple Cash Flows

A simple cash flow is a single cash flow in a specified future time period; it can be depicted on a time line in figure 3:

Figure 3: Present Value of a Cash Flow



where CF_t = the cash flow at time t.

This cash flow can be discounted back to the present using a discount rate that reflects the uncertainty of the cash flow. Concurrently, cash flows in the present can be compounded to arrive at an expected future cash flow.

I. Discounting a Simple Cash Flow

Discounting a cash flow converts it into present value dollars and enables the user to do several things. First, once cash flows are converted into present value dollars, they can be aggregated and compared. Second, if present values are estimated correctly, the user should be indifferent between the future cash flow and the present value of that cash flow. The present value of a cash flow can be written as follows

$$\text{Present Value of Simple Cash Flow} = \frac{CF_t}{(1+r)^t}$$

where

CF_t = Cash Flow at the end of time period t

r = Discount Rate

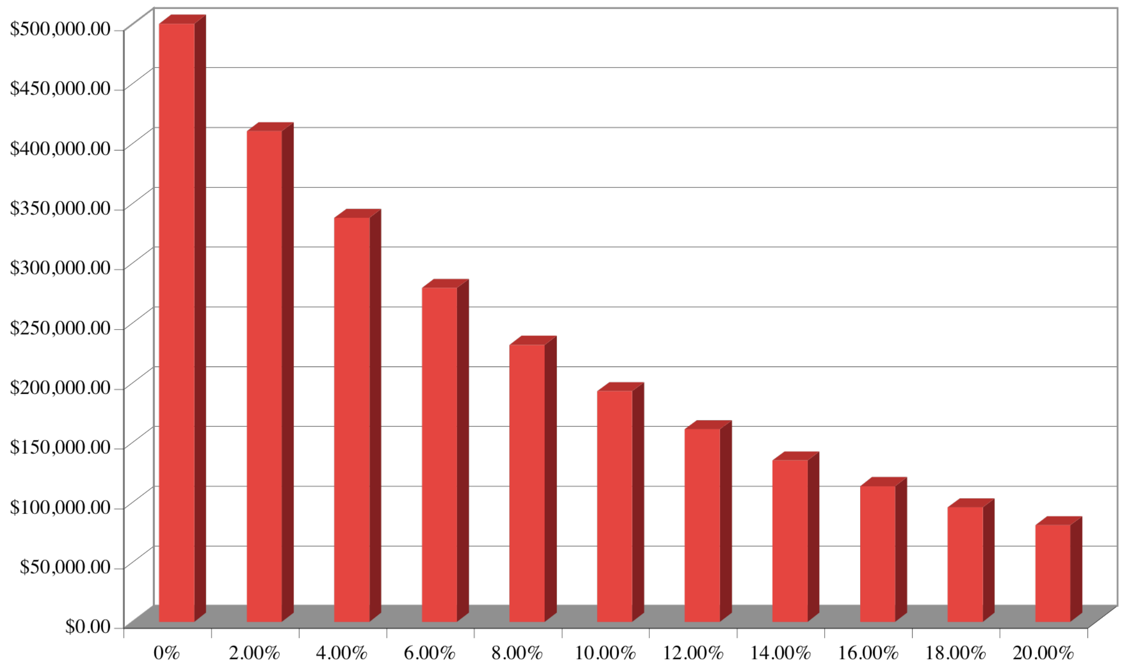
Other things remaining equal, the present value of a cash flow will decrease as the discount rate increases and continue to decrease the further into the future the cash flow occurs.

To illustrate this concept, assume that you own are currently leasing your office space, and expect to make a lump sum payment to the owner of the real estate of \$500,000 ten years from now. Assume that an appropriate discount rate for this cash flow is 10%. The present value of this cash flow can then be estimated –

$$\text{Present Value of Payment} = \frac{\$500,000}{(1.10)^{10}} = \$192,772$$

This present value is a decreasing function of the discount rate, as illustrated in Figure 4.

Figure 4: Present value of $500,000 in 10 years



II. Compounding a Cash Flow

Current cash flows can be moved to the future by compounding the cash flow at the appropriate discount rate.

Future Value of Simple Cash Flow = $CF_0\ (1+r)^t$

where

CF_0 = Cash Flow now

r = Discount rate

Again, the compounding effect increases with both the discount rate and the compounding period.

As the length of the holding period is extended, small differences in discount rates can lead to large differences in future value. In a study of returns on stocks and bonds between 1926 and 1997, Ibbotson and Sinquefield found that stocks on the average made 12.4%, treasury bonds made 5.2%, and treasury bills made 3.6%. Assuming that these returns continue into the future, Table 1 provides the future values of $ 100 invested in each category at the end of a number of holding periods - 1 year, 5 years, 10 years, 20 years, 30 years, and 40 years.

Table 1: Future Values of Investments - Asset Classes

Holding Period	Stocks	T. Bonds	T.Bills
1	$112.40	$105.20	$103.60
5	$179.40	$128.85	$119.34
10	$321.86	$166.02	$142.43
20	$1,035.92	$275.62	$202.86
30	$3,334.18	$457.59	$288.93
40	$10,731.30	$759.68	$411.52

The differences in future value from investing at these different rates of return are small for short compounding periods (such as 1 year) but become larger as the compounding period is extended. For instance, with a 40-year time horizon, the future value of investing in stocks, at an average return of 12.4%, is more than 12 times larger than the future value of investing in treasury bonds at an average return of 5.2% and more than 25 times the future value of investing in treasury bills at an average return of 3.6%.

III. The Frequency of Discounting and Compounding

The frequency of compounding affects both the future and present values of cash flows. In the examples above, the cash flows were assumed to be discounted and compounded annually — i.e., interest payments and income were computed at the end of each year, based on the balance at the beginning of the year. In some cases, however, the interest may be computed more frequently, such as on a monthly or semi-annual basis. In these cases, the present and future values may be very different from those computed on an annual basis; the stated interest rate, on an annual basis, can deviate significantly from the effective or true interest rate. The effective interest rate can be computed as follows

$$\text{Effective Interest Rate} = \left(1+\frac{\text{Stated Annual Interest Rate}}{\text{n}}\right)^{n}-1$$

where

n = number of compounding periods during the year (2=semiannual; 12=monthly)

For instance, a 10% annual interest rate, if there is semiannual compounding, works out to an effective interest rate of

$$\text{Effective Interest Rate} = 1.05^2 - 1 = .10125 \text{ or } 10.25\%$$

As compounding becomes continuous, the effective interest rate can be computed as follows

$$\text{Effective Interest Rate} = \exp^{r} - 1$$

where

exp = exponential function

r = stated annual interest rate

Table 2 provides the effective rates as a function of the compounding frequency.

Table 2: Effect of Compounding Frequency on Effective Interest Rates

Frequency	Rate	t	Formula	Effective Annual Rate
Annual	10%	1	.10	10%
Semi-Annual	10%	2	$(1+.10/2)^{2}-1$	10.25%
Monthly	10%	12	$(1+.10/12)^{12}-1$	10.47%
Daily	10%	365	$(1+.10/365)^{365}-1$	10.5156%
Continuous	10%		$\exp^{.10}-1$	10.5171%

As you can see, compounding becomes more frequent, the effective rate increases, and the present value of future cash flows decreases.

Annuities

An annuity is a constant cash flow that occurs at regular intervals for a fixed period of time. Defining A to be the annuity, the time line for an annuity may be drawn as follows:

	A	A	A	A
0	1	2	3	4

An annuity can occur at the end of each period, as in this time line, or at the beginning of each period.

I. Present Value of an End-of-the-Period Annuity

The present value of an annuity can be calculated by taking each cash flow and discounting it back to the present and then adding up the present values. Alternatively, a formula can be used in the calculation. In the case of annuities that occur at the end of each period, this formula can be written as

$$PV \text{ of an Annuity } = \text{PV(A,r,n)} = \text{A}\left[\frac{1 - \frac{1}{(1+r)^n}}{r}\right]$$

where

A = Annuity

r = Discount Rate

n = Number of years

Accordingly, the notation we will use in the rest of this book for the present value of an annuity will be PV(A,r,n).

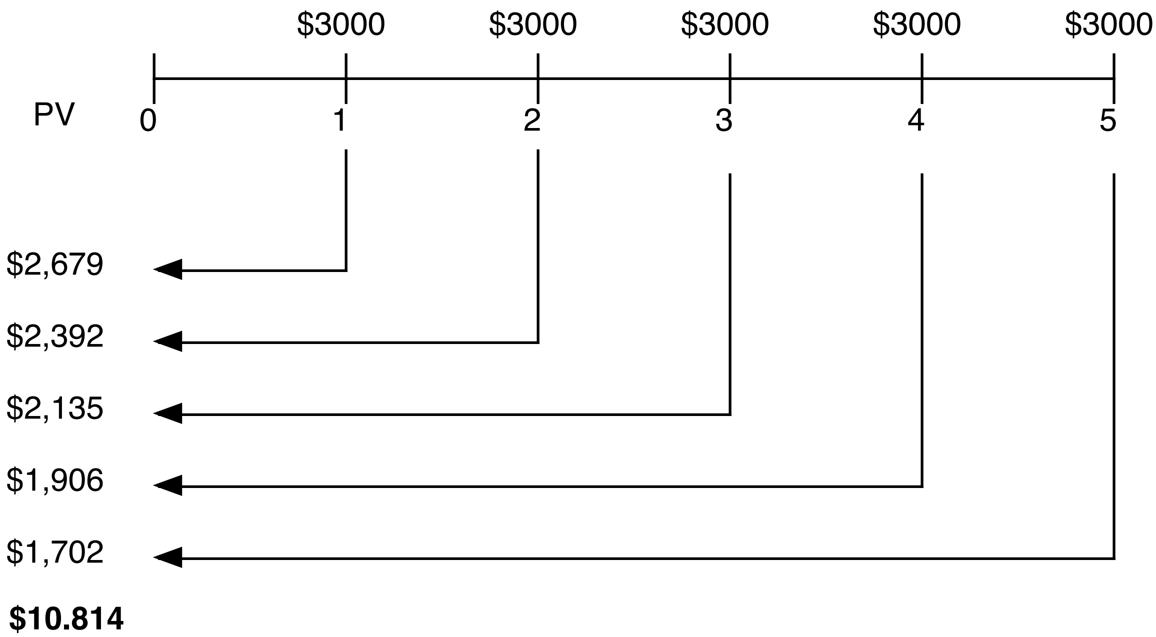
To illustrate, assume again that you are have a choice of buying a copier for \$10,000 cash down or paying \$ 3,000 a year, at the end of each year, for 5 years for the same copier. If the opportunity cost is 12%, which would you rather do?

$$PV \text{ of \$3000 each year for next 5 years } = \$3000\left[\frac{1 - \frac{1}{(1.12)^5}}{.12}\right] = \$10{,}814$$

The present value of the installment payments exceeds the cash-down price; therefore, you would want to pay the \$10,000 in cash now.

Alternatively, the present value could have been estimated by discounting each of the cash flows back to the present and aggregating the present values as illustrated in Figure 5.

Figure 5 :Payment of $ 3000 at the end of each of next 5 years



II. Amortization Factors - Annuities Given Present Values

In some cases, the present value of the cash flows is known and the annuity needs to be estimated. This is often the case with home and automobile loans, for example, where the borrower receives the loan today and pays it back in equal monthly installments over an extended period of time. This process of finding an annuity when the present value is known is examined below –

$$\text{Annuity given Present Value} = A(PV, r, n) = PV \left[\frac{r}{1 - \frac{1}{(1+r)^n}} \right]$$

Suppose you are trying to borrow $200,000 to buy a house on a conventional 30-year mortgage with monthly payments. The annual percentage rate on the loan is 8%. The monthly payments on this loan can be estimated using the annuity due formula:

Monthly interest rate on loan = APR/ 12 = 0.08/12 = 0.0067

$$\text{Monthly Payment on Mortgage} = \$200,000 \left[\frac{0.0067}{1 - \frac{1}{(1.0067)^{360}}} \right] = \$1473.11$$

This monthly payment is an increasing function of interest rates. When interest rates drop, homeowners usually have a choice of refinancing, though there is an up-front cost to doing so. We examine the question of whether or not to refinance later in this chapter.

Iii. Future Value Of End-Of-The-Period Annuities

In some cases, an individual may plan to set aside a fixed annuity each period for a number of periods and will want to know how much he or she will have at the end of the period. The future value of an end-of-the-period annuity can be calculated as follows:

$$\textit{FV}\text{ of an Annuity } = \text{FV(A,r,n)} = \text{A}\left[\frac{(1+\text{r})^{\text{n}} - 1}{\text{r}}\right]$$

Thus, the notation we will use throughout this book for the future value of an annuity will be FV(A,r,n).

Individual retirement accounts (IRAs) allow some taxpayers to set aside \$2,000 a year for retirement and exempts the income earned on these accounts from taxation. If an individual starts setting aside money in an IRA early in her working life, the value at retirement can be substantially higher than the nominal amount actually put in. For instance, assume that this individual sets aside \$2,000 at the end of every year, starting when she is 25 years old, for an expected retirement at the age of 65, and that she expects to make 8% a year on her investments. The expected value of the account on her retirement date can be estimated as follows:

$$\text{Expected Value of IRA set - aside at 65} = \$2{,}000\left[\frac{(1.08)^{40} - 1}{.08}\right] = \$518{,}113$$

The tax exemption adds substantially to the value because it allows the investor to keep the pre-tax return of 8% made on the IRA investment. If the income had been taxed at say 40%, the after-tax return would have dropped to 4.8%, resulting in a much lower expected value:

$$\text{Expected Value of IRA set - aside at 65 if taxed} = \$2{,}000\left[\frac{(1.048)^{40} - 1}{.048}\right] = \$230{,}127$$

As you can see, the available funds at retirement drops by more than 55% as a consequence of the loss of the tax exemption.

IV. Annuity Given Future Value

Individuals or businesses who have a fixed obligation to meet or a target to meet (in terms of savings) some time in the future need to know how much they should set aside each period to reach this target. If you are given the future value and are looking for an annuity - A(FV,r,n) in terms of notation:

$$\text{Annuity given Future Value} = \text{A(FV,r,n)} = \text{FV}\left[\frac{r}{(1+r)^n - 1}\right]$$

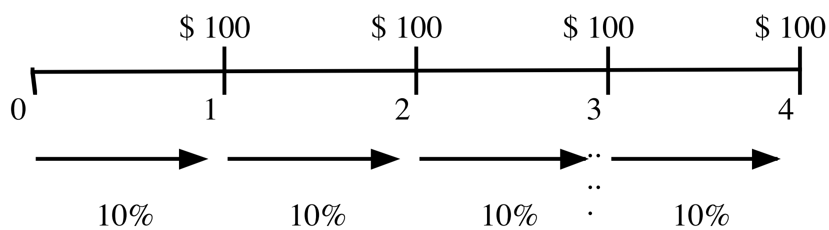
In any balloon payment loan, only interest payments are made during the life of the loan, while the principal is paid at the end of the period. Companies that borrow money using balloon payment loans or conventional bonds (which share the same features) often set aside money in sinking funds during the life of the loan to ensure that they have enough at maturity to pay the principal on the loan or the face value of the bonds. Thus, a company with bonds with a face value of $100 million coming due in 10 years would need to set aside the following amount each year (assuming an interest rate of 8%):

$$\text{Sinking Fund Provision each year} = \$100{,}000{,}000\left[\frac{.08}{(1.08)^{10} - 1}\right] = \$6{,}902{,}950$$

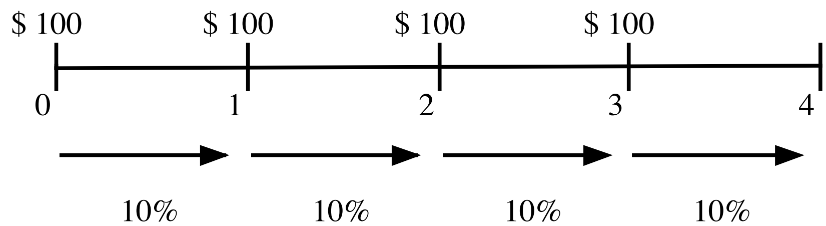
The company would need to set aside $6.9 million at the end of each year to ensure that there are enough funds ($10 million) to retire the bonds at maturity.

V. Effect Of Annuities At The Beginning Of Each Year

The annuities considered thus far in this chapter are end-of-the-period cash flows. Both the present and future values will be affected if the cash flows occur at the beginning of each period instead of the end. To illustrate this effect, consider an annuity of $ 100 at the end of each year for the next 4 years, with a discount rate of 10%.



Contrast this with an annuity of $100 at the beginning of each year for the next four years, with the same discount rate.



Since the first of these annuities occurs right now, and the remaining cash flows take the form of an end-of-the-period annuity over 3 years, the present value of this annuity can be written as follows:

$$PV \text{ of \$100 at beginning of each of next 4 years} = \$100 + \$100 \left[\frac{1 - \dfrac{1}{(1.10)^3}}{.10} \right]$$

In general, the present value of a beginning-of-the-period annuity over n years can be written as follows:

$$PV \text{ of Beginning of Period Annuities over n years} = A + A \left[\frac{1 - \dfrac{1}{(1+r)^{n-1}}}{r} \right]$$

This present value will be higher than the present value of an equivalent annuity at the end of each period.

The future value of a beginning-of-the-period annuity typically can be estimated by allowing for one additional period of compounding for each cash flow:

$$FV \text{ of a Beginning - of - the - Period Annuity} = A\,(1+r) \left[\frac{(1+r)^n - 1}{r} \right]$$

This future value will be higher than the future value of an equivalent annuity at the end of each period.

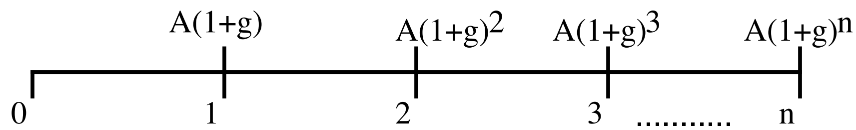
Consider again the example of an individual who sets aside \$2,000 at the end of each year for the next 40 years in an IRA account at 8%. The future value of these deposits amounted to \$ 518,113 at the end of year 40. If the deposits had been made at the beginning of each year instead of the end, the future value would have been higher:

$$\text{Expected Value of IRA (beginning of year)} = \$2{,}000\ (1.08) \left[\frac{(1.08)^{40} - 1}{.08} \right] = \$559{,}562$$

As you can see, the gains from making payments at the beginning of each period can be substantial.

Growing Annuities

A <u>growing annuity</u> is a cash flow that grows at a constant rate for a specified period of time. If A is the current cash flow, and g is the expected growth rate, the time line for a growing annuity appears as follows –



Note that, to qualify as a growing annuity, the growth rate in each period has to be the same as the growth rate in the prior period.

In most cases, the present value of a growing annuity can be estimated by using the following formula –

$$\textit{PV} \text{ of a Growing Annuity } = A(1+g)\left[\frac{1 - \dfrac{(1+g)^n}{(1+r)^n}}{r - g}\right]$$

The present value of a growing annuity can be estimated in all cases, but one - where the growth rate is equal to the discount rate. In that case, the present value is equal to the nominal sums of the annuities over the period, without the growth effect.

PV of a Growing Annuity for n years (when r=g) = n A

Note also that this formulation works even when the growth rate is greater than the discount rate.[1]

To illustrate a growing annuity, suppose you have the rights to a gold mine for the next 20 years, over which period you plan to extract 5,000 ounces of gold every year. The current price per ounce is $300, but it is expected to increase 3% a year. The appropriate discount rate is 10%. The present value of the gold that will be extracted from this mine can be estimated as follows:

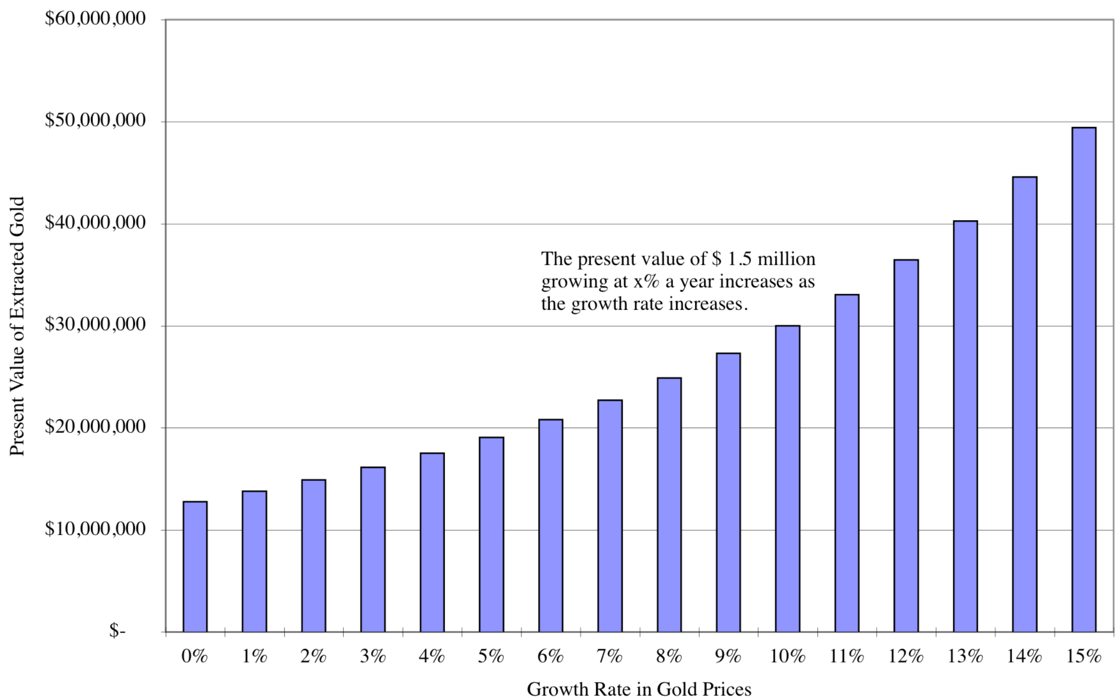
---

[1] Both the denominator and the numerator in the formula will be negative, yielding a positive present value.

$$PV \text{ of extracted gold} = \$300 * 5000 * (1.03) \left[\frac{1 - \frac{(1.03)^{20}}{(1.10)^{20}}}{.10 - .03} \right] = \$16{,}145{,}980$$

The present value of the gold expected to be extracted from this mine is $16.146 million; it is an increasing function of the expected growth rate in gold prices. Figure 6 illustrates the present value as a function of the expected growth rate.

Figure 6: Present Value of Extracted Gold as a function of Growth Rate



Perpetuities

A perpetuity is a constant cash flow at regular intervals forever. The present value of a perpetuity can be written as

$$PV \text{ of Perpetuity} = \frac{A}{r}$$

where A is the perpetuity. The most common example offered for a perpetuity is a console bon. A console bond is a bond that has no maturity and pays a fixed coupon. Assume that you have a 6% coupon console bond. The value of this bond, if the interest rate is 9%, is as follows:

Value of Console Bond = $60 / .09 = $667

The value of a console bond will be equal to its face value (which is usually $1000) only if the coupon rate is equal to the interest rate.

Growing Perpetuities

A growing perpetuity is a cash flow that is expected to grow at a constant rate forever. The present value of a growing perpetuity can be written as:

$$PV \text{ of Growing Perpetuity } = \frac{CF_1}{(r - g)}$$

where CF_1 is the expected cash flow next year, g is the constant growth rate and r is the discount rate. While a growing perpetuity and a growing annuity share several features, the fact that a growing perpetuity lasts forever puts constraints on the growth rate. It has to be less than the discount rate for this formula to work.

Growing perpetuities are especially useful when valuing equity in publicly traded firms, since they could potentially have perpetual lives. Consider a simple example. In 1992, Southwestern Bell paid dividends per share of $2.73. Its earnings and dividends had grown at 6% a year between 1988 and 1992 and were expected to grow at the same rate in the long term. The rate of return required by investors on stocks of equivalent risk was 12.23%.

Current Dividends per share = $2.73

Expected Growth Rate in Earnings and Dividends = 6%

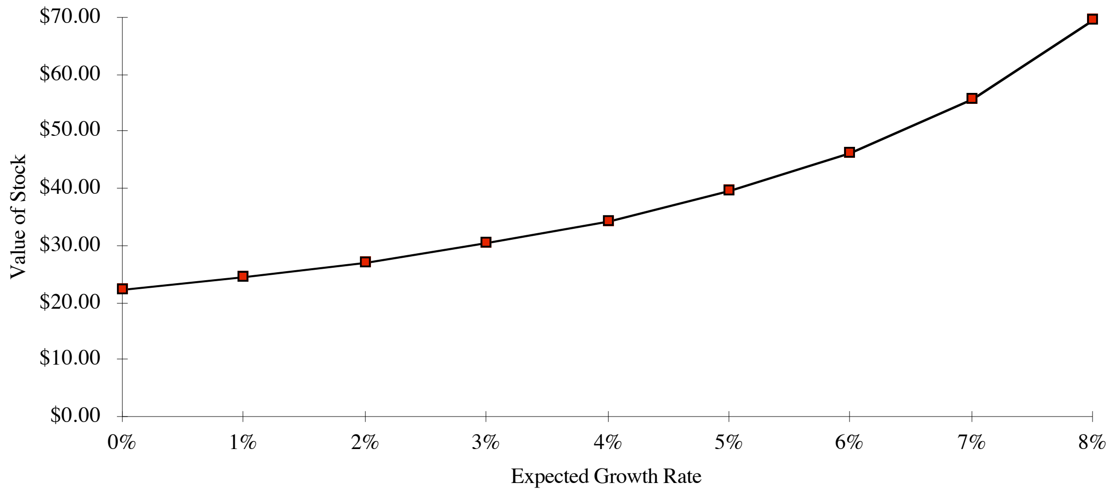
Discount Rate = 12.23%

With these inputs, we can value the stock using a perpetual growth model:

Value of Stock = $2.73 *1.06 / (.1223 -.06) = $46.45

As an aside, the stock was actually trading at $70 per share. This price could be justified by using a higher growth rate. The value of the stock is graphed in figure 7 as a function of the expected growth rate.

Figure 3.7: SW Bell -Value versus Expected Growth



The growth rate would have to be approximately 8% to justify a price of $70. This growth rate is often referred to as an implied growth rate.

Conclusion

Present value remains one of the simplest and most powerful techniques in finance, providing a wide range of applications in both personal and business decisions. Cash flow can be moved back to present value terms by discounting and moved forward by compounding. The discount rate at which the discounting and compounding are done reflect three factors: (1) the preference for current consumption, (2) expected inflation and (3) the uncertainty associated with the cash flows being discounted.

In this chapter, we explored approaches to estimating the present value of five types of cash flows: simple cash flows, annuities, growing annuities, perpetuities, and growing perpetuities.

OPTION PRICING

In general, the value of any asset is the present value of the expected cash flows on that asset. In this section, we will consider an exception to that rule when we will look at assets with two specific characteristics:

- They derive their value from the values of other assets.
- The cash flows on the assets are contingent on the occurrence of specific events.

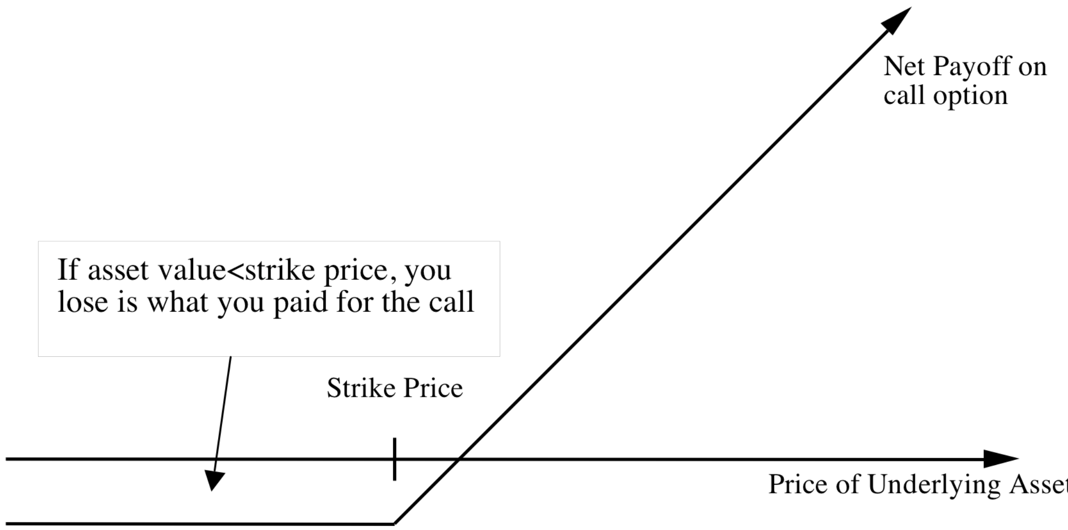
These assets are called options, and the present value of the expected cash flows on these assets will understate their true value. In this section, we will describe the cash flow characteristics of options, consider the factors that determine their value and examine how best to value them.

Cash Flows on Options

There are two types of options. A call option gives the buyer of the option the right to buy the underlying asset at a fixed price, whereas a put option gives the buyer the right to sell the underlying asset at a fixed price. In both cases, the fixed price at which the underlying asset can be bought or sold is called the **strike or exercise price**.

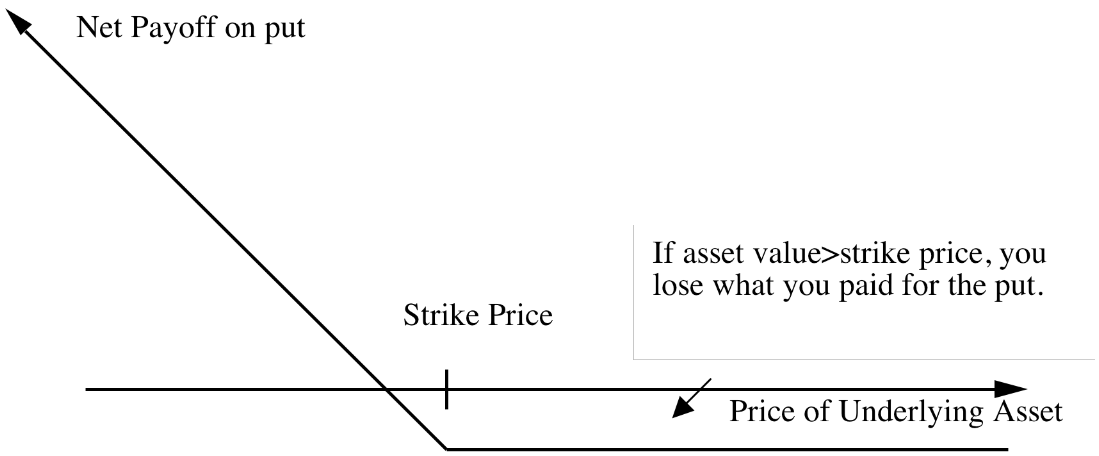
To look at the payoffs on an option, consider first the case of a call option. When you buy the right to sell an asset at a fixed price, you want the price of the asset to increase above that fixed price. If it does, you make a profit, since you can buy at the fixed price and then sell at the much higher price; this profit has to be netted against the cost initially paid for the option. However, if the price of the asset decreases below the strike price, it does not make sense to exercise your right to buy the asset at a higher price. In this scenario, you lose what you originally paid for the option. Figure 1 summarizes the cash payoff at expiration to the buyer of a call option.

Figure 1: Payoff on Call Option



With a put option, you get the right to sell at a fixed price, and you want the price of the asset to decrease below the exercise price. If it does, you buy the asset at the exercise price and then sell it back at the current price, claiming the difference as a gross profit. When the initial cost of buying the option is netted against the gross profit, you arrive at an estimate of the net profit. If the value of the asset rises above the exercise price, you will not exercise the right to sell at a lower price. Instead, the option will be allowed to expire without being exercised, resulting in a net loss of the original price paid for the put option. Figure 2 summarizes the net payoff on buying a put option.

Figure 2: Payoff on Put Option



With both call and put options, the potential for profit to the buyer is significant, but the potential for loss is limited to the price paid for the option.

Determinants of Option Value

What is it that determines the value of an option? At one level, options have expected cash flows just like all other assets, and that may seem like good candidates for discounted cash flow valuation. The two key characteristics of options -- that they derive their value from some other traded asset, and the fact that their cash flows are contingent on the occurrence of a specific event -- does suggest an easier alternative. We can create a portfolio that has the same cash flows as the option being valued, by combining a position in the underlying asset with borrowing or lending. This portfolio is called a **replicating portfolio** and should cost the same amount as the option. The principle that two assets (the option and the replicating portfolio) with identical cash flows cannot sell at different prices is called the **arbitrage principle**.

Options are assets that derive value from an underlying asset; increases in the value of the underlying asset will increase the value of the right to buy at a fixed price and reduce the value to sell that asset at a fixed price. On the other hand, increasing the strike price will reduce the value of calls and increase the value of puts.

While calls and puts move in opposite directions when stock prices and strike prices are varied, they both increase in value as the life of the option and the variance in the underlying asset's value increases. The reason for this is the fact that options have limited losses. Unlike traditional assets that tend to get less valuable as risk is increased, options become more valuable as the underlying asset becomes more volatile. This is so because the added variance cannot worsen the downside risk (you still cannot lose more than what you paid for the option) while making potential profits much higher. In addition, a longer life for the options just allows more time for both call and put options to appreciate in value. Since calls provide the right to buy the underlying asset at a fixed price, an increase in the value of the asset will increase the value of the calls. Puts, on the other hand, become less valuable as the value of the asset increase.

The final two inputs that affect the value of the call and put options are the riskless interest rate and the expected dividends on the underlying asset. The buyers of call and put options usually pay the price of the option up front, and wait for the expiration day to exercise. There is a present value effect associated with the fact that the promise to buy an asset for $ 1 million in 10 years is less onerous than paying it now. Thus, higher interest rates will generally increase the value of call options (by reducing the present value of the price on exercise) and decrease the value of put options (by decreasing the present value of the price received on exercise). The expected dividends paid by assets make them less valuable; thus, the call option on a stock that does not pay a dividend should be worth more than a call option on a stock that does pay a dividend. The reverse should be true for put options.

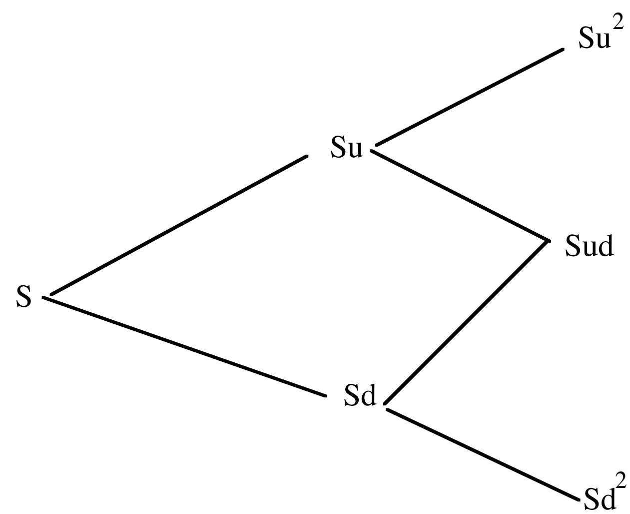
A Simple Model for Valuing Options

Almost all models developed to value options in the last three decades are based upon the notion of a replicating portfolio. The earliest derivation, by Black and Scholes, is mathematically complex, and we will return to it in chapter 27. In this chapter, we consider the simplest replication model for valuing options – the binomial model.

The Binomial Model

The **binomial option pricing model** is based upon a simple formulation for the asset price process in which the asset, in any time period, can move to one of two possible prices. The general formulation of a stock price process that follows the binomial is shown in Figure 3.

Figure 3: General Formulation for Binomial Price Path



In this figure, S is the current stock price; the price moves up to Su with probability p and down to Sd with probability 1-p in any time period. For instance, if the stock price today is \$ 100, u is 1.1 and d is 0.9, the stock price in the next period can either be \$ 110 (if u is the outcome) and \$ 90 (if d is the outcome).

Creating A Replicating Portfolio

The objective in creating a replicating portfolio is to use a combination of risk-free borrowing/lending and the underlying asset to create the same cash flows as the option being valued. In the case of the general formulation above, where stock prices can either move up to Su or down to Sd in any time period, the replicating portfolio for a call with a given strike price will involve borrowing \$B and acquiring Δ of the underlying asset. Of course, this formulation is of no use if we cannot determine how much we need to borrow and what Δ is. There is a way, however, of identifying both variables. To do this, note that the value of this position has to be same as the value of the call no matter what the stock price does. Let us assume that the value of the call is C_u if the stock price goes to Su, and C_d if the stock price goes down to Sd. If we had borrowed \$B and bought Δ shares of stock with the money, the value of this position under the two scenarios would have been as follows:

	Value of Position	Value of Call
If stock price goes up to Su	Δ Su - \$ B (1+r)	C_u

If stock price goes down to Sd	Δ Sd - \$ B (1+r)	C_d

Note that, in either case, we have to pay back the borrowing with interest. Since the position has to have the same cash flows as the call, we get

Δ Su - \$ B (1+r) = C_u

Δ Sd - \$ B (1+r) = C_d

Solving for Δ, we get

Δ = Number of units of the underlying asset bought = $(C_u - C_d)/(Su - Sd)$

where,

C_u = Value of the call if the stock price is Su

C_d = Value of the call if the stock price is Sd

When there are multiple periods involved, we have to begin with the last period, where we know what the cash flows on the call will be, solve for the replicating portfolio and then estimate how much it would cost us to create this portfolio. We then use this value as the estimated value of the call and estimate the replicating portfolio in the previous period. We continue to do this until we get to the present. The replicating portfolio we obtain for the present can t be priced to yield a current value for the call.

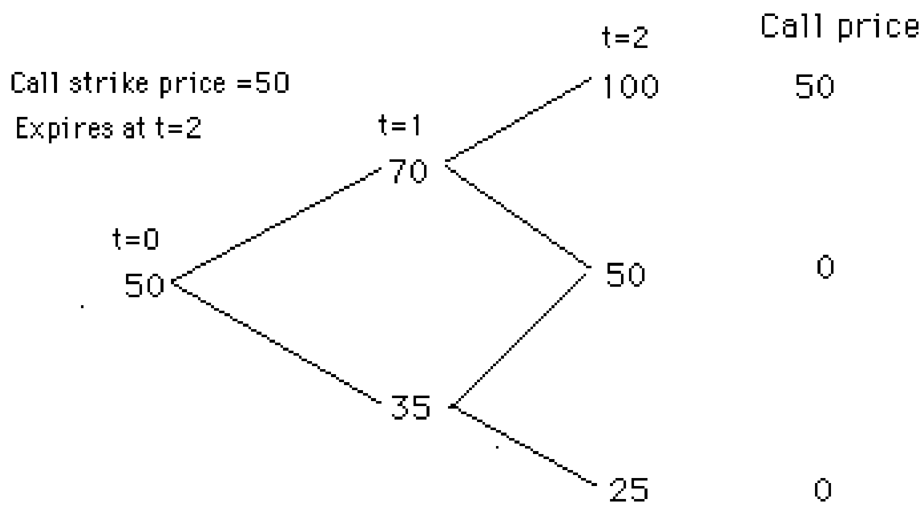
Value of the call = Current value of underlying asset * Option Delta

- Borrowing needed to replicate the option

In Practice 5.12: An Example of Binomial valuation

Assume that the objective is to value a call with a strike price of 50, which is expected to expire in two time periods, on an underlying asset whose price currently is 50 and is expected to follow a binomial process. Figure 4 illustrates the path of underlying asset prices and the value of the call (with a strike price of 50) at the expiration.

Figure 4: Binomial Price Path



Note that since the call has a strike price of \$ 50, the gross cash flows at expiration are as follows:

If the stock price moves to \$ 100: Cash flow on call = \$ 100 - \$ 50 = \$ 50

If the stock price moves to \$ 50: Cash flow on call = \$ 50 - \$ 50 = \$ 0

If the stock price moves to \$ 25: Cash flow on call = \$ 0 (Option is not exercised).

Now assume that the interest rate is 11%. In addition, define

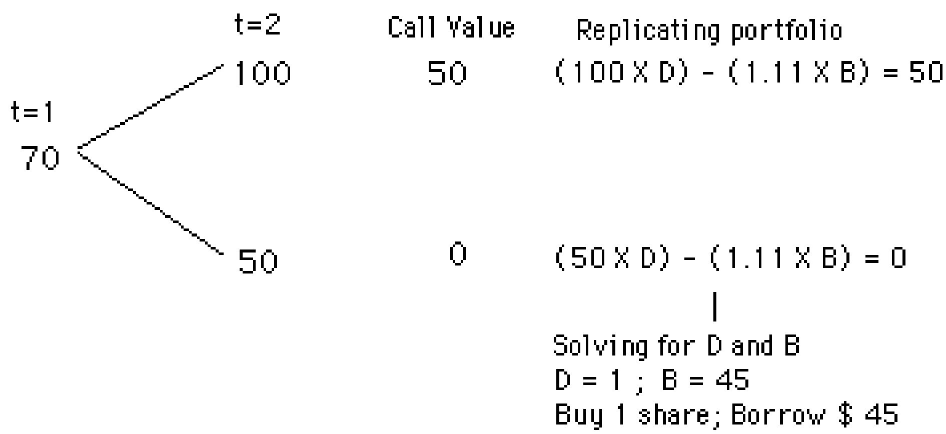
Δ = Number of shares in the replicating portfolio

B = Dollars of borrowing in replicating portfolio

The objective, in this analysis, is to combine Δ shares of stock and B dollars of borrowing to replicate the cash flows from the call with a strike price of \$ 50.

The first step in doing this, is to start with the last period and work backwards. Consider, for instance, one possible outcome at t =1. The stock price has jumped to \$ 70, and is poised to change again, either to \$ 100 or \$ 50. We know the cash flows on the call under either scenario, and we also have a replicating portfolio composed of Δ shares of the underlying stock and \$ B of borrowing. Writing out the cash flows on the replicating portfolio under both scenarios (stock price of \$ 100 and \$ 50), we get the replicating portfolios in figure 5:

Figure 5: Replicating Portfolios when Price is \$ 70



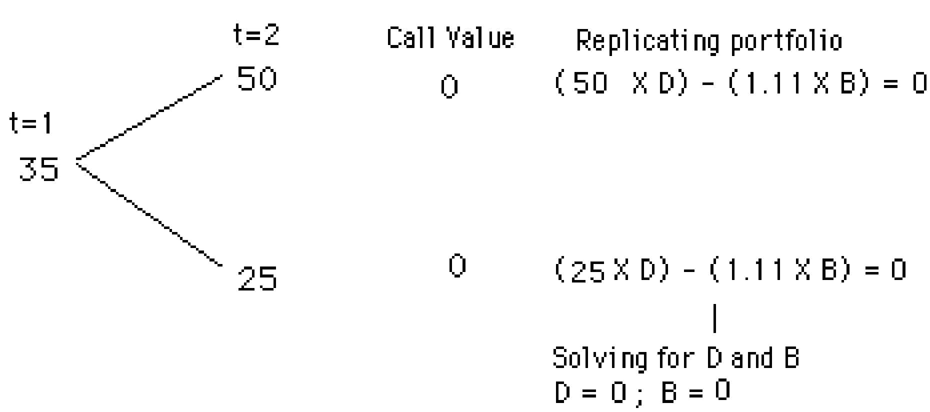
In other words, if the stock price is \$70 at t=1, borrowing \$45 and buying one share of the stock will give the same cash flows as buying the call. The value of the call at t=1, if the stock price is \$70, should therefore be the cash flow associated with creating this replicating position and it can be estimated as follows:

$70\ \Delta - B = 70-45 = 25$

The cost of creating this position is only \$ 25, since \$ 45 of the \$ 70 is borrowed. This should also be the price of the call at t=1, if the stock price is \$ 70.

Consider now the other possible outcome at t=1, where the stock price is \$ 35 and is poised to jump to either \$ 50 or \$ 25. Here again, the cash flows on the call can be estimated, as can the cash flows on the replicating portfolio composed of Δ shares of stock and \$B of borrowing. Figure 6 illustrates the replicating portfolio:

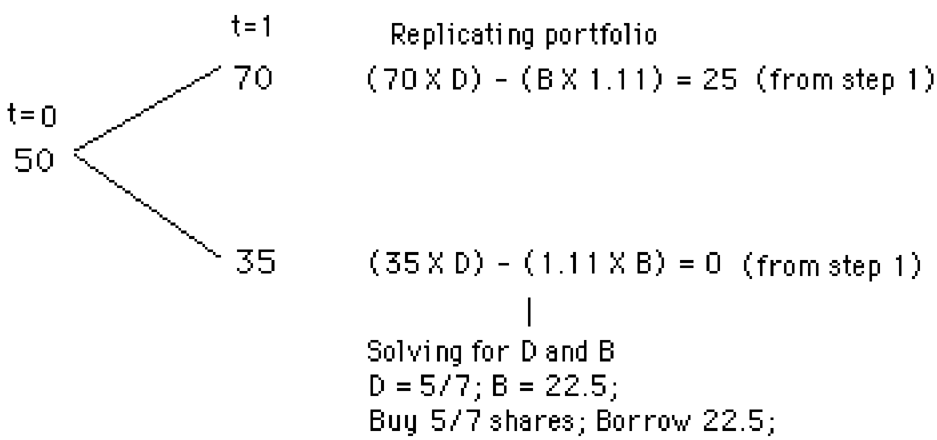
Figure 6: Replicating Portfolio when Price is \$ 35



Since the call is worth nothing, under either scenario, the replicating portfolio also is empty. The cash flow associated with creating this position is obviously zero, which becomes the value of the call at t=1, if the stock price is $ 35.

We now have the value of the call under both outcomes at t=1; it is worth $ 25 if the stock price goes to $ 70 and $0 if it goes to $ 35. We now move back to today (t=0), and look at the cash flows on the replicating portfolio. Figure 7 summarizes the replicating portfolios as viewed from today:

Figure 7: Replicating Portfolios for Call Value



Using the same process that we used in the previous step, we find that borrowing $22.5 and buying 5/7 of a share will provide the same cash flows as a call with a strike price of $50. The cost, to the investor, of borrowing $ 22.5 and buying 5/7 of a share at the current stock price of $ 50 yields:

Cost of replicating position = 5/7 X $ 50 - $ 22.5 = $ 13.20

This should also be the value of the call.

More on the Determinants of Option Value

The binomial model provides insight into the determinants of option value. The value of an option is determined not by the expected price of the asset but by its current price, which, of course, reflects expectations about the future. In fact, the probabilities that we provided in the description of the binomial process of up and down movements do not enter the option valuation process, though they do affect the underlying asset's value. The reason for this is the fact that options derive their value from other assets, which are often traded. Consequently, the capacity investors possess to create positions that have the same cash flows as the call operates as a powerful mechanism controlling option prices. If the option value deviates from the value of the replicating portfolio, investors can create an arbitrage position, i.e., one that requires no investment, involves no risk, and delivers positive returns. The option value increases as the time to expiration is extended, as the price movements (u and d) increase, and as the interest rate increases.

The second insight is that the greater the variance in prices in the underlying asset in this example, the more valuable the option becomes. Thus, increasing the up and down movements, in the illustration above, makes options more valuable. This occurs because of the fact that options do not have to be exercised if it is not in the holder's best interests to do so. Thus, lowering the price in the worst case scenario to \$ 10 from \$ 25 does not, by itself, affect the gross cash flows on this call. On the other hand, increasing the price in the best case scenario to \$ 150 from \$ 100 benefits the call holder and makes the call more valuable.

The binomial model is a useful model for illustrating the replicating portfolio and the effect of the different variables on call value. It is, however, a restrictive model, since asset prices in the real world seldom follow a binomial process. Even if they did, estimating all possible outcomes and drawing a binomial tree, as we have, can be an extraordinarily tedious exercise.