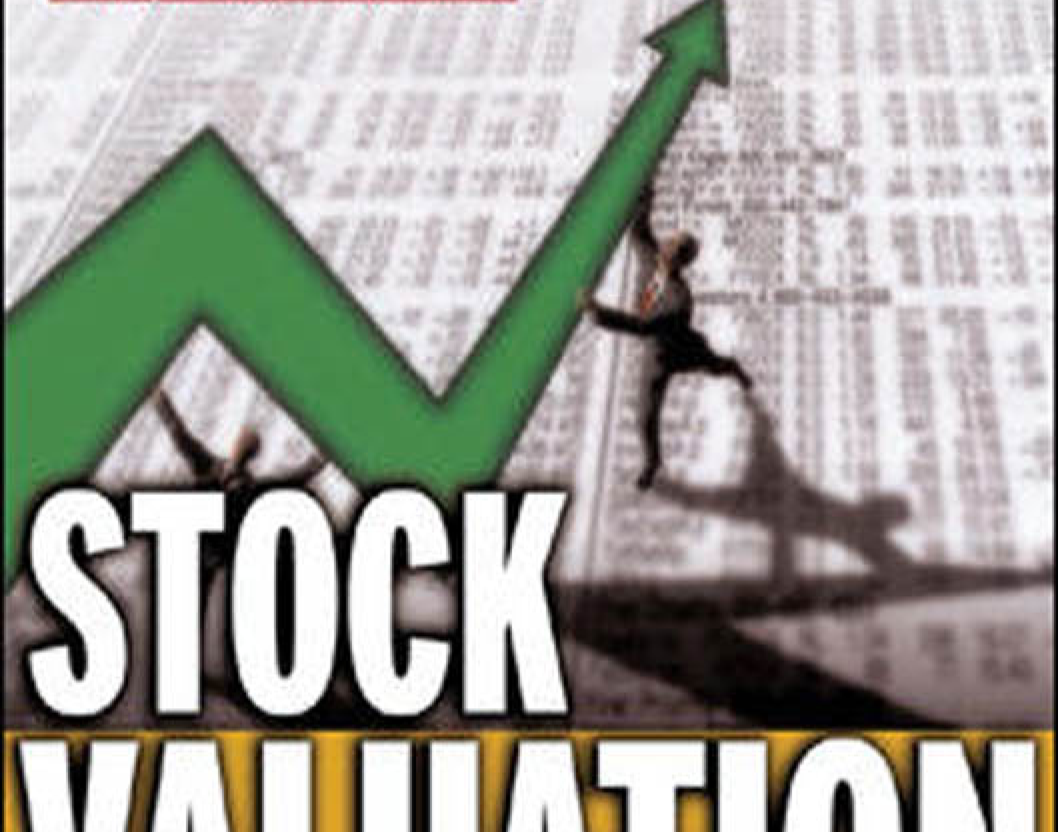
McGRAW-HILL
Library of Investment & Finance



STOCK VALUATION

AN ESSENTIAL GUIDE TO WALL STREET'S MOST POPULAR VALUATION MODELS

SCOTT HOOVER

STOCK VALUATION

An Essential Guide to Wall Street's Most Popular Valuation Models

SCOTT A. HOOVER

McGraw-Hill

New York Chicago San Francisco Lisbon London Madrid
Mexico City Milan New Delhi San Juan Seoul
Singapore Sydney Toronto

0-07-148334-9

The material in this eBook also appears in the print version of this title: 0-07-145224-9.

DOI: 10.1036/0071452249

McGraw-Hill **Professional**

Want to learn more?

We hope you enjoy this McGraw-Hill eBook! If you'd like more information about this book, its author, or related books and websites, please click here.

*To my wife, Annalie;
to my children,
Quinn, Emmalyn,
and Jessa; and to my
parents for their
continual and
unconditional love
and support.*

This page intentionally left blank

CONTENTS

This page intentionally left blank

FIGURES

This page intentionally left blank

PREFACE

In the fall of 2000, I joined the faculty at Washington and Lee University to teach investments and, more interestingly, to act as an advisor to the Williams Investment Society at the university. The Williams Investment Society consists of more than thirty students who manage roughly a million dollars of the school's endowment by investing in common stocks. The society is entirely extracurricular, and the students come from a variety of different backgrounds and a variety of different majors, so teaching those students how to properly value stocks presents some interesting educational challenges. In particular, how do we best teach stock valuation to bright young people who want to work in investments but who may have little or no background in finance? More than anything, this book is an attempt to provide a resource to those people. It will not make them expert stock-pickers, but my hope is that the book will lay the groundwork for their future as investment professionals.

Primarily, I wanted to provide a text on stock valuation that is both theoretically appealing and consistent with how stock valuation is conducted in the real world. Typical investment textbooks lack the real-world perspective these students need, and typical popular books on valuation tend to avoid the theoretical underpinnings that help us truly understand why we do certain things and what the limitations are in doing so. This book is designed to stand between those two approaches. In preparation for writing the book, I spent a great deal of time looking at how investment professionals value stocks. Of special interest were three asset managers who have seemingly defied the odds and outperformed the market over extended periods of time. There are many books available on Warren Buffett (of Berkshire Hathaway), and he has written extensively in his annual letters to shareholders, so I had ample information about his views on valuation. Peter Lynch (formerly of Fidelity's Magellan fund) has himself written extensively on how he picks stocks, which gave me some insight into his thinking. Very little has been written about Bill Miller (of Legg Mason's Value Trust), but he was in a sense the most interesting of the three managers. Perhaps more than any other prominent asset manager, he closely follows what the academics teach. I contacted Miller, and he was especially gracious in allowing me to spend three days with him and his team in Baltimore. In addition, he spent several days at Washington and Lee to observe and educate the investment society. The value of the time with him is incalculable.

In addition to Miller, the Williams Investment Society has hosted a large number of other investment professionals over the years, including fund managers, investment bankers, and other finance-related professionals. All told, these interactions gave me a great deal of exposure to stock valuation in practice. Several investment banks went so far as to provide me with the training materials they use to teach new employees, which was quite useful to gaining an understanding of how they deal with the issues.

To be clear, this book is not intended for the casual investor, but is rather intended for anyone who wishes to work in an investment field. Although the discussions are based more on intuition than on the underlying math, stock valuation is a nontrivial undertaking. As such, we must discuss some difficult concepts. Despite this, I wrote the book to be accessible to those without substantial knowledge of finance or accounting principles. There were three objectives that I kept in mind in choosing a style for the book. First, it would be a stand-alone book that does not require significant prior knowledge of accounting and finance concepts. Rather than assume (or hope) that the reader already understands the time value of money, the relationship between risk and return, and how to analyze financial statements, the book addresses those issues in depth. Second, the book does not focus solely on academic theories or solely on the practices of investment professionals, but rather joins those ideas together. In doing so, we could understand both the theoretical underpinnings of the practices of investment professionals and the difficulties those professionals face in applying the theories. Third, to the extent possible, the book is conversational in nature, so the reader will not be overwhelmed with technical jargon and highly scientific arguments. Instead, concepts are presented in simple, understandable language that focuses on the important intuition. This does not mean that the book lacks rigor, but that the book's highest priority is to communicate an understanding of the key intuition behind the topics—first and foremost, I wanted the reader to understand why investment professionals use various techniques, and what biases might be introduced in using them.

ACKNOWLEDGMENTS

Many people and organizations have contributed to this effort. Most notably, I thank Bill Miller and his team at Legg Mason (particularly Samantha McLemore and Michael Mauboussin), who went way out of their way to accommodate me. People at J. P. Morgan, Morgan Stanley, and Lehman Brothers were quite helpful as well, as were several individuals at smaller investment banks and at other mutual funds. I am in debt to too many individuals to list them all by name, but several are worth mentioning specifically because they contributed directly to the book or because they were instrumental in shaping my thinking on various issues: Fred Sterbenz, Nick Sayers, Brian Castleberry, Will Flynn, Elizabeth Oliver, Chuck Phillips, Bob Culpepper, Robert Battalio, Jeff Tucker, and Ryan Scott. In addition, my father was particularly helpful in answering accounting questions.

This page intentionally left blank

CHAPTER 1

Setting the Stage

PURPOSE AND SCOPE

In this chapter, we set the stage for the remainder of the book by discussing a series of big-picture topics. First, we spend some time thinking about who values stocks and what their goals are in doing so. Next, we briefly lay out the objective of equity investment, which provides the real motivation for the rest of the book. We then discuss some of the common perceptions about stock valuation so that we can begin to understand some of the basic principles we must address. Finally, we briefly discuss the investment process. As part of this discussion, we spend some time talking about the different strategies we might employ to take advantage of our beliefs and the information we have.

WHO VALUES STOCKS?

In considering the investment world, we observe that there are several broad categories of people who need to value stocks. The motivations to undertake valuation include the potential to profit from trading, the desire to establish effective economic policies, the desire to understand and better manage companies, and the need to convey accurate yet simplified information to the public. It follows that there are many different classes of people who need to understand the stock valuation process, ranging from corporate insiders who manage companies to economists who manage the economy.

Corporate Managers

Company managers have a vested interest in valuing not only their own stock, but the stocks of other companies that might make promising strategic partners or profitable acquisitions. Knowing the value of their own stock allows them, for example, to properly make strategic decisions about raising money. For instance, if managers believe their stock is being undervalued by the market, they would generally not want to issue more stock. If in contrast they believe that their stock is being overvalued by the market, it might be a good time to sell more stock. For similar reasons, it is useful for managers to know the value of other companies. If another company's stock is currently being undervalued by the market, the managers might consider acquiring that company.

Financial Analysts: Investment Banking

Investment bankers play a unique role in society as they work to match companies with investors. For example, a company may need to raise money to finance the rollout of a new product. The investment banker would evaluate the company and make recommendations about the best way for the company to raise the needed funds. If the company chooses to follow those recommendations, the investment banker (and associates within the bank and perhaps within other banks) typically works to sell whatever securities are being offered to raise the needed money. As part of this process, investment bankers must not only value the company's stock, but must lay out a convincing case to justify that valuation. In a sense, the task of an investment banker is not to determine what a stock is really worth, but is rather to determine the price at which the investment bank can sell the stock. Although these are slightly different objectives, we do observe that investment bankers use many of the same basic techniques that are used by other financial analysts.

Financial Analysts: Equity Research

Those who work in equity research are responsible not only for tracking companies, but for making assessments of the true values of those companies. These assessments allow the analysts to make recommendations to public and/or private investors. As public investors, we observe buy/sell recommendations along with "upgrades" or "downgrades" of the stocks. Stock prices sometimes react dramatically to these ratings, so there is reason to believe that equity researchers provide meaningful information to investors. Still, there is little empirical evidence supporting the idea that we can earn abnormally high profits based on the information provided by equity researchers. Obviously, the reputation of an analyst is quite important because it can lend credibility to reports and because it potentially allows the analyst to move into a more lucrative job (such as one in asset management).

Asset Managers

Asset managers are professionals who invest money on behalf of individuals and organizations (such as pension funds). In the world of stocks, the main objective of these managers is typically to construct portfolios that will beat the fund's *benchmark* portfolio (i.e., "the market") over the long run. A benchmark portfolio is a well-diversified set of assets that is comparable in structure and risk to the fund. Conceptually, the benchmark represents an equivalent-risk alternative investment that investors might choose. If the asset manager consistently underperforms that benchmark, then investors would find it to their advantage to shift their money into the benchmark itself. If a fund is composed only of large companies, we would consider a well-diversified benchmark portfolio of large companies. If a fund is composed only of healthcare stocks, we would choose a well-diversified benchmark portfolio of healthcare stocks. Whatever the focus of the fund, we know that in order for the fund manager to beat the benchmark consistently, the manager must identify assets that are misvalued by the market. Obviously, this means that asset managers must be well versed in valuation.

Individuals

Many individuals also engage in stock picking and therefore need to know how to value stocks. I hope it will become clear as you read through this book that it is generally unwise for individuals to attempt to pick stocks. Doing so is quite difficult and time-consuming, and individuals are generally better off investing in an index fund rather than trying to pick stocks themselves. Still, stock picking can be quite enjoyable, and we would be naïve to expect individuals to avoid it entirely.

Economic Policymakers

Ever since Alan Greenspan, chairman of the U.S. Federal Reserve Board, uttered the words "irrational exuberance" to describe stock market investors in 1996, even the noninvesting public has known that our policymakers examine valuations in the stock market. The focus of policymakers is different from the others we have mentioned in that they examine the value of the stock market as a whole relative to its "true" value. This allows them to better assess, among other things, the stability of the financial markets and the potential need to change interest rates to generate higher growth or to slow it down. We will not pretend to know what models Chairman Greenspan and his colleagues use to value the stock market, but it is fair to say that in order to value the stock market as a whole, they must understand how to value stocks individually. Indeed, Greenspan (and other members of the Federal Reserve) often talk publicly about corporate inventory levels and other variables that are important to the valuation process, so we have good reason to believe that economic policymakers are well versed in the details of stock valuation.

THE OBJECTIVE OF EQUITY INVESTMENT

Generally speaking, the objective of an equity investor is to substantially increase wealth over time. This is different from but related to the objective of stock picking, which is not only to substantially increase wealth over time, but to increase it by a greater amount than it would increase if we invested in some appropriate benchmark portfolio. If we achieve that goal, we are said to have "beaten the market."

There is a wide spectrum of strategies that give us opportunities to meet the objective of equity investing. At one end of the spectrum, we might simply invest in an index fund or a mutual fund and leave our money there for a long period of time. This is a naturally passive strategy that requires little or no financial knowledge and very little time commitment. At the other end, we might conduct research on stocks, invest in the best ones, and turn over our portfolio from time to time as conditions change. This is a naturally active approach that requires both time and knowledge to be successful. For the vast majority of the investing population, buying an index fund or mutual fund is the best choice. However, the purpose of this book is to discuss the tools and concepts that we must understand to be able to value stocks. We will therefore couch all our discussions in terms of stock picking. Although there is some disagreement about whether stock picking can be an especially profitable undertaking, we will assume for the purposes of this text that it can be if we are willing to put in the time and effort.

We will consider a variety of topics that can be roughly organized into two categories. The first includes topics related to the fundamental tools of finance (e.g., time value of money, estimation of discount rates). The second includes valuation models that utilize those tools. The book is organized in that fashion, with Chapters 2–8 covering the fundamental tools and Chapters 9 & 10 covering the valuation models and the final investment decision.

RELATED CONCEPTS

At this point, it is useful to discuss a few topics that do not fit into either of those categories. Our purpose in doing so is to establish an intuitive understanding of what matters in stock picking. We also seek to eliminate some popular misconceptions about stocks.

Earnings vs. Cash Flow

We need only examine the stock listings in the *Wall Street Journal* or listen to a few minutes of any finance-related television show to see that earnings are a primary focus of the investment world. Indeed, the *price-to-earnings ratio*, which we will discuss in some detail later in the book, is easily the most discussed and cited valuation measure in the investment world. Given all the attention paid to earnings, it may be surprising to learn that earnings are often a relatively poor measure of the success of a company. Rather than measuring the *true* profits generated by the company over the given period, earnings measure the *accounting* profits of the company. In particular, some of the factors of a company's earnings are cash flows that occurred in a previous period or that may occur in a future period. Our desire is of course to examine the actual cash flows generated by a company, so we must address these difficulties. We will find that earnings and cash flow can differ by a substantial amount, because of normal events or even outright manipulation by company managers.

Earnings are not the same as cash flow.

One of the primary tasks we face is therefore to understand the difference between earnings and profitability. Specifically, we must understand how to properly interpret a company's earnings and how we can use information contained in the company's financial statements to compute more appropriate measures of profitability.

Good Companies vs. Good Stocks

One of the more difficult hurdles we need to overcome is the natural tendency to want to choose only high-quality companies. There is certainly nothing wrong with this instinct, but we do need to understand that there is a distinction between picking good companies and picking good stocks. Our intuition tells us that although these may not be one and the same, they are certainly very close. Imagine, however, that everyone suddenly takes this view and invests only in "good" companies. The stocks of "bad" companies then suffer from a lack of demand and their prices drop precipitously. At some point, the prices become so low that the stocks are good investments even though the companies are not so great themselves. The point here is not that we should run out and buy stock in all the poorly run companies we can find. Rather, it is that we must acknowledge the possibility that a mediocre (or even poor) company may in fact be a good investment.

Good companies are not necessarily good investments; good investments are not necessarily good companies.

Simply stated, we need to be open to the possibility that troubled companies may be good investments. Indeed, anecdotal evidence suggests that investing in carefully screened troubled companies may be a key element in the successful management of a portfolio of stocks. For example, Bill Miller's Legg Mason Value Trust (ticker: LMVTX), a mutual fund that has beaten its benchmark (the S&P 500 index) in each of the last 14 calendar years, routinely holds stocks that have seen their prices drop substantially recently. In making that choice, Miller essentially selects stocks that appear to be in trouble, but are ones for which the market seems to have overreacted—he invests "where there is fear."[1] Warren Buffet, the investment wizard behind Berkshire Hathaway (ticker: BRKa), has also been known to invest in companies that appear to be in trouble. We will discuss both Miller and Buffet in Chapter 2.

Size Matters

We cannot possibly conduct a full evaluation of each stock in the marketplace, so we must first reduce the set of possible investments to some manageable number. In doing so, it is useful to eliminate stocks that are the least likely to be mispriced and instead focus on those that are the most likely to be mispriced. It follows that the first challenge of stock picking involves identifying stocks that are the most likely to be undervalued. Intuition might suggest that the best investments are large, stable companies that are unlikely to deteriorate substantially. This might very well be true if our desire is to simply generate a steady return over time. If instead our desire is to beat the market, investing in large, stable companies is unlikely to be productive. In light of our discussion about good companies vs. good stocks, it is clear that we should at least consider small companies that perhaps are not so stable. Furthermore, there is reason to believe that these are the very stocks that the market is most likely to misprice.

To understand this, imagine that you ask one person to tell you what the temperature is outside. You might, by chance, pick someone who happened to glance at a temperature gauge before entering the building and who, by that stroke of fortune, knows with great accuracy what the temperature is. Alternatively, you might pick someone who entered the building many hours ago and who has no real idea how warm it is outside. The accuracy of your temperature estimate arrived at with this technique is obviously in great question. Now imagine that you instead ask 20 people what the temperature is outside, and that you then average the responses.

1. See "Investing with Style—Any Style," *Business Week*, February 7, 2005, p. 90.

It is likely that some of those will overestimate the temperature, some will underestimate it, and some will be very accurate. By averaging these, we are likely to get an answer that is reasonably close to the true temperature.

So what does this have to do with picking stocks? Well, imagine that there is a stock that is followed by only one analyst, and that the stock is not widely covered by the media. There is a significant chance that the analyst's estimate of stock value will be off by a wide margin. If this estimate influences public opinion and the market follows that opinion, the stock price would differ widely from its true value. On the other hand, consider a stock that is followed by many analysts and that is covered widely by the press. Although some analysts are likely to overestimate stock value and some are likely to underestimate it, the analysts collectively (i.e., on average) are not likely to be far from the true value. This suggests that the stocks of companies that are not heavily followed are more likely to be mispriced than the stocks of companies that are heavily followed. Since small companies typically have a smaller following, we conclude the following.

Generally speaking, the stocks of small companies are more likely to be mispriced than the stocks of large companies.

Peter Lynch, formerly of Fidelity's Magellan fund and who we will discuss in the next chapter, uses the phrase "Big Companies, Small Moves" to describe this observation.[2] Not only is it difficult for big companies to grow rapidly, but they tend to be so widely followed that the market's valuation of those companies is not likely to be far from its true value. There is also empirical evidence that hints that smaller companies might generate higher returns than larger ones, even after adjusting for risk.[3]

Growth vs. Value

The concepts of growth investing and value investing are quite pervasive in the financial press and in financial research (by both practitioners and

2. See Lynch (2000, 109).
3. See, for example, Fama and French (1992)

academics). But what is "growth" and what is "value"? The website www.investorwords.com defines a growth strategy as "a strategy based on investing in companies and sectors that are growing faster than their peers" and defines value investing as "an investment strategy which favors good stocks at great prices over great stocks at good prices." The website www.investopedia.com defines a growth stock as "shares in a company whose earnings are expected to grow at an above average rate relative to the market" and defines a value stock as "a stock that is considered undervalued by a value investor." These definitions give us a vague idea of the definitions of value and growth, but they really miss the point. To understand the essence of growth and value strategies, we first make the following observation.

If the market prices stocks accurately, there is no consistent advantage in choosing one type of stock over another.

Academics refer to this as "market efficiency," which is the premise that we cannot consistently earn abnormal profits. By "abnormal profits," we mean the profits above those which are necessary to compensate us for the risk associated with the investment. If indeed the market is efficient, then stock picking is a losing proposition. The time and money we would spend to investigate stocks would not be rewarded with abnormally high returns, so there would be no advantage in doing the research in the first place. (Of course, if no one did research, markets would quickly become inefficient.)[4] So what does this have to do with growth and value? If markets are efficient, then there is no advantage to employing a growth strategy over a value strategy, and vice versa. An implication of this is that we can define growth and value in terms of the general tendencies of the market to misprice stocks.

We can say that a growth investor is an investor who believes that the market is more likely to undervalue stocks with high growth expectations than other stocks. These stocks characteristically have high price-to-earnings (P/E) ratios because the market expects earnings to grow rapidly in the future. The growth investor essentially believes that the market

4. See Grossman and Stiglitz (1980) for a rather elegant argument along these lines.

tends to be too pessimistic when it evaluates companies in high-growth phases. Alternatively, we might say that a growth investor is someone who believes he or she has a special ability to understand companies in high-growth phases. In either case, the growth investor might screen out the low P/E stocks and focus on stocks with high P/E ratios. A value investor, on the other hand, is an investor who believes that the market tends to undervalue stocks that have low growth expectations (and hence low P/E ratios) or simply believes that he or she has a special ability to understand slow-growth companies. The value investor might screen out the high P/E stocks and focus on the stocks with low P/E ratios.

So, who is right? There is certainly some evidence that value stocks have tended to outperform growth stocks historically,[5] but we note anecdotally that the Calamos Growth Fund was one of the highest performing funds over the last decade, with an average annual return around 19% per year. Meanwhile, the Legg Mason Value Trust generated returns that were only slightly lower than that on average. This suggests that neither argument is entirely correct. As many experts (including Warren Buffett and Bill Miller) are quick to mention, the point is not whether growth beats value or vice versa. Rather, the point is that *the role of the stock picker is to identify undervalued stocks regardless of their characteristics*. A successful growth investor is simply someone who, for whatever reason, has an advantage in determining which of the many growth stocks are actually undervalued. A successful value investor is simply someone who, for whatever reason, has an advantage in determining which of the many value stocks are actually undervalued. In both cases, the objective is the same—to identify undervalued stocks. More importantly to us, the tools used by these investors are also much the same. We can apply the same concepts and models to the two types of stocks. It follows that there is no substantive difference between the two in terms of our approach to valuing stocks.

Growth and value are one and the same.

In fact, traditional value investors often invest in growth stocks and vice versa. Miller's Value Trust, for example, currently holds such names as

5. See Haugen (1999) for an interesting discussion of the evidence.

Amazon (AMZN), Google (GOOG), and InterActiveCorp (IACI), all of which have characteristics of growth stocks.

Our point here is that the distinction between growth and value is relatively meaningless, despite the fact that those terms are so widely used. The valuation techniques used are the same whether we are considering a value stock or a growth stock, so there is really no need to differentiate between the two.

Few Stocks vs. Many Stocks

In addition to considering the characteristics of stocks, it is worthwhile to spend some time thinking about portfolio construction. For example, how many stocks should a portfolio contain? We do not pretend to have a definitive answer to that question, but we do note anecdotally that many of the best-performing mutual funds hold a relatively small number of stocks. For example, the Legg Mason Value Trust typically holds 30–40 stocks, while the average domestic equity mutual fund contains in excess of 150 stocks.[6] Peter Lynch recommends holding "as many stocks as there are situations in which: (a) you've got an edge; and (b) you've uncovered an exciting prospect that passes all the tests of research."[7] He goes on to say that he would be comfortable in holding 3–10 stocks in a small portfolio, although he does recognize the benefits of holding more stocks. There are at least two explanations for the success of funds with concentrated holdings. First, managing a portfolio of a large number of stocks is difficult and time-consuming. Simply keeping up with the news items and financial reports of the company is an enormous undertaking. By dealing with a small number of companies, we keep the situation manageable and we become experts on those stocks. Second, investing in more stocks requires the fund, in theory, to accept a lower expected return on the portfolio. To see this, imagine that you have perfect foresight and that you can predict precisely what the return on each stock will be over the next year. Imagine further that you choose to hold 20 stocks while an otherwise identical investor chooses to hold 200. Who would have the higher portfolio return over the next year? Clearly, you would because you would pick the top 20 stocks

6. As of May 31, 2003, the 8,521 domestic equity funds listed in Morningstar's Principia database held an average of 161 positions. The 1,954 international equity funds listed held an average of 142 positions.

7. See Lynch (2000, 239).

while your competitor would choose those 20 plus 180 others that have a lower return. This intuition applies even if we do not have perfect foresight. To add more and more stocks to our portfolio, we must add stocks that are less and less attractive. Thus if we hold a small number of stocks, we have the luxury of choosing only the very best ones. We conclude the following.

Funds holding relatively fewer stocks tend to outperform funds holding relatively more stocks.

This is not to say that we should take the idea to an extreme and hold only one or two stocks. As we will discuss in Chapter 6, diversification is a powerful benefit for investors and we should certainly hold enough stocks to receive that benefit. We will not go so far as to suggest a specific number of stocks, but we do point out that there is a tradeoff here. If markets tend to misprice stocks and if we can identify those mispricings, the fewer stocks we hold, the greater is our expected return.

Broad-Based Portfolios vs. Concentrated Portfolios

A related issue is the decision to hold a portfolio of stocks selected from many industries or a portfolio concentrated in only a few industries. The advantages of concentrating our activities are well known. We can devote our time to understanding one or two industries in great depth instead of spreading ourselves thin and gaining a shallow understanding of a larger number of industries. Perhaps, for example, we are already experts in a given field, so it is both natural and logical that we would want to take advantage of our knowledge base. The difficulty with specializing as a stock picker is that we are forced into a particular class of valuation models that we will later term *absolute valuation* models. In such models, we seek to estimate the true value of stocks. In theory, our goal in using absolute valuation techniques is to determine whether a stock is worth buying. In contrast, *relative valuation* models are such that we seek to estimate the true value of stocks *relative to their peers*. Our goal in using relative valuation techniques is to identify the best stocks in a group.

This is a subtle but very important distinction. Relative valuation lends itself nicely to a portfolio strategy in which we choose to invest in the best stocks in each of a broad cross section of industries. To see why, suppose that we have the ability to identify the best stock among any group of peer companies. If we specialize in a given industry and choose to invest all of our money in the best stock in that industry, it may very well be the case that we will still underperform the market. In fact, it may be disastrous for us to invest in the best stock in an industry that subsequently deteriorates rapidly. Suppose instead that we are broad-based investors and that we invest our money in a portfolio consisting of the best stock in each industry within a broad set of industries. Clearly, we would beat the market by a substantial margin if we followed such a strategy. Although we would choose a few bad stocks in bad industries, those losses would be more than offset by our investments in the best stocks in great industries. On balance, we can conclude the following:

Generally speaking, investors should hold portfolios of assets from many different industries rather than portfolios concentrated in only a few industries.

This is not to say that we would never want to hold a concentrated portfolio. Rather, we simply point out that doing so exposes us to greater risk and requires us to conduct much more extensive analyses. We are reminded, however, of a quote from Mark Twain, "Put all your eggs in one basket and—WATCH THAT BASKET!"[8] An advantage of holding fewer stocks is that it is easier to monitor them, but, in general, we must be extremely confident of our analyses in order to hold so few stocks. This typically will not be the case unless we are insiders in a corporation. It is fine for Bill Gates to hold a relatively undiversified portfolio (consisting almost entirely of Microsoft stock) because he is in a position to know what the stock is really worth.

As we will see clearly later in the book, it is a much easier task to determine whether a stock is undervalued relative to its peers than it is to

8. See Twain's *Pudd'nhead Wilson*, Chapter 15.

determine whether a stock is undervalued. To understand why, consider two companies from the same industry. The stocks of those companies are similar in risk. Company A currently has profits of $3 per share, and we expect those profits to grow at a rate of 11% per year over the foreseeable future. The company's stock is currently trading at $50 per share. Company B, which we believe to be as risky as Company A, currently has profits of $2.80 per share, and we expect those profits to grow at a rate of 10% per year over the foreseeable future. The company's stock is also currently trading at $50 per share. Company B has lower current profits and lower growth expectations than does Company A, yet the stocks of the two companies sell for the same price. In this simple example, it is clear that if our growth expectations are accurate, the stock of Company A is undervalued relative to the stock of Company B. Still, we have no idea whether the stock is a good investment or not. We must do a lot of additional work to make that determination.

THE INVESTMENT PROCESS

At this point, it is useful to discuss a process we might employ in making investment decisions. In doing so, we can identify the areas that we must cover in this book in order to have a reasonable grasp of the stock valuation process. The process we discuss here is only one of many different ways we might approach stock picking. It is not intended to be a definitive explanation of the investment process.

Stock pickers typically take one of two approaches to valuation. The first is a bottom-up approach in which a company is evaluated based on its value relative to its peers. As we discussed earlier, this philosophy is based on the idea that if we buy the best stocks in a well-diversified set of industries, we will consistently outperform the market by a wide margin. An implication of the philosophy is that we pay a little less attention to the prospects of the industry as a whole and a little more attention to the position of a company within its industry. Effectively, we engage primarily in stock selection and not so much in industry selection.

The second approach is a top-down approach in which we first consider macroeconomic conditions as they relate to the well-being of given markets and industries. We then assess the pricing of those markets and industries and make decisions about which industries (if any) are most likely to be undervalued. The stocks we select for investment are then chosen from within the industries that are most likely to be undervalued. For practical purposes, we face three decisions if we use a top-down strategy. First, how much should we invest in the stock market? Second, in which industries should we invest? Third, in which stocks within those industries should we invest?

Market Selection

As an investor, the first step we take is to select markets for potential investment. That is, we decide how much of our money we wish to invest in stocks, how much we wish to invest in bonds, and so on. In making this decision, we consider our willingness to take on risk along with our needs and desires to pull money out of our portfolio. Conventional wisdom suggests that if we are very risk averse and/or if we expect to withdraw money from our investment account after a short period of time, we should prefer safer investments such as bonds. In contrast, the less risk averse we are and/or the longer the time until we expect to withdraw funds, the more money we should allocate for riskier investments such as stocks—time has a wonderful way of reducing the risks associated with investing in the stock market. In making the market selection decision, we also must consider the possibility that assets are mispriced. For example, in the late 1990s, it became increasingly apparent that stocks were trading at prices that were unjustifiably high. If we understood this *and* believed that the market would soon return to more accurate pricing, we might rationally have chosen to avoid the stock market even if we were not risk averse and even if we did not need the money for quite some time.

A related issue is the choice of who will manage our money. For passive investors with little desire or little time to conduct adequate analyses, investing in index funds or carefully screened mutual funds is preferred. In those cases, we generally turn over the responsibility of stock picking to others. For active investors who wish to manage their own money and who can spare the time needed to manage the portfolio, the stock picking responsibilities (which can be both maddening and enjoyable) are left to the individual.

Class/Industry Selection

The second step of the investment process is to identify classes of assets within the markets we have chosen for investment. In the stock market, this means that we select industries for potential investment. In the bond market, we might also select industries in order to identify appropriate corporate bonds, but we have other possibilities as well. For example, we might choose to invest in government securities (U.S. Treasury bonds, for example), municipal bonds, mortgage-backed securities, and so on. This selection process is dependent on the quality of information we have, including the possibility that we have personal expertise in certain area(s). If we work for, say, a computer retailer, then we may have insight into an industry that we may be able to exploit. As with market selection, industry selection involves deciding whether the risk associated with investing in the industry is outweighed by the expected return on the investment. In making that determination, we must again consider the possibility that the stocks in a given industry are mispriced. For example, we know anecdotally that virtually all airline stocks drop precipitously after the crash of a commercial airliner, only to return to near-normal levels a week or two later. We might view this as evidence that the market overreacts to the news of a crash, thereby underpricing the stocks of airline companies. If we believe this, then investing in airline stocks immediately after a major crash might be a reasonable short-term strategy.

To begin any analysis, we must first consider the current state of the industry as it relates to our expectations for the future of the industry. Primarily, we are interested in how the industry sales and cost structures are likely to change over time. This evaluation is often highly subjective, and we rely heavily on recent industry growth, along with macroeconomic conditions. For example, we might study how the revenues of gas station companies are related to changes in oil prices. If prices are currently on the rise and are expected to continue rising, we might base our industry sales forecasts on what we can learn from the historical relationship between oil prices and gas station fundamentals. Much of this work is done on a regular basis by industry analysts, and their reports often provide useful information for our analyses. In addition, industry groups themselves often provide data that is useful in our analyses, although we must be aware that these groups often have incentives to be overly optimistic about the industry's future.

Asset Selection

The last step of the investment process involves the actual selection of and investment in specific assets. This step is the main focus of this book, although we will have some things to say about the other steps. Our focus is the general subject of stock valuation, so we address two primary issues. First, is a stock undervalued relative to its peers? Second, is it undervalued on an absolute basis?

Although stock selection is typically the last step of any investment decision, there are certain aspects of that decision that occur at the beginning of the investment process. There are thousands of stocks to choose from, and we cannot possibly do a complete assessment of all of them. It is therefore reasonable and even necessary to begin the process by reducing the set of stocks for which we will do more detailed analyses. We call this process *screening*.

Initial Screening

Among fund managers, there are a seemingly endless number of ideas about how to best screen stocks. For targeted funds, the screening occurs naturally because the fund invests only in stocks within a specific segment of the market. For broader funds, there is no natural screening and the fund manager has to develop a screening methodology. The purpose of this book is not to provide a comprehensive list of the techniques used by fund managers. Rather, it is to discuss the types of tools used and the characteristics and limitations of those tools. With this in mind, we discuss a few of the more common measures that might be used to screen stocks.

Price Multiples One way to very quickly screen stocks is to examine (or simply look up) multiples that we believe are relevant. As we discussed earlier in this chapter, value managers might choose to consider only stocks with very low P/E ratios, while growth managers might choose to consider only stocks with very high P/E ratios. We can easily take this further by examining other multiples such as price-to-cash-flow, price-to-book-value, price-to-sales, and so on. We investigate this and related ideas in Chapter 9.

Growth-Adjusted Multiples One well-justified criticism of using multiples as indicators of potential mispricings is that they do not specifically account for differences in the expected growth of companies. A company on the rise, for example, should have a higher P/E than a company on the decline, all else being equal. If we have a value-based philosophy and screen on the basis of P/E, we may find that we never give ourselves the opportunity to invest in fast-growing companies, even if they are dramatically underpriced. Fortunately, we can easily adjust the multiple approach for differences in expected growth. This is also addressed in Chapter 9, where we discuss the importance of relative valuation to the screening process.

Once we have screened stocks and chosen a set for further consideration, we then conduct an in-depth examination of those companies. This examination involves a series of tasks that any capable stock market investor will complete before investing.

Company-Specific Analysis

Once we understand the industry and where it is headed and once we have chosen stocks for further investigation, we begin the qualitative assessment of the company itself. In an ideal world, we would write out a recipe to follow here—a checklist of sorts that we follow to ensure that we do not miss anything of importance. Despite this, the assessment is so dependent on company-specific and industry-specific characteristics that creating such a recipe is not feasible. Despite this, we can mention a few items that a high-quality assessment would include.

One critical step is to develop an understanding of how the company accomplished growth in the past. How much of the growth was internal in nature and how much was due to acquisitions? Did sales and profits grow because the company became more efficient or because the company simply bought another company? Similarly, we must develop an understanding of the company's potential for future growth. For example, it is natural to believe that an extremely efficient company makes the best investment, but the managers of such companies often find it difficult to increase profits. In contrast, the managers of a company with an outdated and inefficient inventory control system might easily increase earnings simply by implementing a new system. It follows that inefficiencies *might* provide a tremendous source of growth. Of course, those inefficiencies are also a sign that managers might be incompetent, so we must be careful in our analysis.

It is also important to examine the company's philosophy regarding mergers and acquisitions. A strong emphasis on acquiring other companies might, for example, be an indicator that company managers are more interested in increasing the size of the company than in increasing the wealth of its shareholders. Such situations are often quite difficult to assess because historical growth may have been achieved through acquisition rather than through internal growth. If this is the case, then we must be extremely careful when we make assumptions about the future growth of the company. On the other hand, a company that avoids acquisitions altogether might be indicative of a management team that is excessively risk averse. Conversely, it might be indicative of a situation in which the company has ample opportunities to invest its cash and therefore has no need or desire to acquire other companies. Differentiating between these possibilities is of course quite difficult.

Financial Statement Analysis Perhaps our best source of information is the information provided by companies in the form of financial statements and related materials. In theory, the financial statements provide us with a complete and accurate portrayal of the condition of the company over time. These statements allow us to assess the historical performance of the company and to develop reasonable expectations about the future performance of the company. We consider these issues in Chapters 4 and 5, although the basic concept of financial statements can be found throughout the book. In practice, we must be cautious in interpreting financial statements because they are provided by company managers who generally have incentives to mislead us. In addition, statements might be naturally misleading with no manipulation by company managers at all.

Forecasting It is clear that in order to value stocks today, we must determine what profits those companies are likely to generate in the future. In fact, forecasting company cash flows is probably the most important task we must complete in evaluating a company. The forecasting process, which we discuss in Chapter 7, involves an assessment of the future prospects of the markets for the company's products as well as an assessment of the company's efficiency in creating those products. Forecasting depends heavily on financial statements (which are covered in Chapter 4) and our analysis of those financial statements (which is covered in Chapter 5). When forecasting, we must carefully consider how the company will generate the growth we forecast. This particular task is possibly the most difficult aspect of forecasting, giving us ample opportunity to make mistakes in our analyses. For example, inexperienced analysts often forecast cash flows without specifically incorporating the cost of growth. They may believe that a given industry is about to enter a period of tremendous growth. They correctly assume that the sales of a company in that industry will grow dramatically, but fail to recognize that the company may need to spend a lot of money to generate that growth. If the company does not already have enough funds available for investment, then it will have to either grow at a slower pace or raise money externally. These activities cut into the profits available to current shareholders, and we must specifically incorporate that impact into our analysis.

There are several miscellaneous qualitative issues that can affect our forecasts of a company's cash flows. First, insider trading of a company's stock can provide information about management's view of the company's prospects. Insiders in the company are in the best possible position to understand the company's future prospects, so we are well advised to learn what we can from them. If we see that insiders are consistently buying the stock, we might infer that the insiders believe that the stock is currently being undervalued by the market. If so, then the market has likely underestimated the future growth prospects of the company. We might then focus on more optimistic scenarios when we forecast the company's cash flows. In contrast, we may see that insiders are consistently selling the company's stock. This suggests that those insiders believe the market is currently overvaluing the company's stock. We might consequently choose less optimistic scenarios when we forecast the company's cash flows.

A second qualitative issue is the quality of the company's management team. Although we can assess this to a certain extent by examining the company's financial statements, those statements often do not give us a complete and accurate picture. For example, the company may have hired a new CEO or expanded into a new product area. In those cases and other similar ones, the company's historical financial statements are representative of a company that is significantly different from the company today. Whatever the case, it is important that we assess the qualifications and achievements of company managers and that we in turn choose realistic scenarios when we forecast the company's financial statements. As with insider trading, it is difficult to determine a quantitative relationship between management quality and growth forecasts.

Valuing Stocks To value stocks, we concentrate on both absolute valuation (What is the stock worth?) and relative valuation (Is the stock a better buy than the stocks of peer companies?). Although both classes of models involve the forecasting of company cash flows, the conclusions we can draw from the two approaches differ greatly. We discuss absolute valuation in Chapter 10 when we present the Discounted Cash Flow Model, and discuss relative valuation in Chapter 9 when we consider screening. To value a company's future cash flows, we must determine an appropriate discount rate (Chapter 6) and apply it by using time value of money techniques (Chapter 3).

The Final Decision The last element of the investment decision is consideration of how well the candidate stock fits into our portfolio. Ultimately, the decision is not simply one in which we determine whether the stock is undervalued. Rather, it is one in which we answer the question, does buying the stock improve the risk-return characteristics of our portfolio? An implication of this is that we might choose *not* to invest in one stock, in favor of another that seems to be less undervalued! For example, suppose that our portfolio is heavily weighted in the financial services industry and that we identify yet another financial stock that we believe is substantially undervalued. Suppose further that we have found another stock in the energy industry that we believe is undervalued, but not to the extent of the financial stock. Buying the financial stock might very well increase the expected return of our portfolio, but it does little to decrease the risk of the portfolio. Some structural shift (new legislation, for example) might occur that suddenly makes the stocks in the financial services industry drop in value. If such a shift occurs, our portfolio would suffer greatly. In contrast, buying the energy stock might not increase the expected return on our portfolio as much, but it does give us an added benefit in that it makes our portfolio less concentrated and therefore less susceptible to structural shifts in one particular industry.

ORGANIZATION OF THE BOOK

The book is divided into two sections. The first section of the book deals with the fundamental tools of finance, and the second deals with specific stock valuation techniques. For readers well versed in the fundamentals, the first section serves as a refresher course. In fact, readers who are very confident about their understanding of specific topics in that section might safely skip those topics entirely. Although the book is highly integrated, it is also carefully designed so that the chapters, for the most part, stand alone. The second section of the book, which is the main objective of our study, lays out specific valuation methodologies that we can use to estimate what a stock is really worth. Where reasonable, chapters are organized to lay out both the theory and the practical application of the given topics. A typical chapter is laid out so that we first consider what theory teaches us about how to approach the given situation, and then attempt to apply that knowledge to the real world. In doing so, we discuss the practical issues we face in conducting real-world stock valuation.

Case Study: O'Charley's

A primary focus of this book is how various theoretical concepts are applied in the investment world. To this end, we consider an extended case study that we revisit at the end of most chapters. For this study, we will consider O'Charley's (CHUX), which is a largely regional restaurant chain of about 220 restaurants spread across 17 states in the United States.

There are several reasons for choosing a company like this one. First, the business models of restaurant chains are relatively well known and easy to understand. Companies simply identify a successful model and then replicate it over and over again, either through company-owned stores or through franchises. The key elements of cost structure tend to be labor and the costs of food and beverages, and the fixed assets consist primarily of buildings and food preparation equipment. Because the situation is so simple, we will spend little time discussing it, thereby giving us more time to focus on the analytics involved in valuing the stock. Second, O'Charley's has the potential to be something of a growth company within a very mature industry. This forces us to consider a variety of issues that we might not consider otherwise. It also makes the company quite interesting because if company managers are successful, the company's stock price will likely increase rapidly. Third, in recent years the company has had some difficult times. Customer visits per restaurant dropped, leaving the company in a less than ideal financial situation. In September of 2003, dozens of people allegedly contracted hepatitis A after eating at an O'Charley's restaurant near Knoxville, Tennessee. One person reportedly died from the exposure, and the company is now exposed to potential lawsuits and the negative publicity associated with them.[9] In March of 2005, the company announced that it would restate its financial statements going back to 2002 because the company had improperly accounted for property leases.[10] All of these issues cloud our ability to value the stock, but this is not a bad thing. The cloudier the picture, the more likely it is that the market will misprice the stock and give us an opportunity to generate high returns. This is not to imply that we should choose an investment strategy of simply buying troubled companies. It simply means that if we are interested in beating the market, it is worth looking at companies that are difficult to value. Fourth and finally, O'Charley's has two main characteristics that we must consider in order to truly learn how to value a

9. *Knoxville News-Sentinel*, September 23, 2003.
10. Associated Press, March 4, 2005.

stock: it has a substantial amount of long-term debt and it has a substantial number of employee stock options outstanding. Furthermore, there is ample information available that can be used to assess those issues.

To analyze O'Charley's, we must choose a set of peers for comparison. This will allow us to do a better job of analyzing the company's financial statements and will also allow us to evaluate the price of O'Charley's stock relative to those of its peers. There are many different restaurant chains we could choose as peers, but we will limit ourselves to four because of space constraints. In a real-world analysis, we would likely include other companies to get a more complete view of the industry. The four competitors we will examine are Applebee's (APPB), Darden (DRI, which includes Red Lobster and Olive Garden restaurants), Outback (OSI), and Ruby Tuesday (RI). The companies were chosen based on size, general level of success to date, and the type of customers they seek to attract. Perhaps more importantly, they were chosen because they represent the type of company that O'Charley's seeks to become. As such, we can use those companies to help us evaluate O'Charley's progress in becoming a truly national (and international) restaurant chain.

As we proceed with our analysis, we keep in mind that our focus is on technique rather than detailed accuracy. Developing and explaining a full and complete analysis of O'Charley's would likely double size of this book without adding much to our understanding of stock valuation. As such, our analysis here will not be sufficient to make a buy/sell recommendation on the stock, but rather will be sufficient to explain the techniques we might use to arrive at such a recommendation. As we continue, readers are encouraged to conduct their own analyses of one or more of the four restaurant companies we have chosen as peers.

This page intentionally left blank

CHAPTER 2

Price Formation, Market Efficiency, and Great Investors

PURPOSE AND SCOPE

To understand the potential for stock picking to be profitable, we must first consider how prices are formed in the marketplace. We also briefly consider the existing evidence on market prices and on the possibility that they might be mispriced in a predictable way. We begin the chapter by looking at the mechanisms through which stocks are traded. Although much of the discussion centers around understanding terminology, our underlying purpose is to see how the beliefs of investors are translated into market prices. We consider not only the types of trades that might be submitted by investors, but also the individuals (dealers and specialists) who process those trades and, in doing so, set the prices of stocks in the marketplace.

We then formally define the concept of market efficiency, which deals with the ability of investors to consistently beat the market. This notion is important to investors and has direct implications for their optimal investment strategies. If the market prices stocks efficiently, we are ahead to invest our money in index funds. If not, then we *might* be ahead to invest in mutual funds or pick our own stocks. As we will discuss later in the chapter, there is an important distinction between efficiency and accuracy. Market prices can be entirely inaccurate, yet still be efficient—for markets to be inefficient, we must be able to exploit the pricing inaccuracies. In other words, an inefficient market is one in which there is a certain degree of predictability in the markets. Of course, we cannot predict price movements with a high degree of certainty. Instead, we simply seek to identify investments that are more likely than others to do well. All of investing is in fact a probabilistic endeavor.

We close the chapter by considering several of the world's greatest fund managers. In doing so, we lay out some basic principles that are likely to result in better portfolio performance over the long run.

HOW ARE PRICES DETERMINED?

As we will see in later chapters, a critical part of stock valuation is the assessment of how our expectations for a stock differ from those of the market. It follows that we must first understand how the expectations of stock market investors are effectively translated into market prices. Furthermore, as we learn how stocks are priced, we begin to understand the potential for stocks to be mispriced and therefore the potential for investors to earn abnormal returns.

There are two basic types of markets (*dealer markets* and *auction markets*) and several different types of orders (*market orders*, *limit orders*, and *stop orders*, for example). When an investor submits an order, it makes its way to the marketplace for execution. The marketplace may be a physical location such as the auction market at the New York Stock Exchange or may be an electronic market such as the dealer market provided by the National Association of Securities Dealers (NASD). As we will see, the prices of stocks are determined by the supply of and the demand for the stocks in the marketplace. Roughly speaking, those prices are set so that the supply of the stock is equal to the demand for the stock at each point in time. We do see, however, short-term deviations from that balance during periods in which there is heavy buying or selling pressure. For example, a company may announce that it is being investigated by the Securities and Exchange Commission (SEC). When that announcement is made, we would typically see large numbers of investors selling the stock while few are buying it. This imbalance is absorbed by dealers and specialists in the marketplace, who trade because of fiduciary obligations.

Types of Orders

A *market order* is an order that is an order that has no special instructions. When we submit a market order, we commit to trade at the current price in the marketplace, whatever that might be. We need only specify the stock and the number of shares we wish to trade. The primary advantage of the market order is that the order is executed immediately—we need not worry that the trade will not be executed. The primary disadvantage of the market order is that we give up the opportunity to achieve a better price by conditioning our trade on the price level.

A *limit order*, in contrast, is an order in which we offer to trade a stock if and only if a certain condition is met. A limit buy order is an order to buy the stock if and only if the stock trades at a price *below* some level we specify. For example, we might submit a limit order to buy 100 shares of IBM stock with a limit price of $50. Our order will only be executed if IBM stock trades at $50 or less. A limit sell order is an order to sell if and only if the stock trades at a price *above* some level we specify. For example, we might submit a limit order to sell 100 shares of Amazon stock with a limit price of $60. Our order will only be executed if Amazon stock trades at $60 or more. Limit orders are used by investors who are trying to get a better price than the current market quote. We might be willing, for example, to buy General Motors stock at $32, but it is currently trading at $38. We could submit a limit order to buy with a limit price of $32. If the market price drops to that level, the order will be automatically executed. An advantage of this is that we do not need to be in constant touch with the market in hopes of buying the stock at $32 before it goes back up. Another advantage of a limit order is that if the order is filled, we will get a better price than we would get by using a market order. One disadvantage is that the trade might not be executed at all. Suppose, for example, that a stock is trading at $20 and we believe it is worth $30. We choose to submit a limit order to buy at $19, hoping that through normal everyday volatility the stock will dip down to $19 and allow us to buy cheaper (thereby increasing the return on our investment). After we submit our limit order, the stock might just climb steadily toward $30 without first dipping to $19. If so, our order is not executed and we lose the 50% return we anticipated on the stock. A second and perhaps more important disadvantage is that we commit to trade the stock under circumstances that we might not foresee. For example, our $20 company might suddenly and unexpectedly be hit by a large lawsuit, the news of which drives the stock price down to $10. We would buy at $19 as the stock price drops, thereby giving us a sizable loss on the trade.

A *stop order* is, in one sense, the opposite of a limit order. A stop buy order is an order in which we agree to buy the stock if and only if the stock trades at a price *above* some level we specify. A stop sell order is an order in which we agree to sell the stock if and only if the stock trades at a price *below* some level we specify. Stop orders are often called *stop loss orders* because investors use them to prevent further losses if and when the market moves against them. For example, we may have purchased 200 shares of H. J. Heinz stock at $42 and wish to protect ourselves in case the stock plummets. We could place a stop order with a stop price of $35. If the stock drops to $35, the order would be executed, thereby preventing further losses we might incur if the stock continues to decline. As with the limit order, a primary advantage of the stop order is that we do not need to continually monitor the stock. A second advantage is that our portfolio can be protected, to a certain extent, with stop orders. We can use them to convert our portfolio (or portions of our portfolio) to cash before the damage becomes too severe. The primary disadvantage is the same as that with the limit order. In submitting a stop order, we commit to trade the stock under circumstances that we might not foresee. For example, we might submit a stop order to sell stock at $15 as the stock drops, when the stock is trading at $20. Suppose then that a rumor spreads that the company will be investigated by the SEC, causing the stock to drop below $15. We would sell at $15, but what happens if the rumor is false? When this is discovered, the stock would presumably rebound to $20 and we would have sold a $20 stock for $5 below its value. Thus, an important characteristic of stop orders (and limit orders for that matter) is that investors sometimes trade under circumstances they did not foresee, and perhaps under circumstances in which they do not want to trade. As such, these types of orders are likely to make markets less efficient rather than more efficient.

There are less common types of orders (the *stop limit order*, for example) that are sometimes used in specific situations. In addition, we have the ability to sell stock even if we do not own it. This process is called *short selling* or simply *shorting*. A short sale is one in which we borrow shares and then sell them, promising to buy back shares and return them to their owner at some unspecified later date. In most situations, the shares are borrowed from a broker who requires the investor to meet certain rules (called *margin requirements*) in order to keep the short position open. Those rules boil down to the investor being required to maintain at least some minimum level of collateral. If at any time the value of the investor's collateral becomes insufficient to protect the broker, the broker has the right to liquidate the investor's collateral in order to buy back the shares and settle the debt. Because the short seller sells first and then buys later, the short position is profitable when the stock price drops over time. Thus, short selling provides a means by which we might profit if we can correctly identify a stock that is overpriced in the marketplace. We do note that the margin requirements generally make short selling more difficult and more costly than purchasing. Furthermore, because the stock market tends to trend upward over time, short positions in stocks tend to be money losers over the long run.

Dealer Markets

Dealer markets are typically computerized markets in which dealers offer to buy and/or sell securities for specified prices. The most well-known example of a dealer market is probably the NASDAQ market, which lists over half of the stocks publicly traded in the United States. The dealers in a dealer market may be acting on their own behalf or on behalf of investors. The price at which a dealer is willing to buy shares is called the *bid price* because the dealer is "bidding" on the asset. The price for which a dealer is willing to sell shares is called the *offer price* or the *ask price* because the dealer is "offering" shares at that price, or "asking" that price for the shares. There is no specific limit on the number of dealers in a stock, so there may be a large number of dealers trying to trade a given stock at any one time. This is particularly true for widely traded stocks such as Microsoft (MSFT).

The *quotes* we see for a stock are simply the best bid price and the best ask price currently available. Consider the following example.

Example 2.1: Suppose that stock XYZ is listed on the NASDAQ market. Four dealers actively trade the stock and have offered to trade the stock at the prices and trade sizes shown in Table 2.1. Dealer A is not currently offering to buy any shares, but is willing to sell up to 800 shares at $32.10. Dealer B is not currently offering to sell any shares, but is willing to buy up to 1200 shares at $31.43. Dealer C is offering to buy up to 1000 shares at $31.30 and is offering to sell up to 500 shares at $32.08. Dealer D is offering to buy up to 600 shares at $31.36 and is offering to sell up to 2000 shares at $32.15. Notice that both Dealer C and Dealer D are offering to buy shares at specified prices, and are offering to sell shares at higher prices. This is how dealers hope to earn money; they buy shares at one price and sell

TABLE 2.1

Dealer Market Orders

	Bid		*Ask (offer)*	
Dealer	Price	No. of shares	Price	No. of shares
A	—	—	$32.10	800
B	$31.43	1200	—	—
C	$31.30	1000	$32.08	500
D	$31.36	600	$32.15	2000

them at a higher price. Of course, there is some risk involved because investors might not choose to trade at the prices offered by a given dealer.

From the perspective of outside investors who are watching the market for potential investment, the best bid price is $31.43 and the best ask price is $32.08. These prices are known as the *best bid or offer* (*BBO*), which is what we see when we look up the quote for a given stock. The numbers of shares being offered at those prices are called the *bid depth* and the *ask depth*, respectively. The *quote* for the stock is then 1200 shares at $31.43 and $32.08 for 500 shares.

Auction Markets

An auction market is very similar to a dealer market in that bids and asks are quoted, and they represent offers by investors to buy and sell the stock. It differs from a dealer market in that each stock is managed by a *specialist* (or *market maker*) whose job is to facilitate trading in that stock and ensure that there are always people willing to buy and sell the stock. The specialist is known as the *executor of last resort* because the specialist must trade out of his or her own account if no other investors have offered to trade. Orders submitted by investors are routed to the specialist (or in some cases to an automated execution system), who then processes the orders. The specialist provides the quotes for the stock, which can be based on limit orders from outside investors or based on the specialist's own willingness to buy and/or sell the stock. A simple example illustrates the role of the specialist.

Example 2.2: Consider a hypothetical specialist for a stock. Initially, the specialist has no orders in place. Because there are no orders in place, the specialist must provide a quote out of his or her own account. Suppose that the specialist quotes a bid price of $39 with a depth of 2000 shares and an ask price of $43 with a depth of 1500 shares. This means that the specialist is required to buy up to 2000 shares at $39 and sell up to 1500 shares at $43 if someone submits an order that "hits" the quote. For example, if we were to submit a market order to buy 400 shares, the specialist is required to sell us 400 shares at a price of $43 or better. Those shares come out of the specialist's own account. Suppose then that the orders shown in Table 2.2 arrive over time. We now consider how the specialist might respond as each order arrives for execution. Keep in mind that this is only an illustration of what might happen. We in no way intend to imply that the specialist's choices in this example are optimal ones.

The first order is a limit order to buy at a price of $40 or less. Currently, the specialist is committed (through the quote) to sell at a price of $43. The investor is not willing to buy at $43, so the specialist does not have to fill the order. Instead, the specialist is required to revise the quote to reflect the new order. The best bid price is no longer the $39 quoted by the specialist, but is now the $40 shown in the limit order book. The specialist is therefore required to revise the bid quote to be $40 with a depth of 800 shares (alternatively, the specialist might quote a better price, thereby committing to trading shares out of his or her own account). A similar event occurs when trader 2 arrives. That order is an order to sell 400 shares at a price no lower than $42. Since the investor is not willing to sell at the $40 bid price currently on the books, the specialist is not required to fill

TABLE 2.2

Specialist Order Flow

Trader	Type	Buy/sell	No. of shares	Price	Revised quote
1	Limit	Buy	800	$40	$40 (800) – $43 (1500)
2	Limit	Sell	400	$42	$40 (800) – $42 (400)
3	Market	Sell	300	—	$40 (500) – $42 (400)
4	Market	Buy	200	—	$41 (1000) – $42 (400)

the order. Of course, the specialist might choose to fill the order out of his or her own account, but let us suppose that the specialist does not choose to fill the order. The ask quote must be revised to reflect the new order, so the specialist quotes an ask price of $42 for 400 shares (or quotes something better).

Trader 3 submits a market order to sell 300 shares. Because it is a market order, the specialist is required to fill the order at the current quote or better. In this case, the specialist must buy the shares for $40 (the best bid) or higher. Suppose that the specialist does fill the order at $40. The shares would be sold to trader 1, who offered to buy shares for $40 each. In processing this order, the specialist receives no compensation. The number of shares bid at $40 is reduced from 800 to 500, so the specialist will likely revise the quote accordingly. Trader 4 also submits a market order, but this time the investor wishes to buy 200 shares. The specialist must fill the order at a price no higher than $42. Suppose that the specialist decides to fill the order out of his or her own account. To do so, the specialist must beat the price offered by the investor from order 2, so let us assume that the order is filled at $41.99. Trader 4 buys the shares from the specialist, who provides them out of his or her inventory of the stock. The limit order from investor 2 is unaffected and remains on the books.

Thus far, we have seen four orders submitted and two trades executed. Let us suppose that the specialist becomes concerned about the lack of trading activity. This is a valid concern because the specialist only makes money by trading stock out of his or her own account. To encourage trade, the specialist might revise the quote to offer better terms. Rather than quote out of the *limit order book* (i.e., the list of orders currently active on the specialist's books), the specialist might step inside the quotes and quote, for example, a bid price of $41 for 1000 shares. The quote would then become $41 (1000) − $42 (400). If a market order comes in to sell shares, the specialist would then be required to buy up to 1000 shares out of his or her own account at a price of $41 or higher.

The type of activity illustrated in the above example occurs throughout each trading day. The specialist continually seeks to match buyers and sellers while trading out of his or her own account from time to time in an attempt to earn profits. Interestingly, a good specialist typically does not have an MBA or any formal business training. In fact, specialist companies prefer that their specialists have relatively little business knowledge so that they are not tempted to speculate based on their perception of the "true" value of a stock. Instead, companies want their specialists to simply be processors of order flow, seeking to manage the orders that arrive in such a way that the specialist earns profits. An implication of this is that the specialist generally seeks to balance the order flow so that his or her own account is stable in size. If the specialist's account contains an excessive number of shares, then the specialist company is exposed to excess risk. For example, a specialist for Enron stock may have unwisely built up a large inventory of the stock just prior to Enron's collapse. This would certainly have been a disastrous scenario. Conversely, the specialist would not want to be exposed by holding too few shares of stock (or even by maintaining a short position in the stock). So if the specialist wants to hold a relatively stable number of shares, we can safely conclude that *most of the time, the supply of the stock from investors will be approximately equal to the demand for the stock by investors*.

What Have We Learned about Price Formation?

There are a few important lessons to learn here. First, stock prices are the outcome of a sometimes complex interaction between investors, brokers, dealers, and specialists. An outcome of that interaction is that prices are generally set so that supply equals demand in the marketplace. It follows that stock prices will be set in accordance with public perceptions of the stock, which may or may not be accurate ones.

We also see clearly that the bid-ask spread (i.e., the difference between the ask price and the bid price) represents an indirect cost of trading. Suppose, for example, that we purchase a stock at the ask price of $10 while the bid price on the stock is $9.90. Suppose further that the stock price (i.e., the quote) has not changed when we go to sell the stock at some later date. Even though nothing has changed, we are only able to sell our stock for $9.90, giving us a return of −1.0% on our investment. We are hit with this implicit cost each time we trade in the stock market. Even if our investment is profitable, our profits will be slightly less because of the bid-ask spread. For widely traded stocks, this cost is so small that it is virtually negligible. For thinly traded stocks, the bid-ask spread can be quite large. These stocks tend to be quite poor investments on average because of the high costs of trading. One way to understand this is to recognize that if the bid-ask spread is 10% of the stock price, the stock price would have to go up by 10% just to get us back to even.

MARKET EFFICIENCY

At this point, it is useful to formalize the idea that future prices may or may not be accurate. *Market efficiency* deals with the possibility that we might be able to consistently beat the market. We say that markets are efficient if investors cannot consistently earn positive abnormal returns. The key word in this definition is "consistently," which implies that we must be able to develop a framework in which we have an expectation of beating the market. We then define the term *abnormal return* to be the difference between the actual return on an investment and the return that would be necessary to compensate the investor for the level of risk associated with the investment. The investor may get lucky and earn a positive abnormal return from time to time, but if markets are efficient, the investor cannot expect to do so consistently. In academia, market efficiency is often defined as having different forms, based on the amount of information available to investors. Markets are *strong form* efficient if investors cannot consistently earn abnormal returns. Markets are *semi-strong form* efficient if investors cannot consistently earn abnormal returns with the use of only publicly available information. Markets are *weak form* efficient if investors cannot consistently earn abnormal returns with the use of only historical market information (prices, trade volumes, etc.). We are not so concerned with these distinctions because they are not particularly relevant to investment professionals. We therefore simply say that markets are *efficient* for a market participant if the participant cannot consistently earn positive abnormal returns by using whatever information is available to that participant.

It is worth mentioning that some professionals define efficiency in terms of how quickly the markets react to news, rather than defining it in terms of the accuracy of the response or the ability to interpret the news in such a way that we can beat the market. For the purposes of this discussion, we have chosen a specific definition of efficiency that deals only with the potential for investors to beat the market consistently. We say nothing about the speed with which the market processes information. It is also worth mentioning that market efficiency is not the same as market accuracy. In fact, prices could be extremely inaccurate without our being able to consistently beat the market. For example, suppose that Amazon (AMZN) stock always sells for exactly half of what it is really worth. The market has clearly underpriced the stock by a wide margin, but what are we to do? If the market continues to misprice the stock in this way, we will have no way to generate a positive abnormal return, even though we have correctly identified a mispricing in the marketplace. For markets to be inefficient, we must be able to profit from the inaccurate prices. It follows that if markets are inefficient, not only must there be inaccurate prices in the market, but we must also have the ability to predict how those inaccuracies will change over time. As Rappaport and Mauboussin (2001) point out, the entire stock picking discussion can be cast in terms of understanding the expectations of the market and how they are likely to change over time. In order for us to beat the market consistently, not only must we find mispriced assets, but the market must eventually correct those mispricings—we must be able to predict how market expectations will change over time.

The concept of market efficiency is somewhat controversial in academic circles. Many researchers believe that the market regularly misprices stocks in predictable ways. Others argue markets are efficient, but that the observed anomalies we see in the stock market are simply artifacts of inaccurate risk measurement. In either case, the concept is quite important to us. If the former researchers are correct, then there is hope that we can learn how to pick stocks and beat the market. If the latter are correct, then we can simply look at current market prices to get the best estimates of stock value. This does not suggest, however, that we do not need to know how to value stocks fundamentally. Quite the opposite is true. For example, there are many privately held companies for which we have no market price. To value those companies, we are forced to apply fundamental valuation models.

The Evidence

A major focus of academic research has been on whether abnormal returns are predictable (which is equivalent to whether markets are efficient). Our purpose here is not to get into the technical details of how market efficiency is tested, but rather to simply present a very small portion of the qualitative thinking on the subject. We do note, however, that in order to test whether markets are efficient, we must be able both to properly measure risk and to convert that measure of risk into an appropriate level of return for the investment. We will investigate this idea in Chapter 6.

. . . For Market Efficiency

We will offer little in the way of empirical evidence in favor of market efficiency, primarily because those who believe that markets are efficient have an impossible task in trying to prove it. There are numerous studies showing that if we had used some specified investment rule, we would not have earned abnormal returns consistently. This is not so much evidence against market efficiency, but is rather evidence against being able to use the chosen rule to beat the market. To prove that markets are inefficient, one would need to show that all possible investment rules are such that investors cannot use them to consistently earn positive abnormal returns. Obviously, the set of all possible investment strategies is infinite in size and therefore cannot be tested.

A main argument in favor of market efficiency is as follows. If an inefficiency exists and is discovered by someone, that person would take advantage of the situation to the fullest extent. In doing so, that person would affect the supply and demand in the marketplace in such a way that the inefficiency would quickly disappear. For example, suppose that you can buy candy bars for $0.90 each on one street corner and can sell them for $1 each on another street corner. You would rationally start buying all the $0.90 candy bars you can get, and start selling them for $1 at the other location. The increase in demand for the $0.90 candy bars would naturally cause prices to increase, so you would quickly find that you have to pay $0.91 for bars, then $0.92, and so on. Meanwhile, as you try to sell candy bars for $1, you would find fewer and fewer people willing to pay $1 for one (after all, they are getting full since you are selling so many of them). Thus, you would have to decrease your price to $0.99, $0.98, and so on. You would only stop when the buy and sell prices coincided, in which case the inefficiency is eliminated. This argument suggests that if inefficiencies exist at all, they will only exist for a very short time once they are discovered.

. . . Against Market Efficiency

The case against market efficiency is one of both logic and empirical observation. Grossman and Stiglitz (1980) argue that markets cannot be efficient. If they were, then there would be no advantage in conducting research on assets. In fact, the costs associated with doing the research would lead to us earn *negative* abnormal returns on average. As such, we would quickly find that fund managers (and other stock researchers) would fail in their attempts to beat the market and would therefore stop conducting research. Of course, if no one conducted research, prices would soon deviate from their true values, thereby making it profitable to do research once again. Grossman and Stiglitz argue that there must be some balance in which markets are just inefficient enough to make it profitable for people to conduct research. This argument makes a great deal of sense, but we see empirically that numerous funds stay in business even though they underperform the market. In fact, the average mutual fund tends to underperform an index of equivalent risk. In addition, roughly three-fourths of mutual funds underperform their benchmarks each year.[1] If this is so, why do investors still choose to invest in mutual funds? Brokers and financial planners consistently say that their clients just feel more comfortable having someone knowledgeable specifically watching over their portfolios. With an index, there is no visible manager watching those stocks, and there is an (incorrect) perception that this somehow leads to greater risk.

Robert Haugen also argues against market efficiency in his book, *The New Finance: The Case Against Efficient Markets*. He notes that there is ample empirical evidence showing that markets are "slow to overreact," meaning that markets do not move quickly in interpreting news, and when they do move, they tend to move prices too far. Haugen argues that the evidence is overwhelming that markets are inefficient. Our purpose here is not to rehash that empirical evidence (interested readers are encouraged to read both Haugen's book and the research he cites), but it is useful to consider a basic argument against market efficiency. Haugen suggests that this historical inefficiency is likely to continue well into the future. The stock market is largely dominated by institutional investors, which include pension funds and other entities that invest money pooled from individuals. Haugen argues that these individuals expect strong returns over the short run. This precludes many fund managers from picking stocks that are likely to do well over the long run but are uncertain in the short-run. The recent case of Tyco is a good example. Tyco's problems, which led to a sharp decline in share price, were attributable to the activities of CEO Dennis Kozlowski rather than to fundamental problems with the company's execution of its business model. Still, many fund managers were forced to abandon the company rather than face their clients and try to explain why the fund still held Tyco stock. The more seasoned, reputable managers were able to hold on to the stock (and even buy more) and then wait for the seemingly inevitable turnaround. Haugen's argument is simply that situations like this will tend to repeat themselves over and over again in the future. Unless and until the investing public becomes educated to better understand risk, fund managers will always face such pressures and will therefore always shy away from certain situations, thereby leaving inefficiencies in the marketplace.

1. See Ellis (2002).

The debate over market efficiency is not likely to end soon, although there does seem to be a growing body of people (including many in academia) who believe that markets are decidedly inefficient. We make no claim one way or another in this text, but we do assume for expositional purposes that the markets for stock are inefficient.

A FEW OF THE GREAT INVESTORS

We would be remiss in our examination of stock valuation if we did not at least briefly examine the great investors of our time and consider what they have to say. Rather than undertake a study to determine who is and who is not a great investor, we will arbitrarily choose to consider three of history's greatest managers, along with one other "manager" who may surprise some. We consider two of these managers because they have not only been successful, but much has been written about their philosophies. This gives us ample resources to allow us to consider what those managers believe. We consider a third because, from a statistical standpoint, his fund's performance places him at the very top of the mutual fund world.

As for the other great investor we will consider, suppose that you hear that there is a fund that consistently, on an annual basis, beats the vast majority of all other funds. Furthermore, suppose that over the long run this fund has beaten all funds but a select few. Finally, suppose that this fund charges far lower fees than other funds. This may sound too good to be true, but such a fund does exist. It is the S&P 500 index.

The S&P 500!

We do not ordinarily think of the S&P 500 as a great fund manager, but for all intents and purposes, it is just that. First, note that we can invest in the S&P 500 index just as easily (if not more so in some cases) as we can invest in other funds. Second, the S&P 500 has a remarkable track record. Historically, few fund managers have been able to beat the S&P 500 with any real consistency. Furthermore, the long-run average returns on the index easily outpace the returns on funds of equivalent risk. This suggests that the S&P 500 is a formidable fund, consistently beating the majority of mutual funds and outperforming the average fund by a substantial margin.

So what makes the S&P 500 so special? First, the S&P Index Committee, which selects the stocks for inclusion in the index, does not choose them based on under- or overpricing in the market. Rather, it chooses the stocks to be representative of the market as a whole. (This fact alone makes the index's strong return performance astounding.) To maintain stability in the index, the committee chooses stocks that are likely to be around for a while. It therefore does consider the financial condition of each company insofar as it helps them understand the likelihood of the company surviving for the foreseeable future. This effectively means that the index selects only companies that are of reasonably high quality. Stocks may be removed for a variety of reasons (for example, a stock may be acquired by another company or the stock may no longer be representative of the market as a whole), but those reasons are not generally related to the performance of the stocks. Furthermore, a stock's weighting in the index is not trimmed if the stock price increases dramatically. This gives us an important piece of advice concerning how we should manage our portfolio.

Let winners run!

Many investors follow arbitrary rules such as "sell when the stock doubles." Although this may seem logical, following such a rule specifically prevents the investor from ever hitting a really big winner. Furthermore, such arbitrary rules are not based on the stock's true value relative to its market price, which is what investment decisions should be based on. The bottom line is that we should not mess with our portfolio unless there is a fundamental reason to do so. Letting winners run is sound for another reason. By letting winners run, we avoid selling a stock that would force us to recognize a capital gain for tax purposes. In sum, we see that the S&P 500 index is a low-cost fund that is tax efficient and has a long-run perspective. These are principles that we are well advised to follow in managing our own portfolios.

Warren Buffett

Warren Buffett, currently listed by Forbes as the second wealthiest person in the world, is famous for his long-term success in running Berkshire Hathaway (BRKa and BRKb). Berkshire is not a mutual fund per se, but is rather a holding company that Buffet uses to acquire ownership (minority or majority) in other companies. Buffett's success is not best measured year to year, but is best measured over time—Berkshire Hathaway shareholders have enjoyed an average return of well over 20% per year since Buffett took over the company in 1970. At the same time, the S&P 500 index provided a compounded annual return of about 11%.

Buffett differs in one important way from the S&P 500 index and the other fund managers we will discuss. Rather than assume a passive role in companies he holds, he sometimes chooses to take an active role, buying companies and restructuring them into more efficient configurations. To a certain extent, this makes it difficult for us to apply some of Buffett's ideas to our own investment strategies. Still, there are at least two basic principles that we can draw on. First, Buffett (and, indeed, all of the managers we will discuss) believe in the philosophy of letting winners run and adopting a long-term approach to investing.

Choose stocks for the long run, not for the short run.

Second, Buffett continually stresses that we should invest in high-quality stocks. Although he has a bit of a track record of investing in troubled companies, he typically tends to purchase companies that have quality products and ideas.

Choose only those companies with high quality potential.

Notice that we do not say that we should choose only companies that are of high quality. Rather, we look for companies that have the potential to be of high quality. As we will discuss later in this book, the most efficient and well-run companies often find it difficult to increase per-share profits dramatically because they have only one real source of growth: higher sales. In contrast, a company that is rife with inefficiencies can potentially see dramatic increases in profitability by simply eliminating those inefficiencies.

Peter Lynch

Peter Lynch is perhaps the most famous of all mutual fund managers. He guided Fidelity's Magellan Fund to an outstanding record over a 14-year period from 1976 to 1991. During that period, Magellan earned an average annual return of over 30% per year, far outpacing the S&P 500 index. Lynch, who has written extensively about his thoughts on stock picking, attributes his success to identifying companies with stocks whose prices are low relative to those of comparable companies. He also discusses the importance of understanding what is special about a company's product(s), arguing that we should prefer the stocks of companies with differentiated products that will be purchased repeatedly.

Recurring cash flows are far more valuable than single cash flows.

Lynch essentially argues that we should prefer a company that makes PostIt notes to one that makes markerboards. The PostIt note producer expects repeated sales to the same customer while the markerboard producer expects only one sale to a customer. Lynch also discusses the nature of mispricings in the stock market, arguing that the market tends to misprice the stocks of companies that are not widely followed by Wall Street and/or companies that sell products that are dull or distasteful.

Lynch discusses many other characteristics that good stocks tend to have, but we will focus on only one more.

Stock purchases by insiders are a strong signal that the stock is undervalued.

This applies not only to situations in which company managers are buying stock with their own money, but also to situations in which the company itself is buying back shares. After all, company managers are in the best position to know the true value of the company's stock. If we observe them buying the stock, it is reasonable to conclude that they believe the market has priced it too low.

Bill Miller

The case of Bill Miller (who runs the Legg Mason Value Trust (LMVTX)) is of special interest because he has achieved what seems to be nearly impossible. The Value Trust has beaten the S&P 500 index for fourteen consecutive years. As we noted earlier, roughly 75% of mutual funds will underperform the S&P 500 index in a given year. If we assume that this probability holds for every fund in every year and that the return in any year is not correlated with the return of any other year, the odds that a given fund will beat the market for 14 consecutive years are about 1 in 268 million. Given that the number of mutual funds is measured in the thousands, those odds are so overwhelming that it seems all but certain that Miller has the ability to beat the market and that markets are therefore inefficient. However, our assumptions in calculating those odds are far from realistic. A simple example illustrates the idea that we might reasonably expect to observe streaks such as Miller's.

Example 2.3: Suppose that a fund manager is able to pick stocks in such a way that either the fund will earn either 15% in a given year or the fund will lose everything (a return of −100%). The probability that the fund earns 15% in a given year is 0.9, and the probability that the fund goes under is 0.1. Furthermore, suppose that the S&P 500 index earns 11% each year.

The expected annual return on the fund is $0.9 \times 15\% + 0.1 \times (-100\%) = 3.5\%$, so the fund underperforms the S&P 500 index by a wide margin in expectation. Notice, however, that the probability that the fund will beat the S&P 500 index for fourteen consecutive years is $0.9^{14} = 0.229$, so there is roughly a 23% chance that such a fund would match the streak of the Legg Mason Value Trust over a given fourteen-year period.

Of course this example is overly simplistic, but the intuition is valid. There is a subtle and largely misunderstood distinction between frequency and expectation. Even though we observe a fund beating the market with great frequency, it may very well be the case that the fund will underperform the market over the long run. A related implication is that we must be careful not to rely too heavily on historical evidence in making predictions. Historical success does not necessarily imply future success. Historical underperformance does not necessarily imply future underperformance.

Miller's success can be traced, in part, to his adherence to the basic principles underlying the S&P 500 index. In fact, he has studied the S&P 500 in detail so that he can understand the source of its success in generating returns. Miller tends to let winners run, and he tends to select the stocks of companies that are financially sound. Where Miller deviates from many other fund managers is that he often chooses stocks that have been beaten down in recent months/years. This provides us with another lesson.

The market often overreacts to bad news, particularly when the news does not directly concern the fundamental quality of the company's operations.

Anecdotal evidence of Miller's choices supports this assertion. In the aftermath of the Dennis Kozlowski scandal, the stock of Tyco (TYC) dropped from \$60 to nearly \$8. Miller believed that the scandal had little (if anything) to do with the company's core business model, so he bought heavily. The stock has since rebounded to the mid \$30s, giving Miller a sizable return on his investment. Miller describes this as buying "where there is fear."[2] The lesson here is not that stocks that have performed poorly in recent months are good buys. Rather, it is that there may be good buys within the set of poorly performing stocks. The trick is of course to identify which of them are good buys and which are not.

Miller also believes that investors mistakenly (and perhaps even without realizing it) focus on maximizing the probability of picking a good stock rather than maximizing the expected return on the investment. An implication of this is that Miller does not particularly care if he picks more losers than winners, as long as the winners pay off handsomely. We are reminded of a quote by Earl Weaver, former manager of baseball's Baltimore Orioles, who said, "you win more games with home runs than sacrifice bunts." Peter Lynch agrees with this assessment wholeheartedly, stressing it repeatedly in his writings.

Strive to indentify stocks that have the potential to be big winners.

2. See "Investing with Style—Any Style," *Business Week*, February 7, 2005, p. 90.

Rather than forming a portfolio of many large, safe stocks that have no real potential to go up dramatically in a short period, Miller invests in a relatively small number of stocks that have substantial upside potential. In theory, this forces Miller to invest in stocks that tend to be risky. In practice, this may not be the case. If indeed the market tends to overreact to bad news about companies, then it may be the case that the stocks of these companies (and therefore the portfolio that holds them) are quite safe. The record of the Legg Mason Value Trust is anecdotal evidence in favor of this assertion. Although Miller tends to hold portfolios of seemingly high-risk stocks, he has managed to beat the S&P 500 index in both good economic times and bad, suggesting that his portfolio is less risky than many believe.

Putting It All Together

So what do we learn from all this? We see that market prices are determined by a sometimes complicated interaction between various market participants. Roughly speaking, prices are set so that supply is equal to demand in the marketplace and therefore are set according to the popular beliefs in the marketplace. It follows that if those beliefs are misguided (because of excessive enthusiasm or unwarranted pessimism), market prices will deviate from true value. If they do, then we as investors may be able to identify those mispricings and use our knowledge to generate abnormally high returns.

By studying the beliefs of some of our greatest investors, we are also able to establish some basic principles of stock market investing. Of special note is the importance of adopting a long-term investment strategy. This is sound advice for all of us, whether we believe that the market accurately prices stocks or not.

IN PRACTICE . . .

Much of our discussion in this chapter has centered on the practical lessons we can draw from examining the strategies of great investors. There is one additional lesson we want to understand before moving on. To do so, let us return to O'Charley's, which we consider throughout the book.

FIGURE 2.1

Historical Stock Prices, O'Charley's

Case Study: O'Charley's

The most important point we can draw from examining real-world price movements is that prices often change even when there is no evidence of any change in the company's fundamentals. Consider Figure 2.1, which shows the recent price history for O'Charley's stock. During the period from October 28, 2004 to December 2, 2004, we see a substantial increase in price from $15.00 to $18.98 (a 26.5% increase). When we examine news reports for that period, we find no compelling company-specific reason for an increase of that magnitude. When we also consider that the market itself and other restaurant stocks were all up by far smaller amounts during that period, we find no compelling industry-wide or market-wide reason for the increase. We conclude that the increase in stock price occurred with no explanatory change in the fundamentals of the company. This may not help us in assessing whether the stock is under- or overpriced, but we can reasonably conclude that O'Charley's became a worse buy over the period. Furthermore, we can draw two general conclusions of interest.

If a stock price drops with no apparent change in fundamentals, the stock is a better buy than it was prior to the drop.
If a stock price increases with no apparent change in fundamentals, the stock is a worse buy than it was prior to the increase.

These conclusions are important because they seem to go against our basic instincts. For some reason when a stock price drops, we tend to get scared and avoid investing in it. When the price increases, we tend to want to jump on the bandwagon and buy it before it goes any higher. Interestingly, these instincts are the opposite of what we see in other markets. For example, when an automobile manufacturer offers a rebate on a vehicle (i.e., the price drops with no apparent change in fundamentals), we become more willing to buy rather than less willing. Because our instincts tend to be backward when it comes to stocks, we must be disciplined enough to overcome them.

CHAPTER 3

The Time Value of Money

PURPOSE AND SCOPE

The value of a stock depends on the value *today* of the company's *future* cash flows. The valuation process involves forecasting those cash flows and then discounting them back to the present to obtain the value of the stock today. In addition to forecasting cash flows (which we will discuss in Chapter 7), we must estimate a discount rate (which we will discuss in Chapter 6). In this chapter, we review the basic intuition behind time value of money calculations. Our purpose is to develop equations that might prove useful and to gain a general sense of the importance of various time value of money factors. The theoretical relationships we develop are then applied to a simple retirement problem, so that we can fully grasp the relationship between variables and the limitations of using the equations we develop. What follows is then a discussion of the basic ideas behind the time value of money.

IN THEORY. . .

The premise behind time value of money calculations is one of *indifference*. If we are indifferent between two things, they must have the same value. To estimate the value today of a future stream of cash flows, we must find an amount of money to be received today that would make us indifferent between receiving that amount today and receiving the future stream of cash flows. A simple example illustrates the idea.

Example 3.1: Consider a situation in which you are to receive $1,100 in one year. That cash flow is promised, but is uncertain and therefore risky. Other securities with similar risk pay interest at 10% per year (we call this the *opportunity cost*, which is the appropriate discount rate for time value of money calculations). What is the value of this cash flow today? If we had $1,000 today, we could invest it in a security of similar risk and expect to receive $1,100 in one year. Thus, the value of the cash flow today is $1,000. Why? Because we are indifferent between receiving $1,000 today and receiving the $1,100 uncertain cash flow in one year.

It follows that the value today of a future cash flow can be written as

$$V_0 = \frac{C_t}{(1+R)^t}, \tag{3.1}$$

where V_0 is the value today, C_t is the cash flow to be paid in t years, and R is the appropriate annual discount rate.

Although Example 3.1 is quite simplistic, it illustrates the fundamental issues underlying time value of money calculations. We need to know 1) the dates and amounts of promised cash flows, and 2) the expected return on investments of similar risk. For some securities (such as bonds), the dates and amounts are specified at the time we purchase the securities. For others (such as stocks), we typically do not know the dates or amounts of the cash flows. Before valuing such securities, we must forecast the expected cash flows associated with them. Of course, the quality of our value estimate will depend a great deal on the quality of our cash flow forecasts.

The Discount Rate

Intuition tells us that the higher is the risk, the higher is the return investors must expect. For us to put money into a more risky investment, we must have the expectation that the return will be higher. It follows that to estimate the appropriate discount rate for a security, we must be able to 1) measure the risk associated with the security and 2) determine the relationship between risk and the required return. The appropriate discount rate for a security is precisely this required return. It is the minimum return that investors must receive in order to be compensated for the risk associated with the investment. The *discount rate* has many synonyms. It is often called the *opportunity cost* because investors will not rationally invest in a security unless they expect a return at least as great as the expected return on other opportunities with similar risk. It is often called the *required return* because investors require an expected return at least that large in order to invest. It is also simply called the *expected return* because in equilibrium in efficient markets, each security will have an expected return exactly equal to the required return.

Multiple Cash Flows

Dealing with multiple cash flows is really no more difficult than dealing with a single cash flow, because value is additive. We can write the general equation

$$V_0 = \frac{C_1}{(1+R)^1} + \frac{C_2}{(1+R)^2} + \cdots + \frac{C_n}{(1+R)^n}, \tag{3.2}$$

where C_1 is the cash flow in 1 year, C_2 is the cash flow in 2 years, and so on. This reflects the value today of a series of future cash flows.

Example 3.2: Suppose that a security pays \$200 in 1 year, \$300 in 2 years, and \$400 in 3 years. If the appropriate discount rate is 8%, the value of the security today is simply $\$200/1.08 + \$300/1.08^2 + \$400/1.08^3 = \$185.19 + \$257.20 + \$317.53 = \$759.92$. Why? Because we could invest \$185.19 today to receive $\$185.19 \times 1.08 = \$200$ in 1 year, we could invest \$257.20 today to receive $\$257.20 \times 1.08^2 = \$300$ in 2 years, and we could invest \$317.53 today to receive $\$317.53 \times 1.08 = \$400$ in 3 years.

Another way to understand this concept is to imagine that we invest the \$759.92 in an account that earns 8% annual interest and then make annual withdrawals in the amounts \$200, \$300, and \$400 respectively. Table 3.1 depicts this situation. After 1 year, the account will have grown to $\$759.92 \times 1.08 = \$820.71$, at which time we withdraw \$200. The remaining \$620.71 is left in the account to earn another 8% in interest over the next year. This process is repeated for each of the 3 years. Notice that after

TABLE 3.1

Account Summary for Example 3.2

Date	Balance	Withdrawal	Balance after withdrawal
0	$759.92	—	$759.92
1	$820.71	$200.00	$620.71
2	$670.37	$300.00	$370.37
3	$400.00	$400.00	$0.00

3 years, we have exactly zero dollars left in the account. This illustrates that the $759.92 can be used to exactly replicate the payoffs of the security we are valuing. As such, we are indifferent between the two and the security must have a value today of $759.92.

Developing a Constant Growth Formula

Although we often face situations in which future cash flows follow no simple progression, it is useful to consider a particular situation in which we have constant growth in the promised cash flows. For example, a security might pay $500 in 1 year followed by 5% annual growth ($525 in 2 years, $551.25 in 3 years, and so on). Is there an easy way to value such a stream?

We can examine this situation generally by considering a security that generates the stream of cash flows depicted in Table 3.2. The timeline shows that we expect a single cash flow in 1 year followed by a series of annual cash flows that grow at an annual rate of g. If the appropriate discount rate is R, the value of the security today is

$$V_0 = \frac{C}{(1+R)} + \frac{C(1+g)}{(1+R)^2} + \cdots + \frac{C(1+g)^{n-2}}{(1+R)^{n-1}} + \frac{C(1+g)^{n-1}}{(1+R)^n}. \tag{3.3}$$

A simple mathematical trick allows us to simplify this equation to

$$V_0 = C \times \frac{1 - \left(\frac{1+g}{1+R}\right)^n}{R-g} \tag{3.4}$$

TABLE 3.2

Timeline for a Constant Growth Annuity

Date	Cash flow
1	C
2	$C \times (1 + g)$
...	...
$n - 1$	$C \times (1 + g)^{n-2}$
n	$C \times (1 + g)^{n-1}$

whenever $R \neq g$.[1] This equation gives us the value today of a series of n annual cash flows that begins in 1 year and grows at an annual rate g. We call the factor multiplied by C the *Present Value Interest Factor for Growing Annuities* (*PVIFGA*). Note that although the formula is indeterminate when $R = g$, in that case we can compute V_0 directly from Equation 3.3 to see that $V_0 = nC/(1 + R)$. The representation in Equation 3.4 is particularly useful for evaluating retirement plans, which we will consider at the end of this chapter. A specific case of this equation in which we consider $n = \infty$ will prove to be quite useful in stock valuation.

Although Equation 3.4 is developed under a scenario in which dates are expressed in years and R is the annual discount rate, there is nothing magical about using years. We might, for example, want to value a security that pays semiannual cash flows. If so, we need only express R as a semiannual interest rate and choose n to be the total number of cash flows.

1. Multiplying Equation 3.3 by $(1 + R)/(1 + g)$ gives

$$V_0 \frac{1+R}{1+g} = C(1+g) + \frac{C}{(1+R)} + \cdots + \frac{C(1+g)^{n-3}}{(1+R)^{n-2}} + \frac{C(1+g)^{n-2}}{(1+R)^{n-1}}.$$

Notice that if we subtract Equation 3.3 from this, nearly all of the right-hand-side terms cancel, leaving

$$V_0 \frac{1+R}{1+g} = C(1+g) - \frac{C(1+g)^{n-1}}{(1+R)^{n}}.$$

This can be rearranged to get the desired Equation 3.4.

Relationship to Well-Known Equations

The general form shown in Equation 3.4 simplifies to some well-known equations under various assumptions. First notice that if $g = 0$, the equation reduces to

$$V_0 = C \times \frac{1 - \left(\frac{1}{1+R}\right)^n}{R}, \tag{3.5}$$

which is the formula for valuing an annuity (often called the *present value interest factor for annuities, or PVIFA*). This is particularly useful for bond valuation. For example, consider a 5-year bond with a $1000 face value bond and annual coupon payments of $60. If the appropriate discount rate is 7%, the bond will be worth

$$V_0 = \$60 \times \frac{1 - \left(\frac{1}{1.07}\right)^5}{0.07} + \frac{\$1000}{1.07^5} = \$959.00. \tag{3.6}$$

The first term in the equation is the present value of the coupon payments, and the second term is the present value of the principal payment.

With $g = 0$ and $n = \infty$, we have

$$V_0 = C \times \frac{1}{R}, \tag{3.7}$$

which is the formula for valuing a perpetuity. This formula might be applied to preferred stock or British Consol bonds, for example. Consider preferred stock that pays $2 per year with the next payment due in 1 year. If the appropriate discount rate is 5%, the preferred stock is worth $2/0.05 = $40.

With $g < R$ and $n = \infty$, we have

$$V_0 = C \times \frac{1}{R - g}, \tag{3.8}$$

which is the perpetual growth formula known as the Gordon Model. Although this formula provides useful intuition about the relationship between growth and value, it is often misapplied. Consider, for example, a stock that is expected to pay a $2 dividend in 1 year followed by 3% annual growth forever. If $R = 9\%$, the stock would be worth

$$V_0 = \frac{\$2}{0.09 - 0.03} = \$33.33. \tag{3.9}$$

Notice, however, that when g is close to R, the denominator of Equation 3.8 becomes very small and hence the value estimate becomes very large. If, for example, the annual growth rate is 8% rather than 3%, the stock would be worth

$$V_0 = \frac{\$2}{0.09 - 0.08} = \$200. \tag{3.10}$$

This is a rather dramatic difference that illustrates a basic problem we face when dealing with infinite life growth rates. For companies with growth rates close to the appropriate discount rate, the value estimate will be extremely sensitive to changes in the growth rate. This can easily lead to a large error in our estimate of stock value, even if we only misestimate the growth rate by a small amount. The problem we face is that it is extremely difficult to estimate an infinite life growth rate. For our purposes, the Gordon Model of perpetual growth will be discussed (in Chapters 9 and 10) as one method of estimating the *terminal value* of stocks. In doing so, we must keep in mind the inherent difficulties in using that model. In particular, we must be careful to conduct sensitivity analysis so that we can understand what factors are important.

With $g > R$ and $n = \infty$, Equation 3.8 gives us a negative value, which is clearly absurd. To understand this situation, we return to Equation 3.3, which is our core equation for the present value of a constant growth annuity. Notice that if $g > R$, each term of Equation 3.3 is larger than the one before it. Since there are an infinite number of terms, we see that the value of a growing perpetuity with $g > R$ must be infinite. Since no asset can have an infinite value in reality, we conclude that the growth rate of a constant growth perpetuity must be less than the appropriate discount rate.

Before we continue, it is useful to consider one lesson we might learn that is applicable to stock valuation. Recall that Peter Lynch stresses that recurring cash flows are far more valuable than single cash flows. The following example illustrates this intuition.

Example 3.3: Company XYZ was recently awarded a contract to provide a piece of equipment to a government agency. The contract calls for a one-time, immediate payment to the company of \$50 million. The company's cost of producing the equipment is \$40 million. Another company (Company UVW) was recently awarded a contract to provide maintenance on that equipment. The maintenance contract covers the next 20 years, which is the expected life of the equipment. The government will pay a fixed annual amount of \$2.5 million to UVW, with the first payment due in 1 year. UVW anticipates annual costs of \$0.8 million, so the project is expected to provide \$1.7 million in annual profits. The appropriate discount rate for both companies is 10%.

At first glance, it seems that XYZ's contract adds more value than UVW's contract. This is not the case. The value of XYZ's contract is \$10 million, and the value today of UVW's contract is $\$1.7 \times (1 - (1/1.1)^{20})/0.1 = \$14.47$ million. The difference becomes much more dramatic if the cash flows grow over time. Suppose, for example, that the UVW contract calls for 5% annual growth, so that the payment in the second year is \$2.625 million, and so on. Suppose also that UVW's costs are expected to grow at 5% per year. In this scenario, UVW can expect \$1.7 million in profits followed by a 5% annual growth in profits each year thereafter. The value today of UVW's contract would be $\$1.7 \times (1 - (1.05/1.1)^{20})/(0.1 - 0.05) =$ \$20.59 million.

The example illustrates both the power of recurring cash flows and the power of growth. It is easy to get excited about news that a company has been awarded a large, one-time contract, but we should get much more excited about a company that has been awarded a contract that promises a steady stream of cash flows, particularly if those cash flows are expected to grow over time.

Implied Discount Rates

In many situations, we will know the promised or expected cash flows on a security and will also know the current market price of that security. For example, bonds and preferred stock have prespecified cash flows. If they are publicly traded and liquid, we also know their current market prices. In these scenarios, we can infer the discount rate used by the market. This provides a very useful piece of information, because we know not only what the market expects of the security, but also the market's assessment of the risk associated with the investment. To compute an implied discount rate, we simply set the present value of the future cash flows equal to the current market price and then solve for the discount rate. A few examples illustrate this idea.

Example 3.4: A company has preferred stock outstanding that pays an annual dividend of \$3 per share. The next dividend payment is due in 1 year. The preferred stock is publicly–traded, and its current market price is \$46.

Preferred stock is a perpetuity in which the promised cash flows extend indefinitely into the future. We can therefore use the present value formula for a perpetuity to see that the value of the preferred stock is

$$V_0 = \frac{\$3}{R}, \tag{3.11}$$

where R is the discount rate being used by the market. Setting this equal to \$46 and solving for R gives $R = 6.522\%$. The market in its collective wisdom has determined that this is the appropriate discount rate for the preferred stock. We will see later (in Chapter 6) that this calculation is important in helping us determine the company's cost of using money provided by preferred stockholders.

Our next example illustrates how to compute the implied discount rate on a bond. This rate is called the *yield-to-maturity* or simply the *yield*, which is widely quoted in financial publications and on the internet.

Example 3.5: A bond has 6 years to maturity, has a face value of \$1,000, and pays \$80 annual coupons. The next coupon payment is due in 1 year. The bond is publicly traded and currently sells for \$1,060.

A bond pays coupons each year of its life and pays both a coupon payment and the face value when the bond matures. In this example, the promised payments on the bond consist of \$80 for each of the next 6 years, with an additional \$1,000 paid at the time of the last coupon payment. We can treat the coupon payments as an annuity and calculate the present value of the bond to be

$$\begin{aligned} V_0 &= \frac{\$80}{1+R} + \frac{\$80}{(1+R)^2} + \frac{\$80}{(1+R)^3} + \frac{\$80}{(1+R)^4} + \frac{\$80}{(1+R)^5} + \frac{\$80}{(1+R)^6} + \frac{\$1000}{(1+R)^6} \\ &= \$80 \times PVIFGA_{R,6} + \frac{\$1,000}{(1+R)^6}, \end{aligned} \tag{3.12}$$

where R is the discount rate being used by the market. Setting this equal to \$1,060 and solving for R gives $R = 6.571\%$, which is the market-determined discount rate for the bond.

The yield-to-maturity is particularly useful in helping us estimate the company's cost of using money provided by bondholders. We will revisit this idea in Chapter 6.

IN PRACTICE . . .

In the real world, time value of money concepts are applied in many different settings, from automobile dealerships that must deal with different financing plans, to financial planners who advise people on planning for future needs, to mutual funds that form portfolios to take advantage of market mispricings. Of course, these concepts are also an integral part of stock valuation. Before considering a real-world application that is relevant to all of us—retirement planning—we must first deal with the issue of how interest rates are quoted.

Expressing Interest Rates

Unfortunately, rates are quoted in different ways, depending on the particular setting. For consumer loans, banks use annual percentage rates (APRs) compounded on a monthly basis. Bond yields are typically quoted as APRs with semiannual compounding. Credit cards and option pricing models (which we will discuss later) use APRs that are compounded continuously (there are literally an infinite number of compounding periods per year). In contrast, we generally use effective annual rates (EARs) as discount rates for stock valuation. As we proceed through this book, we will have to deal with these variations. It is therefore useful to spend a few minutes examining the different ways that interest rates might be expressed.

By definition, the APR is equal to the per-period interest rate multiplied by the number of compounding periods per year. For example, if a bank charges 1% interest per month, the APR would be 12%. If a semiannual bond yields 4% every 6 months, the APR would be 8%. It should be apparent that the APR ignores the compounding of interest, which makes it unsuitable for use as a discount rate. In most cases and particularly so for low APRs, the appropriate discount rate will be close to the APR. Still, it is useful to know how to convert an APR into something more precise.

To convert an APR into an appropriate interest rate for use in discounting, we must determine the interest rate we would receive if we were to invest at the per-period rate and reinvest the proceeds. For example, if we invest \$10,000 at 1% monthly interest, we would have \$10,100 after 1 month, \$10,210 after 2 months, \$10,331 after 3 months, and so on. The value in any given month would be the prior month's value multiplied by 1.01. After 12 months, we would have $\$10{,}000 \times 1.01^{12} = \$11{,}268$, which amounts to a 12.68% annual return. We call this interest rate the effective annual rate (EAR). To convert from an APR to an EAR, we use the equation

$$EAR = \left(1 + \frac{APR}{m}\right)^m - 1, \tag{3.13}$$

where m is the number of compounding periods per year. In our example, we have

$$EAR = \left(1 + \frac{0.12}{12}\right)^{12} - 1 = 12.68\%, \tag{3.14}$$

which is the rate of return on the investment under the assumption that returns are reinvested.

Continuously compounded interest rates are based on an infinite number of compounding periods per year. To convert a continuously compounded APR into an EAR, we are tempted to simply plug $m = \infty$ into Equation 3.13. This is not appropriate mathematically, however. Instead, we must consider the limit as $m \to \infty$ in Equation 3.13. Our first instinct suggests that we will get EAR = 0 because the APR/m term would go to zero as m approaches ∞. Notice, however, that as APR/m gets smaller and smaller and the term 1 + APR/m gets closer and closer to 1, the exponent of 1 + APR/m increases toward ∞. We will not step through a formal proof here, but with continuous compounding we have

$$EAR = e^{APR} - 1. \tag{3.15}$$

Here, e is a constant that is approximately equal to 2.7182818.[2] To use discount cash flows for continuously compounded rates, we simply divide by e^{Rt} instead of by $(1 + R)^t$. For example, suppose that the continuously compounded discount rate is 5% and that we wish to estimate the value of a $1,000 cash flow to be paid in 2 years. The value today would be $\$1{,}000/e^{0.05 \times 2} = \$904.84$.

To reinforce these concepts, we now consider a few simple examples. In the first, we will consider the case of a semiannual coupon bond. In the second, we will consider credit cards that quote continuously compounded interest rates. First, let us consider how we would value a semiannual bond.

Example 3.6: Suppose that a company has an 8-year bond outstanding. That bond has a face value of $1,000 and an annual coupon rate of 8%, with the coupons paid on a semiannual basis. Coupon rates are quoted on an annual basis, so the 8% coupon rate means that the company will pay 4% of the bond's face value every 6 months. The yield-to-maturity on the bond is 9.2%. What is the value of the bond today?

Yields are quoted as APRs, so the 9.2% interest rate is not an annual discount rate. By definition, it is the per-period rate multiplied by 2 (the number of compounding periods per year), so the appropriate discount rate is 4.6% every 6 months. This is fortunate, because our PVIFA formula requires us to use the per-period interest rate. Given this, the simplest way to complete our task is to recast the problem in terms of half-years. We have a bond that matures in 16 half-years, pays 16 coupon payments of 4% of the face value, and has a per-period interest rate of 4.6%. The value of the bond would be

$$V_0 = \$40 \times PVIFA_{4.6\%,16} + \frac{\$1{,}000}{1.046^{16}} = \$933.08. \tag{3.16}$$

2. Most calculators are programmed with a key labeled EXP or e^x to do this calculation for us.

A common question is whether we could discount the face value by using the yield-to-maturity. Although we need a per-period rate in order to use the annuity formula to value the coupon payments, nothing suggests that we must use this rate for the face value. However, the APR cannot ever be used as a discount rate, since it ignores compounding during the year. We must either discount at 4.6% for 16 half-years or discount at the EAR (which is 9.41%) over 8 years. Using either method, we will find that the bond has a value of \$933.08.

Next, let us consider credit cards, which are notorious for charging high interest rates. As we mentioned earlier, the interest rates on credit cards are typically quoted as continuously compounded interest rates.

Example 3.7: Suppose that a credit card quotes an interest rate of 18% APR. What is the actual annual interest rate charged on the credit card? According to Equation 3.15, the EAR is $e^{0.18} - 1 = 19.72\%$. This is the actual annual interest rate on the credit card. Because the quoted rate appears in the exponent of the EAR equation, the difference between the quoted rate and the actual rate increases dramatically for higher interest rates. For a low quoted rate of, say, 5%, the actual rate of $e^{0.05} - 1 = 5.13\%$ is quite close to the quoted rate.

So why are interest rates quoted in so many different ways? It seems that we would be much better off if we always quoted rates determined in the same way. It turns out that there are good reasons to quote rates differently in different situations. One advantage of the APR is that we can quickly and easily compute the interest portion of amortized payments. For example, suppose that our mortgage has a balance of \$120,000 and has an interest rate of 6%. The portion of our next payment that counts as interest is $\$120{,}000 \times (6\%/12) = \$600$. The remainder of our payment acts to reduce the balance. Thus, quoting APRs to retail customers generally results in less confusion. It also is useful for accountants who track interest payments for tax purposes. EARs, on the other hand, are needed when we do present (or future) value calculations. The nice feature of an EAR is that we can always discount a cash flow by dividing by $(1 + EAR)^t$. The same cannot be said of the APR. Continuously compounded APRs are also quite useful, particularly when we seek to value options (which we consider in Chapter 8). In option valuation, using continuously compounded interest rates allows us to develop formulas that are generally simpler than what we would get if we used EARs.

Application: Retirement Planning

To reinforce what we have learned about the time value of money, we now apply our knowledge to the retirement planning problem. In doing so, we consider the problem faced by all of us: how much money should we save each year so that we can achieve our retirement goal? One way to address this situation is to consider a simple model in which our annual savings grow at some rate and earn some return until retirement, at which time our annual withdrawals grow at some rate of return while the residual funds earn some rate of return. We can easily use this structure to develop or evaluate a given retirement plan.

To do this, we first adapt Equation 3.4 so that it reflects the *future* value of cash flows. Consider again the basic timeline shown in Table 3.2, but now assume that the cash flows are made into some investment account. That is, we invest $\$C$ in 1 year, $\$C(1 + g)$ in 2 years, and so on. How much will we have saved as of date n? The first cash flow will grow to a value of $C \times (1 + R)^{n-1}$, the second to $C \times (1 + g) \times (1 + R)^{n-1}$, and so on. The value of the stream of cash flows is then

$$V_n = C(1+R)^{n-1} + C(1+g)(1+R)^{n-2} + \cdots + C(1+g)^{n-2}(1+R) + C(1+g)^{n-1}. \tag{3.17}$$

Notice that each term of the above equation is equal to the corresponding term in Equation 3.3 multiplied by $(1 + R)^n$. It therefore follows from Equation 3.4 that

$$V_n = C \times \frac{1-\left(\frac{1+g}{1+R}\right)^n}{R-g} \times (1+R)^n = C \times \frac{(1+R)^n - (1+g)^n}{R-g}, \tag{3.18}$$

which gives the future value as of date n of a series of cash flows that grow at the constant rate g. We call the factor multiplied by C the *future value interest factor for growing annuities* (*FVIFGA*). Notice that the equation gives us the value at the time of the last cash flow. In contrast, the PVIFGA in Equation 3.4 gives us the value one period before the first cash flow. To see how to apply this equation, consider the following example.

Example 3.8: Suppose we plan to retire in 35 years and plan to save \$6,000 this year toward that retirement. We expect our annual salary (and hence our annual savings) to grow at a rate of 4% per year. We plan to invest in a well-diversified equity portfolio that has an expected return of 9% per year. Once we retire, we will shift to a less risky investment that has an expected annual return of 6%. Inflation is expected to be 2% per year indefinitely, and our desire is to maintain the same level of purchasing power during each year of retirement. What is our projected retirement income stream if we expect to live for 25 years after retirement?

To simplify the analysis, suppose that money is saved at the end of each year. Suppose also that the expected annual investment return is achieved each year (that is, there is no volatility in the returns). Using Equation 3.18, we see that our savings after 35 years would be

$$V_n = C \times \frac{(1+0.09)^n - (1+0.04)^n}{0.09 - 0.04} = \$1{,}976{,}146. \tag{3.19}$$

That represents the amount we expect to have available to support retirement.

Now, suppose that we plan to withdraw \$$W$ during the first year of retirement and that, subsequently, we plan to withdraw 2% more money each year to keep pace with inflation. The amount we will be able to withdraw during that first year satisfies

$$V_{35} = W \times \frac{1 - \left(\dfrac{1+0.02}{1+0.06}\right)^{25}}{0.06 - 0.02} \equiv \$1{,}976{,}146. \tag{3.20}$$

In other words, the present value (as of 35 years from now) of our expected withdrawals would equal the amount saved. Solving gives W = \$127,959. So, our retirement plan is one in which we expect to withdraw \$127,959 during the first year of retirement, with all subsequent withdrawals having the same purchasing power as the money withdrawn during that first year (i.e., each subsequent withdrawal will be 2% higher than the previous one). The value of these withdrawals is of course somewhat difficult to grasp because the prices of goods are expected to rise over the next 35 years. We can, however, compute the value of retirement withdrawals in today's dollars. This gives us a better understanding of the quality of life we would experience under the retirement plan. The purchasing power of $127,959 in 36 years (the first year of retirement) is equivalent to $127,959/1.02^{36} = $62,729 in today's dollars. The given retirement plan can then be evaluated based on the acceptability of this number.

This analysis is based on a series of simplifying assumptions. First, we assume all cash flows occur at the end of the year. In reality, we would likely save some amount each month via payroll deductions. Second, returns and inflation rates are treated as certain and constant, when in reality they are both uncertain and volatile. Third, we assume that the annual growth in savings (which would likely come from increases in salary) is constant over time. In reality, it is likely to be volatile simply because salary increases depend in part on volatile inflation. Furthermore, salaries are likely to grow at a slow rate most of the time, with large jumps if and when we receive promotions. Fourth, we make no provision for gradually shifting money into safer investments over time (which is usually recommended by financial planners). Fifth, an implicit feature in the analysis is that retirement savings are entirely depleted 25 years after retirement. If you happened to live longer than that, you would presumably live your last years with no money whatsoever. The first three of these differences turn out to be relatively harmless. We can easily adjust our model to account for the fourth (shifting to safer investments over time), which readers are encouraged to do. We can easily deal with the fifth and last criticism by simply assuming that we will live for a long time—even forever. Contrary to what we might think, it is not far-fetched to believe that we can save enough money while we work to pay for an infinite-life retirement. We will return to this idea later in the chapter.

All of these simplifying assumptions add uncertainty to our projections, suggesting that we should be conservative whenever we use such assumptions. (This theme will reappear in later chapters when we use present value techniques to value stocks.) To get a better understanding of the impact of the variables in our analysis, consider Table 3.3, which shows retirement plans based on different assumptions. Scenario A in the table depicts the analysis we have already made. Scenarios B–H are identical to

TABLE 3.3

Scenario Analysis of Retirement Plans

Scenario	A	B	C	D	E	F	G	H	I
First-year savings	$6,000	$12,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000
Expected annual growth in savings	4.0%	4.0%	5.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Number of working years	35	35	35	40	35	35	35	35	41.353
Expected return during working years	9.0%	9.0%	9.0%	9.0%	10.0%	9.0%	9.0%	9.0%	9.0%
Number of retirement years	25	25	25	25	25	35	25	25	∞
Expected return during retirement years	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	9.0%	6.0%	6.0%
Inflation rate	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	3.0%	2.0%
First-year retirement income	$127,959	$255,919	$144,701	$206,754	$156,417	$106,847	$170,832	$115,755	$145,115
Annual retirement income in today's dollars	$62,729	$125,457	$70,936	$91,801	$76,679	$52,379	$83,746	$39,939	$62,729

Scenario A, except that one of the input variables has been changed. In Scenario B, the first-year savings has been doubled to $12,000. This precisely doubles our annual retirement income, both in actual dollars and in today's dollars. This is not surprising, because our valuation equations are all linear in the annual savings. In Scenario C, we explore the impact of higher annual growth in savings by increasing it from 4% to 5%. This has a relatively small but noticeable impact on our quality of life during retirement. Why is this so? Savings during the first year get no benefit from the higher growth, and savings during the first few years get very little benefit. It is these cash flows that contribute heavily to retirement savings because of the power of compounding; therefore, the change has only a small impact.

In Scenario D, we increase the number of working years from 35 to 40. This has a tremendous impact on our retirement income, increasing it by roughly 50% ($62,729 to $91,801)! The lesson here is that we should begin saving for retirement as early as possible in life. A few extra years of saving has an enormous impact on our quality of life during retirement. In Scenario E, we increase the expected return during working years from 9% to 10%. This relatively small change in expected return increases the retirement income by nearly $14,000 ($62,729 to $76,679). This illustrates the power of investing in higher expected return (and hence higher risk) securities over long periods of time. Many investors choose relatively safe portfolios early in life and end up with substantially less retirement income as a result. A strong argument can be made that we should choose relatively risky portfolios early in life because the expected returns will be high. If we as a matter of chance end up losing money in those portfolios, there would be plenty of time left to make up that loss.

In Scenario F, the expected number of retirement years is increased from 25 to 35 (an increase of 40%). This reduces our retirement income from $62,729 to $52,379 (a decrease of about 16%). The lesson is not that we will have a lower retirement income if we expect to live longer. Rather, it is that the reduction in income is far less (in percentage terms) than the increase in the number of years during retirement. This phenomenon occurs because our retirement savings continue to earn money during retirement, which adds substantial value as we increase the number of retirement years. Scenario G depicts a situation in which the investor does not shift to lower risk investments after retirement. In that scenario, the expected return during retirement is at 9% instead of the 6% base case. The impact is substantial as the first-year retirement income increases from

$62,729 to $83,746. There is a valuable lesson to be learned here. *If* we are in a position to accept higher risk during retirement, there is a substantial benefit to be derived from doing so. If we are not in such a position and are forced to move into safer investments, our retirement income is dramatically reduced. In Scenario H, the inflation rate is increased to 3% from 2%. Recall that our annual retirement income grows at the inflation rate, so this scenario depicts a situation in which our cash flow needs during retirement grow at a faster rate over time. Notice that the higher inflation rate has almost no impact on our retirement income in actual dollars, but has a large impact on our retirement income in today's dollars.

In Scenario I, we seek to answer a simple question. How mush longer would I have to work in order to save enough money to support an infinite-life retirement? In that scenario, we assume an infinite number of retirement years along with 41.353 working years. Here, we see that the expected annual retirement income in today's dollars is $62,729, precisely the same as what we observe in our base case. This illustrates an important point concerning retirement planning. If we plan to work for a few more years (or, equivalently, begin to save a few years earlier), we will effectively save enough money to support us forever! Given the uncertainty about future medical advances and therefore about life expectancy, this seems to be a wise approach. There are two other benefits of this approach. First, whenever we do die, we leave behind a substantial inheritance. Second, because we generate a large fund in anticipation of living forever, there will likely be little need to shift into lower risk investments after retirement. We can therefore invest at a higher expected return during retirement, thereby producing an even greater quality of life during retirement. The message is clear: saving money early in life pays off in a huge way when we retire.

SUMMARY

In this chapter, we have spent a good bit of time exploring issues related to the time value of money. In doing so, we have developed equations that can help us assess virtually any situation we might encounter. Although we applied our knowledge to the retirement problem, our real focus in this book is on valuing stocks. As such, we will return to the time value of money concepts later when we consider how to estimate the value of a company's future cash flow.

This page intentionally left blank

CHAPTER 4

Understanding Financial Statements

PURPOSE AND SCOPE

In this chapter, we discuss the three main financial statements along with the intuition behind them. For many readers, much of this chapter will be review. To those who are new to the world of financial statements, the material in this chapter will be of great importance because stock valuation rests heavily on the company's financial statements.

Three principal financial statements are reported by companies: the balance sheet, the income statement, and the statement of cash flows. The statements are produced with two main purposes in mind. First, publicly traded companies must produce them to satisfy the regulations of the Internal Revenue Service (IRS) and the Securities and Exchange Commission (SEC). Second, companies produce them to convey information to current and potential investors. Unfortunately for these investors, the format and content of financial statements are heavily dictated by accounting rules and regulations, but those regulations are not so specific that the financial statements of different companies are easy to compare. An implication of this is that financial statements are also easy to misinterpret. Compounding this problem, the financial statements can be manipulated by company managers. Although we hope the days of corporate malfeasance are over, we would be naïve if we did not expect some managers to cheat. Besides, statements can be manipulated in ways that are entirely legal. Because of this, we must be fully aware that the statements we see may not be a clear reflection of the true state of the company.

Our objective in this chapter is to present and consider each of the financial statements, highlighting what the key accounts really mean. In the next chapter, we will consider how we might best interpret them. We do not (and probably could not) present an exhaustive list of the accounts used by companies, but instead focus on the general categories of accounts used by typical companies. We also consider the notion of "free cash flows"—the actual cash flows of the company. In doing so, we develop an equation that allows us to translate the information found on a company's financial statements into a measure of the relevant profits of the company. To accomplish this, we first establish a baseline equation by using the income statement. We then consider how we might adjust that baseline calculation in order to better estimate the true cash flow of the company.

FINANCIAL STATEMENTS

A company's financial statements are a numerical record of the activities and status of the company. There are three main financial statements. The income statement is a detailed estimate of the profits generated by the company during a specified period and the factors that contributed to those profits. The balance sheet reflects the accounting value of various accounts at a specific point in time, including the assets of the company and the financing used to support those assets. The statement of cash flows actually shows the change in the balance sheet over a specified period, although this is not obvious at first glance. It also shows the cash flow generated or spent by the company over the period. The balance sheet differs from the income statement and the statement of cash flows in that it reflects the value at a specific *point* in time. In contrast, the income statement and the statement of cash flows reflect the cash flows over a specific *period* of time.

To complicate matters, companies keep two sets of books, one for the Securities and Exchange Commission (SEC) and one for the Internal Revenue Service (IRS). As outsiders, we do not see the books kept for tax purposes, but we do have access to the reports created for the SEC. The books kept for the IRS conform to the IRS codes while the books kept for the SEC conform to Generally Accepted Accounting Principles (GAAP). The GAAP standards are designed so that each company provides financial statements that best represent the state of the company. The IRS standards, in contrast, allow companies to take advantage of tax laws to best benefit the company. The two sets of statements can differ greatly. For example, the company may write off assets on the GAAP statements by using straight-line depreciation (i.e., the same amount each year), but may write them off on the IRS statements by using an accelerated depreciation schedule (i.e., depreciate more in the early years and less in the later years). This allows the company to reduce its tax bill over the next few years in exchange for a higher tax bill in later years.

The Balance Sheet

The balance sheet is a snapshot of the company's assets and financing. The left-hand side of the balance sheet lists the assets owned by the company, along with their accounting values. The right-hand side of the balance sheet lists the accounting values of the company's debt, preferred stock (if the company has any), and common stock. The total value of the company's assets must be equal to the total value of debt, preferred stock, and common stock. This equality is known as the *balance sheet identity*. A rather simple balance sheet is shown in Table 4.1. In the table, CY denotes the current year and CY-1 denotes one year ago. The items on the balance sheet capture the accounting value of assets along with the accounting value of securities held by debtholders, preferred stockholders, and common stockholders. We stress the term *accounting value* because, except for cash, the values shown on the balance sheet are typically not market values (i.e., the prices for which the assets or securities could be sold). As we will see later, this is a critical distinction that we must specifically consider in our analyses. In the following discussion, we will define and discuss each item on that balance sheet.

Cash and Cash Equivalents

The cash account reflects the amount of money the company has on hand for immediate use. The higher the level of *cash* is, the greater is the ability of the company to address unexpected needs and the greater is the ability of the company to maintain operations during lulls in sales. There is, of course, a drawback to holding a high level of cash. Since cash earns little or no interest, higher cash tends to imply lower returns to shareholders. Thus, there is a tradeoff between the safety of holding large amounts of cash and the sacrifice of holding funds that are not productively invested. An especially large cash account might be an indicator that a company is preparing for a large expenditure, such as the acquisition of another company.

TABLE 4.1

A Simple Balance Sheet

Assets			Liabilities and equity		
	CY-1	CY		CY-1	CY
Cash and equivalents	$120	$134	Accounts payable	$178	$213
Accounts receivable	$239	$251	Other current liabilities	$34	$21
Inventory	$412	$398	Total current liabilities	$212	$234
Other current assets	$67	$40	Long-term debt	$317	$202
Total current assets	$838	$823	Total debt	$529	$436
Goodwill	$200	$200	Preferred stock	$0	$0
Accumulated amortization	$113	$124	Common stock	$112	$118
Net goodwill	$87	$76	Additions to retained earnings	$771	$815
Property, plant, and equipment	$580	$604	Total equity	$883	$933
Accumulated depreciation	$116	$163	Total liabilities and equity	$1,412	$1,369
Net property, plant, and equipment	$464	$441			
Other long-term assets	$23	$29			
Total assets	$1,412	$1,369			

Accounts Receivable

The *receivables* account reflects sales that have been made with the good or service provided, but for which the money has not yet been received. Receivables are recorded at the sale price, not at the value of the receivable, which may be something less than that since the buyer may eventually default on the obligation. The actual value of a company's receivables will depend on the company's credit policies and its customer base.

Inventory

The *inventory* account reflects the amount of goods on hand as measured by the cost of producing them. The account fluctuates up and down as additional units are produced and sold. There is a direct correspondence between inventory and the *cost of goods sold*, which appears on the income statement. The inventory level in one period will be the inventory level from the previous period, plus the cost of additional units produced or acquired, less the cost of goods sold. As we will discuss later, an increase in inventory from one period to the next represents a cash outflow used to purchase/produce the inventory.

Other Current Assets

Other current assets is not an account, per se, but is rather a category that includes any number of other short-term assets. For example, deferred income taxes and short-term notes receivable may appear as current assets. In most instances, these accounts will only comprise a small portion of the company's assets, so we often regard them as negligible. In a typical analysis, we first consider other current assets as if they are a regular account. If we then determine that they are important, we investigate the individual elements of the category further. We generally follow this procedure for other catch-all categories in the financial statements.

Total Current Assets

Total current assets is a category that reflects the company's assets that are expected to be converted to cash over the next year. It is important to note that this does not include expected sales over the next year, so the total current assets could be vastly different from the amount of money we actually expect the company to receive over the next year. For a company that turns over its inventory quite often (Wal-Mart (WMT), for example), the company expects to receive far more money over the next year than total current assets suggest. We will consider this idea in more depth in the next chapter.

The Goodwill Accounts

Goodwill is a sometimes misunderstood concept that can be quite important in the valuation process. Suppose that one company (the *bidder*) agrees to buy another company (the *target*). If the bidder pays more than the market value of the target's assets, then the difference is entered onto the bidder's balance sheet under the asset "goodwill." Why would the bidder be willing to do this? There must be something special about the target, such that the bidder has an expectation of being able to generate high returns with those assets. For example, a company may choose to acquire another company simply to gain access to its customers. The expected synergy gains associated with access to those customers make it reasonable for the bidder to pay a premium above the value of the assets. There are three main goodwill accounts, although most companies do not report them separately. The *goodwill* account reflects the total goodwill acquired by the company. That goodwill is reduced over time through amortization (much like what we will see later when we discuss depreciation). The company's *accumulated amortization* account keeps a running total of the amount of goodwill amortized to date by the company. The amount of goodwill remaining on the books is tracked in the *net goodwill* account, which is simply goodwill less the accumulated amortization.

A simple example illustrates how goodwill is treated on the company's financial statements. Suppose that the bidder agrees to pay $50 million for the target, which has assets having a total value of $40 million. When the transaction is executed, the $40 million in assets is added to the bidder's balance sheet under the appropriate asset accounts (e.g., if the target owned $15 million worth of inventory, it would come on the bidder's balance sheet as $15 million worth of inventory). The additional $10 million in purchase price is added to the bidder's goodwill account on the balance sheet. Perhaps more importantly, the bidder can sometimes then amortize that goodwill over time, which will reduce the bidder's taxable income and therefore will reduce the taxes paid by the bidder. In each period, the bidder's goodwill account is reduced by the amount of goodwill amortization shown on the income statement. Eventually, the goodwill will be completely depleted, but in the meantime, the goodwill elevates the bidder's total assets and reduces the bidder's taxable income. Both of these effects could mislead not-so-careful investors. We therefore must be careful in interpreting certain financial ratios (such as sales/total assets) when a given company has a large amount of goodwill.

The Fixed-Asset Accounts

Long-term assets (also known as "capital assets") are similar to goodwill in that they are written off over time rather than all at once. This process is recorded on the balance sheet in three main accounts: *property, plant, and equipment* (PPE); *accumulated depreciation*; and *net property, plant, and equipment* (net PPE). Capital assets are recorded on the balance sheet at the purchase cost at the time of purchase. Over time, most (but not all) of these assets are depreciated. This is analogous to the treatment of goodwill in which the goodwill is depleted over time through amortization. A running total of the depreciation on each asset is tracked and recorded on the balance sheet as accumulated depreciation. As we will discuss later, the depreciation account is tied directly to both the income statement and the statement of cash flows, so that account is quite important to the linkage between the statements. The net PPE account simply tracks the accounting value of the assets, which is PPE less the accumulated depreciation.

The PPE account represents the total historical cost of all properties, facilities, and pieces of equipment purchased and still owned by the company. By "historical cost" we mean the amount paid by at the time of the purchase for the assets.[1] These assets are depreciated over time, but PPE does not reflect that depreciation. If a capital asset is sold, it is removed from the balance sheet and PPE is reduced by the historical cost of the asset. If a new capital asset is purchased, PPE is increased by the purchase price of that asset.

The accumulated depreciation account records the total amount of depreciation taken to date on capital assets owned by the company. As a capital asset is depreciated, the accumulated depreciation keeps a running total of the depreciation on that asset. If the asset is sold, all record of it is removed from the balance sheet. In that case, the accumulated depreciation would be reduced by the total accumulated depreciation on the sold asset.

Net PPE is simply the company's PPE less its accumulated depreciation. The account represents the book value of the company's capital assets, which can often deviate substantially from the market value of the assets. For example, land (which is not depreciated on the books) typically

1. Note that there are exceptions to this definition, particularly those involving how the assets are recorded in bankruptcy situations.

increases in value over time. A company such as General Electric (which has been around for more than 100 years) may own land worth many millions of dollars that is recorded on the books at hundreds or thousands of dollars. A simple example shows the relationship between PPE, depreciation, and net PPE.

Example 4.1: In a given year, a company purchases a piece of equipment for $10,000,000 and intends to write it off by using five-year straight-line depreciation to zero. Table 4.2 shows how this situation is reflected on the balance sheet. Straight-line depreciation over 5 years implies a depreciation of $2,000,000 per year. However, it is conventional for the company to take half of a year of depreciation during the year that the asset is purchased, and half of a year during the last year of depreciation. In this example, one-half-year of depreciation would be taken during Year 1 and another half-year of depreciation would be taken during Year 6. Notice in Table 4.2 that once the asset is purchased and entered on the balance sheet at $10,000,000, it remains there until the company disposes of the asset. Over time, however, the company gradually depreciates the asset. The accumulated depreciation account captures this, increasing by the amount of the depreciation each year. Net PPE decreases over time from $10,000,000 to $0 in our example. This provides the accounting estimate of the value of the asset over time. The true value may of course differ from the accounting value. If and when the asset is sold, the company's taxable income would increase by the difference between the sale price of the asset and its accounting value.

TABLE 4.2

Depreciation Schedule for Example 4.1

Year	Property, plant, and equipment	Accumulated depreciation	Net property, plant, and equipment
1	$10,000,000	$1,000,000	$9,000,000
2	$10,000,000	$3,000,000	$7,000,000
3	$10,000,000	$5,000,000	$5,000,000
4	$10,000,000	$7,000,000	$3,000,000
5	$10,000,000	$10,000,000	$0

Other Long-Term Assets

The category *other long-term assets* includes the company's long-term assets that are not considered capital assets. For example, shares of stock in other companies, deferred compensation, and long-term notes receivable might also appear on the company's balance sheet. As with other current assets, we first consider other long-term assets as if they are a regular account. If we then determine that they are significant, we investigate the individual elements of the category further.

Total Assets

Total assets is the last entry on the left side of the company's balance sheet. It reflects the total book value (i.e., accounting value) of all of the company's assets. In theory, total assets measures the account value of company assets, which is a measure of the liquidation value of those assets. However, this is often a misleading measure, because book values can differ greatly from market values.

Accounts Payable

The *payables* account is typically the first entry on the right side of the company's balance sheet. It reflects money owed by the company for goods and/or services that have already been received. For example, a retailer may purchase goods on credit from a wholesaler. The retailer receives the goods but is not required to pay for them until some later date. The amount due is included as a payable until it is paid.

A simple example illustrates the relationship between sales, cash, receivables, inventory, and payables.

Example 4.2: A retailer buys clothing from a wholesaler on credit and then sells it to customers, some of whom pay cash and others of whom buy on credit. Let us trace a shirt from the time it leaves the wholesaler until the retailer receives money for it from a customer. The retailer agrees to buy the shirt from the wholesaler for $10 during the first quarter of the year. The wholesaler gives the shirt to the retailer but does not require payment for it until the second quarter of the year. During the third quarter of the year, the company sells the shirt to a customer for $15. The customer takes possession of the shirt at that time but is not required to pay for it until the fourth quarter of the year. Table 4.3 shows the impact of the two transactions on the current accounts shown on the balance sheet.

TABLE 4.3

Account Changes for Example 4.2

Account	1st quarter change	2nd 1uarter change	3rd quarter change	4th quarter change
Cash		−$10		+$15
Receivables			+$15	−$15
Inventory	+$10		−$10	
Payables	+$10	−$10		

During the first quarter, both inventory and payables increase by $10. These offset each other because they are on opposite sides of the balance sheet. During the second quarter, the company pays $10 to the wholesaler, which reduces the company's cash account by $10. Once paid, the company's obligation is satisfied, so payables decrease by $10. Again, these offset each other because they are on opposite sides of the balance sheet. During the third quarter, the company provides $10 worth of inventory to the customer, but the customer agrees to pay $15 for it at a later date (i.e., the company earns a $5 profit on the transaction). Thus, inventory decreases by $10 while receivables increase by $15. The difference of $5 (which is the company's profit on the transaction) is absorbed through interaction with the income statement. For example, if there were no taxes and no dividends, the $5 would be passed down the income statement to retained earnings, which are then added to additions to retained earnings on the balance sheet. This would effectively increase shareholders' equity by $5. If instead taxes are paid on those profits, the company's cash account would be reduced by the amount of the taxes. For example, suppose that the company's tax rate is 40%. The company would pay taxes of $2 on the transaction, leaving $3 to be added to retained earnings. These effects offset the changes to receivables and inventory, leaving the balance sheet balanced.

Finally, in the fourth quarter, the customer pays $15 to the company, which increases the company's cash account by $15. Since the customer's obligation is satisfied with that payment, the company's receivables decrease by $15 at that time. The total impact of the two transactions is that the company's cash account increases by $5. If we were to examine only the company's year-end annual balance sheet, we would observe only the $5 increase in cash. This illustrates the importance of considering all of the company's balance sheet accounts in order to more fully understand the activities of the company over the given period.

Other Current Liabilities

There are many types of short-term liabilities other than accounts payable. For example, the company, under certain circumstances, may opt to defer revenue from one period into the next. This revenue would appear on the balance sheet as a short-term liability. More common short-term liabilities include everything from payments due on a revolving line of credit to the current portion of long-term debt. We generally begin an analysis by including these miscellaneous accounts as *other current liabilities*. If we subsequently conclude that they are significant, we revisit the category to identify the specific accounts that are important.

Long-Term Debt

The *long-term debt* account reflects company debt that is due in a year or longer. This account typically includes term loans granted to the company by a bank and bonds issued by the company to capital market investors. The account is particularly important to us because it helps us determine the company's weighted average cost of capital (WACC), which we will consider in Chapter 6. It is also important because we must assess the ability of the company to manage its debt.

Total Debt

The company's *total debt* is simply the total amount owed by the company, including trade debt (i.e., accounts payable), bank debt, outstanding bonds, or any other debt obligation of the company.

Shareholders' Equity Accounts

Shareholders' equity includes both preferred and common stocks, which can cause some confusion. In reality, preferred stock is more like debt than equity, and we should treat it as such. Fortunately, most companies have little or no preferred stock, so we can often ignore it altogether. Common stock is a different matter, however. Earlier, we discussed how fixed assets are recorded on the balance sheet and how changes in the value of those assets are tracked through accumulated depreciation. A somewhat similar approach is used for a company's common stock. The initial value of equity is entered on the balance sheet through the *common stock* account, and changes are subsequently tracked through the *additions to retained earnings* account. In contrast to the fixed-asset situation in which net PPE is equal to PPE less the accumulated depreciation, it is not always the case that *total shareholders' equity* is equal to common stock plus additions to retained earnings. Other miscellaneous accounts may also influence total shareholders' equity.

Preferred Stock The balance sheet shows the book value of any of the company's preferred stock that is outstanding. Since preferred stock has prespecified, typically constant cash flows to be paid on prespecified dates, there is little uncertainty about it. Still, preferred stock represents an obligation of the company and therefore affects the profits the company must generate in order to satisfy its investors. We will return to this idea in Chapter 6 when we consider the appropriate discount rate for company cash flows.

Common Stock and Paid in Surplus The common stock account reflects the par value of common stock held by shareholders. In many cases, there is also a Paid in Surplus account that is the difference between the amount initially paid by shareholders and the par value of the stock. Regardless, it is only at the very beginning of the company's life that the common-stock account resembles the true value of the stock.

Additions to Retained Earnings A running total of the portion of net income that is not paid out in dividends is recorded on the balance sheet under additions to retained earnings. Thus, total shareholders' equity on the balance sheet consists of two primary components. The first is a measure of the amount invested. The second is a measure of the increase in the value of that equity due to the generation of profits. We will later see that net income can be very misleading. It follows that additions to retained earnings can also be very misleading.

Total Shareholders' Equity As financial analysts, we typically do not care at all about the common stock and additions to retained earnings accounts. After all, they are simply accounting devices used to track the total value of the company's stock. Instead, we are concerned about the company's total shareholders' equity, which is also known as the book value of equity. The account can be computed several different ways, including

$$\begin{aligned}\text{Total Shareholders' Equity} = &\ \text{Common Stock} + \text{Paid in Surplus} \\ &+ \text{Additions to Retained Earnings} \\ &+ \text{Other Effects}\end{aligned} \tag{4.1}$$

or

$$\text{Total Shareholders' Equity} = \text{Total Assets} - \text{Total Liabilities}. \tag{4.2}$$

The expression in Equation 4.2, which is simply a rearrangement of the balance sheet identity, best depicts the important intuition behind shareholders' equity. It is the accounting estimate of the amount of money shareholders would receive if all of the company's assets were sold and all of the company's creditors were repaid. Said differently, it is a rough measure of the liquidation value of the company. In reality, the market value of total shareholders' equity (called the *market capitalization*) tends to differ greatly from the book value of total shareholders' equity. The difference between the two reflects the value added by the company's employees in managing the company's assets. This is a rather important point because it implies that we should not use the book value of shareholders' equity as a measure of the investment by shareholders. The significance of this observation will become clear later in the book when we seek to estimate how much money the company must make to satisfy investors.

The Income Statement

In theory, the income statement reflects the best representation of the revenues and costs of the company over a specified period. This sounds simple, but it can be quite confusing at times. For example, a piece of equipment may have been purchased during a previous period, but is still in use by the company. The income statement will reflect a portion of the original cost (the *depreciation*) during the current period, even though there was no actual cash flow. In this way, the income statement is designed to capture what it "really" costs the company to produce its goods and services. Since the equipment was used during the period, it makes sense to somehow include part of the cost of the equipment during the period. This is fine if we are interested in getting a gauge of the company's profitability over the period, but it is not so fine if we are interested in examining the actual cash flows of the company.

Although each account on the income statement represents, in one way or another, a real or expected cash flow of the company, the fact that the cash flows depicted on the income statement may have occurred during some previous period or may occur during some future period often makes the statement quite difficult to interpret. To understand this and other issues, we will consider each item in turn. As a reference, a simple income statement is shown in Table 4.4. In most cases, companies will provide more detailed income statements that are broken down into more refined categories. Still, we usually find that the company's income statement (and other statements for that matter) are insufficient to give us a complete picture of the financial condition of the company. This is quite evident when we recognize that one of our main objectives will be to forecast the cash flows of the company. Those forecasts will not only depend on the historical financial statements, but will also depend heavily on qualitative developments in the company.

We now consider each of the accounts shown on the income statement so that we can begin to understand how to interpret them. Later in the

TABLE 4.4

A Simple Income Statement

	CY
Sales	$2,810
Cost of goods sold	$2,189
Selling, general, and administrative expenses	$348
Depreciation and amortization	$58
Operating income	$215
Other expenses	$17
Earnings before interest and taxes	$198
Interest expense	$45
Taxable income	$153
Taxes	$49
Net income	$104
Dividends	$60
Retained earnings	$44

chapter, we will discuss more about how the income statement is linked to the balance sheet and the statement of cash flows.

Sales

When the company has a binding agreement with a buyer and the good or service being purchased has been substantially provided, the transaction is recorded on the books under *sales*. Although this appears to be a simple and pure concept, it is not.

Sales are recorded at the time that the company has essentially completed its obligations under the contract. This is not necessarily the same time that the cash is received.

Suppose, for example, that a company's salesperson finds a homeless man on the street and offers to sell him a cup of coffee and a sandwich for $1,000,000. The salesperson goes on to explain that the homeless man will be required to pay one penny at that time, and one additional penny each year until the debt is paid. The homeless man quickly agrees, knowing that he will never repay the full amount. The salesperson also knows this, but can record a sale of $1,000,000. This is an exaggerated example (and one that is questionable from an accounting standpoint), but the intuition is important. A company might loosen its credit terms so that it can sell goods to customers with poor credit histories. The company knows that it will on average receive far less than the promised payments for the goods, but it can still record those promised payments as sales. Of course at some unspecified later date, the company would have to write off the bad receivables it created in the process. At that time, the company's earnings would be negatively affected. Thus, the company can effectively report higher earnings today in exchange for lower earnings at some future date.

We now see that the sales shown on the income statement might not represent actual cash receipts. A portion of those sales might have been made on credit to creditworthy customers, in which case the company will expect payment on some future. A portion of those might have been made on credit to customers who are not creditworthy, in which case the company will expect some of those customers to pay and some of them to default on their obligations. We have no concrete way of determining how much of the company's receivables fit into each category, although historical evidence may help us estimate the distribution. We must therefore be very careful in interpreting sales reported by the company. Because the company can change its credit policies to impact sales, company managers may be able to manipulate the sales number to their advantage. Perhaps more common are scenarios in which company managers do not intentionally manipulate sales, but where sales become misleading because of the normal course of events. For example, the company may loosen its credit terms to help penetrate a market. This would presumably cause sales to increase substantially, but might not cause cash receipts to increase substantially. The casual observer might mistakenly interpret the higher sales to be indicative of higher receipts. In this case, the company is not engaging in manipulation, but is simply acting strategically to grab market share in a new market.

Cost of Goods Sold

The company's costs of producing the goods or services being provided are recorded on the income statement as the *cost of goods sold*. The cost is reported on the income statement when the good or service is sold. This leads us to note the following:

Like Sales, the Cost of Goods Sold is recorded at the time that the good or service is provided. This is not necessarily the same time that the company pays for the goods.

There are three basic scenarios that can occur. First, the cost is recorded during the same period that it is paid. Second, the cost is recorded even though the company has not yet paid for the good or service. Third, the cost is recorded even though the company paid for the good or service in some previous period. In addition, it is possible that the company may not have completely provided the good or service during the period covered by the income statement.

Consider a few simple examples. Suppose that a computer retailer purchases a computer for $500 in one year, but sells and delivers it during the next year. No cost is recorded on the income statement during the first year, despite the fact that the company spent money to produce the computer. Instead, $500 is added to the company's cost of goods sold during the second year. Thus, the cost of goods sold in the first year underestimates the company's true costs by $500 and overestimates the company's true costs by $500 in the second year.

Alternatively, suppose that a retailer purchases $1,200 worth of clothing on credit from a producer. The clothing is then sold during that year, but the retailer does not pay the producer until the following year. In this case, $1,200 is added to the company's cost of goods sold during the first year, despite the fact that the company did not pay for the goods during that year. In addition, no cost is recorded on the income statement during the second year at all. Thus, the cost of goods sold in the first year overestimates the company's true costs by $1,200, and in the second year underestimates true cost by $1,200.

In both of these scenarios, the cost of goods sold does not represent the actual cost incurred by the company during the period. Since we are ultimately interested in free cash flow, we will need to figure out a way to adjust for these types of situations. Fortunately, we will be able to use changes in the company's inventory account to help us make appropriate adjustments.

Selling, General, and Administrative (SG&A) Expenses

SG&A expenses are operating expenses that are not directly related to the production of the goods and services being provided by the company. These expenses include the salaries and expenses of executives and sales personnel, along with advertising expenses and other miscellaneous expenses. They *may* also include a portion of the company's depreciation (e.g., depreciation on corporate offices). Some companies report depreciation as a separate item on the income statement, whereas others embed it in other accounts on the income statement. In addition, some companies report income statements in which the expenses in the SG&A category are listed separately, whereas others report them lumped together. Regardless, when we do see an apparent problem with a company's management of its SG&A expenses, it is often quite difficult to pinpoint where the problem lies. In those cases, we typically rely on what we can find in the Management Discussion section of the financial reports, trusting that what management tells us is a fair and accurate representation of the truth. We will discuss this in more detail in later chapters.

Depreciation and Amortization (D&A) Expense

As we discussed earlier in the chapter, depreciation is an account that reflects expenses that the company has chosen to record on the income statement in small amounts periodically rather than record them all at once at the time the money is spent. Depreciation is linked to the capital assets on the balance sheet, which are often referred to as fixed assets or as property, plant, and equipment (PPE). When capital assets are purchased, the company spends money to acquire the assets but then chooses to expense that cost over time rather than all at once. For example, the company may spend $5,000,000 on equipment in a given year. Only a small portion of that cost is included on the income statement at the time of the expenditure. The remaining portion is distributed over future periods that cover the expected life of the asset. An implication of this is that depreciation is a "paper" expense rather than an actual expense. If we are interested in determining the actual cash flow for a company over a period of time, we will need to specifically take this point into account.

Amortization is linked to intangible assets (such as trademarks, patents, and goodwill) in much the same way that depreciation is linked to fixed assets. These intangible assets appear on the balance sheet when acquired and are then amortized over the expected life of the asset. Thus, amortization is similar to depreciation in that it appears on the income statement in bits and pieces over time. It is also similar in that it is a paper expense rather than an actual one.

As is the case with depreciation, many companies do not report amortization expenses as a separate item on the income statement, but rather embed the expense within other expense categories. D&A expenses are listed, however, in the statement of cash flows. This will allow us to properly adjust the income statement in our effort to determine the actual cash flow of the company. Also later in this chapter, we will discuss exactly how the three financial statements are linked. In doing so, we will see that D&A expenses are a key part of that linkage because they are tied directly to all three statements.

Operating Income

Operating income measures the profit earned by the company on the creation and sale of the company's goods and services. It is computed by subtraction of the cost of goods sold, SG&A expenses, and D&A expenses from sales. It follows that our interpretation of operating income is subject to the same difficulties as those we observed above. Simply stated, operating income reflects the profitability of the business itself, without regard to payments to debtholders or to the government. In theory, a company with consistently positive operating income is viable. That does not mean, of course, that the company will necessarily stay afloat. Often a perfectly viable company goes under because of mismanagement of debt.

Other Expenses

The company may incur other expenses that do not fit into the other accounts listed on the income statement. We generally lump these together as *other expenses* and treat them as if they were a single separate account. If we were to subsequently find evidence that these expenses are significant, then we would revisit them to understand the specific events that led to them.

Earnings Before Interest and Taxes

For reasons that will become clear later when we discuss free cash flows and the company's cost of capital, it is useful to consider the earnings that the company would have if it had no debt and paid no taxes. We call this the company's *earnings before interest and taxes*, or just EBIT. EBIT is simply the company's operating income less the miscellaneous expenses we include under other expenses.

Interest Expense

When a company issues debt, it typically pays periodic interest payments as compensation to debtholders. The expense is recorded at the time it is paid, so the interest expense account is typically reliable and fairly easy to interpret. The account is particularly important to our analysis of companies because it helps us evaluate how well companies are using debt to increase the returns to shareholders or, alternatively, how poorly they are managing their debt. We will return to this evaluation in the next chapter.

Taxable Income

The company's *taxable income* is equal to EBIT less the interest expense. Although this number is quite important to accountants, it is seldom used by financial analysts because it is useful for analysts to treat the cash flows to debtholders (and the interest tax deduction that comes with them) separately. We will return to this idea later in the chapter and again in Chapter 6, where we discuss the company's cost of capital.

Taxes

The *taxes* paid by the company are a percentage of the company's taxable income. The tax rate is determined by law in conjunction with IRS rules. Ideally, of course, the company wants to pay as little tax as possible while reporting the highest earnings. To some extent, the company can achieve this because, as we mentioned earlier in the chapter, two sets of books are kept. The books kept for the IRS take advantage of whatever rules are in place so that the company's tax obligation is minimized. This in turn reduces the earnings reported to the IRS. However, the books kept for the general public are based on GAAP, which is designed to make the statements best represent the true status of the company. As such, the company can use the IRS rules to minimize taxable income and hence the tax obligation, but may still be able to report strong GAAP earnings.

Net Income

Net income (earnings) is simply taxable income less taxes. As we have seen, the income statement is far from a picture of the company's true cash flows. It follows that net income can easily be manipulated and that it is often quite misleading. The financial press and many investors unfortunately focus heavily on earnings (and the P/E ratio, which is based on the company's earnings); this focus may in fact contribute to market prices deviating from true value. Net income is linked directly to the statement of cash flows in that it provides a starting point for determining the actual cash flows of the company.

Dividends

Dividends are cash payments to shareholders that (along with share repurchases) represent the only common cash flows directly from the company to shareholders. Companies are very hesitant to reduce dividends, because doing so tends to send a negative signal to investors in the marketplace. Investors interpret a cut in dividends as a sign that the company has an unexpected need for money, perhaps because future prospects are poor. Since this belief is prevalent, companies are backed into a corner in which they cannot trim dividends without suffering a decline in share price. This is unfortunate because a company may have identified a very profitable project and would like to use money on hand to fund it. Instead of doing so, the company may choose to maintain its current level of dividends and resort to issuing additional debt or equity to finance the project. In doing so, the company would incur the costs associated with selling the new securities.

Retained Earnings

Retained earnings (net income less dividends) are a measure of the money generated by a company during a given period that might be used for future investment. Of course since retained earnings are a portion of net income, they too might be significantly misleading. As we discussed earlier, retained earnings are linked to the balance sheet in that in each period we increase additions to retained earnings (and hence total shareholders' equity) by that period's retained earnings.

The Statement of Cash Flows

The statement of cash flows is an accounting report that portrays the actual cash flows of the company. A simple statement of cash flows is shown in Table 4.5. The statement of cash flows begins with net income, which is taken directly from the income statement. All subsequent entries on the statement serve one of two purposes. First, some entries serve to adjust net income for the non-cash-flow items that appear on the income statement. For example, depreciation is subtracted on the income statement

TABLE 4.5

A Simple Statement of Cash Flows

	CY
Net income	$104
Cash flow from operating activities	
Depreciation and amortization	$58
Changes in accounts receivable	−$12
Changes in inventory	$14
Changes in accounts payable	$35
Other changes in operating activities	$14
Cash flow from investing activities	
Capital expenditures	−$24
Investments	−$6
Cash flow from financing activities	
Dividends	−$60
Sale/repurchase of stock	$6
Net borrowings	−$115
Changes in cash and equivalents	$14

despite the fact that it is not a cash flow. We adjust for this on the statement of cash flows by adding it back. Second, some entries on the statement of cash flows reflect actual cash flows that do not appear on the income statement, such as capital expenditures. The output of the statement of cash flows (i.e., the last entry) is the change in the company's cash position. As we will demonstrate a bit later, the statement of cash flows can also be correctly viewed as the change in the company's balance sheet. The statement is divided into three main areas: cash flow from operating activities, cash flow from investing activities, and cash flow from financing activities.

Cash Flow from Operating Activities

Cash-flow items directly tied to the day-to-day operations of the company are listed under cash flow from operating activities. Because net income is an entry here, the cash flow from operating activities implicitly includes all of the items listed on the income statement up to the net income entry. The remaining items in this section of the statement of cash flows can be viewed as adjustments to net income to account for non-cash-flow items on the income statements and to account for a few cash-flow items that do not appear on the income statement.

Net Income The first entry on the statement of cash flows is net income, which as we recall is a measure of how profitable the company was on its sales of goods and services during the period. The net income is taken directly from the income statement covering the same period as covered by the statement of cash flows.

In Table 4.5, the net income of $104 is carried over from the net income on the company's income statement, which is shown in Table 4.4.

Depreciation and Amortization Recall that D&A expense is subtracted on the income statement despite the fact that it is not an actual cash flow. To offset this, we add D&A expense on the statement of cash flows. This removes part, but not all, of the impact of D&A expenses on the income statement. Because they are tax-deductible expenses, higher D&A causes the company to pay lower taxes, all else being equal. Since taxes are an actual cash flow, we need not make any adjustment for the impact of D&A on them.

As with net income, the D&A expense ($58 in Table 4.5) is carried over from the income statement (Table 4.4).

Changes in Accounts Receivable As we discussed earlier, the income statement records sales and not receipts. We adjust for the difference between the two by using the *changes in accounts receivable* account. Suppose that sales are listed at $1,100, but receivables have increased (in comparison with the prior period) from $100 to $150. Our actual receipts from sales are $1050, since we have sold a net of $50 worth of additional goods on credit. Any increase in accounts receivable is therefore subtracted on the statement of cash flows. When receivables have decreased, we effectively add the decrease in accounts receivable on the statement of cash flows. To understand this, suppose that accounts receivable decreased from $200 to $180. This means that a net of $20 in receivables was paid for (by customers) during this period, yet they were sold during some prior period. Those sales were recorded on the income statement when the goods were sold and are therefore *not* reflected on the current income statement. As such, $20 would be added on the statement of cash flows because it represents cash that was received, yet does not appear on the income statement.

In Table 4.5, the changes in accounts receivable are listed as −$12, which is the difference between the current year's accounts receivable ($251 in Table 4.1) and last year's accounts receivable ($239 in Table 4.1). The entry is negative because accounts receivable has increased over the year. Thus, the company has received $12 less in cash than the sales number indicates, and the statement of cash flows must reflect this fact. In general, any increase in an asset will be reflected on the statement of cash flows as a negative number, whereas any decrease will be reflected as a positive number.

Changes in Inventory Recall that spending to create inventory is not recorded on the income statement until the goods are actually sold, so an increase in inventory indicates a disbursement of cash that does not show up on the income statement. We adjust for this situation by using the account *changes in inventory*. If, for example, inventory increased from $50 to $75, then $25 would be subtracted on the statement of cash flows. Similarly, a decrease in inventory would be added on the statement of cash flows. To understand this, suppose that inventory decreased from $120 to $100. A net of $20 worth of inventory was sold in the most recent period, yet was purchased in some prior period. This $20 worth of inventory shows up on the income statement under cost of goods sold, yet the $20 was not spent during that period. To adjust for this, the $20 is added on the statement of cash flows.

In Table 4.5, the changes in inventory are listed as $14, which is the difference between the current year's inventory ($398 in Table 4.1) and last year's accounts receivable ($412 in Table 4.1). The entry is positive because inventory has decreased over the year.

Changes in Accounts Payable For reasons analogous to those for the inclusion of changes in accounts receivable, *changes in accounts payable* are included on the statement of cash flows. In contrast to receivables, an increase in accounts payable is *added* on the statement of cash flows, whereas a decrease in accounts payable is *subtracted* on the statement of cash flows. To see this, suppose that payables increase from $140 to $150. The additional $10 in payables means that the company has acquired a net of $10 worth of goods for which the company has not paid. This further means that the company's net costs are $10 less than what are indicated on the income statement. So, we would add $10 on the statement of cash flows. Now suppose that payables decreased from $80 to $65. To decrease the payables, the company had to spend a net of $15 that is not reflected on the income statement. Thus, we would subtract $15 on the statement of cash flows.

In Table 4.5, we see that changes in accounts payable are listed as $35, which is the difference between the current year's accounts payable ($213 in Table 4.1) and last year's accounts payable ($178). The entry is positive because the liability has increased over time. Thus, the company was able to acquire $35 worth of assets (probably in the form of inventory) without paying for it. This benefit is reflected on the statement of cash flows. In general, any increase in liabilities or equity is reflected as a positive number on the statement of cash flows. Any decrease is reflected as a negative number.

Cash Flow from Investing Activities

Cash flows from activities related to the investment of capital are listed under cash flow from investing activities. Primarily, these items fall into one of two categories: investment in capital assets and investment in financial securities. Because we are interested in forecasting the long-term cash flows of the company, we will be primarily interested in the company's capital expenditures.

Capital Expenditures As we discussed before, capital assets (property, plant, and equipment) are purchased at some point in time but are expensed as depreciation on the income statement periodically over time. *Capital expenditures* therefore represent a disbursement of cash that does not show up on the income statement at the time of disbursement. We therefore subtract net capital expenditures on the statement of cash flows. The capital expenditures are linked directly to the balance sheet in that the company's property, plant, and equipment will increase by the amount of the net capital expenditures.

In Table 4.5, we see that capital expenditures are listed as −$24. This is also reflected on the balance sheet. In Table 4.1, we see that property, plant, and equipment has increased from $580 to $604. To pay for the new fixed assets, the company must have spent $24, which must therefore be reflected on the statement of cash flows.

Investments Investment of cash in financial securities also does not show up on the income statement, yet represents an outflow of capital from the company. Similarly, a sale of securities represents an inflow of cash to the company. The *investments* account on the statement of cash flows reflects changes in the company's holdings of long-term securities (such as the stocks and bonds of other companies). We subtract the net investments in financial securities on the statement of cash flows to reflect the cash flow associated with those changes.

In Table 4.5, we see net investments of −$6. This corresponds to the $6 increase in other long-term assets shown on the balance sheet in Table 4.1.

Cash Flow from Financing Activities

Financing refers to the raising of money from investors to generate the capital needed to run the company. Investors include common stockholders, preferred stockholders, and debtholders. Although financing is critically important to the company and to us as we seek to value the company's stock, we typically will not forecast financing cash flows at all. Instead, we will address those cash flows via the company's cost of capital (which we discuss in Chapter 6). Still, it is important to understand how the financing cash flows affect the company's cash flows so that we can understand the factors that contribute to changes in the company's cash position.

Dividends *Dividends* are actual payments to shareholders, so they must appear on the statement of cash flows. Note that dividends appear on the income statement *after* net income, so we did not include them under cash flow from operating activities. We therefore include them as a separate item here.

In Table 4.5, we have already included net income of $104, but only a portion of this (the retained earnings) is actually kept by the company. To adjust for this effect, we subtract the dividends from Table 4.4, or $60.

Sales/Purchase of Stock The company may issue new stock or buy back outstanding shares of its stock. The sale of stock is a cash inflow to the company, and a repurchase is a cash outflow. Neither of these appears on the income statement, so they must be specifically included on the statement of cash flows. This account is not to be confused with the investments account shown under cash flow from investing activities, which includes the purchase or sale of the stock of other companies.

In Table 4.5, we see a $6 entry for the sale/repurchase of stock. Since the entry is positive, we infer that the company received money and therefore that stock was issued. This is consistent with Table 4.1, which shows that common stock increased from $112 to $118.

Net Borrowings The company may issue new debt or retire old debt. The issuance of new debt is a cash inflow to the company, and the paying down of principal on existing debt is a cash outflow. Neither of these appears on the income statement, so they are included on the statement of cash flows as net borrowings. As noted above, interest payments do appear on the income statement and are therefore not included under the cash flow from financing activities.

In Table 4.5, we see net borrowings of −$115. Since the entry is negative, we infer that the company used money to pay down debt. This is reflected in Table 4.1, where we see a $115 decrease in long-term debt from $317 to $202.

Change in Cash and Cash Equivalents

The last entry on the statement of cash flows is the change in the company's cash position. That entry essentially records whatever cash is left over after all of the other cash flows have been accounted for. As we consider the statement as a whole, we see that it shows how the company's net income is distributed among the accounts on the balance sheet. The organization of the statement of cash flows is such that it begins with net income and then steps through how that net income is distributed among the various accounts shown on the balance sheet, ending with the change in cash and cash equivalents.

In Table 4.5, we see a change in cash and equivalents of $14, which is simply the sum of all of the other entries on the statement of cash flows. This change is also reflected on the balance sheet shown in Table 4.1, in which we see that the cash and equivalents account has increased from $120 to $134.

Linkages Between the Statements

As should be clear from our discussions so far, the three main financial statements are very much intertwined. For example, depreciation appears on all three statements, net income appears on the income statement and the statement of cash flows, and retained earnings are passed from the income statement to shareholders' equity on the balance sheet. The financial statements are indeed closely linked. To get a full understanding of the relationships between the statements, consider Table 4.6, which shows a statement of cash flows that has been reorganized in a way that better portrays the direct linkage between the balance sheet and the statement of cash flows. Headings have been added to clarify the relationships. First, notice that every entry on the statement of cash flows reflects a change in one or more accounts on the balance sheet. Second, notice that every account on the balance sheet is represented on the statement of cash flows. Some relationships are obvious, such as the one between accounts receivable on the balance sheet and changes in accounts receivable on the statement of cash flows. Others are not so obvious, such as how net income and dividends on the statement of cash flows reflect the additions to retained earnings on the balance sheet. Regardless of this, we see from Table 4.6 that the statement of cash flows is quite simply a representation of the change in the balance sheet over the period in question.

To recap what we have shown, we recall that the statement of cash flows simply makes adjustments to the company's income statement to give us the actual cash flows of the company over the period. We can summarize these adjustments as follows.

1. We begin with the company's net income.
2. We must add D&A expense because it was subtracted on the income statement, despite the fact that it is not a cash flow.

TABLE 4.6

A Simple Statement of Cash Flows, Reorganized

Changes in assets	
Changes in cash and equivalents	$14
Changes in accounts receivable	$12
Changes in inventory	−$14
Other changes in operating activities (current assets portion)	−$27
Investments	
Capital expenditures	$24
Depreciation and amortization	−$58
Investments	$6
Total changes in assets	−$43
Changes in liabilities	
Changes in accounts payable	$35
Other changes in operating activities (current liabilities portion)	−$13
Net borrowings	−$115
Total changes in liabilities	−$93
Changes in equity	
Sale/repurchase of stock	$6
Net income	$104
Dividends	−$60
Total changes in equity	$50
Total changes in liabilities and equity	−$43

3. We must subtract the increases in accounts receivables to adjust for sales that have been made on credit for which the company has not yet been paid.
4. We must subtract the increase in inventory to adjust for goods that the company has paid for but has not yet sold.
5. We must add the increase in accounts payable to adjust for goods that have been acquired but for which the company has not yet paid.
6. We must subtract capital expenditures, which are expenses that the company has paid but that have not appeared on the income statement.

7. We must subtract the company's investments in long-term securities because the cost of those investments does not appear on the income statement.
8. We must subtract the company's dividend payments since they are not included in net income.
9. We must subtract money spent by the company to buy back shares and add the money raised by issuing of shares, since those cash flows do not appear on the income statement.
10. Finally, we must subtract money spent by the company to pay down debt and add money raised by the company by issuing of new debt. Neither of those cash flows appears on the income statement.

Once we have made these adjustments, we are left with the cash generated (or used) by the company during the period.

BUILDING THE FREE CASH FLOW EQUATION

It is clear from our discussions that the income statement does not provide a reasonable measure of the company's actual cash flow. Instead, the statement of cash flows provides us with the information we need to assess the company's cash flows. Since the value of any asset is the present value of the expected cash flows, we must ask whether we would even need to forecast the company's balance sheet and income statement. The answer is that the statement of cash flows is very useful for examining the *historical* cash flows of the company, but our ultimate goal is to forecast the *future* cash flows of the company. To confidently forecast these cash flows, we must understand not only the nature of the company's cash flows, but also the impact of corporate strategies on the income statement and the balance sheet. Furthermore, it is quite difficult to forecast the company's cash flows without simultaneously forecasting what the balance sheet and income statement will look like.

Still, it is quite useful to define a measure called the *unlevered free cash flow* (sometimes called simply the *free cash flow*), which is the net cash flow of the company, ignoring all financing-related cash flows. In essence, we ignore dividends (both common and preferred), interest payments, share issuances and repurchases, debt issuances and repayments, and any effects of those payments. An equivalent way to define free cash flow is as the net cash flow created by the company that is available for distribution to investors in the company.

This leads us naturally to ask why interest expense and dividends are ignored. After all, both are actual cash flows of the company. The answer to this question is twofold. First, we desire a measure of cash flow that is independent of the capital structure of the company. Why? Imagine that two companies are identical in every respect, except that one has more debt than the other. The one with more debt will report more interest expense and will therefore report lower net income. This might lead the less-than-careful analyst to incorrectly conclude that the high-debt company operates with less efficiency than the low-debt company. After all, the high-debt company has a lower profit margin. To avoid this issue, we compute cash flows as if there were no debt. For similar reasons, we ignore dividend payments. Second, although we ignore interest expense and dividends in computing free cash flow, we will later (in Chapter 6) explicitly incorporate them by carefully computing an appropriate discount rate for the company. We should not interpret the absence of interest expense and dividends in our cash flow forecasts to somehow imply that they are unimportant or irrelevant. Quite the opposite is true. We do not include them in our free cash flow calculation because, as cash flows to investors, they are of special importance and deserve special treatment. Even more importantly, we will see in Chapter 10 that defining free cash flow in this way makes execution of the discounted cash flow (DCF) model far easier than it would be otherwise.

To create a baseline from which to work, we first consider a measure of profitability that is derived entirely from the income statement. This measure is often called the *net operating profit after taxes* (NOPAT), which is a fancy way of saying that we compute the net income of the company under the assumption that the company has no debt. If the company has debt, we simply remove interest expense from the income statement and then recompute the company's taxes and net income. This gives us

$$NOPAT = EBIT(1 - T), \tag{4.3}$$

where $EBIT$ is the company's earnings before interest and taxes that we discussed earlier, and T is the company's tax rate. We can then make adjustments to $NOPAT$ based on our numerous observations made earlier in this chapter.

NOPAT provides the baseline from which we can build an equation that represents the free cash flow of the company. To generate the company's free cash flow, we adjust *NOPAT* for three main issues: 1) the way in which purchases and sales of goods and services are recorded on the income statement, 2) the absence of capital expenditures on the income statement and the presence of depreciation and amortization on the income statement, and 3) necessary changes in the cash account itself. Our purpose here is simply to develop a core equation for free cash flow. We note that other adjustments may be needed on a case-by-case basis.

Sales and the Cost of Goods Sold: Implications for Free Cash Flow

The income statement is a picture of the operations of the company. As we mentioned earlier, however, it is not a complete picture of the cash flows of the company. In particular, the company's sales and cost of goods sold might be misleading. To make better sense of all this, consider a simple example in which we trace the impact of a sale on the company's financial statements.

Example 4.3: A company purchased vacuum cleaners from a manufacturer for $75 each and sold them to retail customers for $125 each. The company bought (and received) a vacuum cleaner in 2003 on credit, with payment due in 2005. The company then sold it in 2004 on credit, with no payment due until 2005.

The impact on the company's income statement and balance sheet is shown in Table 4.7, along with the actual cash flows associated with the sequence. Positive numbers depict increases in the given item, and minus signs indicate decreases. First notice that because the sale was made in 2004, all income statement references to the sale occurred in 2004. The sale did affect the balance sheet in 2004 and 2005, however. Similarly, the purchase of the vacuum cleaner affected the balance sheet in 2003, but affected only the income statement in 2004. Second, notice that with the exception of cash, the balance sheet effects net out over time. In 2003, inventory increased by $75 because of the acquisition of one vacuum cleaner. This is offset by a $75 increase in the liability accounts payable. In 2004, the inventory account decreased by $75 because the company gave the vacuum

TABLE 4.7

Impact of a Purchase and Sale of a Product, Selected Items

	2003	2004	2005
Sales	$0	+$125	$0
Cost of goods sold	$0	+$75	$0
Taxable income	$0	+$50	$0
Taxes (40%)	$0	+$20	$0
Net income	$0	+$30	$0
Accounts receivable	$0	+$125	−$125
Inventory	+$75	−$75	$0
Accounts payable	+$75	$0	−$75
Actual cash flow	$0	−$20	+$50

cleaner to the customer. This is more than offset by a $125 increase in the asset accounts receivable. Because the sale was recorded on the income statement in 2004, the tax impact of the sale was felt in 2004. In this case, the company recorded an accounting profit of $50 and the company incurred a tax bill in the amount of $20. Thus the company's cash flow for 2004 was −$20. In 2005, the company's payable came due. This had two impacts. First, the company had to pay $75 to the trade creditor. Second, the company's accounts payable was reduced by $75, since the debt had been settled. Also in 2005, the company's receivable came due and the customer paid $125. At that time, accounts receivable was reduced by $125. The total net cash flow for 2005 was then $50.

This example illustrates the basic problem we face in interpreting the income statement. Goods may be purchased and sold at times, with cash flows occurring at other times. Furthermore, the income statement effects may occur on entirely different dates. The example also helps us determine how we might properly adjust *NOPAT* to get free cash flow.

First, notice that when a product is sold on credit, the increase in accounts receivable corresponds to an increase in sales. In this situation, the sales account is higher (by the amount of the sale) than the receipts from sales. Since this is recorded in accounts receivable, we need only subtract any increases in accounts receivable from net income. Second, notice that when the customer finally makes payment, no sales are recorded, but accounts receivable decreases. We therefore need to add any decreases in accounts receivable. Putting this together, we need only subtract the *change* in accounts receivable. If the change is negative (i.e., accounts receivable decreases), the double negative becomes a positive, giving us the desired outcome. At this point, we have the relationship

$$FCF = NOPAT - \Delta AR + \text{Other Effects}, \tag{4.4}$$

where FCF is free cash flow and ΔAR is the change in accounts receivable.

A similar intuition applies to accounts payable and inventory. Notice that although no payment was made for the vacuum cleaner in 2004 in Example 4.3, a cost is recorded on the income statement. At the same time, inventory decreased by the amount of the cost. This suggests that we may need to subtract the change in inventory. So in our example, we would subtract −\$75 in 2004, which gives us the +\$75 needed to offset the higher cost of goods sold. This clearly takes care of the problem in 2004, but what about 2003? Subtracting the change in inventory would give us a cash flow of −\$75 in 2003, but no cash flow actually occurred. Recall, however, that the increase in inventory in 2003 is exactly offset by an increase in accounts payable. This suggests that if we subtract the change in inventory, we must also add the change in accounts payable. This, too, is intuitive because an increase in accounts payable means that we have been able to receive something without paying for it. Clearly, this is a benefit to the company that affects cash flow. At this point, we have shown that free cash flow can be written as

$$FCF = NOPAT - \Delta AR - \Delta INV + \Delta AP + \text{Other Effects}, \tag{4.5}$$

where ΔINV is the change in inventory and ΔAP is the change in accounts payable. We can easily check this formula by examining Table 4.7. In 2003, we have

$$\begin{aligned} FCF &= NOPAT - \Delta AR - \Delta INV + \Delta AP + \text{Other Effects} \\ &= \$0 - \$0 - \$75 + \$75 + \$0 \\ &= \$0, \end{aligned} \tag{4.6}$$

which agrees with the $0 cash flow we determined previously. In 2004, we have

$$\begin{aligned} FCF &= NOPAT - \Delta AR - \Delta INV + \Delta AP + \text{Other Effects} \\ &= \$30 - \$125 - (-\$75) + \$0 + \$0 \\ &= -\$20, \end{aligned} \tag{4.7}$$

which also checks. Finally, in 2005 we have

$$\begin{aligned} FCF &= NOPAT - \Delta AR - \Delta INV + \Delta AP + \text{Other Effects} \\ &= \$0 - (-\$125) - \$0 + (-\$75) + \$0 \\ &= \$50, \end{aligned} \tag{4.8}$$

which again agrees with the cash flow we determined above.

So far, we have developed a formula that allows us to adjust a company's *NOPAT* to account for the fact that sales and costs of goods sold are not intended to fully capture cash flow. There are additional items for which we must adjust. One such item involves the purchase of capital equipment and the subsequent depreciation of that equipment.

Dealing with Capital Expenditures and Depreciation

The purchase of capital equipment clearly represents a cash outflow, but that expenditure is not recorded on the income statement on the date of the cash flow. Instead, it is recorded gradually over time through the depreciation account. Although this may seem odd, the accounting system is actually designed to make the income statement more representative of the true profitability of the company. If a rather large capital expenditure were recorded on the income statement at the date of the expenditure, earnings for that period would appear to be quite low. In subsequent periods during which the equipment is being used but no expenditure is made, earnings would appear to be quite high. This would give the appearance that the company's earnings are quite volatile when they, in fact, might be quite stable. The idea behind depreciation is to feed the capital expenditure into the income statement gradually over the expected life of the asset. In this way, those who analyze financial statements get a better feel for what is actually going on in the company.

Unfortunately for us, this means that we must once again adjust *NOPAT* to account for 1) capital expenditures, which do not show up directly on the income statement, and 2) depreciation, which is not a cash flow item but does show up on the income statement. The first is easy to deal with. Since capital expenditures are cash flows that do not appear on the income statement, we need only adjust our free cash-flow equation by subtracting those capital expenditures. Continuing to build our free cash flow equation, we have

$$FCF = NOPAT - \Delta AR - \Delta INV + \Delta AP - CapEx + \text{Other Effects}, \quad (4.9)$$

where *CapEx* is the capital expenditures of the company during the period. Dealing with the second issue is more difficult because there are two effects when depreciation is included on the income statement. First, depreciation is recorded as an expense when there is no cash flow related to that purchase. Second, depreciation causes the company's taxable income to be lower, which effectively reduces the taxes paid by the company. This reduction is an actual reduction that increases the cash flow of the company. In examining the income statement, we see that the impact of depreciation on *NOPAT* is $-D\&A(1 - T) = -D\&A + D\&A \times T$, where $D\&A$ is the company's depreciation and amortization expense. The first term is the non-cash-flow portion of the effect, and the second is the cash-flow portion. Thus, we need only add depreciation to adjust *NOPAT*. This gives us

$$FCF = NOPAT - \Delta AR - \Delta INV + \Delta AP - CapEx + D\&A + \text{Other Effects}, \quad (4.10)$$

which provides a basic equation for the free cash flow of the company.

Cash

Equation 4.9 gives us a way to calculate the amount of cash created by the company during a given period. It is at this point that the analysis becomes a bit tricky. Recall that we defined free cash flow to be the cash generated by the company that is *available for distribution to investors*. What makes this definition tricky is that as the company grows, it will need more and more cash. The cash account exists for a variety of reasons that we generally place in one of two categories. First, the company has a need for a reserve of cash to meet unexpected needs. For example, sales may be lower this month than expected. To meet payroll, the company may need additional cash beyond that generated by sales. Second, the company will naturally hold cash temporarily as receipts from sales pile up. (It would be quite a coincidence if the receipts from sales perfectly matched the timing of the company's cash outflows.) A typical scenario is that the company receives cash on one day and may have a need for it a week later. Those funds would then be held as cash until needed. In both of these cases, the company will experience a greater need to hold cash as the company grows. The key point here is that some of the cash generated by the company will not be available to pay investors. Because the company gives up the opportunity to use this cash to directly generate returns or satisfy investors, it is effectively a cash *outflow* of the firm!

This can be a difficult concept to grasp, but an increase in the company's cash account must be considered a cash outflow for the purpose of computing free cash flow, *if the cash is needed to support operations*. To understand this, consider that when we make a deposit to our bank account, we give up the right to use that money until such a time that we choose to withdraw it. Thus, a cash deposit is a cash flow *from* us *to* the bank. The same intuition applies to companies.

To value stocks, we will forecast the free cash flows of the company. In doing so, we must keep in mind that we must specifically account for a greater cash need as the company grows. We therefore must adjust our free cash flow equation once again:

$$\begin{aligned} FCF = NOPAT - \Delta AR - \Delta INV - \Delta OC + \Delta AP - CapEx \\ + D\&A + \text{Other Effects}, \end{aligned} \tag{4.11}$$

where *OC* is the company's operating cash. The term "operating cash" (which is not a formal accounting term) refers to the amount of cash that the company needs to maintain day-to-day operations. We differentiate this from other forms of cash, such as cash held temporarily in order to pay dividends at some future date. As we will discuss later, this can be problematic because we use historical financial statements as a basis for forecasting free cash flows. If recent history includes periods in which a company's cash account is abnormally high or low, it may be difficult to accurately forecast future cash account needs.

The Free Cash Flow Equation

Up to this point, we have gradually built an equation that represents the free cash flow of the company. We can simplify the equation a bit by noting that we *subtract* changes in the current asset accounts (cash, accounts receivable, inventory) and *add* changes in the current liability account (accounts payable). We can then define the accounting term *net working capital* (NWC) to be the difference between the company's current assets (CA) and its current liabilities (CL), or

$$NWC = CA - CL. \tag{4.12}$$

Equation 4.10 then becomes

$$\boxed{FCF = NOPAT - \Delta NWC - CapEx + D\&A + \text{Other Effects}} \tag{4.13}$$

which is our basic formula for unlevered free cash flow. We will use this equation later to forecast the future cash flows of the company.

Other Cash Flow Items

Note that "Other Effects" is still included in our free cash-flow formula. This serves as a reminder that we should always be looking for other, less typical items that may be relevant (for example, the company may have deferred taxes). Rather than attempt (and fail) to create an exhaustive list of the other effects, we choose to treat Equation 4.12 as our final representation of the free cash-flow equation. We will refer to this equation again in Chapter 10 when we consider the DCF model.

IN PRACTICE . . .

Understanding financial statements is a bit more difficult in reality than we have seen thus far. The complexities arise because the financial statements of different companies, even including those in the same industry, are often different in timing, detail, and terminology. There is much to be gained from comparing a company with its peers, so our first task must be to mold the financial statements into frameworks that are comparable. When we examine the financial statements of peer companies, we typically run into two main problems. First, companies often have different fiscal year ends. Second, companies often use different account names in their financial statements and have different philosophies concerning how much information to provide. Some companies provide very detailed financial statements, whereas others report no more than they have to.

Nonsynchronous Financial Statements

There are three possible scenarios we might face when comparing the fiscal year ends of companies. First, the companies may have matching fiscal years, in which case we need not worry about nonsynchroneity. Second, the fiscal year ends might differ by 3, 6, or 9 months. For example, O'Charley's has a fiscal year that coincides with the calendar year, whereas Darden's fiscal year ends in June, a difference of 6 months. Situations like these are relatively easy to deal with. Whenever the fiscal year ends differ by a multiple of 3, we can simply use four corresponding quarters from each company for comparison. This requires that we compute our own annual financial statements, but that task is hardly a difficult one. Third, fiscal years may overlap by other than a multiple of 3 months, which puts us in the position of having to compare the statements of companies over slightly different periods of time. For example, the fiscal year end for H. J. Heinz (HNZ) is at the end of April, whereas the fiscal year end for General Mills (GIS) is at the end of May. In comparing the two food companies, our best-case scenario involves comparing the cash flows of the two companies over periods that overlap for all but one month. For stable, nonseasonal industries, this is not all that troublesome. For others, we must be very careful. Suppose, for example, that we are examining toy retailers and one has fiscal year end in November, whereas the other has a fiscal year end in December. Even though their financial statements will differ by only a month, that month could make a huge difference. For one company, we would include the Christmas season from this year. For the other, we would include the Christmas season from last year. Historically, Christmas seasons can differ dramatically from one year to the next, so the 1-month difference in the financial statements could introduce a substantial bias. Although there are somewhat advanced techniques we might use to deal with situations like these, we will not consider them here.

Note that although we have cast the previous discussion in terms of comparing two companies, the same basic intuition can be applied to multiple companies. We simply choose a point in time and then systematically go through all of the companies in our peer group, recasting the financial statements as needed.

To deal with nonsynchronous financial statements, we typically compute and rely on *trailing 12-month* (TTM) statements, which are simply statements that cover the last 12 months of results reported by the company. In doing so, we consider only entire 1-year periods for each company. This ensures that each phase of the year is represented, although we may still face some difficulties.

Before we consider how to compute TTM financial statements, a few observations are useful. First, we need only compute TTM financials for the income statement and the statement of cash flows. Because the balance sheet reflects values at a specific point in time rather than over a period of time, there is no such thing as a TTM balance sheet. Second, although we often focus on TTM financials, this is not meant to imply that quarterly financials are unimportant. In fact, recent quarterly reports are often critically important because they help us get a feel for the current success (or lack thereof) of the company.

To compute a TTM income statement or statement of cash flows, we take the most recent annual statements, add the values from quarterly statements released since then, and subtract the values from the corresponding quarterly reports issued in the previous year. Figure 4.1 illustrates the process for a situation in which we have two quarterly reports since the last annual report. In the following example, we show the process numerically.

Example 4.4: Table 4.8 shows recent income statements for a hypothetical company, along with the corresponding TTM statement. In the table, we have income statements for the first three quarters of last year along with the annual report for that year. In addition, we have the first two quarters of the current year. Our desire is simply to add the quarterly results of the last two quarters of last year and the first two quarters of this year. We do not have the results for the fourth quarter of last year (note that many

FIGURE 4.1

Computing Trailing 12-Month Financial Statements

CY-1				(+)	(+)
Q1 CY-1	Q2 CY-1	Q3 CY-1	Q4 CY-1	Q1 CY-1	Q21 CY-1
(−)	(−)	TTM			

TABLE 4.8

Computing Trailing 12-Month Financials, Example 4.5

	Q1, CY-1	Q2, CY-1	Q3, CY-1	CY-1	Q1, CY	Q2, CY	TTM
Sales	$1,800	$2,192	$2,217	$8,640	$2,381	$2,410	$9,439
Cost of goods sold	$1,254	$1,470	$1,457	$5,831	$1,640	$1,576	$6,323
Selling, general, and administrative expenses	$121	$204	$155	$631	$121	$189	$616
Depreciation and amortization	$104	$205	$190	$733	$195	$139	$758
Operating income	$321	$313	$415	$1,445	$425	$506	$1,742
Other expenses	$58	$77	$93	$311	$58	$52	$286
Earnings before interest and taxes	$263	$236	$322	$1,134	$367	$454	$1,456
Interest expense	$123	$136	$140	$539	$140	$140	$560
Taxable income	$140	$100	$182	$595	$227	$314	$896
Taxes	$49	$35	$64	$208	$79	$110	$314
Net income	$91	$65	$118	$387	$148	$204	$582
Dividends	$15	$15	$15	$60	$15	$15	$60
Retained earnings	$76	$50	$103	$327	$133	$189	$522

companies provide those quarterly numbers in addition to the annual numbers). We can infer, however, what we need from the annual report in conjunction with the quarterlies. In this case, we start with the annual income statement, subtract the results from the first two quarters of last year, and add the results from the two quarters of the current year. This gives us the desired TTM numbers. For example, the last annual report in Table 4.8 indicates that sales were $8,640. TTM sales are then $8,640 − $1,800 − $2,192 + $2,381 + $2,410 = $9,439. We repeat this process for each item on the income statement and on the statement of cash flows, but not on the balance sheet. If and when the third-quarter report comes out, we simply start with our TTM statement, add the new third-quarter results, and subtract the third-quarter results from last year. This gives us an updated TTM financial statement.

Differences in Terminology and Reporting Structure

The second main difficulty we face is that companies often use different accounting terminology and have different reporting philosophies. For example, some companies report depreciation as a separate item on the income statement, whereas others fold the depreciation into other expense categories. Often we must consider companies and accounts on a case-by-case basis, making adjustments to the reported numbers as we go along so that the statements can be compared. We are tempted to simply lay out the companies' financial statements side by side and try to match up the categories, but this tends to be quite frustrating and time consuming. A simpler approach is to scan the companies' financial statements and pick out the accounts that we believe are the most important to our analysis. There are a variety of ways to address the accounts we choose to examine, but, generally speaking, it is best to create financial statement templates and then fit each company's financial statements into those templates. For example, in scanning the income statements of restaurant companies, it becomes apparent that both food and beverage (F&B) costs and labor costs are important elements of the companies' operations. As such, we include those as separate items on our income statement template for restaurants. This gives us something like Table 4.9, which shows the income statement template we will use for our analysis of the restaurant industry.

TABLE 4.9

Income Statement Template, Restaurant Industry

Account	Amount
Sales	$xxx,xxx
Food and beverage (F&B) costs	$xxx,xxx
Labor costs	$xxx,xxx
Other costs of sales	$xxx,xxx
Selling, general, and administrative expenses	$xxx,xxx
Other incomes (expenses)	$xxx,xxx
Earnings before interest and taxes	$xxx,xxx
Interest expense	$xxx,xxx
Taxable income	$xxx,xxx
Taxes	$xxx,xxx
Net income	$xxx,xxx
Dividends	$xxx,xxx
Retained earnings	$xxx,xxx

Case Study: O'Charley's

To continue our analysis of O'Charley's in later chapters, we must first collect the company's financial statements and organize them into a meaningful structure. Furthermore, in order to interpret those financials (which we cover in the next chapter), we must collect the financial statements of peer companies. Once we have those, we simply use the templates we generate to create comparable financial statements for all of the restaurants we are considering. Table 4.10 shows the fiscal year ends for our restaurant companies. We see not only that they are not the same, but that Darden and Ruby Tuesday have year ends that differ from the others by 5 months. Even if we compute TTM financial statements for each company, they will overlap by 11 months at best. This is a common problem in trying to create comparable financial statements. If there is some significant development during the month that the TTM financial statements do not overlap, then our task becomes much more difficult. A related difficulty arises when one company has already reported its results while another has yet to do so. This possibility is exacerbated by regulations, which require companies to file quarterly reports within 45 days of the end of the quarter and annual reports within 90 days of the end of the fiscal year.

TABLE 4.10

Fiscal Year Ends, Restaurant Industry

Company	Ticker	Last month of fiscal year
Applebee's	APPB	December
O'Charley's	CHUX	December
Darden	DRI	May
Outback	OSI	December
Ruby Tuesday	RI	May

For example, suppose that one company has a quarter ending on May 31. Its quarterly report is due by July 15. Another company has a fiscal year that ends on April 30. Its annual report is not due until the end of July. For the last two weeks of July, we have results from the first company covering events through May 31. For the other company, we have results only through January 31 (the end of the company's third quarter). So, we have 5 months more of information for one company than we have on one of its peers. This sort of situation is quite common, and there is very little we can do about it. Of course, the problem can be even worse if a company files late for some reason.

Table 4.11 shows abbreviated financials for O'Charley's. Table 4.12 shows the financials for Applebee's. Table 4.13 shows the financials for Darden. Table 4.14 shows the financials for Outback. Table 4.15 shows the financials for Ruby Tuesday. By "abbreviated," we mean that the statements shown include only broad categories rather than the level of detail sometimes provided by companies. We do this for two reasons. First, our desire here is to focus on a few important categories so that we might demonstrate analysis techniques. Second, using simpler templates makes it easier for us to create comparable financial statements. The statements are also abbreviated in that we include only selected items from the statement of cash flows. Since most of the items on the statement of cash flows can be inferred from the balance sheet, there is no need to examine the entire statement of cash flows.

We will return to these statements in the next chapter as we discuss how we might best interpret them. For now, we simply note that raw

(*text continued on page 115*)

TABLE 4.11

Abbreviated TTM Financial Statements, O'Charley's ($000)

Period ending	**9/30/2001**	**9/29/2002**	**9/28/2003**	**10/3/2004**
Income statement				
Restaurant sales	431,678	482,556	689,242	845,263
Other sales	3,562	4,056	4,800	5,271
Total sales	435,584	487,150	694,535	852,168
Food and beverage costs	140,908	141,825	197,050	258,202
Labor costs	134,502	151,019	225,866	284,911
Other costs of sales	64,736	84,697	130,616	160,495
Total cost of sales	340,146	377,541	553,532	703,608
SG&A expenses	28,381	35,525	51,205	60,047
Interest expense	7,242	5,668	11,775	13,979
Other income (expenses)	−33,359	−29,500	−39,986	−45,456
Taxable income	26,456	38,916	38,037	29,078
Taxes	9,214	13,522	12,763	9,137
Other nontaxable income (expenses)	0	−6,123	0	0
Net income	17,242	19,271	25,274	19,941
Dividends	0	0	0	0
Retained earnings	17,242	19,271	25,274	19,941
Balance sheet				
Cash	617	1,181	3,175	4,902
Receivables	4,395	4,655	7,376	9,680
Inventory	18,345	19,695	20,667	31,077
Other current assets	0	0	0	0
Total current assets	29,317	35,299	45,484	55,970
Net property, plant, and equipment	311,349	373,221	465,072	444,830
Goodwill	0	0	93,353	93,074
Other long-term assets	0	0	0	0
Total assets	356,477	414,413	645,242	641,703
Accounts payable	11,954	13,677	21,179	21,049
Other short-term liabilities	0	0	0	0
Total current liabilities	39,114	53,982	70,245	88,143
Long-term debt	82,573	103,267	223,212	152,582
Other long-term liabilities	−6,803	−18,982	−17,385	−12,782
Total long-term debt	75,770	84,285	205,827	139,800
Total debt	114,884	138,267	276,072	227,943
Preferred stock	0	0	0	0
Stockholders' equity	202,479	222,164	298,925	325,617
Statement of cash flows (selected items)				
Depreciation and amortization	21,519	24,697	33,650	39,044
Net cash provided by operating activities	42,448	62,880	66,910	69,704
Capital expenditures	−67,023	−77,961	−178,561	−63,592
Net cash provided by investing activities	−68,710	−74,263	−176,256	−55,395

Source: Mergent Online.

TABLE 4.12

Abbreviated TTM Financial Statements, Applebee's ($000)

Period ending	9/30/2001	9/29/2002	9/28/2003	9/26/2004
Income statement				
Restaurant sales	647,432	701,376	838,889	954,714
Other sales	84,738	93,225	102,180	122,980
Total sales	740,289	801,052	955,681	1,088,808
Food and beverage costs	176,652	186,795	219,265	251,537
Labor costs	205,874	230,091	275,060	310,903
Other costs of sales	153,270	166,666	183,741	218,627
Total cost of sales	549,426	594,935	704,409	802,010
SG&A expenses	70,939	77,335	91,386	103,035
Interest expense	8,679	2,827	1,935	1,503
Other income (expenses)	−5,164	−8,437	1,077	−19,489
Taxable income	106,479	121,401	141,316	168,547
Taxes	39,184	44,379	50,640	59,354
Other nontaxable income (expenses)	0	−1,249	0	0
Net income	67,295	75,773	90,676	109,193
Dividends	2,779	3,010	3,323	3,911
Retained earnings	64,516	72,763	87,353	105,282
Balance sheet				
Cash	13,372	7,522	3,359	441
Receivables	19,969	25,207	31,778	37,079
Inventory	9,948	7,070	14,114	33,950
Other current assets	9,596	14,286	11,848	21,885
Total current assets	52,885	54,085	61,099	93,355
Net property, plant, and equipment	327,440	353,730	405,141	457,071
Goodwill	79,290	78,614	105,326	116,344
Other long-term assets	24,925	22,415	28,251	47,278
Total assets	484,540	508,844	599,817	714,048
Accounts payable	22,867	28,106	34,700	36,870
Other short-term liabilities	72,784	69,688	96,797	105,755
Total current liabilities	95,651	97,794	131,497	142,625
Long-term debt	79,121	35,192	23,714	43,529
Other long-term liabilities	5,699	3,208	10,188	43,427
Total long-term debt	84,820	38,400	33,902	86,956
Total debt	180,471	136,194	165,399	229,581
Preferred stock	0	0	0	0
Stockholders' equity	304,069	372,650	434,418	484,467
Statement of cash flows (selected items)				
Depreciation and amortization	31,753	34,048	39,389	44,280
Net cash provided by operating activities	116,682	112,966	168,039	172,497
Capital expenditures	−53,721	−61,585	−125,894	−109,710
Net cash provided by investing activities	−51,661	−61,133	−125,389	−124,697

Source: Mergent Online.

TABLE 4.13

Abbreviated TTM Financial Statements, Darden ($000)

Period ending	11/25/2001	11/24/2002	11/23/2003	11/28/2004
Income statement				
Restaurant sales	4,165,987	4,519,804	4,811,107	5,109,140
Other sales	0	0	0	0
Total sales	4,165,987	4,519,804	4,811,107	5,109,140
Food and beverage costs	1,338,422	1,415,777	1,495,885	1,543,419
Labor costs	1,302,381	1,434,745	1,529,859	1,639,839
Other costs of sales	602,136	657,360	743,548	781,253
Total cost of sales	3,242,939	3,507,882	3,769,292	3,964,511
SG&A expenses	415,537	418,736	462,454	483,513
Interest expense	38,401	45,219	47,950	48,315
Other income (expenses)	−149,209	−171,265	−198,278	−250,156
Taxable income	319,901	376,702	333,133	362,645
Taxes	98,994	105,426	74,500	96,309
Other nontaxable income (expenses)	−104,532	−135,010	−152,662	−142,547
Net income	116,375	136,266	105,971	123,789
Dividends	9,329	11,383	13,281	12,660
Retained earnings	107,046	124,883	92,690	111,129
Balance sheet				
Cash	19,999	20,880	27,806	60,431
Receivables	24,579	32,415	25,672	30,905
Inventory	226,796	231,814	256,997	236,441
Other current assets				
Total current assets	346,720	359,586	389,182	411,674
Net property, plant, and equipment	1,824,715	2,039,977	2,239,571	2,292,062
Goodwill				
Other long-term assets				
Total assets	2,321,628	2,562,112	2,812,650	2,887,918
Accounts payable	132,384	165,625	167,535	162,142
Other short-term liabilities	459,607	404,357	527,008	687,756
Total current liabilities	591,991	569,982	694,543	849,898
Long-term debt	514,278	659,656	655,066	502,574
Other long-term liabilities	113,587	144,151	181,673	268,727
Total long-term debt	627,865	803,807	836,739	771,301
Total debt	1,219,856	1,373,789	1,531,282	1,621,199
Preferred stock	0	0	0	0
Stockholders' equity	1,101,772	1,188,323	1,281,368	1,266,719
Statement of cash flows (selected items)				
Depreciation and amortization	152,136	170,698	248,889	212,339
Net cash provided by operating activities	404,729	544,934	636,349	626,480
Capital expenditures	−351,665	−347,813	−511,549	−310,915
Net cash provided by investing activities	−357,357	−387,106	−516,817	−299,689

Source: Mergent Online.

TABLE 4.14

Abbreviated TTM Financial Statements, Outback ($000)

Period ending	9/30/2001	9/30/2002	9/30/2003	9/30/2004
Income statement				
Restaurant sales	2,045,015	2,277,621	2,608,888	3,145,959
Other sales	18,614	19,899	19,967	20,127
Total sales	2,063,629	2,297,520	2,628,855	3,166,086
Food and beverage costs	785,642	846,766	942,977	1,142,661
Labor costs	492,940	555,261	641,492	777,073
Other costs of sales	378,069	458,046	546,531	673,558
Total cost of sales	1,656,651	1,860,073	2,131,000	2,593,292
SG&A expenses	76,135	86,411	99,339	125,819
Interest expense	4,617	2,438	2,476	2,954
Other income (expenses)	−123,392	−112,187	−133,471	−198,197
Taxable income	202,834	236,411	262,569	245,824
Taxes	71,318	83,217	91,669	84,678
Other nontaxable income (expenses)	0	0	-4,422	0
Net income	131,516	153,194	166,478	161,146
Dividends	0	0	36,254	38,689
Retained earnings	131,516	153,194	130,224	122,457
Balance sheet				
Cash	67,513	145,269	74,142	65,654
Receivables	10,368	11,074	9,937	18,457
Inventory	31,716	24,723	53,820	49,492
Other current assets	27,565	38,908	59,217	52,012
Total current assets	126,794	208,900	197,116	185,615
Net property, plant, and equipment	776,298	878,786	1,013,742	1,169,997
Goodwill	0	80,932	84,927	109,318
Other long-term assets	191,675	144,947	101,932	161,516
Total assets	1,094,767	1,313,565	1,397,717	1,626,446
Accounts payable	30,804	48,014	52,308	70,965
Other short-term liabilities	87,892	127,068	168,376	235,286
Total current liabilities	118,696	175,082	220,684	306,251
Long-term debt	12,826	14,255	31,747	99,342
Other long-term liabilities	40,379	60,036	75,458	90,207
Total long-term debt	53,205	74,291	107,205	189,549
Total debt	171,901	249,373	327,889	495,800
Preferred stock				
Stockholders' equity	903,615	1,025,120	1,022,077	1,082,385
Statement of cash flows (selected items)				
Depreciation and amortization	60,801	66,330	81,624	98,760
Net cash provided by operating activities	206,686	308,674	194,247	341,601
Capital expenditures	−186,776	−182,607	−383,928	−240,516
Net cash provided by investing activities	−193,769	−201,197	−221,755	−292,865

Source: Mergent Online.

TABLE 4.15

Abbreviated TTM Financial Statements, Ruby Tuesday ($000)

Period ending	12/4/2001	12/3/2002	12/2/2003	11/30/2004
Income statement				
Restaurant sales	776,512	850,443	958,413	1,054,120
Other sales	12,456	14,084	15,344	22,686
Total sales	789,891	865,227	974,625	1,072,244
Food and beverage costs	211,183	228,989	249,881	271,480
Labor costs	249,412	283,882	308,083	326,027
Other costs of sales	147,812	148,999	160,847	187,219
Total cost of sales	608,407	661,870	718,811	784,726
SG&A expenses	50,743	43,328	54,585	64,705
Interest expense	548	4,452	10,059	7,354
Other income (expenses)	−25,515	−59,083	−41,098	−48,616
Taxable income	104,678	96,494	150,072	166,843
Taxes	37,329	32,425	52,807	59,020
Other nontaxable income (expenses)	−58	0	0	0
Net income	67,291	64,069	97,265	107,823
Dividends	2,848	2,884	2,903	2,956
Retained earnings	64,443	61,185	94,362	104,867
Balance sheet				
Cash	16,251	6,414	19,770	6,668
Receivables	10,303	14,090	11,593	9,108
Inventory	10,183	12,782	14,670	16,466
Other current assets				
Total current assets	81,821	60,897	69,380	54,049
Net property, plant, and equipment	316,248	611,349	708,501	829,200
Goodwill	7,845	7,845	7,845	12,559
Other long-term assets				
Total assets	493,559	756,991	879,067	991,662
Accounts payable	29,849	35,620	34,851	37,306
Other short-term liabilities				
Total current liabilities	78,115	154,087	87,768	82,323
Long-term debt	23,948	149,035	201,782	239,264
Other long-term liabilities	72,338	90,359	109,339	141,577
Total long-term debt	96,286	239,394	311,121	380,841
Total debt	174,401	393,481	398,889	463,164
Preferred stock	0	0	0	0
Stockholders' equity	319,158	363,510	480,178	528,498
Statement of cash flows (selected items)				
Depreciation and amortization	32,593	38,952	50,699	59,311
Net cash provided by operating activities	116,059	142,762	165,896	187,488
Capital expenditures	−80,666	−135,681	−149,945	−149,032
Net cash provided by investing activities	−81,721	−117,410	−158,775	−154,781

Source: Mergent Online.

financial statements are difficult to interpret because companies tend to be of different sizes and have different focuses. The next chapter will consider how we can recast the statements in such a way that they are easier to interpret.

A Note on SFAS No. 123R

In this chapter, we have discussed financial statements as they have been reported for many years. In late 2004, the Financial Accounting Standards Board (FASB) decided to implement the Statement of Financial Accounting Standards (SFAS) No. 123R, which mandates that companies expense employee stock options (ESOs). Barring congressional intervention (which has been threatened), that rule takes effect in the latter half of 2005. Although we will discuss these ESOs in great depth in Chapter 8, a few comments are worth making here. When a company gives stock options to employees, it gives them the right to purchase shares of stock at some prespecified price at some point in the future. At the time ESOs are issued, there is no associated cash flow between the company and employees, but the ESOs do have value. As such, SFAS 123R requires companies to report the value of those ESOs as a salary-related expense on the income statement. Much like depreciation and amortization, ESO expenses will be included on the income statement despite the fact that they are not an actual cash flow. In computing free cash flows, we will therefore treat the ESO expense in the same way that we treat depreciation and amortization—we will add back the ESO expense in the free cash flow equation. This will give us a modified equation for the free cash flow of the company,

$$\boxed{\begin{aligned} FCF = NOPAT - \Delta NWC - CapEx + D\&A \\ + ESO\ Expense + \text{Other Effects} \end{aligned}} \tag{4.14}$$

The new regulation is designed to prevent companies from giving compensation to employees without having to report it as an expense. If (in equilibrium) the company gives ESOs in lieu of cash salaries, the company could effectively report lower expenses and therefore higher earnings. Since this would tend to mislead investors, FASB chose to implement SFAS 123R. It is presumed and hoped that the introduction of the new regulation will reduce the incentives for companies to give ESOs and will therefore result, over time, in far fewer ESOs being issued.

SUMMARY

In this chapter, we discussed the basic intuition behind financial statements so that we can understand what they mean and how they are related to each other. We also developed a rather important equation that allows us to convert the information found on the income statement and balance sheet into the *free cash flow* of the company. This equation will provide the basis for the DCF model we consider in Chapter 10. Finally, we collected the financial statements of our restaurant companies and then computed trailing 12-month financials so that we have a basis for comparing those statements. This provides a natural lead-in to the next chapter, in which we will interpret those financial statements.

CHAPTER 5

Interpreting Financial Statements

PURPOSE AND SCOPE

In the last chapter, we discussed the three main financial statements so that we could understand what they represent and how they are linked together. In this chapter, we consider how we might go about interpreting them. A primary task we face is one of recasting the financial statements into forms that allow us to do a better job of comparing similar companies. We consider three ways to do just that. Common size financial statements are simply normalized versions of the original statements. Each entry on the balance sheet is divided by total assets, and each entry on the income statement is divided by sales. This allows us to do a cross-sectional comparison of similar companies' financial statements. Indexed financial statements are statements in which each entry is expressed as a percentage of its value during some base year. This allows us to do a time-series analysis of a given company's financial statements. We also discuss the turnover balance sheet, which is a variation of common size financials in which we divide each asset entry on the balance sheet into sales. This allows us to evaluate how well the company is using its assets to generate sales.

Financial statement analysis is not unlike the task of a crime detective. The detective observes a wide array of evidence and seeks to find a consistent story that fits the evidence. The detective then tests the story by gathering more evidence in an effort to confirm or reject the hypothesis. Our task is similar. We observe a broad set of evidence from the company's financial statements and seek to find an explanation for what we observe. We then investigate further in hopes that we will confirm or reject our tentative explanation.

There are two ways to approach the body of evidence. First, we can simply stare at it a while in hopes that something will jump out at us. Second, we can develop a systematic approach to analyzing the body of evidence. In doing so, we lay groundwork that greatly increases the likelihood that we will arrive at appropriate and meaningful conclusions about the company. Although there are other systematic approaches we might use, we will focus on the DuPont approach here. The premise behind the DuPont approach is that company managers face three tasks: managing assets, controlling expenses, and managing debt. To analyze the company's financial statements, we evaluate each of those areas before drawing general conclusions about the company.

Toward the end of the chapter, we will briefly discuss a few special ratios that often turn out to be important. These special ratios appear on many finance-related websites, which makes it easy to conduct a very quick first analysis of the company. Finally, we return to the restaurant industry and use the DuPont approach to conduct an analysis of both O'Charley's and Applebee's.

IN THEORY . . .

The core of stock valuation involves forecasting the cash flows of the company. A simplistic but incorrect approach is to forecast the sales growth of the industry and then simply forecast the cash flows under the assumptions that company sales will grow at the same rate as industry sales, and that the relevant financial ratios will not change (roughly speaking, this would be equivalent to assuming that the company does not gain or lose market share and that the company's core competencies do not change). This approach is very nearsighted because it implicitly assumes that the company is capable of (and is desirous of) growing at the industry's growth rate. Furthermore, it assumes that the company's cash flows will grow at the same rate as sales when they might very well grow faster or slower than the company's sales. It follows that forecasting is likely to be far more involved than such simple models suggests. Before forecasting any of the company's cash flows, we must first understand the current and expected financial conditions of the company. This is no small task.

As we suggested in Chapter 4, financial statements are difficult to interpret because accounting profit differs from cash flow and because accounting book values differ from market values. They are also difficult to interpret because the financial statements of competitors may be misleading, will be of different sizes (i.e., competitors will have different levels of sales and of total assets), and may use different account names. Furthermore, the financial statements are provided by company managers. Although there are regulations that must be followed in preparing the statements, we must always be aware that what we get to see is what company managers want us to see. We begin by discussing ways in which we might recast financial statements to our advantage. We then develop a framework in which we might systematically evaluate those statements. The primary purposes in recasting the financial statements are 1) to make them comparable to the financial statements of similar companies and 2) to make trend analysis easier.

Common Size Financial Statements

Common size financial statements are simply financial statements that have been normalized so that they are easier to interpret. Common size income statements are typically expressed as a percentage of sales. Common size balance sheets are typically expressed as a percentage of total assets. Common size statements of cash flow are typically expressed as a percentage of total assets, although we might find it useful to look at certain elements (such as capital expenditures) as a percentage of sales. Table 5.1 shows the financial statements for a hypothetical company. The headings CY-3, CY-2, and CY-1 refer to 3 years, 2 years, and 1 year before the current year, respectively. We use this convention throughout the book. Table 5.2 shows those statements expressed in the common size format. The industry averages for the statements are shown in italics beside the corresponding number for the company. We will return to this company and these tables later in the chapter as we illustrate how to conduct a systematic analysis of financial statements.

In general, there are two primary benefits of using common size financial statements. First, we can examine how the company's basic cash flow and asset structures have changed over time. For example, we might note that the company's labor costs/sales ratio has increased substantially over the past few years. We would then investigate the reason for this. Second, we can easily compare the statements of one company with those of a competitor. Without normalizing the statements, we would have a very difficult time trying to evaluate a company's position within its industry. For example, we cannot infer anything of great importance if we see one company with earnings of $4.3 million and another with earnings of $5.2 million.

TABLE 5.1

Financial Statements, Hypothetical Company

Income statement	CY-3	CY-2	CY-1
Sales	$2,340	$2,509	$2,851
COGS	$1,244	$1,406	$1,698
SG&A expenses	$488	$524	$602
Depreciation	$186	$198	$229
Operating income	$422	$381	$322
Interest	$47	$50	$57
Taxable income	$375	$331	$265
Taxes	$131	$115	$92
Net income	$244	$216	$173
Dividends	$0	$0	$0
Retained earnings	$244	$216	$173
Balance sheet			
Cash	$208	$166	$132
Receivables	$139	$199	$285
Inventory	$406	$584	$649
Total current assets	$753	$949	$1,066
Property, plant, and equipment	$937	$1,180	$1,472
Accumulated depreciation	$81	$279	$508
PPE, net	$856	$901	$964
Total assets	$1,609	$1,850	$2,030
Short-term debt (payables)	$108	$97	$81
Long-term debt	$173	$209	$232
Total liabilities	$281	$306	$313
Common stock	$727	$727	$727
Additions to retained earnings	$601	$817	$990
Total equity	$1,328	$1,544	$1,717
Total liabilities and equity	$1,609	$1,850	$2,030
Statement of cash flows			
Operating activities			
Net income	$244	$216	$173
Depreciation and amortization	$186	$198	$229
Changes in accounts receivable	−$22	−$60	−$86
Changes in inventory	−$167	−$178	−$65
Changes in accounts payable	$7	−$11	−$16
Cash flow from operating activities	$248	$165	$235
Investing activities			
Capital expenditures	−$217	−$243	−$293
Investments	$0	$0	$0
Cash flow from investing activities	−$217	−$243	−$293
Financing activities			
Dividends	$0	$0	$0
Sale/repurchase of stock	$0	$0	$0
Borrowings	$0	$36	$23
Cash flow from financing activities	$0	$36	$23
Change in cash and equivalents	$31	−$42	−$34

TABLE 5.2

Common Size Financial Statements

Income statement	**CY-3**	***CY-3***	**CY-2**	***CY-2***	**CY-1**	***CY-1***
Sales	100.0%	*100.0%*	100.0%	*100.0%*	100.0%	*100.0%*
COGS	53.2%	*54.6%*	56.0%	*56.4%*	59.6%	*59.5%*
SG&A expenses	20.9%	*21.9%*	20.9%	*19.8%*	21.1%	*20.1%*
Depreciation	7.9%	*7.9%*	7.9%	*7.9%*	8.0%	*7.6%*
Operating income	18.0%	*15.7%*	15.2%	*15.9%*	11.3%	*12.9%*
Interest	2.0%	*2.1%*	2.0%	*2.0%*	2.0%	*1.9%*
Taxable income	16.0%	*13.6%*	13.2%	*13.9%*	9.3%	*11.0%*
Taxes	5.6%	*4.7%*	4.6%	*4.9%*	3.2%	*3.8%*
Net income	10.4%	*8.8%*	8.6%	*9.1%*	6.1%	*7.2%*
Dividends	0.0%	*0.0%*	0.0%	*0.0%*	0.0%	*0.0%*
Retained earnings	10.4%	*8.8%*	8.6%	*9.1%*	6.1%	*7.2%*
Balance sheet						
Cash	12.9%	*12.7%*	9.0%	*10.6%*	6.5%	*11.6%*
Receivables	8.6%	*9.9%*	10.8%	*9.4%*	14.0%	*10.5%*
Inventory	25.2%	*26.0%*	31.6%	*30.6%*	32.0%	*31.5%*
Total current assets	46.8%	*48.6%*	51.3%	*50.6%*	52.5%	*53.5%*
Property, plant, and equipment	58.2%	*56.2%*	63.8%	*64.0%*	72.5%	*71.4%*
Accumulated depreciation	5.0%	*4.7%*	15.1%	*14.6%*	25.0%	*25.0%*
PPE, net	53.2%	*51.4%*	48.7%	*49.4%*	47.5%	*46.5%*
Total assets	100.0%	*100.0%*	100.0%	*100.0%*	100.0%	*100.0%*
Short-term debt (Payables)	6.7%	*6.6%*	5.2%	*5.0%*	4.0%	*3.9%*
Long-term debt	10.8%	*15.6%*	11.3%	*16.6%*	11.4%	*11.3%*
Total debt	17.5%	*22.2%*	16.5%	*21.5%*	15.4%	*15.1%*
Common stock	45.2%	*42.6%*	39.3%	*36.3%*	35.8%	*34.5%*
Additions to retained earnings	37.4%	*35.2%*	44.2%	*42.2%*	48.8%	*50.4%*
Total equity	82.5%	*77.8%*	83.5%	*78.5%*	84.6%	*84.9%*
Total liabilities and equity	100.0%	*100.0%*	100.0%	*100.0%*	100.0%	*100.0%*
Statement of cash flows						
Operating activities						
Net income	15.2%	*12.2%*	11.7%	*12.2%*	8.5%	*10.4%*
Depreciation and amortization	11.6%	*11.0%*	10.7%	*10.6%*	11.3%	*11.1%*
Changes in accounts receivable	−1.4%	*−0.4%*	−3.2%	*−1.0%*	−4.2%	*−1.6%*
Changes in inventory	−10.4%	*−6.0%*	−9.6%	*−8.4%*	−3.2%	*−2.5%*
Changes in accounts payable	0.4%	*−0.9%*	−0.6%	*−0.6%*	−0.8%	*−0.9%*
Cash flow from operating activities	15.4%	*15.9%*	8.9%	*12.7%*	11.6%	*16.6%*
Investing activities						
Capital expenditures	−13.5%	*−17.2%*	−13.1%	*−16.1%*	−14.4%	*−10.7%*
Investments	0.0%	*0.0%*	0.0%	*0.0%*	0.0%	*0.0%*
Cash flow from investing activities	−13.5%	*−17.2%*	−13.1%	*−16.1%*	−14.4%	*−10.7%*
Financing activities						
Dividends	0.0%	*0.0%*	0.0%	*0.0%*	0.0%	*0.0%*
Sale/repurchase of stock	0.0%	*0.0%*	0.0%	*0.0%*	0.0%	*0.0%*
Borrowings	0.0%	*2.9%*	1.9%	*3.2%*	1.1%	*−4.5%*
Cash flow from financing activities	0.0%	*2.9%*	1.9%	*3.2%*	1.1%	*−4.5%*
Change in cash and equivalents	1.9%	*1.7%*	−2.3%	*−0.2%*	−1.7%	*1.5%*

Industry averages are in italics.

But if we see that one company's profit margin (earnings/sales) is 6.8% and another's is 2.1%, we can tentatively conclude that the latter company is having trouble generating sales and/or controlling its expenses.

Indexed Financial Statements

Another way me might recast a company's financial statements is to express them as a percentage of some prior period. For example, we might choose the year 2002 as a base year and then express each account in each subsequent year as a percentage of its value in 2002. If, for example, inventory was $980 in 2002, $1,030 in 2003, and $1,176 in 2004, we would express inventory as 100.0%, 105.1%, and 120.0% for the 3 years. Statements expressed in this manner are known as *indexed financial statements*. By expressing statements in this manner, we can immediately see how fast account values have grown over time. A second benefit is that we can quickly and easily compare the growth rates of peer companies. For example, we might observe that one company's sales have grown by 23% over the past 2 years, while a peer company's sales have only grown by 9%. This gives us valuable information about changes in the relative market shares of the companies.

The primary purpose of indexed financial statements is to allow us to quickly and easily evaluate trends in different financial variables. The indexed financial statements for our hypothetical company are shown in Table 5.3. In this case, we have chosen CY-3 to be the base year for our statements. Industry averages are shown in italics beside the corresponding number for the company.

The Turnover Balance Sheet

It is also constructive to express the asset side of the balance sheet in the form sales/X, where X is the given asset account on the balance sheet under consideration. This allows us to quickly examine how well the company is using its assets to generate sales. Table 5.4 shows the turnover balance sheet for our hypothetical company. As with our common size and indexed statements, the industry averages are shown in italics beside the corresponding number for the company. We refer to ratios of the form sales/X as X-turnovers. For example, the ratio sales/cash is termed the "cash turnover." Note that we might also include the right side of the bal-

TABLE 5.3

Indexed Financial Statements

Income statement	CY-3	*CY-3*	CY-2	*CY-2*	CY-1	*CY-1*
Sales	100.0%	*100.0%*	107.2%	*113.3%*	121.8%	*130.0%*
COGS	100.0%	*100.0%*	113.0%	*117.1%*	136.5%	*141.6%*
SG&A expenses	100.0%	*100.0%*	107.4%	*102.7%*	123.4%	*119.7%*
Depreciation	100.0%	*100.0%*	106.5%	*113.4%*	123.1%	*124.6%*
Operating income	100.0%	*100.0%*	90.3%	*115.1%*	76.3%	*106.7%*
Interest	100.0%	*100.0%*	106.4%	*106.6%*	121.3%	*116.1%*
Taxable income	100.0%	*100.0%*	88.3%	*116.4%*	70.7%	*105.3%*
Taxes	100.0%	*100.0%*	87.8%	*116.5%*	70.2%	*105.1%*
Net income	100.0%	*100.0%*	88.5%	*116.3%*	70.9%	*105.4%*
Dividends	NA	*NA*	NA	*NA*	NA	*NA*
Retained earnings	100.0%	*100.0%*	88.5%	*116.3%*	70.9%	*105.4%*
Balance sheet						
Cash	100.0%	*100.0%*	79.8%	*98.2%*	63.5%	*112.5%*
Receivables	100.0%	*100.0%*	143.2%	*111.4%*	205.0%	*130.8%*
Inventory	100.0%	*100.0%*	143.8%	*138.1%*	159.9%	*149.9%*
Total current assets	100.0%	*100.0%*	126.0%	*122.2%*	141.6%	*136.2%*
Property, plant, and equipment	100.0%	*100.0%*	125.9%	*133.7%*	157.1%	*157.2%*
Accumulated depreciation	100.0%	*100.0%*	344.4%	*361.9%*	627.2%	*650.5%*
PPE, net	100.0%	*100.0%*	105.3%	*112.7%*	112.6%	*111.7%*
Total assets	100.0%	*100.0%*	115.0%	*117.3%*	126.2%	*123.6%*
Short-term debt (payables)	100.0%	*100.0%*	89.8%	*88.6%*	75.0%	*72.5%*
Long-term debt	100.0%	*100.0%*	120.8%	*124.4%*	134.1%	*89.1%*
Total debt	100.0%	*100.0%*	108.9%	*113.8%*	111.4%	*84.2%*
Common stock	100.0%	*100.0%*	100.0%	*100.0%*	100.0%	*100.0%*
Additions to retained earnings	100.0%	*100.0%*	135.9%	*140.5%*	164.7%	*177.0%*
Total equity	100.0%	*100.0%*	116.3%	*118.3%*	129.3%	*134.9%*
Total liabilities and equity	100.0%	*100.0%*	115.0%	*117.3%*	126.2%	*123.6%*
Statement of cash flows						
Operating activities						
Net income	100.0%	*100.0%*	88.5%	*116.5%*	70.9%	*105.1%*
Depreciation and amortization	100.0%	*100.0%*	106.5%	*113.2%*	123.1%	*124.8%*
Changes in accounts receivable	100.0%	*100.0%*	272.7%	*320.0%*	390.9%	*546.8%*
Changes in inventory	100.0%	*100.0%*	106.6%	*164.1%*	38.9%	*50.8%*
Changes in accounts payable	100.0%	*100.0%*	−157.1%	*85.4%*	−228.6%	*120.4%*
Cash flow from operating activities	100.0%	*100.0%*	66.5%	*93.5%*	94.8%	*128.6%*
Investing activities						
Capital expenditures	100.0%	*100.0%*	112.0%	*110.4%*	135.0%	*76.7%*
Investments	NA	*NA*	NA	*NA*	NA	*NA*
Cash flow from investing activities	100.0%	*100.0%*	112.0%	*110.4%*	135.0%	*76.7%*
Financing activities						
Dividends	NA	*NA*	NA	*NA*	NA	*NA*
Sale/repurchase of stock	NA	*NA*	NA	*NA*	NA	*NA*
Borrowings	NA	*100.0%*	NA	*130.1%*	NA	*−188.5%*
Cash flow from financing activities	NA	*100.0%*	NA	*130.1%*	NA	*−188.5%*
Change in cash and equivalents	100.0%	*100.0%*	−135.5%	*−13.5%*	−109.7%	*106.3%*

Industry averages are in italics.

TABLE 5.4

Turnover Balance Sheet

	CY-3	*CY-3*	CY-2	*CY-2*	CY-1	*CY-1*
Cash	11.3	*10.9*	15.1	*12.6*	21.6	*12.6*
Receivables	16.8	*14.1*	12.6	*14.3*	10.0	*14.0*
Inventory	5.8	*5.4*	4.3	*4.4*	4.4	*4.6*
Total current assets	3.1	*2.9*	2.6	*2.7*	2.7	*2.7*
Property, plant, and equipment	2.5	*2.5*	2.1	*2.1*	1.9	*2.0*
Accumulated depreciation	28.9	*29.3*	9.0	*9.2*	5.6	*5.9*
PPE, net	2.7	*2.7*	2.8	*2.7*	3.0	*3.1*
Total assets	1.5	*1.4*	1.4	*1.3*	1.4	*1.5*

Industry averages are in italics.

ance sheet in the table, but, generally speaking, those ratios tend to add little value to our analysis.

To understand how we might use the turnover balance sheet, suppose that we observe that a company's sales/total assets ratio is well below industry average. This is suggestive of a company that is apparently underperforming compared with the industry, in terms of generating sales with its assets. Our task is to find, to the greatest extent possible, the source of the underperformance. The turnover balance sheet is especially useful in this undertaking. For example, we might observe that the company's cash turnover, receivables turnover, and fixed asset turnover are all at normal levels, but the inventory turnover is quite low. This suggests that the company might be holding more inventory (relative to sales) than its peers. Our task is then to determine the cause of the excessive inventory. Have the company's sales fallen off, leading to inventory buildup? Has the company built up inventory in anticipation of higher future sales, only to find that the higher sales did not materialize? Is there another explanation? As will often be the case, financial statement analysis serves not only to answer questions about the company, but also to raise additional questions to ask. Note that we need to be careful in interpreting turnover ratios in which the asset account is small in value (either for the company under consideration or for comparable companies that are used to compute industry averages). If so, the ratio becomes quite large and we might easily draw misleading conclusions.

The DuPont Method

It is natural to want to just scan the financials (expressed in whatever manner) and look for items that stand out as being extraordinary. When we do so, it quickly becomes apparent that we need a more systematic approach to analyzing financial statements. Without such an approach, we find that we often miss the point. One systematic approach used and recommended by many who study financial statements is known as the DuPont Method.

In the early 1900s, employees of the DuPont company began conducting internal financial analyses with a systematic approach that decomposes the return on equity (net income divided by equity) into three contributing parts. Essentially, DuPont suggests that managing a company involves three primary tasks: asset management, expense control, and debt management. To understand this, first notice that we can write out the company's *return on equity* (ROE) as

$$ROE = \frac{NI}{E} = \frac{NI}{S} \times \frac{S}{TA} \times \frac{TA}{E}, \tag{5.1}$$

where NI is the company's net income, E is the company's equity, S is the company's sales, and TA is the company's total assets. We then define the *profit margin* to be NI/S and the *asset turnover* to be S/TA. Furthermore, we note that TA/E (which is often called the *equity multiplier* or *leverage multiplier*) is equal to $1 + D/E$. This allows us to write the fundamental DuPont relationship,

$$\boxed{ROE = PM \times AT \times \left(1 + \frac{D}{E}\right)} \tag{5.2}$$

This equation demonstrates that the ROE can be decomposed into three factors: the profit margin, the asset turnover, and the debt-to-equity ratio.

Company managers face three primary tasks: controlling expenses, managing assets, and managing debt.

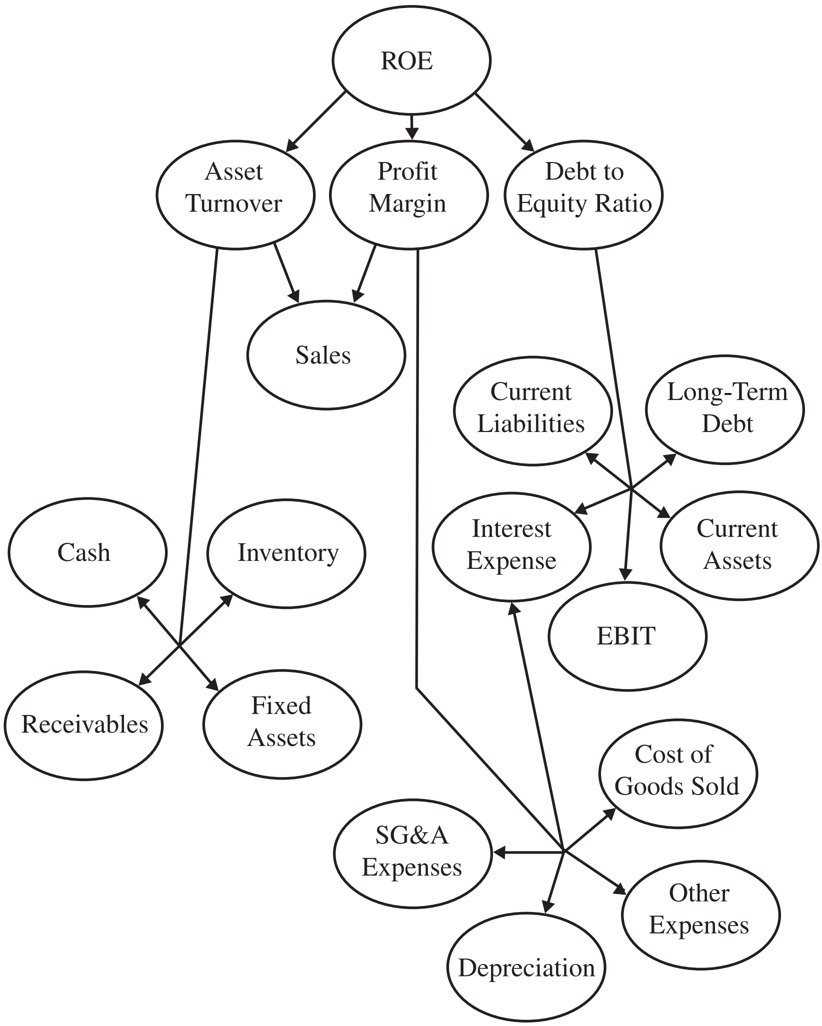
The company's ability to control expenses is reflected in the profit margin. Since net income, by definition, is sales less expenses, a higher profit margin is often indicative of a better ability to keep expenses down. The asset turnover reflects the company's ability to use its assets to generate sales. A higher asset turnover is often indicative of better use of the company's assets. *All else being equal,* the ROE is increasing in the company's debt-to-equity ratio, so the last DuPont factor represents the ability of company managers to use debt to increase the return to shareholders. Generally speaking, however, a higher debt-to-equity ratio corresponds to higher interest expense and therefore to a lower profit margin, so it is not always the case that more debt will increase ROE. We will discuss this idea in more depth later in the chapter. Thus, the company's debt-to-equity ratio tells us little about how well the company is managing its debt. It does provide a useful starting point for our analysis, however.

Simply stated, the DuPont approach is one in which we begin with the three factors and then dig deeper in order to develop a good understanding of what is going on within the company. Our goal (and the best we can reasonably hope for) is to come up with a story that fits all of the facts. Figure 5.1 illustrates the basic DuPont approach. We first examine the ROE and the DuPont factors. Once we have a broad understanding of where the company stands, we examine specific accounts to get a better understanding of where the company's strengths and weaknesses lie. For example, suppose that we see that a company's ROE is below average. Figure 5.1 shows that we should next consider the asset turnover, profit margin, and debt-to-equity ratio. Suppose that when we do, we find that the profit margin is low. A low profit margin is indicative of a company that has low sales and/or high expenses. We would then investigate these possibilities to help us understand the condition of the company. For example, we might note that the company's cost of goods sold is unusually high. We can then focus on why the cost is so high. Perhaps, for example, the prices of raw materials used by the company have increased. Our task would then be to understand why they have increased and to determine whether the increase is likely to be permanent.

Alternatively, we may see that a company has a strong ROE, but its debt-to-equity ratio is well above those of its peers. Our goal would then be to determine whether the company has too much debt. To do this, we would examine the company's debt structure (both short-term and long-term) so that we understand the company's future obligations. We would then consider interest expense in relation to EBIT, which is the money

FIGURE 5.1

The DuPont Approach



generated by the company that is available to pay debtholders, and the *return on invested capital* (ROIC), which is the return generated by the company that is available to compensate all investors (we will define this more formally a bit later). We would also consider the company's current assets because they are a potential source of funds for paying off short-term debt. Although we apply the analysis to *historical* financial statements, our real objective is to generate information that will help us predict the *future*.

Before investigating the DuPont approach in more depth, we must establish some way to determine whether a given financial ratio is high or low. As we will see, this is at best an inexact science. There are two basic approaches we might use. In the first, we compare a given ratio to the industry average for that ratio. To do this, we must identify comparable companies for use in computing the industry averages. For some companies, we can readily identify similar companies and compute meaningful averages. For others (Microsoft, for example), there really are no comparable companies and our analysis becomes quite difficult. A second approach is to examine ratios relative to their historical levels and then draw conclusions based on what we see. With either approach, the task is difficult. We will rarely find a company that does not have a few ratios that are misleading for some reason.

Asset Management

The asset turnover measures the ability of company managers to use the company's assets effectively. In considering asset management, we should always keep in mind that the book values of assets may not be a good estimator of the market values of those assets. A company with old assets (which have a low book value) may have a high asset turnover and thus might appear to have effective asset management. It may be the case, however, that those assets are in poor condition and will soon need to be replaced. At the other extreme, a company may have recently purchased new equipment that has a high initial book value. Such a company may have a low asset turnover and thus may appear to have poor asset management. It may be the case, however, that the company is in great shape because it is operating with the latest, most efficient technology.

Suppose, then, that we suspect that a company is not managing its assets well. How might we investigate further? Referring again to Figure 5.1, we see that our task becomes one of first determining whether the apparent mismanagement is due to sales or whether it is due to a specific class of assets. The turnover balance sheet is particularly useful in this effort. Recall that turnovers are the ratios of sales to X, where X is the balance-sheet value of a given asset class. There are two ways for a ratio to be low. First, the numerator (sales in this case) might be low. Second, the denominator (assets in this case) might be high. It follows that if we observe that several of the company's turnovers are below average, the likely culprit is sales. If instead we see that only one of the turnovers is low, the likely culprit is the given asset class. For example, we might see that a company's asset turnover and cash turnover are low, but that the other turnovers are all average or above average. We would conclude that the company is probably doing a reasonable job of using its operating assets to support and generate sales, but that the company is holding more cash than its peers are holding. We would then attempt to identify the reason for the high level of cash. Is the company saving for a potential acquisition? Is the company worried about future sales and is therefore building up cash as a measure of protection? Might we expect the company to use the excess cash to repurchase shares? Are there other explanations?

Expense Control

The profit margin, which is essentially the fraction of sales that belong to shareholders, measures the ability of company managers to control expenses. When the profit margin is low, there are several potential explanations for this. First and most obviously, company managers are not doing a good job of keeping costs down. Second, sales are low. Because each company has both fixed costs (which do not vary with sales) and variable costs (which do vary with sales), a decline in sales will correspond to an increase in fixed costs relative to sales. This in turn will tend to reduce the profit margin. Third, sales and/or costs may not reflect true sales and costs, which in turn might lead to a low profit margin. For example, the company may have one-time expenses related to the discontinuation of an unprofitable division. These one-time expenses will drive down the profit margin but are not expected to persist over time. Of course the converse is true when the profit margin is high. First, sales might be high; higher sales typically imply higher profit margins because the fixed costs become a smaller fraction of sales. Second, the company might be doing a good job of keeping costs down. Third, sales and/or costs may be misleading. Our goal in investigating expense control is to differentiate between these possibilities and to identify what is really going on within the company.

Evaluating management's ability to control expenses is often difficult for outsiders because we do not typically have access to a detailed breakdown of the expenses of the company. However, we can draw some broad conclusions by examining what we do have. To the extent that the company provides more detailed information, we can conduct a more thorough evaluation.

Debt Management

The debt-to-equity ratio (or alternatively the leverage multiplier) reflects the impact of debt on ROE. In one sense, the debt-to-equity ratio is very much misunderstood by investors. We instinctively believe that less debt is a sign of strength, but this is not always the case. In fact, less debt is often a sign of poor management and/or weak financial condition. Financing with debt can substantially increase the returns to shareholders provided that the company does not take on too much debt. There are two reasons for this. First, interest payments are tax deductible. Suppose that we the company pays 8% interest on its debt. If the company's tax rate is 25%, the effective interest rate on debt is only 6%. This provides a substantial incentive (called the *tax benefit of debt*) for the company to issue debt rather than equity. Second, financing with debt can lead to higher returns to shareholders because of the *leverage benefit of debt*. To understand this, consider the following example.

Example 5.1: Two companies are identical except that one company is financed entirely with equity, whereas the other is financed with 50% equity and 50% debt at 6% annual (after-tax) interest. Now, suppose that each company has access to a project that requires a $100 investment but is expected to return 20% over the next year. Suppose further that both projects indeed return 20%. Table 5.5A shows the payoffs to investors. We see that for the all-equity company, shareholders receive precisely the return on the project, 20%. For the 50-50 company, we see something different. Although the project again pays off $120 (a 20% return), debtholders are paid $53 ($50 plus 6% interest), leaving $67 for shareholders. This constitutes a 34% return, which is substantially higher when the company has debt. This benefit occurs whenever the return on the project exceeds the after-tax interest rate on debt (6% in this case). Table 5.5B shows a pessimistic scenario in which the realized project return is −20%. We see that when project returns are low, shareholders are better off without debt. Intuitively, this occurs because debtholders have a senior obligation—they must be paid in full before shareholders are paid. If project returns are low, then there is little or nothing left for shareholders.

This example illustrates the basic tradeoff faced by the company. Higher debt can lead to higher expected returns to shareholders, but it also leads to

TABLE 5.5A

Returns for Companies with Different Leverage, Example 5.1

	All-equity company	50-50 company
Initial investment from shareholders	\$100	\$50
Initial investment from debtholders	\$0	\$50
Project payoff	\$120	\$120
Payment to debtholders	\$0	\$53
Payoff to shareholders	\$120	\$67
Return to shareholders	20%	34%

more risk. To better understand this idea, we can ask the simple question, under what circumstances is debt good for shareholders? There are a variety of ways that we might answer that question, but we will focus on the company's ROE. Under what circumstances does the presence of debt imply a higher ROE for the company? We begin by recalling our definition of EBIT, which is the company's net income under the assumption that it pays no interest and pays no taxes. We can view EBIT as the amount of money generated by the company during a period that can be used to satisfy the government and the company's investors (debtholders and stockholders). We then define the return on invested capital (ROIC) to be

$$ROIC = \frac{EBIT(1-T)}{Interest\ bearing\ debt + E}. \tag{5.3}$$

TABLE 5.5B

Returns for Companies with Different Leverage, Example 5.1

	All-equity company	50–50 company
Initial investment from shareholders	\$100	\$50
Initial investment from debtholders	\$0	\$50
Project payoff	\$80	\$80
Payment to debtholders	\$0	\$53
Payoff to shareholders	\$80	\$27
Return to shareholders	−20%	−46%

(Note that for simplicity and because it usually does not matter, we have ignored preferred stock in this definition. In reality, preferred stock is simply another form of debt, so we can easily just incorporate it into the denominator of Equation 5.3.) The numerator of the ROIC equation can be viewed as the amount of money generated by the company during a period that can be used to satisfy the company's investors. This numerator is similar to the EBIT, except that we subtract the taxes the company would pay if it had no interest expense. Said differently, the numerator of the ROIC is the net income the company would have if it had no debt. The denominator of the ROIC equation is the total investment in the company. We generally do not include trade debt (i.e., accounts payable) in the numerator because it is not interest bearing. Thus, we cannot infer that the denominator of the ROIC equation is equivalent to total assets. Furthermore, whenever possible, the ROIC should be computed with the use of the market values of debt and equity. The market values reflect the current level of investment in the company, which is the capital upon which company managers need to generate a return.

We can now develop an equation that relates the company's ROE to its ROIC. First, notice that the company's net income can be expressed as

$$NI = \left(EBIT - R_{\mathrm{d}}D\right)\left(1 - T\right). \tag{5.4}$$

The term $R_{\mathrm{d}}D$, which is the interest rate on debt multiplied by the amount of debt outstanding, is simply the interest expense paid by the company. Therefore, $EBIT - R_{\mathrm{d}}D$ is the company's taxable income. Multiplying this by $1 - T$ is the same as subtracting taxes from taxable income, which leaves us with net income. Comparing Equations 5.3 and 5.4 and doing a little algebra gives us the following relationship:

$$\boxed{ROE = ROIC + \left(ROIC - R_{\mathrm{d}}\left(1 - T\right)\right)\frac{D}{E}} \tag{5.5}$$

This representation is informative because it gives an explicit condition under which debt increases the company's ROE. Recall that ROIC (the first term in the above equation) is what the ROE would be if the company had no debt. It is therefore completely independent of the company's capital structure. We then need only consider whether the second term is negative or positive to determine whether debt is hurting or helping the company's ROE. Since the company's debt-to-equity ratio is never negative, we need only examine the sign of the expression in parentheses to make that determination. Specifically, we see that if

$$ROIC > R_d(1-T), \tag{5.6}$$

debt increases the company's ROE. If, alternatively,

$$ROIC < R_d(1-T), \tag{5.7}$$

debt decreases the company's ROE. We acknowledge that this provides only one piece of information in evaluating a company's debt position. Most importantly, it addresses only the returns of the company and not the risks associated with taking on debt. If we were to incorporate the higher risk associated with debt, we would find that the company would prefer less debt not only when the ROIC is less than the after-tax interest rate on debt, but even when it is slightly higher than the after-tax interest rate on debt.

In evaluating the company's management of debt, we must ask not only whether the company has too much debt, but also whether the company has enough debt. If we observe a company with weak cash flows and high debt, we must question whether managers are acting in the best interests of shareholders. Similarly, if we observe a company with strong cash flows and low debt, we must ask why managers have not taken on more debt. Because of these issues, we cannot just look at whether the company's debt-to-equity ratio is high or low relative to industry averages. The determination of "high" or "low" has to be made by examining the company's cash flows in relation to the company's debt obligations.

To stress this a bit more, realize that our first instinct is to compare the company's debt-to-equity ratio (or some equivalent ratio) to those of the company's peers. This is *not* usually a productive undertaking, for two reasons. First, the company's book value of equity (i.e., the value of equity shown on the balance sheet) can deviate substantially from the market value of equity. This can easily lead to misleading debt-to-equity ratios. It might the case, for example, that a company has a debt-to-equity ratio that is much higher than the industry average, yet the company may have too little debt. Second, the debt decision should depend on the company's ability to repay the debt, and not so much on balance sheet items. The company may seem to have a rather large amount of debt, but this is entirely reasonable if the company has the cash flows to support that debt.

As we proceed with the following example, we will consider several calculations that will help in this regard.

An Example: The DuPont Approach

Before discussing some well-known, commonly used ratios, let us first consider a simple example to illustrate the DuPont methodology. As mentioned earlier, Tables 5.1, 5.2, 5.3, and 5.4 show 3 years of a hypothetical company's financial statements expressed in different ways. Recall that in each table, the industry averages are shown in italics beside the number for the company. Recall also that CY-1 designates last year, CY-2 the year before that, and CY-3 the year before that. Using the DuPont approach, we begin by analyzing the three tasks of company managers.

Expense Control The company's profit margin, which is shown as net income on the common size income statement, has deteriorated over the last 3 years, dropping from 10.4% to 6.1%. There are two primary reasons why this might occur. First, the company's sales may have decreased. Second, one or more of the company's expenses may have increased. Our first objective is to differentiate between these two possibilities. When sales are the culprit, we typically observe effects in many areas, including (as we discussed earlier) the turnovers. In this example, we do not see evidence consistent with a deterioration of sales. Although we do see that the company's asset turnover (see Table 5.4) has declined a bit, the decline is far less than we would observe if the company's sales were deteriorating. Furthermore, we see in Tables 5.1 and 5.3 that dollar sales have indeed increased over the last few years. Thus, it does not seem likely that the drop in profit margin can be explained by poor sales. When we examine the cost accounts, however, we see evidence that the company's cost of goods sold (COGS) has increased relative to sales over the 3-year period. In fact, the COGS/sales ratio (in the common size income statement) has increased from 53.2% to 59.6%. This is a rather large increase, given that the company's profit margin is only in the 6–10% range. The sharply decreasing profit margin provides evidence that the company is unable or unwilling to increase prices to help offset the rising costs.

Our task now becomes one of understanding why the COGS has risen so dramatically relative to sales. Are company managers to blame for not doing an adequate job of controlling expenses? Alternatively, is the increase in costs due to forces beyond the managers' control? Key evidence in this regard can be found by examining the industry averages. In this case, the industry average COGS/sales ratio has increased from 54.59% to 59.46% over the last 3 years. Clearly, whatever has caused the company's costs to increase has also affected the company's peers, although the company seems to have been affected to a slightly greater degree. In addition, Table 5.3 shows that the company's selling, general, and administrative (SG&A) expenses have increased at a slightly greater rate than those of its peers (a 23.4% increase compared with a 19.7% increase for the industry). This has caused the company's SG&A/sales ratio to go from being a point better than average to a point worse than average. The net effect of the COGS and SG&A deterioration is that the company's once strong profit margin has dropped to a below-average condition, presumably leaving the company in a weaker competitive position.

We conclude that it is likely that some input into the production process has seen an increase in prices over the last few years. In a real-world example, we would then proceed to determine what input is driving the cost increase, whether the increase is expected to be permanent, and what steps the company (and others in the industry) might take in response to the recent cost increases. We would also want to investigate the change in SG&A expenses to determine whether the change is temporary and whether the shift is a first sign of more trouble to come.

Asset Management The turnover balance sheet shown in Table 5.4 is especially well suited for analyzing the performance of company managers in managing assets. We first note that the company's total asset turnover is quite stable for both the company and the industry. In addition, the company's asset turnover has been roughly the same magnitude as the industry's. We *tentatively* conclude that there have been no serious asset management problems at the company unless they are also present throughout the industry. This provides further evidence that the deterioration in the company's profit margin is not due to declining sales.

Even though we do not suspect serious asset management problems, it is worth the effort to examine the various asset classes. First, notice that the fixed-asset turnover (defined as sales/net property, plant, and equipment) has been increasing for both the company and its peers. This is indicative of an industry in which companies are *not* choosing to invest more in long-term assets. As further support for this hypothesis, notice in Table 5.3 that the industry net PPE has grown by 11.7% over the past 2 years while sales have grown by 30.0%. This is generally consistent with our conclusion that the industry has seen the cost of its production inputs rise. In a declining industry, there is less incentive and less ability to invest heavily in long-term assets (which require a high initial expenditure that is not recouped for a long period of time). Instead, companies rely on older equipment that is more costly to operate and maintain.

Second, notice that the sales/inventory ratio has also been declining and that, again, the magnitudes of the company's ratios are in line with the magnitudes of the industry average ratios. We conclude that company managers have done at least a reasonable job of managing inventory. We also conclude that, for whatever reason, the company and its peers have been increasing their holdings of inventory over the past few years. This is also evident in the indexed balance sheet (Table 5.3), which shows that the company's inventory has increased by about 60% over the past 2 years, while the industry average inventory position has increased by about 50%. In a real-world example, we would then seek to understand why inventory is climbing.

Third, we see that the company's receivables turnover has declined substantially, while the industry average receivables turnover has remained stable. A declining receivables turnover is indicative of a company that is selling more goods and/or services on credit (relative to sales). The indexed financial statements in Table 5.3 confirm this observation, as we see that receivables have more than doubled for the company. The trend is also evident in the common size balance sheet shown in Table 5.2, where we see that the company's receivables have increased from 8.6% of total assets to 14.0% of total assets. This is a significant concern because of the stability observed in the industry. Company managers have apparently responded to the cost increases by loosening the company's credit terms. Even with this loosening, the company's sales have not increased at the pace set by the industry. Thus, the company has lost market share despite loosening of its credit terms. This is solid evidence of company-specific problems in addition to industry-wide problems.

Fourth, notice in Table 5.4 that the company's cash turnover increased dramatically while the industry average cash turnover increased by a far smaller amount. Thus it appears that the company's cash account has been depleted. The raw balance sheet (Table 5.1) and common size balance sheet (Table 5.2) confirm this, as does the indexed balance sheet (Table 5.3), which shows that the company's cash in CY-1 was only 63.5% of its level in CY-3. In contrast, the industry average cash in CY-1 was 112.5% of its level in CY-3.

Our observations concerning the company's cash and receivables are entirely consistent with a company that is struggling to keep pace in a declining industry. In loosening its credit terms, the company essentially sacrificed cash flow (and hence cash itself) in an attempt to maintain its market share. An important lesson of our asset turnover analysis is that we should do a comprehensive analysis, even if our high-level examination shows no major problems. In our example, the total asset turnover appeared to be normal, but this was due to the fact that the low receivables turnover tended to offset the high cash turnover. Thus our tentative conclusion that the company had no serious asset management problems now appears to be questionable.

Debt Management In analyzing the company's performance in managing assets and controlling expenses, we were able to rely on the common size, indexed, and turnover financial statements. Analyzing the company's health with respect to debt requires a bit more work because we must consider the fundamental issue of whether the company has had difficulty in making its debt payments. There are two places we might look in making this determination. The first is to examine the income statement and statement of cash flows to see how large the company's interest payments have been relative to its profits. The second is to consider the balance sheet to judge whether the company is in sufficiently healthy financial condition to meet its short-term obligations. Before addressing these issues, we note that the company's debt ratio (which is defined as debt/total assets and appears on the common size balance sheet) has been below the industry average in each of the last 3 years. This provides a small bit of comfort, given the problems we have already identified, but we must always keep in mind that the debt ratio provides limited information.

Table 5.6 shows a few more calculations that will be useful in our examination. The table includes the historical values of several different ratios for both the company and its industry. Notice first that the company's after-tax interest rate on debt has been several percentage points higher than the industry average, suggesting that the debt market has viewed the company as being riskier than the average company in the industry. Second, notice that both the company and its peers generated substantially more EBIT than was needed to make interest payments. This is evident when we examine the company's EBIT/interest expense ratio (called the *coverage ratio* or *times interest earned*), although the ratio has declined substantially over the past few years. In fact, the company's EBIT was 5.6 times larger than its interest expense last year, and that was the worst performance for the company. This is generally a very positive sign in the sense that the risk of bankruptcy appears to be low, unless the situ-

TABLE 5.6

Selected Ratios

Ratio	CY-3	*CY-3*	CY-2	*CY-2*	CY-1	*CY-1*
ROIC	17.1%	*14.1%*	13.4%	*13.9%*	10.4%	*12.2%*
$R_d(1-T)$	11.1%	*8.6%*	11.6%	*9.1%*	12.2%	*8.7%*
EBIT/interest	8.9	*7.43*	7.6	*8.0*	5.6	*6.8*
CA/CL	7.0	*7.38*	9.8	*10.2*	13.2	*13.9*
(*CA-INV*)/*CL*	3.2	*3.43*	3.8	*4.0*	5.1	*5.7*

Industry averages are in italics.

ation deteriorates a good bit more. Third, notice that the company's *current ratio* (defined as current assets/current liabilities) is well above 1, as is its *quick ratio* (defined as (current assets − inventory)/current liabilities ratio). Both of these ratios provide information about the company's ability to pay its obligations over the next year. If the current ratio is above 1, we know that if the company receives payment on all of its receivables and the company sells off its inventory at cost, it will have enough money to meet its debt obligations over the next year. Thus, the current ratio gives us an indication of the company's short-term financial condition. The quick ratio is similar, except that inventory is removed from the calculation. If the quick ratio is above 1, we know that if the company receives payment on all of its receivables, it will have enough money to meet its debt obligations over the next year, even if it is unable to sell off its inventory. So far, we have seen that the company seems to be having little trouble making its debt payments, but that is not sufficient evidence to conclude that debt is being managed well. What we really care about is not so much whether the company can make payments, but rather whether debt is helping the company. Notice that although the company's ROIC was above the after-tax interest rate on debt in CY-2, it dropped below it in CY-1. Recalling our discussion from earlier in the chapter, we conclude that during CY-1, the company's debt caused ROE to be lower than it would have been with less debt. If we believe that this situation is likely to persist, then we would reasonably conclude that the company currently has too much debt.

Putting It All Together Taken collectively, our analyses of the company's performance in controlling expenses, managing assets, and managing debt suggest the following. The company and others in the industry have come under pressure in recent years as the costs of goods and services used to create industry products have increased. It is likely that these companies are not in a position to raise the prices of their products to maintain profit margins. Perhaps there is a substitute good for their products (for example, heating oil is a substitute for natural gas, so neither industry can raise prices without losing some market share). In response to the increased pressure from higher costs, the company has loosened its credit standards to make its products accessible to more people. In spite of this effort, the company has apparently lost market share. One effect of the relaxation of credit terms is that the company's cash position has deteriorated over time—the company has spent money to generate inventory but has not received a significant portion of the payments from selling that inventory. A second effect is that the company's debt position has deteriorated over time, but not to the point that the company is in any immediate danger of bankruptcy. In fact, it is clear that unless the deterioration continues, the company will have no trouble making its debt payments. Despite this, the company's current debt position is undesirable because it is driving down the ROE rather than increasing it. Thus, company managers must decide whether to take action to reduce the debt or to wait in hopes that industry conditions will improve. The events of the last few years, of course, have likely driven down the company's stock price. Issuing equity in this situation (to raise money to retire debt) might drive the company's stock price further downward, which would be disconcerting to company managers who may be worried about their jobs. Given the deterioration in the cash position, there is no apparent source of funds to pay down the debt. We would therefore anticipate that company managers *might* opt to maintain the current debt position in hopes that conditions will improve. Without further details on the company, we cannot be certain.

Once we have completed our examination of the financial statements and have developed a tentative story that describes the state of the company, we would look to other sources to confirm, clarify, or dispel that story. Those sources include news releases by the company, the company's SEC filings, news stories about the company, reports concerning the industry, and so on. We would also focus on one other critical piece of information: what the market thinks of the company. The market price of the company's stock provides valuable information, because that price is determined by the collective trades of many investors who have presumably conducted their own analyses of the stock. If the stock appears to be priced quite low (we will later discuss how to determine whether a price is "low"), then we know that the market is not optimistic about the company's future. If, on the other hand, the stock appears to be priced high, then we know that the market views the current situation as temporary and that the company's problems will likely be resolved over time.

Special Ratios

Many ratios seem to come up repeatedly in analyses because they are especially symptomatic of the strengths and weaknesses of a company. During an analysis, it is tempting to simply list these ratios (along with their industry averages) and then attempt to evaluate the company by examining that list. The danger in doing this is that we often miss subtle points that are not evident in these special ratios. It seems far better to use a systematic approach (like the DuPont approach) that naturally guides us to the important points. Still, these special ratios are worthy of discussion, and we will examine them in the following pages. Note that these ratios (along with their industry averages) can be found on many finance-related internet sites.

Expense Management Ratios

Expense management ratios help us evaluate how well company managers have performed in controlling expenses. In addition to the ratios found on the common size statement, we often see two related ratios, the gross margin and the operating margin.

Gross Margin The *gross margin* (defined as (sales − COGS)/sales) is a measure of the profitability of the core business. Literally, it is the fraction of the company's sales that the company has available to pay expenses beyond those needed to actually create the goods being sold. A low gross margin is a sign that the company's product line may not be viable or that the company may not be effectively producing the goods. A high gross margin, on the other hand, is indicative of a generally good line of business or of generally effective production of goods.

Operating Margin In contrast to the gross margin, the *operating margin* (defined as operating income/sales) includes operating expenses other than those directly related to the production of the company's goods.

A low operating margin, in conjunction with a normal or high gross margin, is a sign that the company is spending too much money to market its goods, pay managers, etc. Although this situation is a sign of inefficiency, it could also be a possible source of growth for the company. If company managers are able to correct the spending problem, earnings might increase substantially in a short period of time. A related ratio is SG&A/sales, which appears in the common size income statement and directly measures the percentage of the company's sales that are spent on SG&A expenses.

Asset Management Ratios

Asset management ratios are ratios that allow us to investigate company performance in managing assets. Many of these ratios appear on the turnover balance sheet, which measures how well company managers are using assets to generate sales. Among them are the cash turnover, receivables turnover, inventory turnover, and fixed-asset turnover. In addition there are several variations of these that are perhaps a bit more intuitive and easier to interpret.

Days Sales in Cash Cash is beneficial in that it provides protection in the event that the company has unexpected, short-term cash needs. It is detrimental in that it earns little or no interest, so the larger the cash account is, the lower the shareholder returns tend to be. In contrast, a small amount of cash is associated with higher short-term risk yet higher returns to investors. To determine whether a company has too much or too little cash on hand, we can consider the extent of the short-term risk. To gauge this, we might examine such things as the volatility of sales, the volatility of the prices of inputs to the production process, etc. The higher the volatility of the company's cash flow items is, the greater is the need for cash. We can also gauge the extent of the risk by examining other current asset accounts as well as the current liability accounts. Companies with high levels of other current assets have a lower need for cash over the subsequent year, because those other assets can be used to generate cash quickly if needed. Companies with low levels of current liabilities have a lower need for cash over the subsequent year because the expected needs are lower.

It follows that a high cash turnover (defined as sales/cash) could be indicative of a well-run company, but it might alternatively be indicative of a company in trouble. (This sort of dichotomy is evident in many of our ratios.) A high cash turnover may indicate that the company is effective at keeping its cash account low. This in turn increases net income because money is not tied up in low- or no-interest accounts. In contrast, a high cash turnover may indicate that the company's sales have dropped off and the company has had to dip into its cash account to meet payroll and other needs. Determining which scenario is correct requires us to consider other financial ratios.

Similarly, a *low* cash turnover might be indicative of a well-run company or a poorly run company. If a company is doing well and is generating a lot of excess cash, the cash turnover will be low until the company makes use of that cash. A special case occurs when a company is preparing for a possible acquisition. Company managers may choose to stockpile a "war chest" of cash, which leads to a low cash turnover and a low total asset turnover. In contrast, company managers might be so worried about the future of the company that they have opted to cut dividends and other expenses in order to build up the cash account in hopes of weathering the coming storm. In that case, a low cash turnover is indicative of a company in trouble.

Another way to look at this concept involves computing the *days sales in cash* (DSC), or

$$DSC = \frac{Cash}{Sales/n}, \tag{5.8}$$

where n is the number of days in the period. Roughly speaking, this gives us the number of days the company can continue to operate if sales were to dry up completely. This ratio becomes especially important during recessionary periods, when the sales of some companies are hit hard.

Receivables Turnover in Days The receivables turnover (which appears on the turnover balance sheet) has no especially elegant interpretation, so we often rely on a related ratio that has a nice interpretation. The *receivables turnover in days* (RTD) is defined as

$$RTD = \frac{Receivables}{Sales/n}, \tag{5.9}$$

and essentially gives us the number of days worth of sales that are outstanding in the form of accounts receivable. As with the cash turnover, interpreting the receivables turnover can be difficult at times. What we do know is that if the RTD has increased over time, the company is likely to have loosened its credit terms. In many cases, this is a bad sign because the company may be using its credit policy strategically to prop up sales. As the credit terms are loosened, the company sells to clients that are less likely to pay for the goods. Although this increases sales in the short run, it may result in a writeoff of those receivables in the future. In general, the greater the RTD is, the greater is the expectation that the proceeds from some sales will never be received.

Inventory Turnover in Days Inventory turnover is often calculated as COGS/inventory instead of sales/inventory (which appears on the turnover balance sheet). Although the calculations are different, the interpretations are much the same. The higher the inventory turnover is, the more effective is the use of inventory in generating sales. A related calculation is the *inventory turnover in days* (ITD),

$$ITD = \frac{Inventory}{COGS/n}, \tag{5.10}$$

which essentially tells us how often our inventory turns over (i.e., is completely replaced on the shelves). A lower ITD is associated with greater efficiency in the management of inventory. A higher ITD is often indicative of a company that has been having trouble selling its products.

Debt Management Ratios

Debt management ratios allow us not only to evaluate the company's past performance in utilizing debt, but to assess how well the company is positioned to cover its obligations in the future. As we discussed earlier, the debt-to-equity ratio (and related ratios like the debt ratio and the equity ratio) tells us very little about how well the company is managing debt. To truly understand the company's debt position, we must rely on other ratios.

Current Ratio The *current ratio* (defined as current assets/current liabilities) is the ratio of assets that the company expects to liquidate in the next year to liabilities that the company expects to repay in the next year. Intuitively, a higher current ratio means that the company is in better shape to handle its short-term liabilities. Of course if the current ratio is too high, then the company forgoes the returns from more productive investment of its current assets. When interpreting the current ratio, we must keep in mind that the company has short-term obligations that are not included in current liabilities (payroll, for example) and short-term cash sources that are not included as current assets (the sale of inventory that has not yet been produced or acquired, for example).

If the current ratio is less than 1, then the company is not in a position to meet its short-term obligations unless it generates sufficient additional sales over the next year, sells off long-term assets, or raises additional money through some other means. For some industries (high-volume retailers, for example), current ratios much less than 1 are normal. The companies in those industries reasonably expect a stable cash flow from sales, so they do not need to maintain high levels of reserves to handle expected or unexpected short-term outflows. For companies with volatile, unpredictable sales, higher current ratios are optimal.

Quick Ratio One difficulty with the current ratio is that inventory is included in the numerator. The ratio therefore gives information about the ability of the company to meet its short-term obligations under the assumption that the inventory can be sold. To assess what might happen to the company if sales were to suddenly dry up entirely, we can consider a variation of the current ratio in which inventory is not included in the numerator. This variation is called the *quick ratio*.

The quick ratio (defined as (current assets − inventory)/current liabilities) measures the ability of the company to meet short-term obligations without selling off its inventory. The ratio is interpreted in much the same way that we interpret the current ratio. The lower the quick ratio is, the lower is the ability of the company to meet its short-term obligations. Companies with very high quick ratios may be overinvested in short-term assets, which earn little or no interest.

Interest Coverage (also known as "Times-Interest-Earned") The *interest coverage* ratio (defined as EBIT/interest expense) helps us assess how much money the company made beyond that which was necessary to make debt payments. As such, interest coverage is a measure of the company's safety net for making debt payments. A coverage ratio of 1 means that the company generated precisely the amount of money needed to satisfy its debtholders, with nothing left to pay the government or shareholders. In that case, the company's tax bill would be zero, because taxable income would be zero, and the company's earnings would be zero as well (barring unusual items). Coverage ratios less than 1 suggest that the company did not generate enough income to make its interest payments and therefore would have needed to use other funds to meet its obligations.

Investors often mistakenly believe that a high coverage ratio is always desirable. Indeed, a high coverage ratio is indicative of a company with a large margin of safety for shareholders. In creating such a margin, however, the company sacrifices potentially higher returns to shareholders because of the leverage and tax benefits of debt. Thus, we might conclude that a company with a high coverage ratio is actually not acting in the best interests of its shareholders.

Unused Assets

In the preceding discussion, we focused on how the financial statements can help us understand the company's success (or lack thereof) at controlling expenses, using its assets effectively, and managing its debt. In doing so, we ignored a subtle but potentially important issue: assets that are not currently in use. For example, a company may have stopped operations at a manufacturing facility but still owns the property and buildings. If so, the company holds fixed assets that are not generating sales. There are two main implications of such a scenario. First, the company's asset turnover and fixed-asset turnover will tend to be low. Second, the unused assets are a possible source of funds for the company. The company may be able to sell the assets to generate cash, thereby reducing its need to generate cash elsewhere. Unfortunately, as outsiders we will typically have very little information regarding the specific assets held by the company. An exception to this is cash.

Excess Cash

As we discussed earlier, all companies hold some amount of cash to handle expected and unexpected short-term needs. In some instances, however, a company may strategically choose to hold more cash than is needed in the short term. Company managers, for example, might plan to use the excess cash to acquire another company or repurchase shares. In any case, any excess cash held by the company is important for several reasons. First, it contributes directly to the value of the company. Second, it provides an opportunity for the company to use the cash strategically. Third, it gives outsiders hints about the future plans of the company. If a company is holding a substantial amount of excess cash, then we might reasonably infer that the company intends to acquire another company, increase dividends, repurchase shares, or take any of a number of other actions. It will therefore be useful to identify some method that we can use to estimate the excess cash held by a given company.

Estimating Excess Cash Essentially, our task is to differentiate between cash that is needed for operations ("needed cash") and cash that is not needed ("excess cash"). Needed cash requires special treatment because the company cannot use it for purposes such as paying down debt, paying higher dividends, buying back shares of stock, and acquiring other companies. Instead, it holds the cash in reserve to handle any unexpected cash flow needs. To estimate a company's level of excess cash, we must first ask what level of cash is normal. We are tempted to simply look at the historical level of cash held by the company, but this could be misleading if the company has held an unusual amount of cash recently. For example, the company may have been increasing its cash account gradually over time to prepare for future acquisitions. We are therefore better off if we look at historical cash levels throughout the industry. In doing so, we seek to identify a needed cash/sales ratio that we can then apply to find the level of excess cash held by a company. Unfortunately, companies do not report "needed cash" and "excess cash" on the balance sheet. We are left to subjectively infer the level of excess cash by examining the historical data. The following example depicts one way that we might estimate excess cash.

Example 5.2: Table 5.7 shows historical levels of cash and sales for seven hypothetical companies in an industry. Also shown is the cash/sales ratio for each company. Suppose that we wish to estimate the level of excess cash for a peer company that currently has sales of $531 million and cash of $38.43 million, for a cash/sales ratio of 7.24%. Historically, companies in the industry have had cash/sales ratios ranging from 0.30% to 14.00%, which is a large but realistic range. The industry averages have ranged from 2.52% to 4.75%, with no apparent trends over the five years of data. We are tempted to simply take the average of the annual industry averages (3.57%) and use that to estimate how much cash a company with no excess cash would have. This does not make sense, however, because some (or perhaps all) of the companies may be holding excess cash. We therefore are forced to remove companies that we believe have excess cash. This naturally introduces some subjectivity into the process, but that

TABLE 5.7

Cash and Sales, Example 5.7

Company	Ticker	CY-3	CY-2	CY-1
A	Sales	$690	$744	$827
	Cash	$12.07	$22.75	$15.67
	Cash/sales	1.75%	3.06%	1.90%
B	Sales	$2,160	$2,474	$2,887
	Cash	$12.34	$13.31	$10.09
	Cash/sales	0.57%	0.54%	0.35%
C	Sales	$4,021	$4,367	$4,655
	Cash	$61.81	$162.78	$48.63
	Cash/sales	1.54%	3.73%	1.04%
D	Sales	$576	$592	$615
	Cash	$29.03	$82.92	$65.37
	Cash/sales	5.04%	14.00%	10.63%
E	Sales	$1,906	$2,127	$2,362
	Cash	$131.60	$136.24	$208.15
	Cash/sales	6.90%	6.40%	8.81%
F	Sales	$4,021	$4,367	$4,655
	Cash	$61.814	$162.779	$48.630
	Cash/sales	1.54%	3.73%	1.04%
G	Sales	$706	$746	$775
	Cash	$2.10	$13.32	$2.65
	Cash/sales	0.30%	1.78%	0.34%
Average	Cash/sales	2.52%	4.75%	3.45%
Average without D&E	Cash/sales	1.14%	2.57%	0.94%

cannot be avoided. In this case, it seems clear that companies D and E are likely to be holding excess cash. If we remove them from the sample, we see that the industry averages over the past 3 years were 1.14%, 2.57%, and 0.94%. The average of these is 1.55%, which represents one estimate of how much cash a company in the restaurant industry should hold as a percentage of sales. We can then estimate the level of needed cash for our company to be $531 × 1.55% = $8.21 million. Therefore, we estimate that our company is holding excess cash in the amount of $30.22 million.

We will return to the idea of excess cash later when we consider forecasting (Chapter 7) and the DCF Model (Chapter 10).

IN PRACTICE . . .

Once we have collected and manipulated the financial statements of the company and its peers in order to make them comparable, the financial statement analysis process is relatively simple. Still, we face real difficulties if any of the financial statements contain misleading elements. In the recent past, much attention has been paid to companies (e.g., Enron, WorldCom) with managers who have misled investors by illegally issuing dishonest financial statements. In addition, there are less extreme cases in which company managers have legally manipulated financial statements in efforts to report higher earnings. Finally, there are cases in which financial statements are naturally misleading. Regardless of the reason, it is wise for us to evaluate the trustworthiness of the financial statements issued by a company. Our desire in doing so is to identify items that are misleading and that might cause us to draw incorrect conclusions about the state of the company.

Identifying Misleading Items

Unfortunately, there is no magic formula we can use to determine whether financial statements have been manipulated or are naturally misleading. There are, however, clues that may be of use to us. We have no comprehensive list of things to look for, but we do know some common symptoms of misleading financial statements.

The market has long been fixated on earnings, and company managers are well aware of this fact. It is therefore natural to begin our discussion with the components of earnings: sales, costs, depreciation and amortization, and taxes.

Sales

An easy way for the company to inflate sales is to relax credit terms. That is, the company can sell goods and services on credit to customers who are not all that creditworthy. Evidence of this can be found by an examination of receivables in relation to sales. If a company has relaxed its credit terms, we would typically see that receivables have grown at a faster rate than sales. This was evident in our example earlier in the chapter, in which our hypothetical company apparently relaxed its credit standards in response to industry-wide problems.

The company can also inflate "same-store sales," which are sales at companies that were included in the prior period's sales. Investors often focus on same-store sales as a better indicator of success than sales. To understand why, consider two companies that both have seen sales grow at 12% over the last year. One company has precisely the same set of stores this year as last year. The other has seen sales at each store drop substantially, but has added new stores. The sales at those new stores have been poor but have more than made up for the decrease in same-store sales. These two pictures are very different. Our first company appears to be doing very well, while the second appears to be struggling. If we examine same-store sales, we would find that the first company's grew at 12% while the second company's dropped substantially.

To make same-store sales appear to grow more quickly, the company can simply shut down or franchise poorly performing stores. Either way, the stores are removed from the same-store calculation, leaving only the higher growth stores. We can typically uncover this activity by looking at how the number of company-owned stores and franchises have changed over time. A drop in company-owned stores and/or a shift from company-owned stores to franchises suggests that same-store sales may be misleading.

Costs

There are many ways that a company might cut costs in order to inflate earnings. One way is to simply reduce and/or delay research and development (R&D) expenditures. In theory, there will be no immediate effect on sales (since R&D is done in hopes of increasing future sales), so the lower R&D expense would result in higher earnings.

Another way involves shifting costs by writing off inventory in one period and selling it in a later period. To write off the inventory now, the company only needs to argue that the product is obsolete. When the inventory is later sold, there is no cost to report, since the inventory was already written off. This allows the company to report lower earnings during one period in exchange for higher earnings in a later period. Inventory writeoffs in one period followed by strong earnings in a later period are a sign that those strong earnings might be misleading.

Yet another way that companies have cut costs is by offering more employee stock options (ESOs) as compensation in lieu of higher salaries. Employee compensation typically consists of a base salary and (in some cases) options to buy the company's stock. Historically, the company had to report the base salary as a cost but did not have to report the options until the employee actually exercised the options and bought the stock. This effectively meant that the company was able to shift costs from one period to a later period (sometimes years into the future). To do so, the company simply offered lower base salaries with more options. We can often identify these situations by looking at the size of the company's ESO plan in comparison with the company's competitors. An especially large plan is a sign that the company's reported costs are artificially low. Fortunately, in December of 2004 the Financial Accounting Standards Board (FASB) implemented SFAS No. 123R, which was designed to eliminate the loophole that allowed companies to give ESOs as compensation without reporting them on the income statement or balance sheet. For public companies that do not file as small businesses, SFAS 123R is in effect for reporting periods that begin after June 15, 2005. For public companies that file as small businesses, the standard is in effect for reporting periods that begin after December 15, 2005. So how does this affect us as analysts of the financial statements? First, the new standard makes earnings more comparable across companies, thereby eliminating the bias associated with companies that provide a large number of ESOs as compensation. Second, our task is more difficult if we wish to compare earning from the post-123 period with the pre-123 period. If we wish to make such a comparison, we must restate either the pre-123 financial statements or the post-123 financial statements so that they can be compared.

We will return to ESOs in Chapter 8 as we seek to understand their impact on stock value and how we might adjust our stock valuation procedures to account for them.

Case Analysis: O'Charley's

At this point, it is useful to apply our knowledge of financial statement analysis to our case study of O'Charley's. Our purpose here is not to conduct an exhaustive analysis of the financial statements of these companies. Rather, it is simply to demonstrate the techniques we discussed earlier in the chapter. As such, our analysis will be a bit superficial. In particular, all of our restaurant companies have both company-owned restaurants and franchises and have an international presence. In a complete analysis, we would want to break down those areas and examine them in light of the companies plans for the future. We will not do that here, so that we can focus on the basic techniques used to analyze financial statements.

Generally speaking, financial statement analysis will tell us a great deal about a company, but at the same time will generate additional questions that we must answer by using other sources. That will certainly be the case with O'Charley's. We begin by examining the common size statements shown in Table 5.8, the indexed statements shown in Table 5.9, and the miscellaneous information shown in Table 5.10.

Return on Equity

From Table 5.10, we see that the ROE for O'Charley's has been well below the industry average. This suggests that there might be a fundamental problem with O'Charley's business model or management's execution of that business model. Although O'Charley's has consistently generated positive profits, the company has trailed its peers in generating profits for its shareholders. To begin to understand why this has happened, we examine the three DuPont factors. We see that for each of the past 3 years, O'Charley's profit margin and asset turnover have been below industry average, whereas its leverage multiplier has been above industry average. This is a generally troublesome set of facts because the high leverage multiplier (which by itself implies a high ROE) has been mitigating the effects of the low profit margin and asset turnover. Without that high multiplier, the ROE would be even lower.

Expense Control and Asset Management

Recall from our discussion earlier in this chapter that a low profit margin coupled with a low asset turnover is typically indicative of low sales. This is our initial hypothesis for O'Charley's. In thinking about the restaurant industry, it seems reasonable to conclude that if sales are low, labor costs will be high relative to sales (since employees must manage the restaurant even if there are only a few customers there). F&B costs, on the other hand, would tend to vary directly with sales and would therefore not tend to be high relative to sales. We observe both of these characteristics in O'Charley's (see Table 5.8), which provides support for our hypothesis that the company is suffering from low sales.

We also observe a drop in the ROE from CY-2 to CY-1, which can be attributed to a drop in the profit margin. Investigation of the expense structure shows that the drop was due to an increase in F&B costs. Given that the industry has not seen such an increase, we might hypothesize that O'Charley's modified its business plan by adding more expensive items to the menu. There are, of course, other possible explanations.

TABLE 5.8

Common Size Financial Statements, O'Charley's

Income statement	CY-3	*CY-3*	CY-2	*CY-2*	CY-1	*CY-1*
Total sales	100.00%	*100.00%*	100.00%	*100.00%*	100.00%	*100.00%*
Food and beverage costs	29.11%	*29.42%*	28.37%	*28.78%*	30.30%	*29.00%*
Labor costs	31.00%	*29.69%*	32.52%	*29.82%*	33.43%	*29.81%*
Other costs of sales	17.39%	*17.98%*	18.81%	*18.16%*	18.83%	*18.59%*
Total cost of sales	77.50%	*77.37%*	79.70%	*77.31%*	82.57%	*77.78%*
SG&A expenses	7.29%	*7.00%*	7.37%	*7.19%*	7.05%	*7.20%*
Interest expense	1.16%	*0.63%*	1.70%	*0.80%*	1.64%	*0.70%*
Other income (expenses)	−6.06%	*−4.52%*	−5.76%	*−3.81%*	−5.33%	*−4.56%*
Taxable income	7.99%	*10.58%*	5.48%	*10.51%*	3.41%	*9.86%*
Taxes	2.78%	*3.60%*	1.84%	*3.52%*	1.07%	*3.32%*
Net income	3.96%	*6.10%*	3.64%	*6.33%*	2.34%	*5.99%*
Balance sheet						
Cash	0.28%	*2.90%*	0.49%	*1.92%*	0.76%	*1.53%*
Receivables	1.12%	*2.01%*	1.14%	*1.88%*	1.51%	*1.96%*
Inventory	4.75%	*3.75%*	3.20%	*4.04%*	4.84%	*4.50%*
Total current assets	8.52%	*11.43%*	7.05%	*10.61%*	8.72%	*10.58%*
Net property, plant, and equipment	90.06%	*77.37%*	72.08%	*74.47%*	69.32%	*73.65%*
Goodwill	0.00%	*5.66%*	14.47%	*7.80%*	14.50%	*7.76%*
Total assets	100.00%	*100.00%*	100.00%	*100.00%*	100.00%	*100.00%*
Accounts payable	3.30%	*4.73%*	3.28%	*4.55%*	3.28%	*4.44%*
Other short-term liabilities	0.00%	*7.83%*	0.00%	*9.38%*	0.00%	*10.62%*
Total current liabilities	13.03%	*17.64%*	10.89%	*16.66%*	13.74%	*18.05%*
Long-term debt	24.92%	*15.67%*	34.59%	*17.41%*	23.78%	*15.50%*
Total long-term debt	20.34%	*19.31%*	31.90%	*22.07%*	21.79%	*22.15%*
Total debt	33.36%	*36.94%*	42.79%	*38.73%*	35.52%	*40.20%*
Stockholders' equity	53.61%	*59.86%*	46.33%	*58.41%*	50.74%	*56.46%*
Statement of cash flows (selected items)						
Depreciation and amortization	5.96%	*5.90%*	5.22%	*6.45%*	6.08%	*6.34%*
Net cash provided by operating activities	15.17%	*20.20%*	10.37%	*18.76%*	10.86%	*19.32%*
Capital expenditures	−18.81%	*−15.26%*	−27.67%	*−20.21%*	−9.91%	*−13.17%*
Net cash provided by investment activities	−17.92%	*−15.17%*	−27.32%	*−20.10%*	−8.63%	*−14.02%*

Industry averages are in italics.

TABLE 5.9

Indexed Financial Statements, O'Charley's

Income statement	CY-3	*CY-3*	CY-2	*CY-2*	CY-1	*CY-1*
Total sales	100.00%	*100.00%*	142.57%	*119.08%*	174.93%	*137.12%*
Food and beverage costs	100.00%	*100.00%*	138.94%	*116.49%*	182.06%	*135.85%*
Labor costs	100.00%	*100.00%*	149.56%	*119.96%*	188.66%	*138.57%*
Other costs of sales	100.00%	*100.00%*	154.22%	*120.97%*	189.49%	*142.44%*
Total cost of sales	100.00%	*100.00%*	146.62%	*119.13%*	186.37%	*138.43%*
SG&A expenses	100.00%	*100.00%*	144.14%	*122.74%*	169.03%	*142.53%*
Interest expense	100.00%	*100.00%*	207.75%	*141.95%*	246.63%	*138.60%*
Other income (expenses)	100.00%	*100.00%*	135.55%	*85.42%*	154.09%	*158.02%*
Taxable income	100.00%	*100.00%*	97.74%	*113.83%*	74.72%	*117.34%*
Taxes	100.00%	*100.00%*	94.39%	*110.44%*	67.57%	*115.29%*
Net income	100.00%	*100.00%*	131.15%	*117.81%*	103.48%	*122.38%*
Balance sheet						
Cash	100.00%	*100.00%*	268.84%	*161.19%*	415.07%	*171.90%*
Receivables	100.00%	*100.00%*	158.45%	*111.50%*	207.95%	*128.76%*
Inventory	100.00%	*100.00%*	104.94%	*149.58%*	157.79%	*213.80%*
Total current assets	100.00%	*100.00%*	128.85%	*111.67%*	158.56%	*124.65%*
Net property, plant, and equipment	100.00%	*100.00%*	124.61%	*116.04%*	119.19%	*125.91%*
Goodwill	0.00%	*100.00%*	0.00%	*116.99%*	0.00%	*154.04%*
Total assets	100.00%	*100.00%*	155.70%	*121.18%*	154.85%	*132.54%*
Accounts payable	100.00%	*100.00%*	154.85%	*117.25%*	153.90%	*127.10%*
Other short-term liabilities	0.00%	*100.00%*	0.00%	*133.91%*	0.00%	*169.00%*
Total current liabilities	100.00%	*100.00%*	130.13%	*113.89%*	163.28%	*137.32%*
Long-term debt	100.00%	*100.00%*	216.15%	*148.19%*	147.75%	*241.01%*
Total long-term debt	100.00%	*100.00%*	244.20%	*142.17%*	165.87%	*180.50%*
Total debt	100.00%	*100.00%*	199.67%	*133.09%*	164.86%	*153.59%*
Stockholders' equity	100.00%	*100.00%*	134.55%	*118.15%*	146.57%	*126.83%*
Statement of cash flows (selected items)						
Depreciation and amortization	100.00%	*100.00%*	136.25%	*130.19%*	158.09%	*142.74%*
Net cash provided by operating activities	100.00%	*100.00%*	106.41%	*110.21%*	110.85%	*124.10%*
Capital expenditures	100.00%	*100.00%*	229.04%	*164.46%*	81.57%	*118.13%*
Net cash provided by investment activities	100.00%	*100.00%*	237.34%	*164.28%*	74.59%	*126.68%*

Industry averages are in italics.

TABLE 5.10

Miscellaneous Information, O'Charley's

Dupont	**CY-3**	***CY-3***	**CY-2**	***CY-2***	**CY-1**	***CY-1***
Return on equity*	6.34%	*10.82%*	6.92%	*11.10%*	5.08%	*10.72%*
Profit margin	3.96%	*6.10%*	3.64%	*6.33%*	2.34%	*5.99%*
Asset turnover	1.18	*1.48*	1.08	*1.47*	1.33	*1.53*
Leverage multiplier*	1.36	*1.25*	1.77	*1.33*	1.63	*1.32*
Other						
Free cash flow/sales	−2.34%	*3.1%*	−15.74%	*−1.4%*	1.68%	*3.4%*
Free cash flow/total assets	−2.75%	*5.75%*	−16.95%	*6.04%*	2.23%	*6.04%*
Market capitalization	381	*1,800*	360	*2,080*	359	*2,252*
ROIC*	4.76%	*5.63%*	3.27%	*5.09%*	1.89%	*4.61%*
After-tax interest rate on debt	3.98%	*5.55%*	4.79%	*5.08%*	5.10%	*3.85%*

Industry averages are in italics. Items marked with an asterisk were computed with the use of the market value of equity.

When we look at the indexed financial statements for O'Charley's (see Table 5.9), we see, perhaps surprisingly so, that O'Charley's sales have grown by over 70% over the past 2 years, whereas industry sales have grown by only 37%. This may seem to contradict the idea that sales have been low relative to the industry, but the two stories are in fact consistent. Although it appears that O'Charley's is attracting fewer customers *per restaurant* than its peers are, this does not at all prevent the company from expanding by building new restaurants. The business model does appear to be a profitable one, so it should not be surprising to find evidence that O'Charley's has been expanding by opening new restaurants.

Debt Management

The above-average leverage multiplier for O'Charley's (each of the last 3 years) tends to elevate the company's ROE, which is good for shareholders as long as the company is stable enough and profitable enough to handle the higher debt. Looking at the common size statements for O'Charley's (Table 5.8), we see that the company's interest expense has been roughly double the industry average. In addition, interest expense was well over half of net income during CY-1, which represents a deterioration over time. We tentatively conclude that either O'Charley's has taken on too much debt given its financial condition, or the O'Charley's management team is simply more aggressive than the managers of the peer companies. To distinguish between these possibilities, we can examine the relative levels of the company's ROIC and its after-tax interest rate on debt. In Table 5.10, we see that the company's ROIC has decreased over time and has been well below the industry average. In contrast, the company's after-tax interest rate on debt has increased over time and is now above the industry average. Most importantly, the after-tax interest rate on debt is now well above the ROIC, which tells us that the presence of debt has been *reducing* the company's ROE rather than increasing it. This does not necessarily mean that the company's debt has been mismanaged. It may be the case, for example, that company managers expect the low ROIC to be temporary and they therefore wish to maintain the current level of debt, believing that it will be optimal going forward. If the low ROIC is expected to continue, then it is clear that the company has too much debt and should consider ways to reduce it. Of course, reducing the debt would require the company to raise money from some other source. The most likely scenario involves the issuance of equity, which is not an attractive option, given that (as we will see later in Chapter 9) the company's stock price is low relative to its peers. This leaves the company in a less than desirable situation.

Putting It All Together

Our quick examination of the company's financial statements revealed that the company is suffering from low sales relative to its peers. In particular, it appears that the company is attracting fewer customers to a given restaurant than its peers are. Because the company must still pay employees to manage those stores, the company's labor costs are now a higher percentage of sales, which has driven down the company's ROE and ROIC. A result of this is that the company is now in the position of having debt that is harming the return to shareholders rather than helping it. This is consistent with Table 5.10, which shows that the company is generating free cash flow at a pace well below that of its peers (and in fact generated negative free cash flow for the first 2 years in the table).

Case Study: Applebee's

More than any other technique discussed in this book, financial statement analysis is very much a subjective process. As such, it is useful to walk through an analysis of another company so that we can see what an apparently well-run company looks like. Let us consider Applebee's, which in many respects represents the level of success that O'Charley's would like to achieve. The common size financial statements for Applebee's are shown in Table 5.11. The indexed financial statements are shown in Table 5.12. Miscellaneous information is shown in Table 5.13.

Return on Equity

We first note from Table 5.13 that Applebee's generated ROEs over 16% for each of the last 3 years, whereas the industry average was around 11%. This is a substantial difference, suggesting that from an overall perspective, Applebee's has performed extremely well over the 3-year period. In looking at the DuPont factors, we immediately see the source of the high ROE. Applebee's profit margin exceeded the industry average by 3–4% for each of the last 3 years. The asset turnover was roughly average and the leverage multiplier was a bit below average, suggesting that the source of the high ROE is likely due solely to lower-than-average expenses.

Expense Control

From our discussion earlier in this chapter, we know that the profit margin is a measure of the ability of company managers to control expenses. We know, however, that high sales might create the misleading impression that a company excels at controlling expenses. If the company generates high sales, then its fixed costs will be a low percentage of sales, thereby triggering a high profit margin. In such scenarios, we typically find that the company's asset turnover is high and that most or all of the company's expense-to-sales ratios are low. For Applebee's, neither of these is true, so we tentatively conclude that the high profit margin (and hence the high ROE) is indeed due to lower costs. From the common size statements in Table 5.11, we see that the Applebee's Food and Beverage (F&B) costs have consistently been well below the industry average. Interestingly, we also see that Applebee's SG&A expenses have consistently been above the industry average, but they were not so high that they offset the lower F&B costs. So what does this really mean? Applebee's might achieve lower F&B costs through special relationships with suppliers or by simply buying cheaper goods than other food companies buy. Any number of possibilities might explain the high SG&A expenses we observe, including more advertising or higher salaries for executives.

TABLE 5.11

Common Size Financial Statements, Applebee's

Income statement	CY-3	*CY-3*	CY-2	*CY-2*	CY-1	*CY-1*
Total sales	100.00%	*100.00%*	100.00%	*100.00%*	100.00%	*100.00%*
Food and beverage costs	23.32%	*29.42%*	22.94%	*28.78%*	23.10%	*29.00%*
Labor costs	28.72%	*29.69%*	28.78%	*29.82%*	28.55%	*29.81%*
Other costs of sales	20.81%	*17.98%*	19.23%	*18.16%*	20.08%	*18.59%*
Total cost of sales	74.27%	*77.37%*	73.71%	*77.31%*	73.66%	*77.78%*
SG&A expenses	9.65%	*7.00%*	9.56%	*7.19%*	9.46%	*7.20%*
Interest expense	0.35%	*0.63%*	0.20%	*0.80%*	0.14%	*0.70%*
Other income (expenses)	−1.05%	*−4.52%*	0.11%	*−3.81%*	−1.79%	*−4.56%*
Taxable income	15.16%	*10.58%*	14.79%	*10.51%*	15.48%	*9.86%*
Taxes	5.54%	*3.60%*	5.30%	*3.52%*	5.45%	*3.32%*
Net income	9.46%	*6.10%*	9.49%	*6.33%*	10.03%	*5.99%*
Balance sheet						
Cash	1.48%	*2.90%*	0.56%	*1.92%*	0.06%	*1.53%*
Receivables	4.95%	*2.01%*	5.30%	*1.88%*	5.19%	*1.96%*
Inventory	1.39%	*3.75%*	2.35%	*4.04%*	4.75%	*4.50%*
Total current assets	10.63%	*11.43%*	10.19%	*10.61%*	13.07%	*10.58%*
Net property, plant, and equipment	69.52%	*77.37%*	67.54%	*74.47%*	64.01%	*73.65%*
Goodwill	15.45%	*5.66%*	17.56%	*7.80%*	16.29%	*7.76%*
Total assets	100.00%	*100.00%*	100.00%	*100.00%*	100.00%	*100.00%*
Accounts payable	5.52%	*4.73%*	5.79%	*4.55%*	5.16%	*4.44%*
Other short-term liabilities	13.70%	*7.83%*	16.14%	*9.38%*	14.81%	*10.62%*
Total current liabilities	19.22%	*17.64%*	21.92%	*16.66%*	19.97%	*18.05%*
Long-term debt	6.92%	*15.67%*	3.95%	*17.41%*	6.10%	*15.50%*
Total long-term debt	7.55%	*19.31%*	5.65%	*22.07%*	12.18%	*22.15%*
Total debt	26.77%	*36.94%*	27.57%	*38.73%*	32.15%	*40.20%*
Stockholders' equity	73.23%	*59.86%*	72.43%	*58.41%*	67.85%	*56.46%*
Statement of cash flows (selected items)						
Depreciation and amortization	6.69%	*5.90%*	6.57%	*6.45%*	6.20%	*6.34%*
Net cash provided by operating activities	22.20%	*20.20%*	28.02%	*18.76%*	24.16%	*19.32%*
Capital expenditures	−12.10%	*−15.26%*	−20.99%	*−20.21%*	−15.36%	*−13.17%*
Net cash provided by investment activities	−12.01%	*−15.17%*	−20.90%	*−20.10%*	−17.46%	*−14.02%*

Industry averages are in italics.

TABLE 5.12

Indexed Financial Statements, Applebee's

Income statement	CY-3	*CY-3*	CY-2	*CY-2*	CY-1	*CY-1*
Total sales	100.00%	*100.00%*	119.30%	*119.08%*	135.92%	*137.12%*
Food and beverage costs	100.00%	*100.00%*	117.38%	*116.49%*	134.66%	*135.85%*
Labor costs	100.00%	*100.00%*	119.54%	*119.96%*	135.12%	*138.57%*
Other costs of sales	100.00%	*100.00%*	110.25%	*120.97%*	131.18%	*142.44%*
Total cost of sales	100.00%	*100.00%*	118.40%	*119.13%*	134.81%	*138.43%*
SG&A expenses	100.00%	*100.00%*	118.17%	*122.74%*	133.23%	*142.53%*
Interest expense	100.00%	*100.00%*	68.45%	*141.95%*	53.17%	*138.60%*
Other income (expenses)	100.00%	*100.00%*	−12.77%	*85.42%*	230.99%	*158.02%*
Taxable income	100.00%	*100.00%*	116.40%	*113.83%*	138.83%	*117.34%*
Taxes	100.00%	*100.00%*	114.11%	*110.44%*	133.74%	*115.29%*
Net income	100.00%	*100.00%*	119.67%	*117.81%*	144.11%	*122.38%*
Balance sheet						
Cash	100.00%	*100.00%*	44.66%	*161.19%*	5.86%	*171.90%*
Receivables	100.00%	*100.00%*	126.07%	*111.50%*	147.10%	*128.76%*
Inventory	100.00%	*100.00%*	199.63%	*149.58%*	480.20%	*213.80%*
Total current assets	100.00%	*100.00%*	112.97%	*111.67%*	172.61%	*124.65%*
Net property, plant, and equipment	100.00%	*100.00%*	114.53%	*116.04%*	129.21%	*125.91%*
Goodwill	100.00%	*100.00%*	133.98%	*116.99%*	147.99%	*154.04%*
Total assets	100.00%	*100.00%*	117.88%	*121.18%*	140.33%	*132.54%*
Accounts payable	100.00%	*100.00%*	123.46%	*117.25%*	131.18%	*127.10%*
Other short-term liabilities	100.00%	*100.00%*	138.90%	*133.91%*	151.75%	*169.00%*
Total current liabilities	100.00%	*100.00%*	134.46%	*113.89%*	145.84%	*137.32%*
Long-term debt	100.00%	*100.00%*	67.38%	*148.19%*	123.69%	*241.01%*
Total long-term debt	100.00%	*100.00%*	88.29%	*142.17%*	226.45%	*180.50%*
Total debt	100.00%	*100.00%*	121.44%	*133.09%*	168.57%	*153.59%*
Stockholders' equity	100.00%	*100.00%*	116.58%	*118.15%*	130.01%	*126.83%*
Statement of cash flows (selected items)						
Depreciation and amortization	100.00%	*100.00%*	115.69%	*130.19%*	130.05%	*142.74%*
Net cash provided by operating activities	100.00%	*100.00%*	148.75%	*110.21%*	152.70%	*124.10%*
Capital expenditures	100.00%	*100.00%*	204.42%	*164.46%*	178.14%	*118.13%*
Net cash provided by investment activities	100.00%	*100.00%*	205.11%	*164.28%*	203.98%	*126.68%*

Industry averages are in italics.

TABLE 5.13

Miscellaneous Information, Applebee's

Dupont	CY-3	*CY-3*	CY-2	*CY-2*	CY-1	*CY-1*
Return on equity*	16.53%	*10.82%*	16.43%	*11.10%*	17.07%	*10.72%*
Profit margin	9.46%	*6.10%*	9.49%	*6.33%*	10.03%	*5.99%*
Asset turnover	1.57	*1.48*	1.59	*1.47*	1.52	*1.53*
Leverage multiplier*	1.11	*1.25*	1.09	*1.33*	1.12	*1.32*
Other						
Free cash flow/sales	6.47%	*3.1%*	4.46%	*−1.4%*	4.39%	*3.4%*
Free cash flow/total assets	10.19%	*5.75%*	7.11%	*6.04%*	6.69%	*6.04%*
Market capitalization	1,240	*1,800*	1,898	*2,080*	1,969	*2,252*
ROIC*	6.08%	*5.63%*	5.59%	*5.09%*	5.50%	*4.61%*
After-tax interest rate on debt	3.14%	*5.55%*	4.22%	*5.08%*	2.90%	*3.85%*

Industry averages are in italics. Items marked with an asterisk were computed with the use of the market value of equity.

Asset Management

The asset turnover for Applebee's has been consistently close to the industry average over the 3-year period. This is not sufficient, however, to conclude that Applebee's is doing an adequate job of managing its assets. It might be the case, for example, that a company has a high level of cash but a low inventory. These could offset each other in the asset turnover calculation, giving us a misleading impression. Looking at the common size statements for Applebee's, we see that the company currently has substantially less cash than its peers but more receivables. Furthermore, the indexed financial statements in Table 5.12 show that the cash account is less than 6% of what it was 2 years before. We also see that the receivables growth (47.1% over 2 years) has outpaced the sales growth (36.1% over 2 years), suggesting that at least some portion of the sales growth is on somewhat shaky ground. In addition, we see that the company's net PPE has grown at about the same rate as sales, so the company has generated sales through capital expenditures and not simply from increased traffic at existing restaurants.

Debt Management

The leverage multiplier for Applebee's is below the industry average and has been for the past 3 years. We are tempted to say that Applebee's has too little debt, but remember that the optimal debt level for a company does not depend on how much debt it has, but rather depends on its ability to repay that debt. In this case, we see that Applebee's interest expense has been well below the industry average for the past 3 years. Furthermore, its profits have been well above the industry average. Moreover, the interest expense for Applebee's is 53.2% of what it was 3 years ago, while the industry average interest expense has grown by 38.6% over that period (see Table 5.12). Most importantly, we see in Table 5.13 that the company's ROIC is well above the after-tax interest rate on debt. This all suggests that Applebee's could easily afford to take on more debt and that doing so would likely increase the company's ROE. This leads us to ask why Applebee's does not have more debt. One possible explanation for this is that company managers are simply conservative in nature and are willing to sacrifice higher returns for additional risk. Another possible explanation is that the company's low level of cash and high levels of receivables are indications that the company cannot afford more debt, even though the profitability suggests otherwise.

Putting It All Together

To sum up our findings on Applebee's, we learned that the company has achieved a high profit margin over the last few years by keeping its F&B costs down. We also learned that although the company has used capital expenditures to achieve sales growth in line with the industry average, a portion of that growth can be attributed to higher growth in receivables, so we do not (all else equal) expect the company's cash flows to grow at the same rate as sales. This is entirely consistent with our observation that the company's cash account has decreased to a very low level. The company's debt position is strong in that it does not appear that the company is having any trouble making the required payments. Furthermore, the company is generating a high enough ROIC so that the presence of debt increases the company's ROE, thereby presumably increasing the wealth of shareholders. Finally, we see in Table 5.13 that the company has consistently generated strong free cash flows.

SUMMARY

In this chapter we considered how we might go about analyzing the financial statements of companies. We discovered that the tasks of company managers can be organized into three categories, expense control, asset management, and debt management. Those categories correspond to three important financial ratios, the profit margin, the asset turnover, and the leverage multiplier (or, equivalently, the debt ratio). We also explored how we can determine whether the company's debt is helping or hurting shareholders, which is a critical part of any analysis. Finally, we closed the chapter by briefly conducting case studies of O'Charley's and Applebee's. In doing so, we identified specific weaknesses in O'Charley's and found that Applebee's has performed quite well in recent years.

This page intentionally left blank

CHAPTER 6

Capital Structure and the Cost of Capital

PURPOSE AND SCOPE

Perhaps the most difficult concept we must address is the relationship between risk and return. This relationship is critical to company managers because it determines how great a return they must generate in order to satisfy the company's investors. It is critical to us for the same reason. At the core of stock valuation is the notion that we must calculate the present value of expected cash flows. We therefore have two main tasks: 1) estimate the future cash flows and 2) estimate the appropriate discount rate for use in discounting those cash flows. The appropriate discount rate is simply the lowest return that will satisfy the company's investors. In other words, it is the return that exactly compensates investors for the risk associated with the investment. Another way to look at the appropriate discount rate is that it is the expected return on alternative investments of equivalent risk. If the investment under consideration has an expected return below the expected return on some other investment with the same risk, we would of course prefer the alternative. It follows that we must understand how to measure risk before we can determine the appropriate discount rate.

To understand the relationship between risk and return, we must first note the obvious—higher risk must be associated with higher expected returns. If that were not the case, then rational risk-averse investors would avoid the high-risk investments with low expected returns, leading to a disequilibrium in the marketplace. For example, startup tech stocks clearly tend to be riskier than well-established conglomerates. Hence, investors would not rationally purchase tech stocks unless they expected to receive a higher return. Our desire (and the purpose of this chapter) is to incorporate this idea into valuation models by discovering how to measure risk and how to convert that measure of risk into a corresponding required return.

We begin the chapter by discussing the sources of capital available to the company. This topic is of great importance to the company for several reasons, most notably because a company cannot grow unless it has money to finance that growth. It is easy to mistakenly believe that companies with fast-growing sales have no need for cash. After all, fast growth in sales corresponds to fast growth in cash receipts. This is generally true, but we must understand that in order to generate those receipts, the company must *first* spend money to build facilities, hire workers, buy raw materials, produce inventory, and so on. So the company will spend money in preparation for higher sales and receive money from those sales at some later date. For some companies and some products, the turnaround time is short. For others, it can be quite lengthy. Whatever the case, we know that companies need money in order to make money. In discussing the sources of capital, we present the Pecking Order Hypothesis, which is a broad but generally realistic representation of how company managers determine what type of financing to use. We then discuss the company's choices in more detail, focusing in part on what we can learn when we observe the company making a specific financing choice. We also discuss the practical realities of that choice.

The sources of capital include internal sources such as excess capacity, cash generated from operations, and asset sales. They also include external sources such as the issuance of debt, preferred stock, and common stock. Because internal sources are "free" to the company, we will focus our efforts on how we should estimate the cost of using external sources. When used in this framework, the term "cost" is often misunderstood to be a cost measured in currency. It is not. Instead the term "cost" refers to the expected interest rate paid by the company to the holders of those securities. Our ultimate goal is to determine the company's *cost of capital*, which is the weighted average cost of money available to the company through the issuance of debt, preferred stock, and common stock. But how do we go about estimating the costs of debt, preferred stock, and common stock? For debt, the process is relatively simple because of two features of bonds. First, they have prespecified cash flows. If we have a current market price for a company's bonds, we can infer the interest rate on the bond by finding the interest rate that makes the present value of the bond cash flows equal to the market price. This implied interest rate (called the *yield-to-maturity* or simply *yield*) is usually a reasonable estimate of the company's *cost of debt*. Second, many corporate bonds are rated by Moody's and/or Standard and Poor's (S&P). If we know the debt rating of a company's bonds, we can look at the yields on other bonds with the same debt rating. Since the interest rate on investments of similar risk should be similar, the yields on those other bonds provide us with an estimate of the company's cost of debt.

Like debt, preferred stock has prespecified cash flows, so the market price allows us to infer the appropriate discount rate on the preferred stock. If we do not have that market price, we can use our knowledge that common stock is riskier than preferred stock, which is riskier than debt. The implication is that the *cost of preferred stock* should fall between the cost of debt and the cost of equity. We can use this to get a rough approximation of the cost of preferred stock. In the vast majority of cases, companies have little or no preferred stock, so we are generally not overly concerned if our estimate of the cost of preferred stock might be somewhat inaccurate.

Estimating the cost of common stock (i.e., the cost of equity) is more difficult because the cash flows to shareholders are not prespecified. We therefore focus on estimating the risk associated with holding stock and how we might translate that level of risk into a return that shareholders must get in order to be compensated for that risk. The solution we discuss is perhaps the most famous model in finance—the Capital Asset Pricing Model (CAPM). We present the intuition behind the CAPM and show how to use it. We then discuss the problems we face in applying the model. We should keep in mind that the CAPM is somewhat of a controversial model. The theory behind it is elegant and intuitive, but there is much controversy about its application. Warren Buffet, for example, is not a proponent of the CAPM, and he declines to use it in his analyses. Instead, he assumes that the cost of equity will simply be some arbitrary amount above the yield on certain U.S. Treasury securities. (As we will see, this sounds remarkably like the CAPM.) Bill Miller, on the other hand, uses the CAPM to help in the estimation of discount rates. For our purposes, we will implicitly assume that the CAPM is a reasonable model for determining the appropriate discount rate for valuing stocks. We do acknowledge, however, that there is significant disagreement about the validity of doing so.

IN THEORY . . .

We begin with two fundamental questions. Why does a company need capital in the first place? What financing sources are available? As we noted earlier, it is a common misconception that a fast-growing company does not need external financing. In most cases, the opposite is true. In order to grow, the company must have money to build facilities, buy materials, pay workers, and so on. In contrast, slow-growing but profitable companies may not need external financing at all. Their existing projects may generate enough cash flow to support what little growth the company anticipates. It is no coincidence that slow-growth companies like Tyco (TYC) and General Electric (GE) consistently generate cash flows that are more than enough to support the growth of their current projects. They therefore need to raise relatively little external capital and instead focus on what to do with the excess cash generated. Any excess cash these companies generate is typically used for a variety of endeavors, including paying dividends and acquiring other companies. When they do raise external capital, it is typically done to support acquisitions. These activities are quite characteristic of slow-growth companies. In contrast, fast-growing companies need money to finance that growth. They therefore raise large sums of money from the capital markets, pay no dividends, and acquire only those companies specifically needed to help them operate their core businesses.

The Pecking Order Thoery

Perhaps the most well-known theory of capital structure is the Pecking Order Hypothesis (see Myers and Majluf (1984)), which suggests that a company should have specific preferences when it comes to financing. The basic theory is that company managers should prefer first internal financing, then debt and/or preferred stock, and then common stock. The preference for internal financing over the others follows from the observation that the company generally prefers not to take on additional debt or preferred stock (which would increase expense obligations and would therefore decrease earnings) and not to take on additional equity (which would dilute the ownership of current shareholders). Internal financing is also preferred because it is the least costly in terms of the time commitment from managers. The preference for debt and/or preferred stock over common-stock equity follows from the company's desire to avoid dilution whenever possible and practical. According to the Pecking Order Hypothesis, equity is used only when the interest cost of debt is prohibitively high and/or the additional risk associated with issuing debt is too high for the managers' tastes. We can of course break the preferences down into more refined categories (such as preferred stock, callable debt, convertible debt, preferred stock, convertible preferred stock, and so on). To do so, we can rely on other approaches such as the FRICTO approach popularized at Harvard. FRICTO is an acronym that describes some of the factors that are part of the financing decision:

Flexibility: In making the financing decision, managers must consider the flexibility it is likely to have in the future. For example, it may be the case that if the company issues debt now, it will be very difficult to issue debt again in the near future. If the company subsequently needs to raise money, it might be forced to issue equity. If the stock price happens to be abnormally low at that time, the dilution effect might be substantial.

Risk: When the company issues debt or preferred stock, a cash-flow obligation is created. This increases the risk of the company's stock because if the expected cash flows do not materialize, there would be little or no money left to compensate shareholders. It follows that risk is a key component of the financing decision.

Income: Another key component of the financing decision involves the impact of the decision on the company's earnings per share. Although earnings per share is less important than many investors believe, company managers still are loathe to take actions that tend to decrease those earnings. It follows that managers will be careful to consider how each possible financing alternative will affect the company's income.

Control: For some companies, the issue of control is an important one. Consider, for example, the long battle at Disney (DIS) over control of the board and therefore of company management. In March of 2004, 43% of shareholders withheld their votes from former CEO Michael Eisner to protest the protectionist activity in which eleven board members stood for election without opposition. With only a bit more support those protestors would have had a majority and could have effectively overturned control of the company. Threats of this nature can easily influence decision making. For example, it may be in a company's best interests to issue equity, but doing so will cause those in power to lose majority voting power. Instead, company managers might unwisely choose to issue debt, or might forgo profitable opportunities altogether. Thus, control can be an important factor in the financing decision.

Timing: Company managers may also be influenced by specific events that may occur. For example, managers may believe that earnings will be especially strong next quarter. Rather than issue equity now, the managers may choose to wait until after those earnings are reported to the general public. In doing so, the company would presumably benefit from a higher stock price, thereby reducing the dilution effect that occurs when shares are issued.

Other: There are of course many other factors that contribute to the decision. The age of company managers might matter, for example. An older CEO who is near retirement might choose less risky strategies than a younger one. The company may wish to issue equity so that its publicly traded shares become more liquid, which would presumably benefit other shareholders. We could continue this list almost indefinitely, but that is not the focus of our study.

Internal Financing

We begin our discussion of specific sources by considering the ways that the company can generate capital internally. This rather broad category includes retained earnings, the sale of assets, and increasing the use of existing assets. It also includes less used techniques, like factoring receivables and deferring payroll or taxes. Obviously, some of these methods are common in practice, whereas others are used only in somewhat desperate circumstances.

Excess Capacity

It may be the case that the company currently has excess capacity. For example, a manufacturing facility may have enough unused floor space to put in a new assembly line. A company running one shift may be able to add additional shifts. Perhaps a company that went through troubled times chose not to lay people off for the good of the local community, even though there was not enough work to fully employ them. These employees may be operating at less than full productivity, so the company can increase production without hiring new workers. A company may have a larger than usual stockpile of raw materials and may therefore be able to produce more goods without spending money for the production materials needed. For any of these reasons or many others, it may be the case that a company can temporarily grow at a fast rate without spending an inordinate amount of capital. Technically speaking, excess capacity is not a source of financing, but it does reduce the amount of financing the company needs.

As outsiders, it is difficult for us to know how much (if any) excess capacity a company has. In some cases, we can at least partially infer the extent of the excess capacity through examination of the company's financial statements.

Example 6.1: For the first quarter of 2001 (prior to the September 11 attacks), Delta Airlines (DAL) reported sales of $3.598 billion. For the first quarter of 2002 (after the attacks), Delta reported sales of $2.878 billion. Now, suppose that we planned to forecast sales for the remainder of 2002 and that we used the first-quarter results as a basis for those forecasts. As we will see in Chapter 7, our forecasting technique relies on the idea that as sales grow, the company's assets will tend to grow with those sales. For example, if we assumed that Delta's sales would grow at 5% the next quarter, we would generally also assume that Delta's fixed assets (airplanes primarily) and short-term assets (receivables, for example) would grow at the same rate. In this scenario, however, we would likely err in doing so. In the corresponding quarter the year before, Delta generated over $700 million more in sales. Unless Delta has reduced its fixed assets since then or ticket prices have dropped substantially, we could safely assume that Delta could increase sales to at least $3.598 billion (and probably a good bit higher) without purchasing new fixed assets. If we failed to incorporate this into our analysis, we would have underestimated Delta's future cash flows by overestimating how much it would cost to generate higher sales. In this case, the "financing" for Delta's future sales growth came in the form of empty seats on its aircraft.

Of course, growth from excess capacity is *always* a temporary phenomenon. If the company continues to grow, the excess capacity will eventually be exhausted and the company will be forced to finance growth via other means.

Cash Flow

There are two primary internal sources of capital. One is the cash flow generated by operations and the other is the sale of assets. Ideally, the company generates cash flows that are then invested to generate greater cash flows in the future. In this scenario, the company's growth is generated *organically*. Generally speaking, we can divide companies into two categories. In the first, the cash flows of the company are insufficient to support the company's growth. In that case, the company must either restrict its own growth or obtain additional financing. In the second, the cash flows of the company are more than sufficient to support the company's growth. In that case, the company must decide how to spend the additional cash being generated. We will consider these situations in some detail in Chapter 7 when we discuss forecasting.

As we mentioned earlier, internal financing is generally preferred to other sources for two reasons. First, the company incurs no additional financial obligations and earnings are not adversely affected. Second, the claims of shareholders are not diluted. Because of this preference, it is often wise to first forecast the future cash flows of the company under the assumption that only the company's cash flows are used to finance the growth. Once that baseline is established, we can investigate how the company might grow faster by using the other sources. An important point to remember is that if we use any other source, we must specifically incorporate the cost of doing so, whether it is a real or implied cost.

Sale of Assets

The sale of assets is the second primary source of internal financing. Selling off assets is a relatively easy source of funds, *assuming that the company does not need them*. For example, a company might own pieces of equipment that were used for a previous project and that are not currently in use. Those assets might be sold to raise money for new projects. At the other end of the complexity spectrum, companies might sell off entire divisions to raise cash for new projects. It is quite difficult for outsiders to identify and evaluate these sorts of assets because the company typically does not provide a list of assets along with information on how those assets are being used. For the most part, this is not a major concern, because asset sales are not generally a major source of funds.

External Financing

When a company finances externally, the company sells claims on the company's future cash flows. Although we often think only of the simple cases in which the company issues debt or equity, the company has a wide array of choices available. For example, the company may not want to issue straight debt, because the interest payments would be too high, but at the same time the company may not want to issue equity because it would dilute the shares of existing shareholders (and potentially affect the control of the company). In this scenario, the company might wisely choose to issue convertible debt, which is a hybrid of debt and equity. Our purpose here is not to present an exhaustive list of the alternatives available to the company, but rather it is to briefly discuss the major categories of external financing and then to consider how to estimate the company's cost of financing.

Debt

There are three primary advantages to issuing debt. First, the claims of common stockholders are not diluted. Instead, the company gives up a senior claim on company cash flows. Second, interest payments are tax deductible, so the company receives a tax break from the government. Third, more debt can increase the returns to shareholders. Debt has two main drawbacks. First, the expected cash flows of the company are reduced by the expected interest or preferred dividend payments. Second, the higher level of debt increases the risk to shareholders. Of course, higher debt can also increase the expected return to shareholders, so the increase in risk might be well rewarded. The choice between debt and equity is therefore one of weighing the dilution effect from issuing shares against the lower cash flows, higher risk, and possibly higher shareholder returns associated with issuing debt.

Preferred Stock

Preferred stock is very much like debt in that the company raises money today in exchange for a promise to make prespecified payments in the future. Preferred stock is more flexible than debt in one respect—preferred stockholders cannot force the company to pay them anything. They have no expectation of receiving the promised dividend payments, except that the company has promised to pay them. On the surface, this sounds like an awful situation for preferred shareholders, but this is not the case. If the company misses a preferred stock dividend, the market will typically react strongly, driving down the price of the company's common stock. Since company managers have a vested interest in increasing the value of the company's common stock, those managers will only skip preferred-stock dividend payments as a last resort. As such, preferred stock is generally considered safer than common stock, but it is generally riskier than debt.

In general and in contrast to interest payments, preferred stock dividends are not tax deductible. There are two categories of preferred stock, cumulative and noncumulative. With noncumulative preferred stock, the company is under no obligation to make up missed dividend payments. For example, suppose that a company has cash-flow problems and decides to skip a dividend payment. In a noncumulative situation, the company has no legal obligation to ever pay that dividend. With cumulative preferred stock, the company must pay all of the promised dividends to date before the company can pay any dividends to common-stock holders. This is a subtle issue that is seldom of importance, but in rare circumstances this distinction can affect our assessment of the value of the company's common stock.

Common Stock (Equity)

A very naïve view is that issuing equity is a "free" source of funds for the company. After all, company managers have no legal obligation to ever pay stockholders anything. However, we must keep in mind that shareholders are the true owners of the company and that managers are beholden to them. As such, there is certainly an expectation that company managers will act in ways to provide shareholders with a reasonable return on their investment. If they do not do so, shareholders can attempt to remove those managers. Company managers must therefore understand several important aspects of issuing equity. First, when the company chooses to issue additional shares, current shareholders will see a decrease in the fraction of the company that they hold. For example, a company may have 10,000,000 shares outstanding, of which we hold 100,000 shares. If the company chooses to issue an additional 1,000,000 shares, our ownership will drop from 1.0% of the company to 0.91%. This is the *dilution* effect we referred to earlier. This may seem to be a trivial difference, but there are two main effects of the decrease. First, managers must increase earnings by at least 10% in order to offset the dilution of shares. Second, the voting power of the original shareholders decreases, thereby reducing their control over the company. In most cases, the change in voting power is not a big deal, but it can be significant for companies involved in a power struggle (such as the Disney case we discussed earlier).

According to the Pecking Order Hypothesis, the company will only issue common stock when all other sources have been exhausted. This is a reasonable expectation *if markets are efficient*. When we consider the possibility that markets might not be efficient, the pecking order becomes a bit blurred because asset prices might differ from their true values. For example, a company whose stock is being overpriced by the market might choose to sell shares even though the company has more than enough debt capacity to cover the need. If this is true, the company's choice of financing should convey information to the market about the beliefs of company managers. We call this effect *signaling*.

Signaling Effects

A valuable element of stock valuation is the understanding that the actions of company managers reveal information about their beliefs. This is important because these managers naturally know a lot more about the company than we know. It is also important because we cannot completely trust the word of company managers by itself. Suppose, for example, that the CEO of a company announces that the company's stock is being dramatically undervalued by the market. Would we run out and buy the stock, knowing that the CEO likely has a financial incentive to convince us to do so? In contrast, suppose that a CEO begins to invest his or her own money in the company and initiates a stock repurchase plan for the company. Would we be more likely to want to buy the stock in that case? Clearly, the fact that the CEO is putting personal funds at risk and is using the company's funds to buy stock allows us to conclude quite confidently that the CEO believes the market is underpricing the stock. Said differently, the CEO has more optimistic expectations for the market than are implicit in the stock price.

It follows that a company might rationally choose to issue equity even though it is generating high cash flows, has unused assets it could sell, and has excess debt capacity! A simple example illustrates the decision faced by company managers.

Example 6.2: Suppose that company managers believe that their common stock is worth \$18 per share, but the current market price is \$36. The company needs to raise $9 million to finance its planned expansion. The company has a large stockpile of cash, with $10–$15 million more than the company needs for day-to-day operations. Furthermore, the company is in such a strong financial condition that it could easily issue $9 million in debt at a low interest rate. What should the company do?

According to the Pecking Order Hypothesis, the company would use its cash instead of issuing debt or equity. However, the company in our example may very well choose to issue equity. Why? Relative to what managers believe is fair, the company can issue equity at half the dilution cost! At fair value ($18 per share), the company would need to issue 500,000 shares to raise $9 million. At the current market price, the company need only issue 250,000 shares. This is a compelling argument in favor of issuing equity. In fact, the company might conceivably issue equity and then use the proceeds to pay dividends!

The interesting and important implication of this example and other, similar ones is that we as outsiders can infer things by looking at the decisions made by company managers. If we observe the company issuing equity, we might reasonably infer that company managers believe the stock is overvalued. If we observe the company buying back shares, we might reasonably infer that company managers believe the stock is undervalued. We must be careful to not read too much into these observations. It may, for example, be optimal for the company to issue equity even if the market has accurately priced the stock.

There is no clear-cut method by which we can determine whether management decisions convey special information about the prospects of the company, but we can use common sense to draw some conclusions. For example, we might first estimate the optimal financing arrangement for the company under the assumption that all assets are properly priced (note that this is not an easy task, nor is it an exact science). If we then observe a different financing decision, we might conclude something about the beliefs of company managers. Consider an example along these lines.

Example 6.3: A company financed entirely with equity currently has 25 million shares outstanding. Those shares are trading at $18 per share, so the company has a market value of $450 million. We have analyzed the company and have determined that the company can easily issue debt, and, more importantly, can increase ROE by doing so. Company managers, however, believe that the stock is actually worth only $12 per share, so the "true" value of the company is $300 million. Suppose then that company managers decide to sell 2 million shares of stock. The $18 share price represents the market equilibrium from investors, so selling the company will be able to sell the shares for some price below $18. (The sale of stock increases the supply without a corresponding increase in demand for the stock at $18, so the price will drop.) Suppose that the company is able to sell the shares for $16 per share. The inflow of $32 million increases the true value of the company to $332 million, while the number of shares increases to 27 million. The true value of a share of stock is then $12.30. Thus, company managers have been able to increase the wealth of original shareholders by bringing about a wealth transfer from new shareholders to old ones.

We learn several things from this example. First, note that the market price must be substantially above the true value of the stock in order for the sale to have a meaningful impact on the wealth of existing shareholders. Furthermore, we have ignored the costs associated with issuing equity. This will tend to reduce the size of the wealth transfer. Second, even when the stock is dramatically overpriced, selling stock will not typically have a dramatic effect on the wealth of existing shareholders. To have a dramatic effect, the company would need to sell a large number of shares. But in doing so, the share price would drop even further because of the especially large increase in the supply of the stock. Third, the opposite effect will hold if the stock is being underpriced by the market. If the company were to sell the stock at that time, the wealth of existing shareholders would decrease.

There are many other scenarios we might observe. What can we infer, for example, when we see company managers initiating a share repurchase plan? In most cases, such a plan is initiated when the company has excess cash to spend. For example, slow-growing yet profitable companies are typically faced with the problem of what to do with the excess cash being generated. There are four main alternatives for these companies. First, they might choose to do nothing, which would cause the company's cash account to build up over time. Second, they might choose to buy other companies. Third, they might choose to pay the cash out as dividends. Fourth and finally, they might choose to repurchase shares. The latter two of these alternatives involve direct distributions of cash to shareholders, so how do company managers choose between them? For reasons opposite those we noted in Example 6.3, the company can increase the per-share value of the company's stock by buying back stock if it is being underpriced by the market. This creates a wealth transfer from those who sell their stock to those who choose to keep it. It follows that when we observe a company initiating a stock repurchase plan, we can reasonably infer that company managers believe the stock is being undervalued by the market. Many fund managers (including Peter Lynch and Bill Miller) regard this as a relatively strong signal that managers believe the market price is too low.

A special case of this occurs when the company issues debt to raise the money to buy back shares. It is one thing for a company to distribute excess cash to shareholders by buying back shares. It is quite another for a company to go to the trouble of issuing debt to raise money for a share repurchase. We interpret such scenarios as especially strong signals that the stocks in question are being undervalued by the market. There are, of course, exceptions to these situations.

There are many other possible financing decisions that may provide information about management beliefs. For example, we might consider circumstances in which companies issue such securities as convertible debt, callable debt, debt with warrants, sinking fund debt, and so on. Rather than do that, we simply stress that it is important for us to pay special attention when a company does something unexpected. This is true not only for capital structure decisions, but for any other significant corporate decisions.

The Cost of Capital

Our ultimate goal in this chapter is to estimate an appropriate discount rate for use in calculating the present value of a company's expected cash flows. By definition, the discount rate is the interest rate that would exactly compensate investors for the risk associated with the investment. For our purposes in this chapter, this discount rate is the company's marginal cost of financing, including the costs of equity, debt, and preferred stock. By "marginal" we mean that we wish to estimate the interest cost the company would have to pay in order to raise one additional dollar of financing. We call this cost of financing the *weighted average cost of capital* (WACC) or often just the *cost of capital*. The term "cost" is a bit of a misnomer in that we do not desire a cost expressed in dollars (or some other currency for that matter). Rather, we are interested in computing the percentage cost or interest rate on the company's financing.

The company can finance by issuing common stock (equity) and/or preferred stock and/or debt. As we discussed earlier, there are more than a few variations within these categories. For now, we will ignore these variations and just consider what we can learn from basic theory. We begin by logically building a simple equation for the cost of capital.

The Weighted Average Cost of Capital Equation

Suppose that a company has raised $50 million by selling shares of common stock and $50 million by issuing debt. The company has agreed to pay debtholders an annual interest rate of 8% and is expected to pay shareholders an annual interest rate of 12%. Intuition suggests that the company's cost of financing is 10%, which is the weighted average of the cost of equity and the cost of debt. This intuition is basically correct, but we must also be aware that interest payments on debt are tax deductible, whereas dividend payments are not. If the company pays 8% interest to its debtholders, the actual net cost to the company is less than 8%. Suppose, for example, that the company's tax rate is 25% and that the company has taxable income before interest of $100 million. Without interest, the company would face a tax bill of 25% of $100 million, or $25 million. With an interest payment of $4 million (8% of $50 million), the company's taxable income would be $96 million and the tax bill would be $24 million. Thus, the company gets an added benefit in the amount of $1 million from holding debt. We see that the actual net cost of debt is $3 million, or 6% of the $50 million. In general, the after-tax cost of debt is $R_d(1 - T)$, where R_d is the company's cost of debt and T is the company's tax rate.

Since there is no interest tax deduction on common stock and none (in most circumstances) on preferred stock, we can write out the cost of capital equation,

$$WACC = w_d R_d (1 - T) + w_{ps} R_{ps} + w_e R_e \tag{6.1}$$

where w_e is the weight on equity, w_d is the weight on debt, and w_{ps} is the weight on preferred stock. R_{ps} and R_e are the company's costs of preferred stock and equity, respectively. By "weight" we mean the proportion of the company's financing provided by the given financing choice (common stock, debt, or preferred stock). If the company has common stock outstanding with a value of E, debt outstanding with value D, and preferred stock outstanding with value PS, then we have

$$w_d = \frac{D}{D + PS + E}, \tag{6.2}$$

$$w_{ps} = \frac{PS}{D + PS + E}, \tag{6.3}$$

and

$$w_e = \frac{E}{D + PS + E}. \tag{6.4}$$

It is important to point out that the values of E, D, and PS are market values rather than book values. We therefore cannot always just simply pull the values off the company's balance sheet. We will deal with the implications of this observation later when we consider applying our knowledge to the real world. Before doing so, we first discuss each of the financing types and their associated costs.

The Cost of Debt

There are two main approaches to estimating the cost of debt. In the first, we compute the implied interest rate on the company's existing debt. In the second, we rely on the credit rating of the company's existing debt in conjunction with *credit spreads* for corporate bonds. If we happen to find ourselves in a situation in which neither of those approaches is available, we must improvise to estimate the cost of debt. For example, we might identify close peers for which we can estimate the costs of debt. Those costs might provide a basis for estimating the cost of debt for our company.

Yield-to-Maturity as the Cost of Debt If the company has publicly traded debt and we can observe the market price of the debt, we can estimate the company's cost of debt by computing the yield-to-maturity on the company's debt.

Example 6.4: Suppose that a company has an 8-year, 7% annual coupon bond outstanding. The bond, which comprises all of the outstanding debt for the company, is publicly traded and has a current market price equal to 96% of the face value of the bond. What is the company's cost of debt?

We know that the cost of debt can be estimated by examining the yield-to-maturity of outstanding debt. Thus, the cost of debt satisfies the equation

$$\$960 = \$70 \times PVIFA_{R_d,8} + \frac{\$1,000}{\left(1+R_d\right)^8}, \tag{6.5}$$

where we have assumed that the face value of the company's debt is \$1000. We cannot solve this equation analytically (we get an eighth-order polynomial in R_d when we try), but we can easily solve it with a financial calculator, with a spreadsheet program, or by trial and error. In this case, we find $R_d = 7.69\%$.

This example illustrates the basic intuition behind the cost of debt, but as we will see later in the chapter, applying this intuition can sometimes be quite problematic.

Using Credit Spreads to Estimate the Cost of Debt An alternative approach to estimating a company's cost of debt involves relying on the credit ratings put out by agencies such as Moody's or S&P. Those agencies analyze the financial condition of companies and assess the likelihood that those companies will default on their debt. Letter-coded ratings are assigned, which give investors an idea of the risk associated with the debt. Table 6.1 shows the ratings issued by Moody's and S&P, along with the credit spreads corresponding to those ratings. The credit spread depends on the maturity of the bond, which is also shown in the table. The highest ratings are Aaa for Moody's and AAA for S&P, and the lowest investment-grade ratings are Baa3 and BBB–, respectively. Ratings below these are reserved for highly speculative "junk" bonds.

A *credit spread* is simply the difference between the yield on a given corporate bond and the yield on a corresponding Treasury bond with the same maturity. For example, the credit spread for an average 5-year bond rated A3 by Moody's is 63 basis points. This means that an average bond within this class would have a yield-to-maturity that is about 0.63% higher than the yield-to-maturity on a 5-year U.S. Treasury security. We can use this information to help us estimate a company's cost of debt.

TABLE 6.1

Corporate Bond Yield Spreads (in basis points)

Moody's rating	S&P rating	1 yr	2 yr	3 yr	5 yr	7 yr	10 yr	30 yr
Aaa	AAA	9	11	22	32	48	60	82
Aa1	AA+	17	25	26	41	56	69	91
Aa2	AA	19	32	34	46	59	72	95
Aa3	AA−	20	34	35	50	63	73	101
A1	A+	38	43	47	57	71	85	109
A2	A	41	46	49	59	73	87	113
A3	A−	45	49	52	63	76	90	116
Baa1	BBB+	57	67	75	84	113	135	162
Baa2	BBB	60	75	83	89	120	143	169
Baa3	BBB−	67	80	85	94	125	150	174
Ba1	BB+	180	190	200	210	230	250	270
Ba2	BB	190	200	210	220	240	260	280
Ba3	BB−	200	210	220	230	250	270	290
B1	B+	260	270	280	310	350	390	440
B2	B	270	280	290	320	360	400	450
B3	B−	280	290	300	330	370	410	460
Caa	CCC	445	455	465	490	500	510	540

Source: www.bondsonline.com, March 18, 2005.

Before doing so, we must address one other issue. What bond maturity should we use? Many believe that the maturity should match the time frame of the model being used. For example, if we choose to forecast and discount 5 years' worth of cash flows, we would choose a 5-year maturity. The problem with this intuition is that it depends on our choice of time frame rather than on some natural mechanism. Others believe that we should always use a long-term maturity (such as 10 years), regardless of our choice of time frame. Although there is certainly disagreement within the investment community, the vast majority of practitioners seem to use 5 years or 10 years. In most cases, choosing one over the other will make only a small difference in our value estimate. The important thing to remember is that we must be consistent in our choice so that we can properly compare the valuations of different companies. Here and throughout the remainder of the book, we will arbitrarily choose to use a 10-year maturity for our estimates. To understand the basic technique, consider the following example.

Example 6.5: Suppose that a company has a credit rating of BB+ as rated by S&P. What is our best estimate of the company's cost of debt?

From Table 6.1, we see that 10-year bonds with a BB+ rating have a credit spread of 250 basis points. This suggests that the cost of debt will be 2.50% higher than the yield on 10-year Treasury bonds. Suppose then that the 10-year Treasury yield, which can be found on numerous websites and in numerous publications, is 4.53%. Our estimate of the company's cost of debt would be 4.53% + 2.50% = 7.03%.

As we noted in Chapter 3, yields are quoted as APRs rather than EARs. To be technically correct, we would convert our cost of debt estimate from an APR to an EAR before using it in the WACC calculation. For typical costs of debt that are not excessively high, this adjustment would have only a very small impact. As such, most investment professionals tend to ignore the adjustment altogether.

The Cost of Preferred Stock

If a company has preferred stock at all, it typically represents only a small portion of the company's financing. As such, a company's WACC is usually very insensitive to errors in our estimate of the cost of preferred stock. This is fortunate, because we often have little information with which we can accurately estimate that cost.

The typical estimation technique is to compute the implied discount rate on the company's preferred stock. Because the dividend payments on preferred stock are prespecified and known, we can set the present value of those payments equal to the current price of the preferred stock and solve for the discount rate. This implied discount rate, which is analogous to the yield-to-maturity for bonds, is our estimate of the cost of preferred stock. The following example illustrates the technique.

Example 6.6: A company has outstanding preferred stock that pays an annual dividend of $2 per share. The next dividend payment is due in 1 year. Currently, that preferred stock sells for a price of $30 per share. What is the company's cost of preferred stock?

Because the preferred stock is a perpetuity, we know from Chapter 3 that the present value of the dividends is simply the amount of the cash flow divided by the discount rate. Setting this equal to the price of the preferred stock and solving for the discount rate gives

$$R_{ps} = \frac{\$2}{30} = 6.67\%, \tag{6.6}$$

which is our estimate of the company's cost of preferred stock.

In the absence of a market price for the company's preferred stock (which is often the case), we often simply rely on our intuition and knowledge of securities. It is unlikely that we will be able to find peers with similar structure and for which we have market prices, so we have few options. What we do know, however, is that common stock is generally riskier than preferred stock, which is riskier than debt. It follows that the cost of preferred stock will usually fall somewhere between the cost of debt and the cost of equity. As a last resort, we might simply average the cost of debt and the cost of equity to get an estimate of the cost of preferred stock.

The Cost of Equity

Estimating the cost of equity is difficult conceptually. Unlike debt and preferred stock, there is no contract specifying the return that will be paid to shareholders, nor are the future dividends specified. We cannot therefore simply equate the present value of the future cash flows to the current stock price and solve for the discount rate. Instead, we must infer what the cost of equity should be.

Basic Intuition Our purpose is twofold. First, we seek a way to measure the risk of a given stock. Second, we seek a way to translate that risk into an expected return on the stock. Consider a simple example in which two investors choose to buy stock in a meat packager. The first investor invests 100% of the available funds in the stock. The second investor invests only 1% and invests the remainder in other stocks that are not involved in meat packaging. Now, suppose that news comes out that *E. coli* bacteria have been found in hamburger meat packaged by the company, and that the stock price subsequently drops by 20%. How does this affect the portfolios of the two investors? The first investor's portfolio faces a return of −20%, and the second investor's portfolio faces a return of −0.2%. In retrospect, we see that the first investor chose to take on far more risk than the second investor chose to take on. The second investor faced less risk because the risk associated with the meat packager was diversified. From this example, we learn that investors who hold diversified portfolios care very little about *company-specific* risk because that risk can have little impact on their portfolios.

What about risk that is not company-specific? Continuing our example, suppose that an economic report is released which indicates that inflation is much higher than investors thought. Furthermore, the chairman of the Federal Reserve testifies before Congress that he is concerned about the potential for even higher inflation. Since higher inflation leads to higher interest rates, the intrinsic values of stocks in general will decrease. As a result, the stock market (including the meat packager) suffers a decline of 10%. How does this affect our two investors? The first investor faces a return of −10%, and the second investor's portfolio also faces a return of −10%. In this case, the second investor received no benefit from diversification because the risk of higher inflation affects all stocks. We conclude that *market risk* is not diversifiable and that all investors are affected by it.

Our goal, of course, is to establish a relationship between risk and expected returns. We begin by making a few observations. First, equilibrium stock prices are set so that supply equals demand. That is, the number of shares being bought by investors is equal to the number of shares being sold by investors. Second, the vast majority of shares are held by investors with well-diversified portfolios. To see this, we can simply check any of a number of finance-related websites to find the fraction of a company's shares that are held by institutional investors, which tend to hold well-diversified portfolios. Table 6.2, for example, shows the institutional ownership for ten representative stocks. We see that although there is a wide variance in the ownership by institutions, the institutions hold a large percentage of the outstanding shares. Furthermore, it is likely that many of the remaining shares are also held by people with well-diversified portfolios. We can reasonably conclude the following.

Market prices will be set primarily based on the trading activity of well-diversified investors.

A specific implication of this is that stock prices will tend to be determined without regard to company-specific risk. This intuition leads us to the desired relationship between risk and expected return.

TABLE 6.2

Institutional Ownership, Selected Companies

Company	Ticker	Percentage of shares held by institutions
AES Corp	AES	75.01
CIT Group	CIT	93.55
CVS Corp	CVS	84.56
Harris Corp	HRS	87.20
Microsoft	MSFT	54.80
Neenah Paper	NP	73.65
O'Charley's	CHUX	95.00
Open Text Corp	OTEX	53.17
Usana Health Sciences	USNA	48.82
VF Corp.	VFC	87.98

Source: finance.yahoo.com, March 23, 2005.

The Capital Asset Pricing Model The relationship described above provides the basis for what is known as the Capital Asset Pricing Model (CAPM). This model is both well-known and controversial. Since our focus is on the practical implications of stock valuation, we omit a formal development of the mathematics behind the CAPM. Instead we will examine the CAPM formula and discuss it as it relates to the intuition we have developed.

The CAPM equation is

$$\hat{R}_e = R_f + \beta\left(\hat{R}_m - R_f\right), \tag{6.7}$$

where $\hat{R}_e$ is the expected return on the stock (equity), R_f is the risk-free rate of return, β is a measure of the level of market risk in the stock, and $\hat{R}_m$ is the expected return on the market portfolio. The equation is intuitive in that it consists of two components, the return on a risk-free investment and an adjustment for the risk of the stock. The beta (β) of the stock is a measure of how much risk remains in the stock after all possible risk is diversified. That is, it measures all of the market risk associated with the stock, yet measures none of the company-specific risk. Mathematically, β is directly proportional to the covariance of the stock's returns with the market returns and inversely proportional to the market variance (volatility),

$$\beta = \frac{\text{Cov}(R_e, R_m)}{\text{Var}(R_m)}, \tag{6.8}$$

where $\text{Cov}(R_e,R_m)$ is the covariance between the stock's returns and the market's returns and $\text{Var}(R_m)$ is the variance of the market's returns. Using the definition of covariance, we can write

$$\beta = \frac{\text{Cov}(R_e, R_m)}{\text{Var}(R_m)} = \frac{\rho\sigma_e\sigma_m}{\sigma_m^2} = \frac{\rho\sigma_e}{\sigma_m} \tag{6.9}$$

where ρ is the correlation coefficient between the stock's returns and the market's returns, σ_e is the standard deviation of the stock's returns, and σ_m is the standard deviation of the market's returns. We see that β is simply a correlation coefficient multiplied by the ratio of two standard deviations. The higher the correlation between the stock and the market is, the higher is β. The higher the standard deviation of the stock's returns is, the greater will be the magnitude of β. We note that the correlation coefficient varies between -1 and $+1$, and negative coefficients are indicative of stocks that tend to move in the direction opposite that of the market, and positive coefficients are indicative of stocks that tend to move in the same direction as the market.

Our discussion of β mirrors the intuition we developed earlier. For example, since higher inflation affects all stocks, the risk will be correlated across stocks and will hence be reflected in β. When company-specific events affect a stock, the market itself is not affected and hence there is zero correlation (and covariance) between the stock and the market.

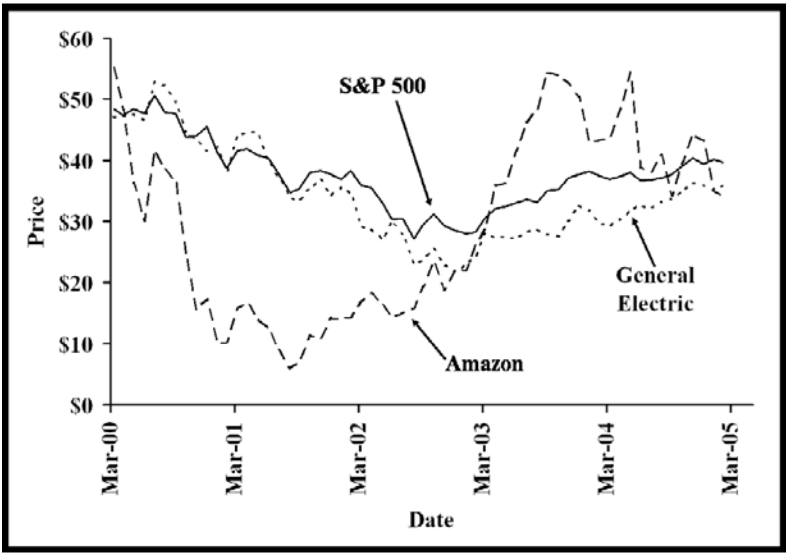
The measure β is multiplied by the *market risk premium* $(\hat{R}_m - R_f)$ in Equation 6.7. This risk premium is the additional return (above the risk-free rate) needed to induce investors to invest in the market rather than in a risk-free security. We can view β as simply a multiplier that adjusts the risk premium upward or downward, depending on whether the stock is more or less risky than the market in general. Notice that if $\beta = 1$, the expected return on the stock is equal to the expected return on the market. We can correctly infer that a stock with $\beta = 1$ has the same level of market risk as the market itself. Notice also that if $\beta = 0$, the stock has an expected return equal to the risk-free rate. We can correctly infer that the stock has no market risk at all. In other words, the stock's returns are not correlated with the market returns, and therefore all risk associated with the stock is diversifiable.

For stocks with $\beta > 1$, we see that the level of market risk is greater than the risk of the market itself. These stocks tend to swing up and down along with the market, but tend to have wider swings than the market. For stocks with β between 0 and 1, we again see that the stocks tend to swing up and down along with the market, but they tend to not swing as much as the market itself. Stocks that consistently have negative β are rare, but they do exist. Such stocks are negatively correlated with the market and, according to the CAPM, have expected returns that are less than the risk-free rate. This leads inevitably to the question, if that is true, then why would anyone buy them? To understand why rational people might buy them, notice that such stocks act as natural insurance for portfolios. When the market declines, negative β stocks tend to increase and therefore lessen the impact of the market downturn on portfolios. When viewed from this perspective, it is easy to see why such stocks might be valuable additions to a portfolio.

Figure 6.1 shows 5-year price charts of two different stocks along with the S&P 500 Index. For presentation purposes, the S&P 500 Index is shown at 1/30th of its value. The prices of General Electric (GE) stock and Amazon (AMZN) stock have not been scaled. Notice first that General Electric's stock price seems to track almost perfectly with the S&P 500 Index. There is clearly a strong positive correlation between the two, and the two appear to have similar return volatilities. This is not at all surprising, given that General Electric is a large conglomerate that shares many of the characteristics of the market itself. From the chart, we suspect that the β for General Electric stock is likely to be close to 1 over the 5-year period. When we actually compute it, we find that the β was about 0.9. This tells us that over the period in question, General Electric stock exhibited less nondiversifiable risk than the S&P 500 Index. In contrast, the stock of Amazon shows a very different pattern. As the S&P 500 Index falls initially, Amazon's stock falls at a much faster pace. Later when the S&P 500 Index began moving upward, Amazon's stock moved upward at a much faster pace. There are a few segments of the chart in which Amazon stock appears to have moved in a direction opposite that of the S&P 500 Index, but those movements were likely due to firm-specific factors. Overall, we suspect that Amazon's stock had a β substantially higher than 1 over the period in question. When we compute it, we find that the stock indeed exhibited a β of about 2.6 over the period in question. This is entirely consis-

FIGURE 6.1

Historical Stock Prices



tent with what we observe in Figure 6.1—that Amazon stock was indeed far riskier than General Electric stock over the period in question.

IN PRACTICE . . .

To this point in the chapter, we have discussed basic techniques that are used to estimate the cost of capital for a company. When we attempt to apply those techniques, we immediately run into difficulties. The difficulties include a lack of needed information (such as the market price of securities), dealing with multiple issues of a particular type of security (such as multiple debt issues with different maturities), understanding the implications of call and conversion rights, and having to use historical information as a basis for estimates.

Problems with Estimating the Cost of Debt

There are three primary problems we face in estimating the cost of debt. First, corporate debt is typically quite illiquid, and we often do not have reasonable current estimates of the value of the outstanding debt. Second, bonds are often callable or convertible, which throws into question the use of a yield-to-maturity as the cost of debt. Third, many companies have more than one outstanding debt issue, each with different maturity and possibly different provisions.

To get a rough idea of how these difficulties often play out, consider two peer companies that both have outstanding debt. The debt of our first company has 2 years left to maturity, is callable, and is publicly traded. The debt of our second company is a 5-year bank loan that carries a floating interest rate. Our task, of course, is to estimate the cost of debt for both of these companies and to do so in a consistent manner so that we can compare the two companies. This is clearly a difficult if not impossible task. We are left with simply doing the best we can under the circumstances.

Bonds with embedded options are particularly troublesome because the yield-to-maturity may bear little resemblance to the actual discount rate on the debt. To see this, consider the following rather simple example.

Example 6.7: Suppose that a 2-year bond with a face value of $1,000 is convertible into 100 shares of stock any time in the next 2 years. The bond pays annual coupons of $80, and the next payment is due in 1 year. Suppose further that the current stock price is $15 per share. If the shares were to be converted today, the holder would receive $1,500 worth of stock. Thus, the bond must sell for at least $1,500. Suppose, then, that the bond is indeed selling for $1,500. At that price, the observed yield-to-maturity would satisfy

$$\$1{,}500 = \$80 \times PVIFA_{ytm,2} + \frac{\$1{,}000}{\left(1 + ytm\right)^2}. \tag{6.10}$$

Solving this gives a yield of −12.44%. This is clearly absurd as a cost of debt. In this case, the bond yield bears no resemblance to the appropriate discount rate for the bond cash flows because the bond will almost be converted. In general, we can only use the yield-to-maturity of a convertible bond as an estimate of the cost of debt when there is virtually no chance that a convertible bond will be converted. Otherwise, we would hope to use the credit spread approach to determine the cost of debt.

Using the yield-to-maturity of callable bonds can be useful if it is extremely unlikely that the bond will be called *or* it is extremely likely that the bond will be called. If we do not believe that bond will be called, we simply compute the yield-to-maturity as usual. If we believe the bond will be called, we can use something called the yield-to-call. By definition, the yield-to-call is the interest rate that makes the present value of the promised bond cash flows equal to the current price of the bond, *assuming that the bond will be called*. Consider the following example.

Example 6.8: A company's outstanding bonds have 8 years to maturity, have a face value of $1,000, and pay annual coupons of $90 per year, and the next one is due in 1 year. The bond is callable in 3 years for $1,050. The current price of the bond is $1,120, and we believe it is all but certain that the bond will be called. What is our best estimate of the cost of debt for the company?

Since we are virtually certain that the bond will be called, the expected cash flows of the bond are as shown in Table 6.3. The yield-to-call then satisfies

$$\$1{,}120 = \$90 \times PVIFA_{ytc,2} + \frac{\$1{,}050}{(1+ytc)^2}. \tag{6.11}$$

Solving gives us $ytc = 6.95\%$, which is our estimate of the company's cost of debt.

TABLE 6.3

Cash Flows for Callable Bond, Example 6.8

Date	Cash flow
1	$90
2	$90
3	$90
4	$90
5	$90 + $1,050 = $1,140

Multiple Issues with Different Maturities

Table 6.4 shows the long-term debt structure for General Electric (GE). In addition, the company currently has a line of credit, fixed-rate securitized debt, and floating-rate securitized debt. So, where do we begin if we want to estimate the cost of debt for General Electric? Some might argue that we should use the debt with the longest maturity issue. Others might argue that we should use all of the issues by taking some weighted average of the yields of those issues. Either of these might be problematic, particularly if we wish to compare the valuations of peer companies. For example, one company in an industry might have debt that matures in 2 years, while another company in that industry might have debt with a 10-year maturity. Since longer maturities are usually associated with higher yields, we would estimate a higher cost of debt for the latter company, even if the two companies are otherwise identical. The implication is that we ideally should use the same maturity for each company. This leads naturally to the question of what maturity we ideally would like to use. There is no widely accepted theoretical basis for choosing a specific maturity, but practitioners typically argue for 5 years, 10 years, or the longest maturity available.

Suppose we have decided that 10 years is the maturity we would like to use, but we are investigating a company that has no debt with a maturity near 10 years? We prefer to use the yield-to-maturity on outstanding debt because it represents the market's current assessment of the appropriate discount rate for the company's debt. We can use our credit spread

TABLE 6.4

Long-Term Debt for General Electric (GE)

Amount (000,000)	Description
$7,483	3.74% senior notes, due 2005–2013
$331	1.39% industrial development/pollution control bonds, due 2005–2027
$212	6.70% payable to banks, principally non-U.S., due 2005–2008
$362	Other long-term debt
$149,049	3.42% senior notes, due 2005–2055
$12,229	1.27% extendible notes, due 2007–2008
$1,262	7.52% subordinated notes, due 2005–2035

Source: www.mergentonline.com, March 22, 2005.

information to adjust our yields. The following example illustrates the basic process.

Example 6.9: A company has outstanding debt with a yield-to-maturity of 5.08%. That debt has 5 years to maturity. Five-year Treasury bonds are currently yielding 4.29%, and 10-year Treasury bonds are yielding 4.63%. What is our best estimate of the company's cost of debt if we wish to use a 10-year maturity for the cost of debt?

The yield spread on the company's 5-year bond is currently 5.12% − 4.29% = 0.83%, or 83 basis points. In Table 6.1, we see that 83 basis points on a 5-year issue corresponds to a credit rating of Baa1/BBB+. If we assume that the company's credit rating would be the same if it had 10-year debt, we can infer that the yield spread on that 10-year debt would be about 135 basis points, or 1.35%. Since the 10-year Treasury bonds are currently yielding 4.63%, we estimate the company's cost of debt to be 4.63% + 1.35% = 5.98%.

In this example, we do not immediately know the company's credit rating, but instead infer it from the credit spread table. If we did know that company's credit rating, we would simply use it to look up the 10-year credit spread.

In general, estimation of the cost of debt depends very much on the specific company under consideration. In many cases, we will not have enough information to come up with an accurate estimate. In those cases, we simply use whatever information we have, along with our best judgment. This will be the case when we consider O'Charley's a bit later in the chapter.

Problems with Estimating the Cost of Preferred Stock

The difficulties we face in dealing with preferred stock are similar to those we face with debt. We may not have a reasonable measure of the current market price of the preferred stock, and the preferred stock may have embedded options. In addition, the preferred stock may be cumulative or noncumulative, which complicates the situation further. Clearly, cumulative preferred stock will sell for a higher price than noncumulative stock, all else being equal. Therefore, the implied interest rate (and hence the estimated cost of preferred stock) of cumulative preferred stock will be lower than the implied interest rate of noncumulative preferred stock, all else being equal. This distinction is generally not of great concern because the difference between the implied interest rates is small.

More often then not, we will find that we have no reasonable way to estimate the cost of preferred stock. Fortunately, most companies have little or no preferred stock, so we are generally not overly concerned if we cannot precisely determine the cost of preferred stock. One approach we can use is to rely on our knowledge of the risk of preferred stock relative to common stock and to debt. Since debtholders are paid before preferred stockholders, who are paid before common stockholders, preferred stock should be safer than common stock but riskier than debt. It follows that the cost of preferred stock will typically fall between the cost of the debt and the cost of stock. Once we have estimated the costs of debt and common stock, we might then choose to average them to get an estimate of the cost of preferred stock.

Problems with Estimating the Cost of Equity

Although in this book we rely on the CAPM to estimate the cost of equity, we stress that there are significant problems with doing so in practice.

To use the CAPM, we use historical data to estimate β and then plug into the basic CAPM equation. We therefore need historical stock returns and historical market returns, as well as a risk-free rate of interest. The closest thing we have to a truly risk-free security is a short-term Treasury bond. However, a stock is a long-term investment, and there is something to be said for choosing a Treasury security that more closely corresponds to the expected term of our investment. Copeland, Koller, and Murrin (1995) make a compelling argument for 10 years by noting that 10 years approximates the duration[1] of stocks and is therefore consistent with how we estimate β and the market risk premium. An important point here is that we should match the maturity of the risk-free asset to the maturity we choose in estimating the cost of debt. To do otherwise would necessarily lead to a bias in our estimate of the WACC. For our purposes, we will

[1]Duration, by definition, is the weighted average time in which we expect to receive money back from our investment. It is also a measure of the sensitivity of the security's price to changes in interest rates. The concept is most often applied to bonds and is quite important to managers of bond portfolios, including commercial and retail bankers who invest money in long-term assets.

use a 10-year maturity for both the risk-free asset and our estimates of the cost of debt.

To estimate the β of a stock, we need historical stock returns and historical market returns. Historical stock returns are readily available on the internet, but what about the market returns? In theory, the market portfolio is a portfolio consisting of very small positions in all assets. We cannot possibly identify and measure such a portfolio, so we must choose a proxy for the market portfolio. Typically, we would choose a well-diversified stock index such as the S&P 500 Index or the Russell 3000 Index. Although this is problematic in that we only include stocks in the proxy for the market portfolio, using the S&P 500 index or some similar stock benchmark is the standard in the investment world. In addition, β values are widely published on the internet, so we need not compute them ourselves. For example, www.yahoo.com and www.investor.reuters.com both include β values for publicly traded stocks, as do many other sites. These estimates are typically computed with the use of monthly returns for the previous 5 years. Of course we compute β to help us estimate a discount rate for use in the discounting of *future* cash flows. This leads us to ask, is the historical estimate of β applicable to the future? Many well-known investment professionals say no and completely shun the CAPM. Most notable of these is Warren Buffett. Although Buffett and others choose not to use the CAPM, they do believe in the basic notion that the cost of equity should be the risk-free rate plus some risk premium. Detractors of the CAPM simply believe that we have no real ability to estimate what the company's β will be in the future. Instead, they choose to simply use common sense and experience to determine the appropriate risk premium. Fama and French (1992) provide evidence suggesting that there are other problems with applying the CAPM. They find that two additional factors are statistically significant determinants of expected stock returns: the size of the company and the ratio of the book value of equity to the market value of equity. In contrast, the CAPM theory implies that the risk-free rate, the expected market return, and β should be the only factors that influence expected stock returns. Still, the CAPM is widely used in the investment community and certainly has some validity. Furthermore, we can adjust β to account for one particular problem we face.

In some cases, the estimated β for a stock will not make sense intuitively. For example, we expect large conglomerates such as General Electric (GE), Honeywell (HON), Tyco (TYC), and United Technologies (UTX) to have β*'s* around 1. After all, they are microcosms of the market itself.

TABLE 6.5

Betas for Selected Conglomerates

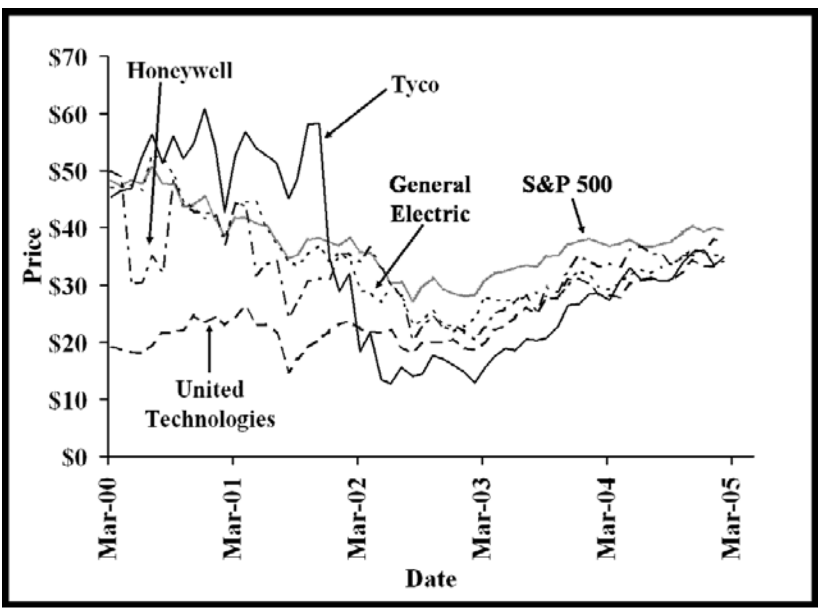
Company	Ticker	β
General Electric	GE	0.97
Honeywell	HON	1.39
Tyco	TYC	2.13
United Technologies	UTX	0.91

Source: www.investor.reuters.com, March 22, 2005.

Table 6.5 shows the β's for these companies. Notice that the β's of General Electric, Honeywell, and United Technologies are near 1 (although Honeywell's is a bit higher than expected), but Tyco's is 2.13! Do we really believe that Tyco's stock is more than twice as risky (in a nondiversifiable sense) as the market itself? The answer is clearly no. Figure 6.2, which

FIGURE 6.2

Historical Stock Prices, Conglomerates



shows the historical prices for the companies, gives us some insight into the situation. Notice that there was a large drop in the price of Tyco stock in late 2001. This corresponded to the revelation that Tyco CEO Dennis Kozlowski had essentially misappropriated funds. Thus, the large drop was due to a company-specific event and not to correlation with the market. However, the drop in Tyco's price coincided with a drop in the market. From a statistical standpoint, this contributed in a large positive way to the estimate of β, thereby rendering it incorrect and unusable.

So how do we handle this situation? Since all four companies are large conglomerates and operate in similar industries, we can reasonably conclude that the β's of the companies' core operations are likely to be similar. Any differences we might observe in the true β's are therefore likely to be due only to differences in capital structure. To see this, consider the balance identity: assets equal debt plus equity. Since the β of a portfolio of assets is the weighted average of the β's of the components, we can view the company as being a portfolio of debt (including preferred stock) and equity and then write

$$\beta_a = w_d\beta_d + w_{ps}\beta_{ps} + w_e\beta_e. \quad (6.12)$$

Here β_a is the beta of company's operations, β_d is the beta of the company's debt, β_{ps} is the beta of the company's preferred stock, and β_e is the beta of the company's equity. w_d is the fraction of total company value in the form of debt and w_e is the fraction of total company value in the form of equity. The betas for debt and preferred stock (which is debt-like) are typically very close to zero, so

$$\beta_a \cong w_e\beta_e. \quad (6.13)$$

This equation and a rearrangement,

$$\beta_e \cong \beta_a / w_e, \quad (6.14)$$

allow us to estimate a β for Tyco's stock by using the information found in the β's of its peers.

Example 6.10: Consider Table 6.6, which shows selected information on the five conglomerates we have been discussing. In addition to the historical equity β's, the table includes the balance sheet values of long-term

TABLE 6.6

Selected Information, Conglomerates

Company	Ticker	Debt	Preferred stock	Equity (market capitalization)	Equity β
General Electric	GE	$213.16	$0	$376.30	0.97
Honeywell	HON	$5.03	$0	$32.53	1.39
Tyco	TYC	$16.53	$0	$69.98	2.13
United Technologies	UTX	$4.27	$0	$52.62	0.91

Source: www.investor.reuters.com, March 22, 2005. Dollar values are in billions.

debt and preferred stock, along with the market value of outstanding common stock. Because Tyco's historical β is inconsistent with our knowledge of the company, and because we have good reason to believe it is misleading, our desire is to use Tyco's peers to give us a better estimate of Tyco's beta.

The basic process is as follows. We first use Equation 6.12 to estimate the asset β's for each member of the peer group. In doing so, we *delever* the β's. We then compute the average asset β in the industry, which is our estimate of the nondiversifiable risk associated with the industry's core operations. We then use Equation 6.13 to *relever* the industry asset β, using the information we have about Tyco's capital structure. This is then our estimate of Tyco's future β.

Table 6.7 shows the results of the delevering process. We see that the average asset β is 0.888 for the industry, which is very much in line with

TABLE 6.7

Delevering the Betas, Conglomerates

Company	Equity β	w_e	Asset β
General Electric	0.97	0.638	0.619
Honeywell	1.39	0.866	1.203
United Technologies	0.91	0.925	0.842
Average			0.888

Source for betas: finance.yahoo.com.

our expectations. We can then relever this β with the use of Equation 6.13 and Tyco's equity ratio ($69.98/($16.53 + $69.98) = 0.809) to get

$$\beta_e \cong 0.888/0.809 = 1.098 \tag{6.15}$$

which is our estimate of the appropriate β for use in determining Tyco's cost of equity.

This particular process is quite useful when we suspect that the historical β is misleading or when we do not have an estimate of the historical β of the company's stock. For example, a company may be privately held or may have been public for only a short time. In both cases, we would have insufficient data to compute the historical beta.

Once we have estimated the β of the stock, we need only plug into the CAPM equation to determine the company's cost of equity. To do this, we must estimate the expected return on the market portfolio. This is quite difficult because it seemingly depends so heavily on macroeconomic conditions. Historical estimates vary greatly, depending on the time period used for the estimation. Applying more advanced techniques does not seem to help us much. A study by Ibbotson Associates showed that the market return exceeded the risk-free rate by an average of 7.4% over the period from 1926 to 1999. Recent studies suggest, however, that the market risk premium is likely to be much less, perhaps on the order of 3–4%. The lack of certainty, of course, contributes a certain amount of error to our estimate of the expected return on a stock. Buffett and others say that this uncertainty renders the model useless. Supporters say, however, that we should use the model but then do sensitivity analysis to understand the impact of potential errors. For the purposes of this text, we will adopt the latter philosophy.

Problems with Estimating Weights for the WACC Calculation

In theory, a given weight in the WACC calculation is the ratio of the market value of the given security class to the total market value of financing. Thus, we desire estimates of the market values of debt, preferred stock, and common stock. In some circumstances, these are easily obtained. In others, they are not and we must use approximate measures.

Estimating the Market Value of Debt

If a company has publicly traded "straight" debt that is relatively liquid, we can easily estimate the market value of debt by multiplying the number of bonds outstanding by the market value of a bond. By "straight" we mean that the debt has no embedded options. If a company does not have publicly traded debt or if the debt is illiquid, we can estimate the market value of debt by using our estimate of the cost of debt. Regardless of which technique we use to estimate the cost of debt, we compute the market value of a bond by using that cost and then compute the market value of debt by multiplying the number of bonds outstanding by our estimate of the market value of one bond. If the company's debt has an embedded option, our task is more difficult. There are techniques we might use to estimate the value of such debt, but these techniques are well beyond the scope of this book. Furthermore, these techniques are seldom used as part of the stock valuation process. Instead, analysts typically use the value of long-term debt shown on the company's balance sheet. As long as the interest rate (i.e., the cost of debt) has not changed considerably since the debt was issued, the market value of debt will be close to the book value of debt. If this is the case, then we introduce little error by using the book value of debt in the WACC calculation. Furthermore, the stock valuation calculation is typically not very sensitive to changes in the value of debt used in the CAPM equation. As evidence of this, consider the following simple example.

Example 6.11: We have estimated a company's cost of debt to be 5%, its cost of equity to be 9%, and its tax rate to be 35%. The company has no preferred stock outstanding. The current market value of the company's equity is $10 million, but we have no way to accurately estimate the market value of the company's debt. We do know, however, that the book value of the company's debt is $4.0 million. From this we estimate the company's WACC to be

$$WACC = \frac{\$4}{\$4+\$10} \times 5\% \times (1-0.35) + \frac{\$10}{\$4+\$10} \times 9\% = 7.36\%. \qquad (6.16)$$

In addition, suppose that we have forecasted the company's free cash flow to be $1 million this year, followed by 3% annual growth forever. Using our perpetual growth formula from Chapter 3, we estimate that the company is worth

$$V_0 = \frac{\$0.75}{0.0736 - 0.03} = \$17.2 \text{ million.} \tag{6.17}$$

Now, suppose that the true market value of the company's debt is $5 million. This would mean that our estimate was 20% lower than the actual number, so this scenario represents a sizable error. Our estimate of the company's WACC would change to

$$WACC = \frac{\$5}{\$5 + \$10} \times 5\% \times (1 - 0.35) + \frac{\$10}{\$5 + \$10} \times 9\% = 7.08\%, \tag{6.18}$$

and our estimate of the value of the company would change to

$$V_0 = \frac{\$0.75}{0.0708 - 0.03} = \$18.4 \text{ million.} \tag{6.19}$$

Thus, our estimate of the company value would be 6.5% below its true value. Although this is not a trivial difference, it does highlight the fact that large errors in the estimate of the market value of debt tend to lead to much smaller errors in our value estimates.

Estimating the Market Value of Preferred Stock

As with the cost of preferred stock, the market value of preferred stock is often difficult to estimate because the stock may not be publicly traded or, even if it is, it may be illiquid. As with debt, in the absence of a market price for the preferred stock, we typically use the book value of preferred stock as our estimate. Since the value of preferred stock is almost always very small relative to the values of debt and equity, very large errors in estimating the value of preferred stock lead to very small errors in our value estimates.

Estimating the Market Value of Equity

The market value of common stock is usually easily to obtain because it is just the current share price multiplied by the number of shares outstanding. Many finance-related websites list this as the *market capitalization* of the company. We run into problems only when the stock is privately held, which is not a major focus of this book. One issue that does come up is whether the existence of ESOs requires any adjustment to our estimate of the market value of equity. Although it is true that ESOs will likely dilute the value of current shares at some point in the future, the exercise of ESOs tends to have only a small impact on the market value of equity. What little impact there is comes from the cash inflow to the company from those who exercise their ESOs. Since the impact on total market capitalization does tend to be small, we generally ignore it entirely and do not make any WACC adjustments for the presence of ESOs.

Case Study: O'Charley's

Computing the WACC for O'Charley's is relatively simple because the company has publicly traded stock, no preferred stock, and debt that is rated by S&P. The company's debt is rated B by S&P, which is a rating two steps below investment grade. This should not be surprising given our analysis in the previous chapter, which showed that the company's debt position is weak. Table 6.1 shows that the credit spread for a B rated bond with a 10-year maturity is 400 basis points, or 4%. The 10-year Treasury yield can be found on a number of websites and was 4.64% on March 23, 2005[2] (the date of this analysis). This gives us a cost of debt of 4% + 4.64% = 8.64%, which is quite high because of the company's weak financial condition. The cost of equity can be estimated with the use of the CAPM, although the estimate will turn out to be suspect.[2] The 60-month β for O'Charley's is 0.228,[3] which seems quite low for a company that seems to be struggling. Table 6.8 shows the β's for all of our restaurant companies. We see that O'Charley's has the lowest β, whereas Outback has the highest. The table also shows the results of our delevering/relevering process, which gives us an estimate of 0.516 for the β of O'Charley's. Using the CAPM with a risk-free rate of 4.64% and a market risk premium of 4.00%, we estimate O'Charley's cost of equity to be $4.64\% + 0.516 * 4.00\% = 6.70\%$. Ordinarily, this would not be of great concern, but we have already estimated the cost of debt to be 8.64%, which is a good bit higher than our estimate of the cost of equity. This conflicts with our understanding of the

[2]Source: www.cnnfn.com.
[3]Source: finance.yahoo.com.

TABLE 6.8

Betas, Restaurant Companies

	Applebee's	O'Charley's	Darden	Outback	Ruby Tuesday
Ticker	APPB	CHUX	DRI	OSI	RI
β	0.290	0.228	0.445	0.767	0.284
Current share price	$28.46	$20.76	$27.49	$45.36	$24.00
Shares outstanding (000)	81,076	21,370	158,868	73,765	64,133
Market capitalization ($000)	$2,307,423	$443,641	$4,367,281	$3,345,980	$1,539,192
Debt ($000)	229,581	227,943	463,164	495,800	463,164
Equity weight	0.910	0.661	0.904	0.871	0.769
Asset β (average = 0.341)	0.264	0.151	0.402	0.668	0.218
Relevered β	0.374	0.516	0.377	0.391	0.443

Source: finance.yahoo.com.

risk of debt as it compares with the risk of equity. Since debtholders are paid first, we know that debt will (in usual circumstances) be less risky than equity and therefore that the cost of debt will be less than the cost of equity. Warren Buffett and others who eschew the CAPM would likely argue that this is further evidence that the CAPM cannot be applied practically, despite its intuitive and desirable theoretical basis. In cases like that of O'Charley's, they may very well be right. For now, we will go ahead and compute the WACC for O'Charley's, using a cost of equity of 6.7%. We will also consider how the WACC would change if the true cost of equity were higher. This will allow us to conduct a more informed sensitivity analysis later in the book.

Table 6.9 shows the WACC for O'Charley's as a function of different β's. In the table, we use a cost of debt of 8.64%, a tax rate of 35%, and a weight on equity of 0.661. We see that the WACC for O'Charley's is 6.34% if we use a cost of equity of 6.7%, but might be much higher if believe the true β is higher. If, for example, we believe the stock is riskier (in a nondiversifiable sense) than the market itself, we might opt to use a β on the order of 1.25, which would give us a WACC of 8.94%. Buffett and others in his camp would likely argue that the stock of a company like O'Charley's should earn 10–12% per year to compensate investors for its risk. There is nothing wrong with this, because Buffett has so much experience that he knows instinctively what kind of return an investment should pay. For

TABLE 6.9

Weighted Average Cost of Capital, O'Charley's

β	Cost of equity (%)	WACC (%)
0.516	6.70	6.34
0.75	7.64	6.95
1	8.64	7.61
1.25	9.64	8.28
1.5	10.64	8.94

those of us without that wealth of experience, the CAPM often provides us with our best estimate of the cost of equity. We will revisit this issue in later chapters when we consider specific valuation models.

SUMMARY

In this chapter, we considered how to estimate the appropriate discount rate for use in discounting the expected cash flows of a given security. There are two main approaches used to estimate discount rates. In the first, we simply determine the discount rate that is implied by market itself. For publicly traded bonds and preferred stock, we can use the yield-to-maturity as an estimate of the appropriate discount rate. For bonds and preferred stock that are not publicly traded, we can often rely on credit ratings that are provided by credit agencies such as S&P and Moody's. Estimating the appropriate discount rate for common stock is a more difficult matter because the cash flows are not prespecified. If the stock is publicly traded, however, we have access to historical data that will help us. To use this data, we focus on the important distinction between diversifiable risk and nondiversifiable risk. In equilibrium, only nondiversifiable risk will contribute to the expected returns on a security. This allows us to develop a rather simple formula (the Capital Asset Pricing Model formula) that gives us an estimate of the cost of equity. Once we have the costs of debt, preferred stock, and common stock, we can compute the company's weighted average cost of capital (WACC), which is the appropriate discount rate for use in discounting the unlevered free cash flows of the company.

We also continued our case study of O'Charley's and discovered that the CAPM estimate of the cost of equity is quite suspect. This is often the case in practice, and in such cases we must rely on our basic knowledge of the risk-return relationship. We must also conduct a careful sensitivity analysis whenever we have reason to believe that our discount rate estimate may be inaccurate. We will revisit this idea in later chapters.

This page intentionally left blank

CHAPTER 7

Forecasting

PURPOSE AND SCOPE

In this chapter, we examine issues associated with forecasting the financial statements of the company. The specific role of forecasting is twofold. First, it allows us to get an understanding of how various assumptions affect the company's financial condition. Second, it provides the basis for the forecasting of the company's free cash flows, which are in turn used to estimate the value of the company.

As we will see throughout the remainder of this book, virtually all of stock valuation boils down to understanding growth. In particular, we seek to understand how our expectations of growth differ from the expectations embedded in market prices. To begin, we show a theoretical relationship between the DuPont factors and the maximum rate at which company sales can grow without a substantial amount of external capital being raised. In that scenario, the company relies on its retained earnings to generate the funds needed to support future growth. This rate of growth is called the *sustainable growth rate* because it represents the growth rate the company can sustain if its core efficiencies do not change and if it uses only internal capital (along with a small amount of additional debt to maintain capital structure) to generate the growth. The company may actually grow at a faster rate (which forces the company to raise additional capital and perhaps dilute the company's shares) or at a slower rate (in which case some of the company's retained earnings are not reinvested and the company's cash position typically increases).

We then spend some time discussing the actual forecasting process, which is based on first forecasting sales and then forecasting other financial variables based on how we expect them to be related to sales. There are two main approaches used in forecasting. In the first, we create pro forma financial statements for the coming years. This approach is comprehensive and has some real advantages, namely that we are able to gain an in-depth understanding of the entire company and we are able to confidently forecast the capital needs of the company. This exhaustive approach allows us to carefully consider each of the company's financing alternatives so that we understand the impacts on earnings and cash flow. In the second, we forecast only those variables that are components of the company's free cash flows. The main advantage of this approach is that it requires less time. This allows us to evaluate many different scenarios very quickly, which can give us a much better feel for the true financial status of the company. The main disadvantage is that it shortcuts the forecasting process, leaving us without a thorough understanding of the implications associated with different types of financing. We will discuss both of these approaches but will first focus on developing full pro forma financial statements.

At the end of the chapter, we return to our analysis of O'Charley's and evaluate the company by the shorter of the two forecasting approaches. In doing so, we stress that a given forecast represents only one scenario of many possible ones. There is a real danger that we will forecast the statements and then come to believe that they are somehow the one "true" forecast. In practice, all of financial modeling involves oversimplifications of reality. As such, modeling should *only* be used to help us understand the given situation. It is only then that we can begin to assess how our expectations differ from those that are embedded in market prices.

IN THEORY . . .

To estimate future growth, we might rely on historical growth, industry forecasts, and any of a number of other pieces of information that help us understand where the company is headed. The accuracy and reliability of each of these depend heavily on the company under consideration. Using historical growth to estimate future growth is simple, yet will only provide meaningful results if we believe the company is likely to remain fundamentally unchanged over the next few years. For example, over the years 2000–2004, the annual earnings per share of O'Charley's grew at −20.16%, 45.45%, −31.94%, and 7.14%. We might then estimate that earnings will grow at the average of these (0.12%) over the next few years. This would, of course, be an absurd way to forecast the earnings of a company that is as volatile as O'Charley's. Alternatively, we might look for general trends over time and use them to forecast the future. Neither of these approaches is likely to be at all accurate, because the future prospects of the company are likely to differ from the past, and because we ignore detailed information we might have that would help us better forecast the company's future. It follows that our task is to use historical information along with our understanding of current conditions to generate a forecast of the future. There is no simple way to do this. To further understand the basic difficulties we face in using historical information, consider the following simple scenarios.

> *Scenario 1*: A company's sales and earnings have grown at 10% per year for the past 5 years. The company's capital structure was stable over that period, and no new shares of common stock were issued. The growth was due solely to increased sales of the company's product rather than such activities as acquisitions of other companies. Furthermore, industry sales have mirrored the company's growth over the past few years. Finally, we see no evidence suggesting that the company's core efficiency is likely to change.
>
> *Scenario 2*: A company's sales and earnings have grown at 10% per year for the past 5 years. The company's core products were in decline over that period, but the company was able to grow through a series of acquisitions. Meanwhile, industry sales increased at about 10% per year, so the company would have lost market share had it not acquired other companies. To finance the acquisitions, the company issued new shares of stock twice in the past 5 years, thereby reducing its debt ratio and diluting its shares of common stock. Finally, our financial statement analysis shows that the company has become less and less efficient over time.

Although both companies have historical sales and earnings growth of 10%, our perspectives on the future growth rates of the companies are quite different. In Scenario 1, we see a very stable company for which historical growth is likely to be a good predictor of future growth. In Scenario 2, we see a company that apparently has negative organic growth (its core products were in decline), but the company has managed to grow by acquiring other companies. To finance those acquisitions, company managers chose to dilute the shares of existing shareholders. The company is also becoming less efficient for some reason—perhaps the company's technology is becoming outdated or worker pessimism is having an effect. Given all this, is it at all reasonable to conclude that the historical growth rate of the company is a good predictor of the future growth rate? Even if you believe it is, you must consider the likelihood that current shareholders may not receive the benefits of that growth, because their shares may once again be diluted.

Our point in considering these scenarios is that forecasting growth is not an easy task. Because of this, we must take great pains to investigate the factors that contribute to (or take away from) growth. Essentially, successful forecasting boils down to understanding and evaluating the potential sources of growth. This is a critical issue.

Growth is not free! The company must spend money to make money.

Furthermore, growth is tied directly to shareholder returns.

I think you have to learn that there's a company behind every stock, and that there's only one real reason why stocks go up. Companies go from doing poorly to doing well or small companies grow to large companies.
—Peter Lynch

To create growth, the company typically must hire people, purchase materials, produce goods, devise a distribution system, market products, and so on. Any discussion of growth must therefore focus on the sources of the money needed to generate that growth. We begin our discussion by assessing how fast a company can grow if it relies only on retained earnings (along with a small amount of additional debt to maintain the company's capital structure). We call this assessment the *sustainable growth rate*, and it provides a baseline from which we can assess how fast the company can grow and what it will take for the company to achieve that growth.

Growth from Retained Earnings

"Growth" has long been a buzzword used to describe phases in a company's life. We begin by asking the question, growth in what? Are we talking about growth in sales? Earnings? Free cash flow? In theory, the objective of company managers is to maximize shareholder wealth, so we should be concerned about the growth in shareholder wealth. In accounting terms, the growth in shareholder wealth is measured by the return on equity (ROE), which as we recall is the company's net income divided by its equity. The net income of the firm is just sales less expenses, so the change in shareholder wealth is tied directly to the change in sales. This provides a useful starting point for our discussion.

To understand the growth in sales, it is useful to think of assets in terms of their ability to generate sales. In order to increase sales by 20%, for example, the firm will typically (but will not always) need to acquire an additional 20% in assets. This suggests that the *asset turnover* (sales/total assets) is a critical determinant of growth. A second determinant is the *profit margin* (net income/sales), which reflects the fraction of the firm's sales that belong to shareholders. Of course, only a portion of net income (the retained earnings) can be used by the firm to acquire additional assets, so the *earnings retention rate* (retained earnings/net income) must be a third determinant of sustainable growth. Finally, the firm's *debt-to-equity ratio* is a determinant of sustainable growth. As the firm retains more and more earnings, it can take on more and more debt without an increase in risk. We might reasonably assume, for example, that the debt-to-equity ratio will be roughly constant over time. If the equity on the company's balance sheet increases because of an increase in additions to retained earnings, then the debt would increase by a corresponding amount, so that the debt-to-equity ratio remains unchanged.

The Sustainable Growth Rate

We can use this intuition to generate a formula that allows us to estimate the sustainable growth rate for sales. Sustainable growth is, by definition, the growth rate that the firm can sustain without issuing new equity and without changing its capital structure (i.e., without changing the debt-to-equity ratio). For simplicity in the following discussion, we will assume that preferred stock is simply another form of debt, and we will include any preferred stock as part of our debt calculation. To develop a formula for the sustainable growth rate of the company, we initially assume that the profit margin, asset turnover, earnings retention rate, and debt-to-equity ratio are all constant over time. We will also assume that the firm will not issue additional equity over the period, which is consistent with the idea that company managers do not like to dilute the company's shares. These assumptions are, of course, entirely unrealistic, but they do allow us to establish a baseline for sales growth. We can then consider what happens when we relax those assumptions, which allows us to evaluate what must change in order for the firm to grow at a faster rate (or at a slower one, for that matter).

Suppose then that sales are S_0 over a given period of time and that we wish to know how fast sales can grow under our assumptions. We define ΔS as the change in sales from that period to the next. The growth rate for sales over the period is then $\Delta S/S_0$. Now consider the balance sheet. In order to generate a sales increase of ΔS, the firm must purchase $\Delta S \times (TA/S)$, where TA/S is the inverse of the company's asset turnover (which we assume to be constant). If the company's total assets were to change by some other amount, the asset turnover ratio would change, thus violating our assumption that it is constant. Thus,

$$\Delta TA = \Delta S \times \frac{TA}{S}. \tag{7.1}$$

The equity on the balance sheet increases by the company's retained earnings for the period. The retained earnings are the company's net income for the period multiplied by the earnings retention rate, which we will denote by b. The retained earnings (i.e., the change in equity) will be the company's sales multiplied by the profit margin, so

$$\Delta E = \left(S_0 + \Delta S\right) \times \frac{NI}{S} \times b. \tag{7.2}$$

Under our assumptions, the debt-to-equity ratio is constant. It follows that the debt on the balance sheet must increase by $(S_0 + \Delta S) \times (NI/S) \times b \times (D/E)$, so that the debt-to-equity ratio is constant. Thus,

$$\Delta D = \left(S_0 + \Delta S\right) \times \frac{NI}{S} \times b \times \frac{D}{E}. \tag{7.3}$$

We can now assess the growth in sales as a function of the various factors. For the balance sheet to balance, the increase in assets must be equal to the increase in debt plus the increase in equity, or

$$\Delta TA = \Delta D + \Delta E. \tag{7.4}$$

Substituting from our observations above, we have

$$\Delta S \frac{TA}{S} = \left(S_0 + \Delta S\right) \times \frac{NI}{S} \times b \times \frac{D}{E} + \left(S_0 + \Delta S\right) \times \frac{NI}{S} \times b. \tag{7.5}$$

We can rearrange this equation to get

$$\boxed{g^* \equiv \frac{\Delta S}{S} = \frac{\frac{NI}{S} \times b \times \left(1 + \frac{D}{E}\right)}{\frac{TA}{S} - \frac{NI}{S} \times b \times \left(1 + \frac{D}{E}\right)}} \tag{7.6}$$

where g^* denotes the company's sustainable growth rate. Notice that g^* is increasing in the profit margin, the earnings retention rate, and the debt-to-equity ratio. It is also increasing in the asset turnover, although this may not be obvious at first. The inverse of the asset turnover appears in the denominator of Equation 7.6, so a higher asset turnover decreases the denominator and therefore increases g^*. Of course, we make these observations under the assumption that nothing else changes at the same time. In reality, a higher debt-to-equity ratio might lead to a lower sustainable growth rate. To see this, notice that to increase the debt-to-equity ratio, the company might increase debt. Since this leads to higher interest expense, we know that a higher debt-to-equity ratio can be associated with a lower profit margin. These two effects at least partially offset each other in the sustainable growth equation, so g^* could go up or down as the company increases its debt. Alternatively, the company might decrease equity to increase the debt-to-equity ratio. Of course, this would require cash to buy back the shares, which would eat up some of the funds being used to finance the growth in the first place.

The sustainable growth rate gives us the relationship between the growth in sales and several key accounting ratios. The fact that the profit margin, asset turnover, and debt-to-equity ratio appear in the formula reinforce what we discovered when examining the DuPont approach—that those ratios are tremendously important when evaluating the health of the firm. We know, of course, that those ratios and the earnings retention rate are not constant over time. Despite this, Equation 7.6 is useful because it helps us understand the company's ability to grow. Consider the following example.

Example 7.1: A company currently has a profit margin of 8.1%, an asset turnover of 2.1, a debt-to-equity ratio of 0.6, and an earnings retention rate of 37%. We note, however, that the company has developed a new inventory control system that will allow the company to reduce its costs. Because of this, we believe the company's profit margin will increase from 8.1% to 9.3%. How does this affect the company's capacity to increase its sales without taking on new equity or changing its capital structure?

Plugging these numbers into Equation 7.6, we see that the company is currently operating with a sustainable growth rate of 11.2%. If indeed the profit margin increases as we expect, the sustainable growth rate will be 13.1%, an increase of 1.9%. Thus, the new inventory control system would allow the company to grow at a substantially faster rate without paying the usual costs associated with raising money in the capital markets.

To use the sustainable growth rate, we first estimate it and then compare it with our expectations of the company's future growth in sales. If we expect the company's sales to grow at some rate below the sustainable growth rate, then we expect the company to generate excess cash. That cash can be used for any of a number of different purposes, including the acquisition of other companies and increasing the payments (such as common stock dividends) to investors. If in contrast we expect the company's sales to grow at some rate below the sustainable growth rate, then we must evaluate how the company will come up with the money to finance that excess growth.

The Forecasting Process

There are a variety of ways in which we might forecast the financial statements of the company, but the most common technique involves first forecasting sales and then forecasting the other variables based on the expected relationship between them and sales. Loosely speaking, we can write out the following steps for forecasting the financial statements of the company.

1. Estimate the future sales of the company over the desired forecast period.
2. Forecast the other financial variables under the assumption that the company will not issue additional long-term debt or equity unless we already know that the company has plans to do so. In a typical scenario, we would forecast many of the variables as a percentage of sales. The remaining variables would then be forecast with the use of different but logical approaches. Table 7.1 shows a list of the financial variables and how we would typically estimate them. The table is only a rough guide, and we may use other approaches for some variables, depending on the specific situation we are analyzing.
3. Determine the company's financing need (or financing excess) by looking at the difference between forecasted total assets and forecasted total liabilities and equity.
4. If the company has a financing need, estimate how the company will likely meet that financing need (issue equity? issue debt or preferred stock? deplete cash reserves? do something else?). If the company has excess financing, determine what the company will likely do with the excess financing (buy back stock? pay down debt or preferred stock? acquire another company? hold excess cash? do something else?).
5. Redo the forecast to incorporate changes that will eliminate the financing need or the excess financing (i.e., we make changes so that the balance sheet balances). It is possible that we will have to repeat this process several times until we are satisfied with the result. One particularly tricky aspect arises if we make changes to the company's long-term debt. If we forecast that the company will issue additional debt, we would then forecast higher interest payments. This in turn would reduce the company's retained earnings and therefore would increase the company's need for cash. We will see how this plays out a bit later when we consider a numerical example.

Of course, our understanding of the company's sustainable growth rate underlies this entire process, giving support to the assumptions we make

TABLE 7.1

Typical Forecasting Techniques for Financial Variables

Financial variable	Forecast technique
Cost of goods sold (COGS)	Percentage of forecasted sales
Selling, general, and administrative costs (SG&A)	Percentage of forecasted sales
Depreciation (Dep)	Percentage of company's Net PPE
Operating income (OpInc)	Sales − COGS − SG&A − Dep
Interest expense (INT)	Percentage of company's interest-bearing debt
Taxable income (TaxInc)	OpInc − Dep
Taxes	Percentage of taxable income
Net income (NI)	TaxInc − Taxes
Dividends (Div)	Constant initially. We may later forecast that the company will increase or decrease dividends
Retained earnings	NI − Div
Current assets (including cash, receivables, and inventory)	Percentage of forecasted sales
Property, plant, and equipment (Net)	Percentage of forecasted sales or inferred from capital expenditure forecasts in conjunction with depreciation
Capital expenditures	Inferred from the fixed asset accounts or forecast directly.
Current liabilities	Percentage of forecasted sales
Long-term debt	Constant initially. We may later decide that the company will pay down or issue additional debt.
Preferred stock	Constant initially. We may later decide that the company will buy back or issue additional preferred stock.
Equity	Initially, the level in previous period plus retained earnings. We may later decide that the company will buy back stock or issue new stock.

and giving us an understanding of the potential of the company. A long but straightforward example illustrates the process.

A Forecasting Example

A company's stock is currently trading for $17 per share, with 750,000 shares outstanding. The company has no excess cash and has no long-term assets that are idle and therefore available to sell to raise capital. The company has the historical financial statements shown in Table 7.2. Recall that CY-1 denotes 1 year before the current year (i.e., "last year"), CY-2 denotes 2 years before the current year, and so on. Table 7.3 shows se-

TABLE 7.2

Historical Financial Statements for Example 7.2

Income statement	CY-3	CY-2	CY-1
Sales	$8,071	$8,428	$8,560
COGS	$4,468	$4,484	$4,614
SG&A	$843	$1,021	$1,168
Depreciation	$540	$689	$899
Op income	$2,220	$2,234	$1,879
Interest	$112	$135	$139
Taxable income	$2,108	$2,099	$1,740
Taxes	$674	$629	$574
Net income	$1,434	$1,470	$1,166
Earnings per share	$1.91	$1.96	$1.55
Dividends	$1,020	$1,020	$1,020
Dividends per share	$1.36	$1.36	$1.36
Retained earnings	$414	$450	$146
Balance sheet			
Cash	$684	$766	$701
Receivables	$1,023	$1,186	$1,299
Inventory	$860	$932	$894
PPE	$5,921	$6,820	$7,958
Accumulated dep.	$1,612	$2,301	$3,200
PPE, net	$4,309	$4,519	$4,758
Total assets	$6,876	$7,403	$7,652
Short-term debt	$832	$909	$1,012
Long-term debt	$1,910	$1,910	$1,910
Total liabilities	$2,742	$2,819	$2,922
Common stock	$903	$903	$903
Additions to retained earnings	$3,231	$3,681	$3,827
Total equity	$4,134	$4,584	$4,730
Total assets and liabilities	$6,876	$7,403	$7,652

Amounts are in thousands of dollars.

TABLE 7.3

Historical Value as a Percentage of Sales, Example 7.2

	Technique	CY-3	CY-2	CY-1
COGS	% of sales	55.36%	53.20%	53.90%
SG&A	% of sales	10.44%	12.11%	13.64%
Depreciation	% of prior year's net PPE	NA	15.99%	19.89%
Interest	% of prior year's long-term debt	NA	7.07%	7.28%
Taxes	% of taxable income	31.97%	29.97%	32.99%
Dividends	% growth from prior year	NA	0.00%	0.00%
Cash	% of sales	8.47%	9.09%	8.19%
Receivables	% of sales	12.68%	14.07%	15.18%
Inventory	% of sales	10.66%	11.06%	10.44%
PPE, net	% of sales	53.39%	53.62%	55.58%
Short-term debt	% of sales	10.31%	10.79%	11.82%

lected items from the financial statements rewritten as a percentage of the relevant variable. For example, the cost of goods sold (COGS) is shown as a percentage of sales, and depreciation is expressed as a percentage of net PPE. We will use these percentages as information that will help us estimate the future values of the various accounts.

Our task is to create pro forma financial statements for the next several years. Since the statement of cash flows is simply the change in the balance sheet, we will only need to forecast the income statement and balance sheet for the company. If we wish to compute the company's free cash flows, we can infer capital expenditures from our forecasts of the fixed asset accounts. Suppose that we have chosen a forecast period of 4 years. Suppose further that we have analyzed the strategic position of both the company and its industry and have concluded that the company is in a position to increase its sales at an annual rate of 8% for the next 3 years. So that we can focus on the basic forecasting techniques, we will not spend a lot of time talking about how we come up with the initial sales forecast. In most cases, the forecast is based on a somewhat qualitative assessment of the prospects for the industry and the company's position within that industry.

Recall that our basic procedure consists of five steps, the first of which is the sales forecast. The second step involves forecasting individual items on the financial statements based on our expectations for those variables as they relate to the company's expected sales. The results of this analysis are shown in Table 7.4. In that table, "a" designates actual results and "p" designates predicted ones. In the following pages, we will discuss the individual entries in that table.

TABLE 7.4

Initial Forecast

Income statement	CY-1 (a)	CY (p)	CY+1 (p)	CY+2 (p)	CY+3 (p)
Sales	$8,560	$9,245	$9,984	$10,783	$11,646
COGS	$4,614	$5,006	$5,407	$5,840	$6,307
SG&A	$1,168	$1,294	$1,448	$1,617	$1,805
Depreciation	$899	$854	$922	$996	$1,075
Op income	$1,879	$2,090	$2,208	$2,330	$2,459
Interest	$139	$137	$137	$137	$137
Taxable income	$1,740	$1,953	$2,071	$2,193	$2,322
Taxes	$574	$618	$655	$694	$735
Net income	$1,166	$1,335	$1,415	$1,499	$1,587
EPS	$1.55	$1.78	$1.89	$2.00	$2.12
Dividends	$1,020	$1,020	$1,020	$1,020	$1,020
DPS	$1.36	$1.36	$1.36	$1.36	$1.36
Retained earnings	$146	$315	$395	$479	$567
Balance sheet					
Cash	$701	$794	$857	$926	$1,000
Receivables	$1,299	$1,403	$1,515	$1,636	$1,767
Inventory	$894	$991	$1,070	$1,156	$1,248
PPE	$7,958	$9,192	$10,525	$11,965	$13,520
Accumulated dep.	$3,200	$4,054	$4,976	$5,971	$7,047
PPE, net	$4,758	$5,139	$5,550	$5,994	$6,473
Total assets	$7,652	$8,326	$8,992	$9,712	$10,489
Short-term debt	$1,012	$1,014	$1,096	$1,183	$1,278
Long-term debt	$1,910	$1,910	$1,910	$1,910	$1,910
Total liabilities	$2,922	$2,924	$3,006	$3,093	$3,188
Common stock	$903	$903	$903	$903	$903
Additions to retained earnings	$3,827	$4,142	$4,538	$5,017	$5,584
Total equity	$4,730	$5,045	$5,441	$5,920	$6,487
Total assets and liabilities	$7,652	$7,970	$8,446	$9,013	$9,675
Financing deficit (surplus)		$357	$546	$698	$814

Amounts are in thousands of dollars.

Forecasting Items on the Income Statement

Sales: At 8% annual growth, we forecast sales of $9,245,000, $9,984,000, $10,783,000, and $11,646,000 for the next 4 years.

Cost of Goods Sold (COGS): In general, the COGS will tend to be a relatively constant percentage of sales over time. This example is no exception, as the COGS/sales ratio was right around 54% for each of the last 3 years. At this point in a real-world analysis, we would consider whether there is reason to believe that the COGS/sales ratio will differ in the future. For example, we may be analyzing a company that uses oil in the manufacturing process. If oil prices have been high over the past few years but are now declining, we might forecast a lower COGS/sales ratio for the next few years. For this example, we will assume that we have no such information and therefore that the COGS/sales ratio will be the average of the historical numbers (54.15%) in the years to come. This gives us a COGS forecast of $9,245,000 × 54.15% = $5,006,000 in the current year, $5,407,000 in CY + 1, and so on.

Sales, General, and Administrative (*SG&A*) *Expenses*: SG&A expenses also generally tend to vary with sales over time. In our example, we see that the SG&A/sales ratio has risen from 10.44% to 13.64% over the last 3 years. This is a concern because we see a sizable trend in the wrong direction. In a real-world example, we would pause to investigate the trend so that we might gauge the likelihood that it will continue. The trend is noteworthy enough that we would certainly expect company managers to discuss it, either in the company's reports (the Management Discussion section is a likely place to find such information) or in conference calls (which are typically archived on the company's website). In this example, let us assume that management has indicated that SG&A expenses will continue to rise over the next few years. To account for this, we will assume that SG&A will be 14%, 14.5%, 15%, and 15.5% of sales over the next 4 years (these numbers are entirely arbitrary for this example). This gives us estimates of $9,245,000 × 14% = $1,294,000 in the current year, followed by $1,448,000 in CY + 1, and so on.

Depreciation: We defer the calculation of our depreciation estimation until we have forecast the company's need for fixed assets. Once we have that forecast, we will assume that depreciation for 1 year is a percentage of the company's net PPE from the end of the previous year (i.e., the beginning of the contemporaneous year). In doing so, we should be aware that this is a rough approximation. During the year, the company may sell old equipment and/or purchase new equipment, either of which might affect the depreciation during the year. Since those effects are likely to be small relative to the depreciation on the rest of the company's PPE, it is reasonable to simply use the net PPE from the end of the previous year. In the last 2 years, we see that depreciation was 15.99% and 19.89% of the company's Net PPE from the year before (an average of 17.94%). For example, depreciation in CY-1 was $899, which is 19.89% of the $4,519,000 in net PPE from CY-2. Note that we cannot compute the percentage for CY-3 because we do not have the financial statements from CY-4. Although the percentages for CY-1 and CY-2 are quite different, we do not expect to see significant trends over time. Depreciation schedules are regulated based on the type of asset being depreciated, so we can generally count on depreciation to be a relatively constant percentage of net PPE. In our example, we will assume that future depreciation will be 17.94% of the prior year's net PPE.

Earnings Before Interest and Taxes (EBIT): We do not estimate EBIT directly, but instead calculate it by subtracting COGS, SG&A expenses, and depreciation from sales. Of course, this example is relatively simple. In a more realistic example, there may be other types of expenses that will also be subtracted.

Interest Expense: Recall that we initially assume that the company will not change its level of long-term debt. We therefore need only estimate the interest rate on debt to forecast the interest expense. In the last 2 years, the company paid interest that was 7.09% and 7.27% of the prior year's long-term debt. This leads us to ask whether this information provides the basis for a meaningful estimate of the future interest rate on the company's debt. Fortunately, the interest expense estimate is not all that critical at this point, because interest expense is excluded from the unlevered free cash flow calculation. Our purpose in estimating it here is simply to help us get a better understanding of the company's financing needs. In this example, we have no reason to assume that the interest rate will change, so we will assume that interest expense will be 7.17% (the average of 7.07% and 7.28%) of the debt level at the beginning of the year. Currently, the company has $1,910,000 in long-term debt, so we forecast an interest expense of $1,910,000 × 7.17% = $137,000 for each of the next 4 years. If at some point we do forecast that the company will issue new debt (either to refinance debt that is maturing or, as we will discuss later, to satisfy a financing need), we would need to estimate the interest rate on the new debt. The simplest (and perhaps most accurate) approach would be to use our cost of debt estimate (which we discussed in the previous chapter) as a forecast of the interest rate the company will pay on its debt. We could also estimate the interest rate by looking at the company's interest expense as a percentage of the book value of the debt. This approach is fine as long as the company's financial condition has not changed substantially since the debt was issued. If it has, then the book value of debt would differ substantially from its market value and our estimate of the cost of debt would be biased.

One other point is worthy of discussion here. Interest expense is based on the outstanding balance, which can vary throughout the year. The company may pay down its debt or issue new debt, and we will generally not know the details of the change until the company's new reports are released. For reasons similar to those offered when we discussed how to estimate depreciation, we will simply assume that the company pays the interest rate multiplied by the debt level at the end of the previous period (i.e., the beginning of the current period). This will become important when we consider scenarios in which the company issues new debt.

Taxable Income: We do not directly estimate taxable income, but instead calculate it by subtracting interest expense from EBIT.

Taxes: We defer the estimation of taxes until we have completed our forecasts of depreciation. We do note that in the past 3 years, the company's tax bill has been 31.97%, 29.97%, and 32.99% of taxable income. Seeing no clear trend and having no reason to believe otherwise, we will assume that taxes will be 31.64% of taxable income (the average of the past 3 years).

Net Income: We do not directly estimate net income, but instead calculate it by subtracting taxes from taxable income.

Dividends: In one sense, dividends are unpredictable because they often do not seem to be a relatively constant percentage of sales or of any other item. In reality, they tend to vary with earnings over the long run, but may not over the short run. This occurs in part because company managers are very hesitant to decrease dividends. If they do, the market will surely interpret the cut in a very negative fashion, causing the company's stock price to drop substantially. Indeed, there is ample historical evidence to support this expectation. Company managers are also cautious when considering a dividend increase because they want to be all but certain that they will be able to continue paying dividends of at least that amount. In our example, dividends have been constant at $1,020,000 each of the last 3 years. We will therefore assume that the company will continue paying $1,020,000 in dividends per year. If we later find that the company will generate excess cash, we may revisit the issue and perhaps forecast that the company will increase its dividend payments. If in contrast we forecast that the company will issue additional equity, we may increase the dividend forecast so that the company will not cut dividends per share. In general, however, it is reasonable to assume that the company's earnings retention rate will be constant over time.

Retained Earnings: We do not directly estimate retained earnings, but instead calculate it by subtracting dividends from net income.

Having done all we can do with the items on the income statement, we proceed to the items of the balance sheet.

Forecasting Assets on the Balance Sheet

Cash: Cash is used to support operations, so it is reasonable to expect it to be a relatively constant percentage of sales. There can of course be wide deviations from this as companies seek to build up cash for reasons not associated with current operations, or as cash is depleted to handle unexpected needs. As we discussed in Chapter 4, we would typically examine peer companies to help us estimate how much of the company's cash is operating cash and how much is excess cash. In this example, we assume for simplicity that the company currently has no excess cash. We can therefore rely on the company's historical level of cash relative to sales. In the past 3 years, the company's cash/sales ratio was in the 8–9% range, with an average of 8.58%. Given that the historical numbers are relatively consistent, we will assume that future cash will be 8.58% of sales. Therefore, we forecast that cash will be $9,245,000 × 8.58% = $794,000 during the current year, $857,000 during CY + 1, and so on.

Receivables: As with cash, receivables are directly related to a company's sales, so we expect them to be a relatively constant percentage of sales. In our example, we see that receivables have been 12.68%, 14.01%, and 15.18% of sales over the past 3 years. The substantial increase in the ratio is worrisome because it suggests that the company's recent sales growth is partially attributable to relaxed credit standards. At this point, we would ordinarily revisit the company's reports and news items to try to determine whether the trend is likely to continue. In addition, this fact alone would also cause us to revisit our sales forecast to be sure that we have not misinterpreted historical sales growth and then used that misinterpretation as a partial basis for our growth estimate. For example, we might observe that the company's product is gradually becoming obsolete and that the company has responded by relaxing its credit standards in hopes of sustaining sales. For illustration purposes, let us assume that company managers have indicated (and we believe) that the recent trend is not likely to continue and that the receivables/sales ratio is likely to stabilize at or around the current level. We will therefore assume that receivables will be 15.18% of sales during the next 4 years. We then forecast receivables of $9,245,000 × 15.18% = $1,403,000 during the current year, $1,515,000 during CY + 1, and so on.

Inventory: A company's inventory is typically a relatively constant percentage of sales, but there are clearly exceptions. In a declining economy, we might see inventory build up while sales decline. The opposite may be true in an advancing economy. Our expectations depend heavily on the nature of the company. As evidence, consider a retailer that has a fixed amount of shelf space. Higher sales simply means that merchandise is leaving the shelves and being replaced at a faster rate. The amount of inventory on hand at different points in time is the same because of shelving constraints. In our example, we observe that inventory has been relatively constant in the 10.5–11% range. We will therefore assume that future inventory will be 10.72% of sales (the average of the historical percentages). Thus, we forecast inventory to be $9,245,000 × 10.72% = $991 during the current year, $1,070,000 during CY + 1, and so on.

Net Property, Plant, and Equipment (net PPE): The fixed assets of a company are the assets that help generate the products or services sold by the company. It follows that net PPE will tend to be a relatively constant percentage of sales. It is worth noting that we often see cases, particularly for smaller companies, in which net PPE does not appear to vary with sales over the short run. Imagine, for example, that a small printing company has purchased a new printing press that has an expected life of 10 years. That press constitutes 50% of the company's fixed assets. Assuming that the company does not purchase other fixed assets, we will observe net PPE gradually decrease over time as the printing press is depreciated. If sales do not also decrease during that time, then the net PPE/sales ratio would seem to drop dramatically over the next 10 years. When the company finally replaces the printing press (presumably in 10 years), we would see a large increase in net PPE during that year. In this way, net PPE tends to vary with sales over the long run, but may not over the short run. It is worth noting that this problem is minimal when we are dealing with large companies that buy and sell many fixed assets each year. This tends to smooth the time series of net PPE and make it more predictable.

In our example, net PPE has increased from 53.62% of sales to 55.58% of sales in the last 2 years. In a real-world scenario, we would very likely be able to determine the company's plans for capital expenditures (which determine the level of net PPE). In particular, the issue is very often addressed both in the company's reports and in their conference calls with analysts. In this example, we will arbitrarily assume that the company will maintain the current level of net PPE relative to sales, 55.58%. We therefore forecast net PPE to be $9,245,000 × 55.58% = $5,139,000 during the current year, and so on.

Now that we have forecast the company's net PPE, we can return to the income statement and complete our estimate of the company's future depreciation. Recall that we chose to estimate depreciation as 17.94% of the prior year's net PPE. We therefore forecast depreciation to be $4,758,000 × 17.94% = $854,000 for the current year, $922,000 for CY + 1, and so on. This provides the last piece of the income statement forecast, so we can now estimate EBIT, taxable income, taxes, net income, and retained earnings, the values of which are all shown in Table 7.4.

We can also now estimate the company's PPE and its accumulated depreciation. In reality, there is no particular need to do this if we are only concerned about forecasting free cash flows, but we will do so in this case in order to be complete and to help us understand the company's need for financing. The accumulated depreciation account reflects the total amount of depreciation taken to date on the fixed assets on the company's balance sheet. To compute it, we take the accumulated depreciation from the prior year, add the new depreciation from the income statement, and subtract the accumulated depreciation of any fixed assets that were disposed of (sold or scrapped) during the year. To keep this example simple, we will assume that the company has not sold any fixed assets and that it has no plans to do so in the near future. We therefore forecast accumulated depreciation to be $3,200,000 + $854,000 = $4,054,000 for the current year, $4,976,000 for CY + 1, and so on.

Finally, we can now forecast the company's PPE, which is the total amount of money spent by the company to acquire the fixed assets on the company's balance sheet. In making the forecast, we use the identity that the net PPE is equal to PPE less the accumulated depreciation. For example, PPE for the current year would be $4,054,000 + $5,139,000 = $9,193,000. (Note that this differs from the Table 7.4 estimate of $9,192,000 because of rounding in the spreadsheet used to calculate the table.) Since we have assumed that the company will not sell or scrap any of its fixed assets, the company's capital expenditures will be the change in PPE. For example, we would infer capital expenditures of $9,192,000 − $7,958,000 =

$1,234,000 for the first. This information would be necessary if we were to compute the company's free cash flows.

Forecasting Liabilities and Equity on the Balance Sheet

At this point, we have completed our initial forecast of the assets on the balance sheet. In doing so, we have effectively estimated the company's need for capital in the future. We now turn to the right-hand side of the balance sheet, which addresses the financing of the assets on the left-hand side. In conducting our initial forecast, we will assume that the company will not issue new debt or equity. If we then find that our forecasts of the assets are greater than our forecasts of the liabilities and equity, then we will have identified a financing need for the company. If we find the opposite, we will conclude that the company will have excess financing in the future. This will cause the company's cash account to grow over time unless company managers opt to spend the excess cash.

Accounts Payable: A company uses current liabilities such as accounts payable to help manage day-to-day operations. For example, the company may purchase raw materials on credit from a supplier. The debt enters the balance sheet as a trade payable under accounts payable. It follows that accounts payable will tend to be a relatively constant percentage of sales. In our example, we see that accounts payable was generally around 11% over the last 3 years, so we will assume that future accounts payable will be 10.97% of sales (the average of the historical numbers). We therefore forecast accounts payable to be $9,245,000 × 10.97% = $1,014,000 in the current year, $1,096,000 in CY + 1, and so on.

Long-Term Debt: As mentioned earlier in this chapter, our initial presumption is that the company will maintain its current level of long-term debt. Once we determine how much additional financing the company will need, we will reassess this assumption. If we happened to know of specific plans for the company to issue debt, we would include the effects of those plans in our initial forecast.

Equity: The company's equity on the balance sheet consists of two primary elements, initial contributions from investors (to purchase shares) and retained earnings. If the company issues no new shares and repurchases no shares, the only typical changes to the company's equity will come from retained earnings. This is the case for the historical financial statements of our hypothetical company. In each of the last 2 years, we see that the company's equity is equal to the prior year's equity plus retained earnings. In our initial forecast of the company's equity, we will estimate future equity using the same logic. Unless we know of the company's plans to issue new shares or buy back shares, we begin with the presumption that the shares outstanding will not change. Once we determine the financing needs of the company, we can revisit our forecast and make changes where appropriate.

In our example, we forecasted retained earnings to be $315,000, $395,000, $479,000, and $569,000 during the next 4 years. These numbers are then transferred to the balance sheet under the additions to retained earnings account. For example, additions to retained earnings in the current year would be the old level ($3,827,000 in CY-1) plus the new forecasted retained earnings ($315,000), or $4,142,000. This then directly increases total shareholder's equity, which is the initial value of common stock issued plus the additions to retained earnings. We therefore estimate total equity to be $903,000 + $4,142,000 = $5,045,000 in the current year, followed by $5,441,000 in CY + 1, and so on.

This completes our initial forecast of the company's income statement and balance sheet, which are shown in Table 7.4. Examination of the balance sheet shows something peculiar—the balance sheet does not balance! In this case, we see that the company's total assets are expected to exceed its total liabilities and equity by an amount that increases each year, leading to a deficit of $814,000 in 4 years. It should not be surprising that our balance sheet does not balance initially, especially if we consider the techniques used thus far. We estimated the left-hand side of the balance sheet by assessing the level of assets needed to support the anticipated sales. In contrast, we made no changes to long-term debt on the right-hand side of the balance sheet and only changed the equity to reflect expected additional retained earnings. It would be quite a coincidence if the balance sheet were to balance at this point.

Addressing the Financing Need (or Surplus) To this point, we have forecasted the financial statements under the unrealistic assumption that the company will not change its financing. As we have seen, this is absurd for the company in our example. According to our projections, the company cannot grow at a rate of 8% per year unless it raises additional money. This is consistent with the notion of sustainable growth. Notice that in the first year of our projection (see column CY(p) of Table 7.4), we have a profit margin of $1,335,000/$9,245,000 = 14.4%, an asset turnover of = \$9,245,000/\$7,970,000 = 1.11, a debt-to-equity of \$2,924,000/5,045,000 = 0.65, and an earnings retention rate of \$315,000/\$1,335,000 = 0.24. Using Equation 7.6, we see that the company's sustainable growth rate is

$$g^* \equiv \frac{\Delta S}{S} = \frac{0.144 \times 0.24 \times 1.65}{\frac{1}{1.11} - 0.144 \times 0.24 \times 1.65} = 6.66\%, \tag{7.7}$$

which is less than our 8% growth forecast. Any time the growth forecast exceeds g^*, we will be a position in which the company has a financing need. Of course, it may be the case that the sustainable growth rate will be forecasted to increase over time, in which case we might find that over the long run, the financing need will tend to disappear. This is not the case in our example. We do keep in mind that the assumptions behind the sustainable growth calculation include keeping the debt-to-equity ratio constant over time. This means that the company can issue a small amount of debt in each period to keep pace with increases in equity due to retained earnings. We can explicitly incorporate this into our initial forecast if we so choose. Either way, we should end up with the same final forecast.

Our task then becomes one of evaluating how the company is likely to meet its financing need. This can be a rather important step. For example, we may conclude that the company is not strong enough financially to issue additional debt. If the company instead issues equity, we know that shares will be diluted. The implication is that the benefit of any anticipated sales growth would have to be shared with new stockholders. Alternatively, we may believe that the company will issue additional long-term debt, in which case current shareholders will receive the bulk of the benefit of future sales growth.

It would be next to impossible to create an exhaustive list of all of the choices available to a company with a financing need, but we will briefly discuss a few of the more prominent ones.

1. *Issue Equity*: This dilutes the shares of current shareholders, but does not create an additional cash flow obligation for the company. However, if the company pays dividends, company managers will not want to decrease earnings per share. If the company does issue new shares, we can reasonably infer that dividend per share will stay the same or increase. This would make the company's total dividend payments higher in the future.

2. *Issue Long-Term Debt or Preferred Stock*: This creates an obligation under which the company will need to make future interest or dividend payments. In addition, when any debt that is issued matures, the company will need to raise money to repay the principal (i.e., the company will need to refinance the debt).
3. *Issue Short-Term Debt*: This meets the company's short-term financing needs without subjecting the company to a long-term debt obligation. It also gives the company more flexibility, especially if the expected sales growth does not materialize. One drawback is that the company would be faced with the same decision in a short period of time when the debt comes due. If interest rates rise unexpectedly, the company will find that its interest expenses will subsequently be higher than anticipated.
4. *Hold Less Cash*: This avoids the difficulties associated with issuing equity or debt, but potentially puts the company at risk of having short-term cash flow problems. In addition, every company has a limited stockpile of cash. It follows that using cash to finance growth is only a short-term solution when the company has a financing deficit.
5. *Sell Assets*: Selling off fixed assets is nice if the company does not need them, but most companies do not leave idle fixed assets lying around. A more likely scenario is that a company might choose to sell off an entire division to finance growth in its remaining divisions. As with cash, this can be only a short-term solution to the financing problem.
6. *Restrict Sales Growth!*: Most people find it difficult to accept that a company might want to grow at a slower rate than it can, but there is ample evidence that companies can grow too fast. In particular, if the company's free cash flow yield is below its cost of capital, then higher growth will actually reduce the value of the company! To understand this, recall that the cost of capital is basically the interest rate that the company must pay its investors in order to satisfy them. The free cash flow yield is the actual return on the company's investments. If the free cash flow yield is below the cost of capital, the company is essentially borrowing at one interest rate and investing to earn a lower one! We will revisit the idea later. One way for, say, an exporter to slow down its growth is to simply increase the prices of the

goods and/or services provided by the company. Alternatively (for restaurant chains like O'Charley's, for example), the company might just delay its expansion plans until such time as the free cash flow yield is above the cost of capital.

Returning to our example, it seems unlikely that the company has enough cash to meet the projected $814,000 need. If the company tried to do so, we would see that the company's cash/sales ratio would drop precipitously over the next few years. Unless the company is already operating with substantial excess cash (and we have assumed that it has no excess cash), such a drop would not be wise. It is also unlikely that the company could issue enough short-term debt (even if it wanted to). To do so would require the company to operate with a short-term debt/sales ratio that is nearly double what it has been in recent years. Of course this does not preclude the possibility that the company might use a combination of reduced cash and higher short-term debt to meet the need. This would typically be only a short-term solution. If sales continue to grow at a rapid pace, the company would eventually run out of cash and would no longer find others (trade creditors or banks, typically) willing to issue more short-term debt. We therefore eliminate this possibility for our example. This leaves the possibilities that the company would issue additional equity, issue additional long-term debt, or restrict sales.

So how do we decide between the alternatives? In theory, we would consider each possibility in turn and estimate the per-share value of the company's common stock. The alternative with the highest value would be chosen. This is, as we might imagine, a great deal of work. In practice, company managers are often so focused on earnings per share that they simply choose the alternative that maximizes earnings per share. In many cases, we can quickly rule out one or more possibilities. For example, our analysis of the company's financial statements might already suggest that the company has too much long-term debt and that it would be too risky for the company to take on more debt (recall that we discussed how to make this determination in Chapter 5).

In our example, we will take a look at all three alternatives so that we understand how the forecasting process differs in the three cases.

Meeting the Financing Need by Issuing Long-Term Debt

First, suppose that the company does issue additional long-term debt at 7.17% interest. When would it do so? How much would it issue? We are tempted to say that since the company needs $357,000 during the current year and $814,000 over 4 years, it should go ahead and issue debt in the amount of $814,000 now. There are a few things to consider here. First, is 4 years the best time frame to choose? If we had forecast 5 years out, we would have seen that the company needs even more than $814,000. Should we not plan for more than $814,000 so that we have a buffer and so that we are covered for more than 4 years? Alternatively, we might argue that the company should not commit itself yet. After all, the 8% growth rate might not be realized. The implication is that the company may want to consider a series of planned debt issues instead of just one. Along those lines, the company might choose to arrange a line of credit to maintain flexibility in its financing arrangement. Second, it is important to realize that the company will have to issue more than $814,000 to be fully covered over 4 years. The interest payments on that debt will reduce net income and will hence reduce retained earnings. This in turn will reduce total equity on the balance sheet, which increases the financing need. The effect of this is that the company would have to issue more than $814,000 to be covered over 4 years. To determine how much more, we could do some algebra and identify the precise equation, but using trial and error in a spreadsheet is somewhat easier. Furthermore, we need not be extremely precise here. As long as we are close, we can simply let the cash account absorb any small amounts of financing need (or financing excess for that matter).

In this simplistic example, we have no real way to determine what choice the company would make. Much of that decision would depend on the aggressiveness of managers, the confidence in the sales forecast, and other issues that we have not quantified. For illustrative purposes, we will assume that the company plans to issue enough long-term debt now to cover the expected need for the 4-year period. After some trial and error, we find that the company would have to issue about $954,000 in new debt to cover the $814,000 forecasted deficit and the additional impact on retained earnings (due to higher interest payments). This scenario is depicted in Table 7.5. Examining the table, we see that the candidate debt issue does not have a devastating effect on EPS. The forecast shows strengthening EPS over time, which is something the company probably really needs after the substantial drop in EPS from CY-2 to CY-1. Of course we must still evaluate our other alternatives.

Looking at Table 7.5, we see that we now forecast a financing surplus of $597 in the current year and that our balance sheet still does not

TABLE 7.5

Forecast Assuming One-Time Long-Term Debt Issue

Income statement	CY-1 (a)	CY (p)	CY+1 (p)	CY+2 (p)	CY+3 (p)
Sales	$8,560	$9,245	$9,984	$10,783	$11,646
COGS	$4,614	$5,006	$5,407	$5,840	$6,307
SG&A	$1,168	$1,294	$1,448	$1,617	$1,805
Depreciation	$899	$854	$922	$996	$1,075
Op income	$1,879	$2,090	$2,208	$2,330	$2,459
Interest	$139	$137	$205	$205	$205
Taxable income	$1,740	$1,953	$2,002	$2,125	$2,253
Taxes	$574	$618	$634	$672	$713
Net income	$1,166	$1,335	$1,369	$1,453	$1,540
EPS	$1.55	$1.78	$1.82	$1.94	$2.05
Dividends	$1,020	$1,020	$1,020	$1,020	$1,020
DPS	$1.36	$1.36	$1.36	$1.36	$1.36
Retained earnings	$146	$315	$349	$433	$520
Balance sheet					
Cash	$701	$794	$857	$926	$1,000
Receivables	$1,299	$1,403	$1,515	$1,636	$1,767
Inventory	$894	$991	$1,070	$1,156	$1,248
PPE	$7,958	$9,192	$10,525	$11,965	$13,520
Accumulated dep.	$3,200	$4,054	$4,976	$5,971	$7,047
PPE, net	$4,758	$5,139	$5,550	$5,994	$6,473
Total assets	$7,652	$8,326	$8,992	$9,712	$10,489
Short-term debt	$1,012	$1,014	$1,096	$1,183	$1,278
Long-term debt	$1,910	$2,864	$2,864	$2,864	$2,864
Total liabilities	$2,922	$3,878	$3,960	$4,047	$4,142
Common stock	$903	$903	$903	$903	$903
Additions to retained earnings	$3,827	$4,142	$4,491	$4,923	$5,444
Total equity	$4,730	$5,045	$5,394	$5,826	$6,347
Total assets and liabilities	$7,652	$8,924	$9,353	$9,874	$10,489
New debt		$954			
Financing deficit		($597)	($361)	($162)	$0

Amounts are in thousands of dollars.

balance for the years CY, CY + 1, and CY + 2. Because it is a surplus, this is not of great consequence. It simply means that the company has raised more money than it needs in the short term. To make our balance sheet balance, we can simply add the surplus to the company's cash account.

Alternatively, we might use it to pay down short-term debt or take some other short-term action.

Meeting the Financing Need by Issuing Equity Our second possibility is that the company would issue additional equity. We again face the questions of "how much?" and "when?" One might imagine that the company would issue shares each year in precisely the amount needed to raise the required funds. In theory this is great because the company would not need to pay dividends on the new shares until they were really needed. In practice, however, issuing equity is an expensive, time-consuming undertaking that company managers would prefer to do as infrequently as possible. In a situation such as the one in our example, the company would almost certainly prefer to do one large issue rather than a series of issues.

One advantage of issuing equity instead of debt is that the company's earnings would not be reduced by higher interest payments. Issuing equity is hardly free, however. First, current shareholders would see their shares diluted, and the company's earnings would be split among more shareholders. Second, if the company chooses to issue more shares, it would likely sell them for some amount less than the current share price ($17 in our example). There are two reasons for this. First, in selling shares, the company sends a signal (whether it is an accurate one or not) that the company's stock may be overvalued. Second, investors have different beliefs about what the stock is worth. Nonshareholders have apparently decided that the stock is not worth paying $17 for (or they would have already bought it). To induce these shareholders to purchase, the shares must sell for some smaller amount. In addition, the investment bank (which raised the money for the company) will take a cut of the proceeds, so the company will not receive the amount paid by new shareholders. We call the investment bank's fee a "flotation cost," which effectively increases the company's cost of financing.

In our example, let us suppose that the company can issue shares for a net price of $15 per share. To raise $814,000 (enough to satisfy the expected needs for the next 4 years), the company would need to issue roughly 54,270 new shares. Notice, however, that our initial forecast assumed that the company's dividends would remain constant. This is not the same as assuming that the company's dividends per share would remain constant. If the company raises only $814,000 worth of new equity and makes no other changes, it will have to decrease dividends per share to $1.27 per share. To see this, notice that there would be 804,270 shares out with total dividends of $1,020,000, or $1.27 per share. We know that company managers are extremely hesitant to cut dividends because of the negative signal it would send to the market. It is therefore better to assume that the company would not cut dividends. In our example, this means that we should assume that dividends will continue to be $1.36 per share. This leaves us in a situation similar to the one we faced for the candidate debt issue. The company must not only issue the $814,000 needed to cover the forecasted deficit, but must issue an additional amount to cover the dividends on the new shares issued! We can again resort to trial and error to find the amount of equity the company would need to issue, which turns out to be $1,277,000 in our example. This scenario is depicted in Table 7.6.

Examining the table reveals that if the company chooses to meet the financing need by issuing debt, the company's EPS would be $1.60 in the current year, followed by increases up to $1.90 in 4 years. Given that these numbers are significantly less than the EPS forecasts under the long-term debt alternative, we conclude that the company would likely prefer to issue long-term debt unless doing so would increase risk too much. This decision would in reality depend to a great extent on the aggressiveness of company managers.

Eliminating the Financing Need by Restricting Sales The last remaining alternative is for the company to restrict sales. This is a particularly difficult scenario to assess because of the uncertainty about how sales would be restricted and how that would affect financial ratios. For example, the company may choose to increase the price of its products. This might lower sales, but it would also decrease the company's COGS/sales ratio and might change other ratios as well. For this illustration, let us assume that our original assumptions about the company's ratios are acceptable and that the growth in sales will be only 2%. This scenario is depicted in Table 7.7.

Notice that we forecast a small short-term financing need that turns into a financing surplus over time. This occurs because the expected growth in sales is below the sustainable growth rate. The magnitudes of this need and surplus are so small that they can easily be absorbed through the cash account. For the short-term needs, the company simply holds a bit less cash. For the longer-term surpluses, the company simply holds a bit more cash. We see that restricting sales has a rather disheartening impact on the company's EPS forecasts. We see that EPS is expected to stagnate over the next few years, hovering around $1.60 when the company was earning over $1.90 per share just a few years ago. Company managers would surely

TABLE 7.6

Forecast Assuming One-Time Equity Issue

Income statement	CY-1 (a)	CY (p)	CY+1 (p)	CY+2 (p)	CY+3 (p)
Sales	$8,560	$9,245	$9,984	$10,783	$11,646
COGS	$4,614	$5,006	$5,407	$5,840	$6,307
SG&A	$1,168	$1,294	$1,448	$1,617	$1,805
Depreciation	$899	$854	$922	$996	$1,075
Op income	$1,879	$2,090	$2,208	$2,330	$2,459
Interest	$139	$137	$137	$137	$137
Taxable income	$1,740	$1,953	$2,071	$2,193	$2,322
Taxes	$574	$618	$655	$694	$735
Net income	$1,166	$1,335	$1,415	$1,499	$1,587
EPS	$1.55	$1.60	$1.69	$1.80	$1.90
Dividends	$1,020	$1,136	$1,136	$1,136	$1,136
DPS	$1.36	$1.36	$1.36	$1.36	$1.36
Retained earnings	$146	$199	$280	$364	$451
Balance sheet					
Cash	$701	$794	$857	$926	$1,000
Receivables	$1,299	$1,403	$1,515	$1,636	$1,767
Inventory	$894	$991	$1,070	$1,156	$1,248
PPE	$7,958	$9,192	$10,525	$11,965	$13,520
Accumulated dep.	$3,200	$4,054	$4,976	$5,971	$7,047
PPE, net	$4,758	$5,139	$5,550	$5,994	$6,473
Total assets	$7,652	$8,326	$8,992	$9,712	$10,489
Short-term debt	$1,012	$1,014	$1,096	$1,183	$1,278
Long-term debt	$1,910	$1,910	$1,910	$1,910	$1,910
Total liabilities	$2,922	$2,924	$3,006	$3,093	$3,188
Common stock	$903	$2,180	$2,180	$2,180	$2,180
Additions to retained earnings	$3,827	$4,026	$4,306	$4,670	$5,121
Total equity	$4,730	$6,206	$6,486	$6,850	$7,301
Total assets and liabilities	$7,652	$9,131	$9,492	$9,943	$10,489
New equity issued		$1,277			
Shares outstanding (millions)	750	835	835	835	835
Financing deficit		($805)	($499)	($231)	$0

Amounts are in thousands of dollars.

want to avoid this scenario, so we can safely eliminate the restricting of sales as a choice for the company. Generally speaking and as we mentioned earlier, the company will want to restrict sales only if the expected free cash flow yield is below the company's cost of capital.

TABLE 7.7

Forecast Assuming Sales Growth is Restricted to 2%

Income statement	CY-1 (a)	CY (p)	CY+1 (p)	CY+2 (p)	CY+3 (p)
Sales	$8,560	$8,731	$8,906	$9,084	$9,266
COGS	$4,614	$4,728	$4,823	$4,919	$5,018
SG&A	$1,168	$1,222	$1,291	$1,363	$1,436
Depreciation	$899	$854	$871	$888	$906
Op income	$1,879	$1,927	$1,921	$1,914	$1,906
Interest	$139	$137	$137	$137	$137
Taxable income	$1,740	$1,790	$1,784	$1,777	$1,769
Taxes	$574	$566	$564	$562	$560
Net income	$1,166	$1,223	$1,219	$1,215	$1,209
EPS	$1.55	$1.63	$1.63	$1.62	$1.61
Dividends	$1,020	$1,020	$1,020	$1,020	$1,020
DPS	$1.36	$1.36	$1.36	$1.36	$1.36
Retained earnings	$146	$203	$199	$195	$189
Balance sheet					
Cash	$701	$750	$764	$780	$795
Receivables	$1,299	$1,325	$1,351	$1,379	$1,406
Inventory	$894	$936	$955	$974	$993
PPE	$7,958	$8,907	$9,875	$10,862	$11,869
Accumulated dep.	$3,200	$4,054	$4,924	$5,813	$6,718
PPE, net	$4,758	$4,853	$4,950	$5,049	$5,150
Total assets	$7,652	$7,864	$8,021	$8,181	$8,345
Short-term debt	$1,012	$958	$977	$997	$1,017
Long-term debt	$1,910	$1,910	$1,910	$1,910	$1,910
Total liabilities	$2,922	$2,868	$2,887	$2,907	$2,927
Common stock	$903	$903	$903	$903	$903
Additions to retained earnings	$3,827	$4,030	$4,230	$4,424	$4,613
Total equity	$4,730	$4,933	$5,133	$5,327	$5,516
Total assets and liabilities	$7,652	$7,801	$8,020	$8,234	$8,443
Financing deficit		$62	$1	($53)	($98)

Amounts are in thousands of dollars.

The Final Financing Decision In comparing the alternatives, we conclude that the company will likely choose to issue additional long-term debt. In light of this and assuming that the financing surplus during the years CY, CY + 1, and CY + 2 will be held in the form of cash, we end up with a final pro forma balance sheet, shown in Table 7.8. In a real-

TABLE 7.8

Final Forecast

Income statement	CY-1 (a)	CY (p)	CY+1 (p)	CY+2 (p)	CY+3 (p)
Sales	$8,560	$9,245	$9,984	$10,783	$11,646
COGS	$4,614	$5,006	$5,407	$5,840	$6,307
SG&A	$1,168	$1,294	$1,448	$1,617	$1,805
Depreciation	$899	$854	$922	$996	$1,075
Op income	$1,879	$2,090	$2,208	$2,330	$2,459
Interest	$139	$137	$205	$205	$205
Taxable income	$1,740	$1,953	$2,002	$2,125	$2,253
Taxes	$574	$618	$634	$672	$713
Net income	$1,166	$1,335	$1,369	$1,453	$1,540
EPS	$1.55	$1.78	$1.82	$1.94	$2.05
Dividends	$1,020	$1,020	$1,020	$1,020	$1,020
DPS	$1.36	$1.36	$1.36	$1.36	$1.36
Retained earnings	$146	$315	$349	$433	$520
Balance sheet					
Cash	$701	$794	$857	$926	$1,000
Receivables	$1,299	$2,000	$1,876	$1,798	$1,767
Inventory	$894	$991	$1,070	$1,156	$1,248
PPE	$7,958	$9,192	$10,525	$11,965	$13,520
Accumulated dep.	$3,200	$4,054	$4,976	$5,971	$7,047
PPE, net	$4,758	$5,139	$5,550	$5,994	$6,473
Total assets	$7,652	$8,924	$9,353	$9,874	$10,489
Short-term debt	$1,012	$1,014	$1,096	$1,183	$1,278
Long-term debt	$1,910	$2,864	$2,864	$2,864	$2,864
Total liabilities	$2,922	$3,878	$3,960	$4,047	$4,142
Common stock	$903	$903	$903	$903	$903
Additions to retained earnings	$3,827	$4,142	$4,491	$4,923	$5,444
Total equity	$4,730	$5,045	$5,394	$5,826	$6,347
Total assets and liabilities	$7,652	$8,924	$9,353	$9,874	$10,489

Amounts are in thousands of dollars.

world situation, we would then evaluate this forecast qualitatively, both to ensure that we have not committed errors in logic and to learn what we can from the forecasts. We would also conduct a great deal of sensitivity analysis so that we understand the implications of changes in our assumptions. In later chapters, we will discuss how to use our forecasts to help us estimate the value of the company's stock.

IN PRACTICE . . .

Many investment professionals do not create a full-blown forecast as we did earlier in the chapter (which allows us to examine the financing decision in detail), but instead treat the financing decision as an entirely separate issue. Instead, they forecast only those items needed to determine the unlevered free cash flows of the company. Once they evaluate those free cash flows and conduct sensitivity analysis, they then consider whether it is realistic for the company to achieve those free cash flows, given its access to financing. An advantage of this approach is that we do not have to redo the full analysis for each scenario we consider. Since we have already explored the full forecasting model in depth, it is useful to consider its shorter, more popular version. We will do this as part of our continuing cash study of O'Charley's.

CASE STUDY: O'CHARLEY'S

We begin by computing the sustainable growth rate for O'Charley's, using the most recent financial statements (which we computed in Chapter 5). The information we needed is shown in Table 5.10. There, we see that in CY-1 (the most recent trailing 12-month period), O'Charley's had a profit margin of 2.34%, an asset turnover of 1.33, and a debt-to-equity ratio of 0.63. In addition, O'Charley's does not pay dividends, so the earnings retention rate is 1. Plugging these into Equation 7.6, we find that O'Charley's had a sustainable growth rate of 5.34% during that period. This tells us that if those ratios do not improve going forward, the company will not be able to increase its sales at a rate above 5.34% unless the company arranges additional external financing.

We now make a series of initial assumptions concerning O'Charley's future. Table 7.9 shows selected statistics from the last 3 years of O'Charley's trailing 12-month financial statements (which we computed in Chapter 5). To simplify the process a bit, we have lumped the net working capital (NWC) accounts together into one category. As we proceed (particularly later in the book), this will allow us to focus on what really matters to O'Charley's right now: expenses. Over the last few years, O'Charley's sales have grown at a significant pace, but our analysis of Chapter 5 suggests that it would not be wise for them to continue at that pace. As we recall, the company's expenses are out of line with the industry, and the company should address that issue before expanding. Of course, to address

TABLE 7.9

Selected Statistics, O'Charley's

	CY-3	CY-2	CY-1
Growth in sales	11.79%	42.83%	22.64%
F&B costs/sales	29.11%	28.37%	30.30%
Labor costs/sales	31.00%	32.52%	33.43%
Other costs of sales/sales	17.39%	18.81%	18.83%
SG&A/sales	7.29%	7.37%	7.05%
Other income (expense)/sales	−6.06%	−5.76%	−5.33%
Depreciation/net PPE	7.93%	9.02%	8.40%
Growth in CapEx	16.32%	−17.54%	−1.09%
NWC/sales	−3.84%	−3.57%	−3.78%
ESOs granted/sales	0.60%	0.47%	0.95%
Tax rate	34.75%	33.55%	31.42%

that issue, it is likely that the company will need to focus on attracting more customers to existing restaurants. In fact, company managers have reported just that: "In 2004, we reduced our planned growth rate of our O'Charley's concept to approximately 7%, in order to better focus on our sales-building initiatives in our existing O'Charley's restaurants as well as to focus on brand development in new expansion markets" (O'Charley's 10-Q report, filed November 12, 2004, p. 23).

Although the company has other restaurant concepts, its plans for the O'Charley's concept indicate that company managers will indeed slow down the expansion. If their "sales-building initiatives" are successful, then we would expect more customers per restaurant, which would effectively bring the company's costs in line with the rest of the industry. If and when that happens, managers could then return to their attempts to quickly grow the company.

Before we proceed, we do want to stress that the analyses in this book are provided so that we can understand the underlying techniques. They should not be interpreted in any way as exhaustive analyses. For example, in an exhaustive analysis, we would examine management plans for each of the restaurant concepts of O'Charley's, and would then base our sales forecasts (at least in part) on those plans.

Although it seems that O'Charley's plans to grow at a rate slightly greater than the 5.34% sustainable growth rate, we will initially assume a sales growth rate of 5.34%. There are good reasons to do this. First, we know that at this rate, the company will not need a significant amount of external financing. It follows that the benefit of the growth will accrue to current shareholders. If we assume a higher growth, then we would need to analyze how the company would likely finance that growth. Second, because the benefits of any additional growth would need to be shared by new investors (whether they are new shareholders or new debtholders), current shareholders would get only a fraction of that growth. Therefore, that higher growth would tend to provide somewhat less value to current shareholders. The real exception to this would occur if O'Charley's could improve its efficiency, which would in turn increase the sustainable growth rate.

The assumptions we use for Scenario 1, which will be the 5.34% sales growth case, are shown in Table 7.10. We will not discuss the assumptions on an item-by-item basis, but suffice it to say that each assumption is based on an examination of the company's recent history. We will later explore how changes in those assumptions will affect our forecasts. Table 7.11 shows our forecasts for the next 10 years (including the current year) based on those assumptions. Notice that in this abbreviated forecasting method, we have not forecasted all of the financial statement items but have rather

TABLE 7.10

Forecasting Assumptions, Scenario 1, O'Charley's

Variable	Assumption
Growth in sales	5.35%
F&B costs/sales	30.00%
Labor costs/sales	33.00%
Other costs of sales/sales	18.80%
SG&A/sales	7.20%
Other income (expense)/sales	−5.40%
Depreciation/net PPE	9.00%
Growth in net PPE	5.35%
NWC/sales	−3.75%
Tax rate	34.00%

TABLE 7.11

Unlevered Free Cash Flow Forecasts, Scenario 1, O'Charley's

	CY-1 (a)	CY (p)	CY+1 (p)	CY+2 (p)	...	CY+8 (p)	CY+9 (p)
Total sales	852,168	911,820	975,647	1,043,942	...	1,566,676	1,676,343
Food and beverage costs	258,202	273,546	292,694	313,183	...	470,003	502,903
Labor costs	284,911	300,901	321,964	344,501	...	517,003	553,193
Other costs of sales	160,495	171,422	183,422	196,261	...	294,535	315,153
SG&A expenses	60,047	65,651	70,247	75,164	...	112,801	120,697
Other income (expenses)	−45,456	−49,238	−52,685	−56,373	...	−84,601	−90,523
EBIT	43,057	51,062	54,636	58,461	...	87,734	93,875
EBIT(1-T)	30,575	33,701	36,060	38,584	...	57,904	61,958
Net PPE	444,830	475,968	509,286	544,936	...	817,802	875,048
Depreciation	39,044	40,035	42,837	45,836	...	68,787	73,602
Capital expenditures	63,592	68,043	72,806	77,903	...	116,911	125,095
NWC	−32,173	−34,193	−36,587	−39,148	...	−58,750	−62,863
Change in NWC	−7,412	−2,020	−2,394	−2,561	...	−3,843	−4,113
Free cash flow	13,439	7,712	8,484	9,078	...	13,624	14,577

Amounts are in thousands of dollars.

chosen to forecast only those items needed to compute the company's unlevered free cash flows. At this point, we learn little from Table 7.11 because we do not yet know how to value the free cash flows. In Chapter 10, we will return to this scenario and attempt to do just that.

Having determined a baseline scenario for O'Charley's, it is useful to consider another scenario of interest. From the quarterly report, we know that company managers plan to grow the number of O'Charley's stores by about 7% per year. We also know that they are working to increase customer visits to existing restaurants. This suggests two sources of sales growth, one due to additional restaurants and one due to better use of existing restaurants. In addition, we know that if more customers come to the restaurants, the company's expense ratios (particularly labor costs/sales) will likely improve. Let us consider a second scenario in which we make the assumptions shown in Table 7.12. Scenario 2 differs from Scenario 1 in several ways. First, we have assumed that the company's labor costs will be 30% of sales instead of 33%. This alone would increase the profit margin by about 2%, giving O'Charley's a sustainable growth rate of over 10%. Second, we assume that sales will grow at 10% per year rather than 5.35%. Part of this (7%) will be due to expansion and the rest (3%) to increasing customer visits per store. Third, and consistent with our expansion assumption, we assume that net PPE (i.e., capital assets) will grow at 7% per year. In this optimistic scenario, we essentially assume that the

TABLE 7.12

Forecasting Assumptions, Scenario 2, O'Charley's

Variable	Assumption
Growth in sales	9.00%
F&B costs/sales	30.00%
Labor costs/sales	30.00%
Other costs of sales/sales	18.80%
SG&A/sales	7.20%
Other income (expense)/sales	−5.40%
Depreciation/net PPE	9.00%
Growth in net PPE	7.00%
NWC/sales	−3.75%
Tax rate	34.00%

company's sales-building initiative will succeed and that the company will follow its stated expansion plans.

The forecasts for Scenario 2 are shown in Table 7.13. When we compare those forecasts to the ones from Scenario 1 (Table 7.11), we immediately see a dramatic difference. In the tenth year of our forecast (CY + 9), we see that the company's unlevered free cash flow would be nearly $70 million in Scenario 2, whereas it would be less than $15 million in Scenario 1. There is an important lesson to learn here. Seemingly small changes in our assumptions can often cause a large difference in our cash-flow forecasts. As we will see later in Chapter 10, this can have an astounding impact on the value of the company's stock. As we might imagine, our task will become one of trying to assess whether O'Charley's can turn the company around. Specifically, can it increase customer visits per restaurant and can it get its expense ratios in line with the industry? If so, the stock would likely increase in value severalfold.

SUMMARY

In this chapter, we explored the idea of forecasting, which is a critical part of the stock valuation process. In fact, there is little doubt that it is the most important part of that process. We discussed the *sustainable growth rate*, which gives us an indication of how fast the company can increase its sales without raising a lot of external capital. This is quite important because if the company has to raise external capital to finance growth, current shareholders will not receive all of the benefit of that growth. In fact, in some circumstances, they may not receive any of it. If analysts misunderstand this concept, it is quite easy for them to make errors in estimating the value of a stock. A common mistake, for example, occurs when an analyst forecasts a growth rate that is higher than the sustainable growth rate but then does not specifically incorporate how the company will pay for the excess growth. This will introduce a positive bias into the value estimate, which leads us to believe the stock is worth more than it really is.

We discussed two forecasting approaches. In the first, we conduct a comprehensive analysis and specifically assess the implications of different financing choices on the company's future financial statements. In the second, we forecast only those variables that are needed to compute the company's free cash flows. This approach is simpler and less time-

TABLE 7.13

Unlevered Free Cash Flow Forecasts, Scenario 2, O'Charley's

	CY-1 (a)	CY (p)	CY+1 (p)	CY+2 (p)	...	CY+8 (p)	CY+9 (p)
Total sales	852,168	928,863	1,012,461	1,103,582	...	1,850,818	2,017,392
Food and beverage costs	258,202	278,659	303,738	331,075	...	555,245	605,217
Labor costs	284,911	278,659	303,738	331,075	...	555,245	605,217
Other costs of sales	160,495	174,626	190,343	207,473	...	347,954	379,270
SG&A expenses	60,047	66,878	72,897	79,458	...	133,259	145,252
Other income (expenses)	−45,456	−50,159	−54,673	−59,593	...	−99,944	−108,939
EBIT	43,057	79,882	87,072	94,908	...	159,170	173,496
EBIT(1-T)	30,575	52,722	57,467	62,639	...	105,052	114,507
Net PPE	444,830	475,968	509,286	544,936	...	817,802	875,048
Depreciation	39,044	40,035	42,837	45,836	...	68,787	73,602
Capital expenditures	63,592	68,043	72,806	77,903	...	116,911	125,095
NWC	−32,173	−34,832	−37,967	−41,384	...	−69,406	−75,652
Change in NWC	−7,412	−2,659	−3,135	−3,417	...	−5,731	−6,247
Free cash flow	13,439	27,373	30,633	33,989	...	62,659	69,261

Amounts are in thousands of dollars.

consuming, which allows us to quickly assess a large number of possible scenarios. The biggest drawback is that we may make mistakes like the one mentioned in the last paragraph. In addition, this approach leads to a less complete understanding of the company's financial condition.

Finally, we continued our case study of O'Charley's, which will prepare us for later work in which we actually try to estimate the value of the company's stock.

This page intentionally left blank

CHAPTER 8

Valuing Employee Stock Options

PURPOSE AND SCOPE

An employee stock option (ESO) gives the employee the right to purchase a share of the company's stock at a prespecified priced under prespecified conditions. Of course, an ESO will only be exercised if the stock price exceeds that prespecified price. Thus, holders of ESOs are often able to buy shares at below-market prices. As far as stock valuation is concerned, the primary effect of this is that shares are diluted—that is, each share of stock becomes a smaller portion of the company when ESOs are exercised.

ESOs received a great deal of attention in recent years as more and more companies issued them in lieu of paying higher salaries. There were two perceived benefits in doing this. First, the ESOs gave employees extra incentives to increase the price of the company's stock. This is presumably a good thing, although it simultaneously gave employees extra incentives to misrepresent the company so that the stock price increased. Second, ESOs did not have to be expensed on the income statement, so paying employees with ESOs instead of hard money allowed the company to report higher earnings. As we mentioned in earlier chapters, the Financial Accounting Standards Board has since mandated that companies specifically expense any ESOs that are granted.

For some companies, an enormous number of ESOs were granted. For example, Interactive Corp (IACI) granted over 56 million ESOs in

2003 alone.[1] The company currently has almost 700 million shares of stock outstanding, so the ESOs granted in that year alone represent about 8% of the outstanding shares. Technology companies seem to have issued the most ESOs, but even companies like O'Charley's now have a significant number of ESOs outstanding. It follows that we must be especially careful to specifically assess the impact of ESOs on stock value.

Our purpose in this chapter is twofold. First, we seek to understand the nature of ESOs and why they are important to stock valuation. Second, we seek to develop techniques we might use to value those ESOs. Later in Chapter 10, we will use what we learn here to help us estimate the value of common stock. To begin this chapter, we define and discuss the basic issues associated with ESOs. We then discuss the most famous and most widely used approach, the Black-Scholes Option Pricing Model. That model was developed for secondary market options, which are somewhat different from ESOs, so we will spend some time discussing how to adjust the Black-Scholes model so that we can apply it to ESOs. We do not discuss another popular approach, the binomial model. That model is decidedly more difficult to implement than the Black-Scholes model, but it does provide more flexibility in dealing with issues like the payment of dividends and possible suboptimal behavior by those who hold ESOs. Finally, we will discuss how ESOs are addressed in practice. As part of this discussion, we will consider the idea of using dilution-based approaches to incorporate the impact of ESOs on stock value. These approaches, for the most part, are ill-advised and lead to biases in our estimates of stock value. We close the chapter by returning to our case study of O'Charley's so that we can value the ESOs the company currently has outstanding.

Before we begin, a warning is in order. Far more than the other techniques in this book, ESO valuation is based on somewhat sophisticated math. Although we will not get into the calculus behind the Black-Scholes formula, this chapter is easily the most difficult part of the book from a mathematical perspective. In particular, we will discuss and use a few rather nasty-looking formulas that we can use to value ESOs. It is easy for us to get lost in trying to follow the math and lose sight of the big picture, which is to develop an understanding of how the presence of ESOs decreases the value of outstanding common stock. Inexperienced stock analysts and those simply interested in learning about the stock valuation

1. See *2004 Annual Report*, Interactive Corp (IACI), p. 133.

process are encouraged to focus on understanding the other techniques in this book and to return to ESOs once they are comfortable with those other techniques.

IN THEORY . . .

An ESO is very much like an American call option on a stock—both give the holder the right to purchase a share of stock for a prespecified *exercise price* (or *strike price*) on or before a prespecified date. This allows us to use call option theory as a basis for valuing ESOs. We will have to make a few adjustments to account for differences between call options and ESOs, but those adjustments are relatively easy ones. But why do we need to value ESOs in the first place? After all, our ultimate goal is to estimate the value of a share of stock. There are two ways that ESOs affect the value of the company's common stock. First, when an ESO is exercised, cash is paid to the company in exchange for shares. Thus, there is a cash inflow to the company at the time an ESO is exercised. Second, when an ESO is exercised, the company issues a new share of stock, thereby increasing the number of shares outstanding. This is important because the ESO holder will only exercise the right to buy if the exercise price is below the market price. In that case, the holder pays money to the company in exchange for shares, but does so at a cheap price. This necessarily harms previous shareholders because of something called *dilution*. Suppose, for example, that we hold 100,000 shares of a company with 10,000,000 shares outstanding. If employees then exercise 1,000,000 ESOs, our ownership will drop from 1% of the company to 0.91% of the company. This effect may seem small, but it is quite meaningful if there are a substantial number of ESOs outstanding. This can be seen more clearly in the following example.

Example 8.1: A company has 100 shares outstanding, each with a value of \$20. Employees hold ESOs on 10 shares of stock with an exercise price of \$5. If the employees exercise their rights, what is the impact on company ownership?

Prior to the exercise, the company's equity has a total value of \$2,000 (100 shares × \$20 per share). When the ESOs are exercised, the company receives \$50 from the employees (10 ESOs × \$5 per ESO). This increases the value of the company's equity to \$2,050. At the same time, the number of shares outstanding increases from 100 to 110. Therefore, the value of a share of stock drops to $18.64 ($2,050 value of equity ÷ 110 shares outstanding). Old shareholders see their shares drop in value from $2,000 to $1,864, a decrease of $136. Meanwhile, the employees have paid $50 for 10 shares that now have a value of $186, a gain of $136. Thus, there has been a wealth transfer from old shareholders to new ones.

At first glance, the existence of ESOs seems to be a lose-only situation for existing shareholders. After all, ESO holders will only exercise when such a wealth transfer exists. This may not be the case, however, because there are two main benefits for existing shareholders. First, when employees hold ESOs, they have an extra incentive to work hard and behave efficiently so that the stock price will increase. Second, when a company gives employees ESOs, it can (in equilibrium) pay them a lower cash salary. Whether the benefits outweigh the drawback is an open question, although more and more investment professionals seem to believe that ESOs on balance tend to act to the detriment of shareholders rather than to their benefit.

It is clear from Example 8.1 that the number of (and value of) ESOs issued by a company should be of significant interest to someone who is considering an investment in the company's stock. If the company has a large number of ESOs outstanding with a low exercise price, then purchasers of the company's stock should fully expect their ownership to be significantly diluted in the future. Note that this does not imply that the stock is a poor investment. In theory, the market would incorporate the impact of ESOs into the stock price. Thus, the existence of and the number of ESOs are not necessarily a signal to buy or sell a stock. Still, if a company seems to have issued an excessive number of ESOs, we must question whether company managers are truly acting in the best interests of their shareholders.

A convenient way to understand how ESOs affect stock value is to recognize that there are actually *four* types of owners of the company. We know three of these from the balance sheet: debtholders, preferred stockholders, and common stockholders. The fourth consists of contingent owners such as holders of ESOs. Because all four types gain value only from the company, we know that the value of the entire company must be the sum of the values of the holdings in those four categories. It is even a bit more difficult than that, because we may expect the company to issue more ESOs in the future. If so, we must also include the value of yet-to-be-issued ESOs!

$$\begin{aligned}\text{Value of Company} = {} & \text{Value of Debt} \\ & + \text{Value of Preferred Stock} \\ & + \text{Value of Common Stock} \\ & + \text{Net Value of Existing ESOs and} \\ & \quad \text{ESOs to be issued}\end{aligned} \tag{8.1}$$

We say "Net Value" of ESOs because we must incorporate the cash inflow that occurs when an ESO is exercised and because the company gets a tax deduction when ESOs are exercised. We will deal with this later in the chapter. The formula provides the basis for much of stock valuation, including the DCF model that most regard as the centerpiece of stock valuation. We can rearrange Equation 8.1 to get

$$\boxed{\begin{aligned}\text{Value of Common Stock} = {} & \text{Value of Company} \\ & - \text{Value of Debt} \\ & - \text{Value of Preferred Stock} \\ & - \text{Net Value of Existing ESOs and} \\ & \quad \text{ESOs to be issued,}\end{aligned}} \tag{8.2}$$

which is the basic stock valuation identity. We then estimate the values of the company, of debt, of preferred stock, and of current and future ESOs, and use them to infer the value of common stock. The fourth component is often misunderstood by investors (even including some investment professionals) and is sometimes ignored entirely in the stock valuation process. For many companies, this leads to only a small error because the value of ESOs is small relative to the value of the common stock. For other companies (as we will see later in our study of O'Charley's), ESOs can have a significant impact on stock value. It is therefore essential that we understand how to estimate the value of ESOs.

One problem we face is that many investment professionals disagree on how to best value the ESOs. There seem to be three main approaches to incorporating their impact into stock valuation methodologies. The first relies on directly incorporating the impact of dilution on share value. We will briefly discuss this toward the end of the chapter. The second approach involves using something called a binomial model to specifically value the ESOs. Although this approach, in theory, gives us the best chance to accurately estimate the value of the ESOs, it is seldom used by stock-picking investment professionals. For most people, the binomial model is a bit difficult to understand and apply. Given that we only get small gains in accuracy from using it, most investment professionals rely on another approach that relies on a specific formula, the well-known Black-Scholes option pricing formula, which we can use in conjunction with Equation 8.2 to value the company's stock. We begin by considering the Black-Scholes model.

The Black-Scholes Option Pricing Model

The most commonly used option valuation technique is the Black-Scholes Option Pricing Model, which was developed for European call options on stocks that do not pay dividends. A *call option* is very similar to an ESO, except that when the option is exercised, a share is purchased from a secondary market investor rather than from the company itself. The ESOs issued by companies are referred to as *warrants* rather than as call options, so that we specifically acknowledge the differences. "European" options are options that may only be exercised on the expiration date. In contrast, "American" options can be exercised on the expiration date or on any date preceding that. ESOs are usually a hybrid of these in which there is a vesting period during which the ESOs cannot be exercised. Once the ESOs are vested, they can be exercised at any point prior to expiration. We must therefore consider whether we need to adjust for early exercise, dilution, and dividends, and, if so, how we would make those adjustments. The mathematical proof of the Black-Scholes model is beyond the scope of this book, but we will present the Black-Scholes formula and discuss how we might use it.

The Black-Scholes formula was developed under a specific set of assumptions, including the following:

1. The risk-free rate is constant over time
2. The underlying asset (common stock in our case) has a price that is lognormally distributed.[2]
3. The volatility of the underlying asset is constant over time.

2. If x is a normally distributed random variable (i.e., it follows the bell curve), then e^x would follow the lognormal distribution.

4. There are no distributions associated with the underlying asset (for example, the company does not pay dividends on the stock).
5. The option may not be exercised early.

We stress that the formula was developed for true stock options and not ESOs (which are warrants). At first glance, it appears that the formula may not be of great use to us. In reality, the risk-free rate is not constant, stock prices are close to but not quite lognormally distributed, the volatility of stock prices is not constant over time, many stocks pay dividends, and ESOs are a hybrid of sorts in which holders can exercise early but usually only after a vesting period. The assumptions behind the Black-Scholes formula just do not seem to match the characteristics of ESOs. Fortunately, many of the differences between the two are not substantial. The assumption of a constant risk-free rate turns out to be harmless, the assumption of lognormally distributed stock prices is actually quite close to what we observe, and the assumption of a constant volatility of stock prices also turns out to be relatively harmless. However, the early exercise provision does matter if the stock pays dividends before the ESO expires.[3] In fact, there are several circumstances in which ESOs will optimally be exercised early. Fortunately, we can adjust the Black-Scholes technique to largely account for these possibilities. Finally, we can adjust the Black-Scholes formula for the fact that ESOs are warrants rather than options. We will deal with these issues later in the chapter.

The Black-Scholes formula can be written as

$$C = S_0 N(d_1) - \frac{X}{e^{R_f T_m}} N(d_2),$$

where

$$d_1 = \frac{\ln\left(\frac{S_0}{X}\right) + \left(R_f + \frac{\sigma^2}{2}\right) T_m}{\sigma\sqrt{T_m}} \tag{8.3}$$

and

$$d_2 = d_1 - \sigma\sqrt{T_m},$$

3. There are other rare circumstances in which a call option might be exercised early, even in the absence of dividends. For example, a shareholder may own slightly less than half of the company's shares. If the shareholder has ESOs, they might be exercised, thereby giving the shareholder the majority of the shares and complete control of the company. If that control is important to the shareholder, then the ESOs might optimally be exercised early.

where S_0 is the current stock price, X is the exercise price of the option, R_f is the continuously compounded risk-free rate, T_m is the time until the option expires, and σ is the annual volatility of the stock returns. The natural logarithm function is denoted ln, and the variables d_1 and d_2 are included to make the representation of the formula a bit easier to understand. The function $N()$ is the cumulative normal distribution, which computes the area under the standard normal density function (i.e., the bell curve) up to the point specified (d_1 or d_2 in our case). Table 8.1 shows an abbreviated cumulative normal table. If, for example, we compute d_1 to be -0.3, we would use the table to find that $N(d_1)$ is 0.3821. Spreadsheet programs typically include the cumulative normal distribution as a function. For example, Excel has the NORMSDIST function, which is equivalent to our $N()$. To understand how to use the formula, consider a simple example.

TABLE 8.1

Cumulative Normal Table

x	*N*(*x*)	*x*	*N*(*x*)	*x*	*N*(*x*)
−3	0.0013	−1	0.1587	1	0.8413
−2.9	0.0019	−0.9	0.1841	1.1	0.8643
−2.8	0.0026	−0.8	0.2119	1.2	0.8849
−2.7	0.0035	−0.7	0.2420	1.3	0.9032
−2.6	0.0047	−0.6	0.2743	1.4	0.9192
−2.5	0.0062	−0.5	0.3085	1.5	0.9332
−2.4	0.0082	−0.4	0.3446	1.6	0.9452
−2.3	0.0107	−0.3	0.3821	1.7	0.9554
−2.2	0.0139	−0.2	0.4207	1.8	0.9641
−2.1	0.0179	−0.1	0.4602	1.9	0.9713
−2	0.0228	0	0.5000	2	0.9772
−1.9	0.0287	0.1	0.5398	2.1	0.9821
−1.8	0.0359	0.2	0.5793	2.2	0.9861
−1.7	0.0446	0.3	0.6179	2.3	0.9893
−1.6	0.0548	0.4	0.6554	2.4	0.9918
−1.5	0.0668	0.5	0.6915	2.5	0.9938
−1.4	0.0808	0.6	0.7257	2.6	0.9953
−1.3	0.0968	0.7	0.7580	2.7	0.9965
−1.2	0.1151	0.8	0.7881	2.8	0.9974
−1.1	0.1357	0.9	0.8159	2.9	0.9981

Example 8.2: A stock is currently trading for $42.31 per share. A European call option on that stock expires in 2 years and has an exercise price of $40. The volatility of the stock is 36% per year, and the continuously compounded risk-free rate of interest is 3.22%. In addition, the company does not pay dividends. What is the value of the call option today?

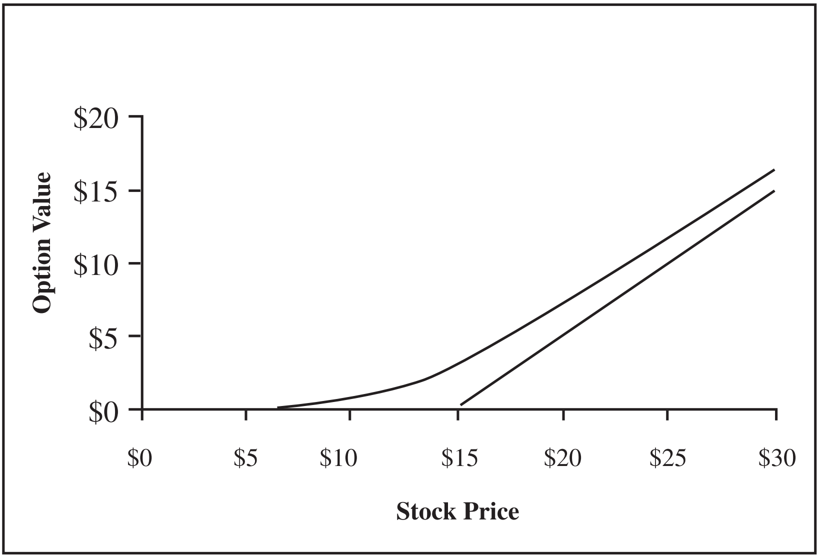
From the problem statement, we have $S_0 = 42.31$, $X = 40$, $\sigma = 0.36$, $T = 2$, and $R_f = 0.0322$. Notice that all numbers are entered as decimals rather than as percentages (i.e., we enter 0.36 for σ, not 36). Plugging into our formulas for d_1 and d_2, we get $d_1 = 0.4913$ and $d_2 = -0.0178$. Using Table 8.1, we see that $N(d_1)$ is somewhere between 0.6554 and 0.6915. We can interpolate between the two to get the approximation 0.6883 (the actual number is 0.6884 to four decimal places, so interpolation is quite reasonable). Similarly, we find that $N(d_2)$ is 0.4929 (using either interpolation or the actual number). We can then plug these numbers into Equation 8.3 to find that the value of the call option is $10.64 according to the Black-Scholes formula.

All of the inputs to the Black-Scholes formula are readily available if the company is publicly traded, although we must estimate the stock's volatility. The formula requires the volatility of the stock from now until the option expires. Since we are not fortune-tellers, we typically will use historical data to estimate the recent volatility of the stock and then use that as our estimate of the future volatility. To the extent that the future volatility differs from the recent past, the volatility estimate may introduce error into our estimate. Alternatively, we might rely on the company's estimate of the volatility of its stock, which the company is required to report under the new FASB regulation, SFAS No. 123. The exercise price is specified in the options contract. The current stock price is available if the stock is publicly traded. The current risk-free rate can be estimated by taking the yield on a Treasury security with a maturity close to the maturity of the option.

Figure 8.1 shows a chart depicting the value of an option as a function of the current stock price. The chart was produced with the assumptions $\sigma = 30\%$, $X = \$15$, $T_m = 2$, and $R_f = 5\%$. The straight line on the chart depicts the cash flow the holder would receive if the option were exercised today. For stock prices to the left of the exercise price, the option would not be exercised and the holder would receive nothing. For

FIGURE 8.1

Black-Scholes Option Value



stock prices to the right of the exercise price, the option would be exercised and the holder would earn a profit in the amount of the difference between the stock price and the exercise price. The curved line on the chart depicts the Black-Scholes value of the call option based on the given current value of the stock itself. Each point on the curve corresponds to a specific value of the company's stock price. For example, if the current price of the company's stock is $15, the option would have a value of a little more than $3 ($3.18 according to the Black-Scholes formula). Notice that each point on this curve is above the corresponding point on the exercise line. That is, the Black-Scholes value is always greater than the cash flow obtained from exercising the option. This observation is true regardless of the parameter values we choose. It follows that under the Black-Scholes assumptions, it will never be optimal to exercise a call option early. Even if we really needed the money, we would be ahead to just sell the option rather than exercise it.

Dealing with Dividends

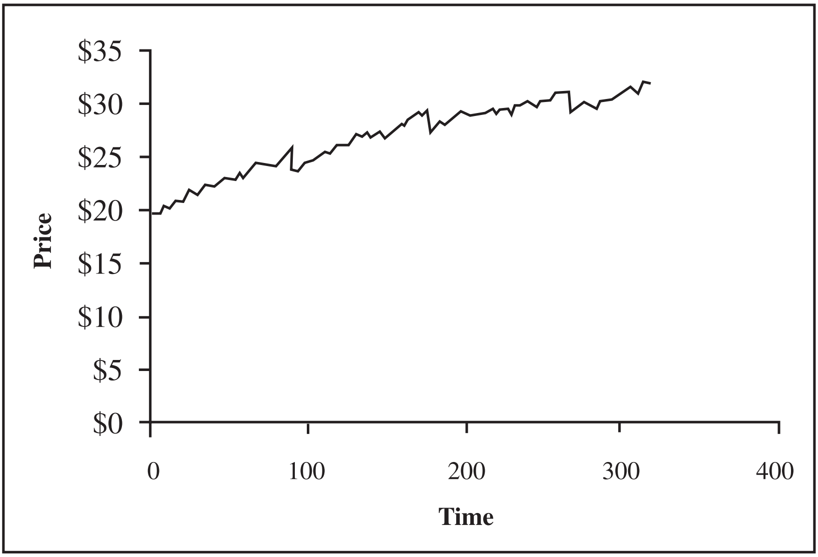
The Black-Scholes formula applies in a world in which the company does not pay dividends between now and the option's expiration date. The academic literature contains somewhat sophisticated models that incorporate dividends into option valuation,[4] but those models are well beyond the scope of this book. Instead, we consider how dividends influence the exercise decision and how we might reasonably approximate the value of options on dividend paying stocks.

We have already shown that a call option will never be exercised early in the absence of dividends, but this may not be the case for an option on a dividend-paying stock. To understand this, suppose that a stock is currently trading for $20 per share and that the company decides to pay a $2 dividend on that stock. What happens to the market price of the stock? Ignoring all other effects, the price will drop to $18 per share because the company's cash account will literally drop by $2 per share. Figure 8.2 shows a typical pattern for a dividend-paying stock. To make the effect quite clear, we consider an exaggerated example in which the stock pays a $2 dividend every quarter. In the figure, notice that the stock has consistently trended upward, except for three noticeable drops at dates 90, 180, and 270. Those drops correspond to the $2 dividend payments. For example, at the 90-day mark, the stock drops from $25.95 to $24.04. The stock did not drop by a full $2 because of another presumably random movement in the stock price. The $2 portion of the drop is entirely predictable, so option holders would anticipate a drop on that date. Now, suppose that there is an American call option on the stock with an exercise price of $20. Suppose further that the option expires on day 90, just after the dividend is to be paid. What should holders of the option do if they fully expect the $2 dividend payment? If the option is exercised just prior to the dividend, the holder pays $20 for a $25.95 stock, for a net payoff of $5.95. We might (incorrectly) think that this is a temporary gain because we expect the stock price to drop to $23.95, but keep in mind that the holder owns the stock at that point and is therefore entitled to the $2 dividend. Thus, the $2 drop in price is exactly offset by the dividend payment. Now, suppose instead that the option holder chooses to wait until after the dividend is paid. Instead of receiving a $25.95 stock upon exercise, the holder

4. See, for example, Roll (1977), Geske (1979, 1981), and Whaley (1981). Taken together, those papers comprise what has become known as the Roll-Geske-Whaley model for valuing options on dividend-paying stocks.

FIGURE 8.2

Price of Dividend-Paying Stock



expects to receive a $23.95 stock for a net payoff of $3.95. Unless some other factor causes the stock to increase by more than $2 to offset the drop in price due to the dividend, the holder would have been better off exercising the option early. In our example, no such increase occurred, so early exercise would have turned out to be the right decision.

The example illustrates the basic intuition behind the early exercise of call options. The benefit of exercising early is that the option holder is able to exercise prior to the dividend payment, thereby avoiding the corresponding drop in stock price. The benefit of waiting is that the stock price may climb enough to more than offset the drop due to the dividend payment. We will return to this idea later, but first we will consider how dividends affect the value of a European call option.

No Early Exercise: Present Value of Dividends Approach

It turns out that there is a relatively simple way to estimate the value of a European option on a dividend-paying stock. Stock prices tend to grow over time, and although it is not immediately obvious, this growth is explicitly incorporated into the Black-Scholes formula. As we noted earlier, dividend payments tend to reduce the current stock price and therefore tend to reduce the basis for the growth. Because of this, the value of the stock at all subsequent points will tend to be lower than it would have been if dividends had not been paid. This is very much like having an interest-bearing account with a value of $1,000. If we then withdraw $100 from the account, the account value at each subsequent point would be nine-tenths of what it would have been if there had been no withdrawal. To adjust the Black-Scholes formula for this, we need only subtract from the current stock price the present value of the dividends we expect the company to pay between now and the option's expiration. That is, instead of plugging S_0 into the Black-Scholes formula, we plug in S_0 minus the present value of the expected dividends. Of course, future dividend payments are unknown, so we must estimate them. This adds an additional source of uncertainty to our analysis.

The following example illustrates how we might compute the value of a European call option on a dividend-paying stock.

Example 8.3: Suppose that a stock is currently trading for $30 per share and that the stock's annual return volatility is 48%. A European call option on the stock expires in 6 months and has an exercise price of $25. The company is expected to pay a dividend of $1 in 2 months and a dividend of $1.10 in 5 months. The continuously compounded risk-free rate is 3%. What is the value of the option today?

Before specifically incorporating the impact of dividends, let us compute the value of the option while ignoring dividends. This will provide a baseline from which we can assess the potential error from ignoring dividends. Using $30 for the stock price and plugging in our other variables gives us a Black-Scholes valuation of $6.96. This is an upper bound on the value of the option because the presence of dividends, which lowers the expected stock price, can only reduce the value of the option.

Recall from our discussions in Chapter 3 that if R is a continuously compounded interest rate, then e^{Rt} is equivalent to $(1 + \text{EAR})^t$. We can therefore discount the expected dividend payments as follows:

$$\text{Present Value of Expected Dividends} = \frac{\$1}{e^{0.03 \times \frac{2}{12}}} + \frac{\$1.10}{e^{0.03 \times \frac{5}{12}}} \tag{8.4}$$

$$= \$2.08$$

To compute the Black-Scholes valuation of the option, we simply plug in a stock price of $30 − $2.08 = $27.92 instead of $30. Using this, we find that the option is worth $5.42. Thus, the option is worth about 22% less than our original estimate in which we ignored dividends. Of course, this particular stock has an extremely high dividend yield, so the errors we observe in reality will be less than that for the most part.

For an option that matures in a short period of time, this approach is quite manageable. For longer maturity options, our task becomes a bit more difficult. Imagine, for example, that we are considering an option with 10 years until expiration. If the stock pays quarterly dividends, we would need to forecast the next 40 dividend payments in order to use the approach illustrated in Example 8.3. A simple way to do this is to assume some constant dividend growth rate over the 10-year period. We can then apply the formula we developed in Chapter 3 for the present value of a growing annuity.

The example above and ones to follow illustrate how important it is to take dividends seriously when we value a company's options. For companies that pay high dividends relative to their stock price, the unadjusted Black-Scholes valuations of options can differ dramatically from their true values, especially for options with long maturities. If we completely ignore dividends, we may greatly overestimate the value of a company's ESOs, which in turn could cause us to underestimate the value of the company's stock.

No Early Exercise: The Continuous-Dividends Approach

Another way we might account for dividends is to assume that they are paid continuously. That is, rather than assume (as is typically the case) that dividends are paid quarterly, we assume that shareholders are paid an infinitely small dividend each instant, with the total dividend payment over each period of time being equal to the actual dividend payment. This may seem to be an odd assumption that is difficult to understand, let alone accept, but there are at least two advantages to making this assumption. First, we can adjust the Black-Scholes formula and come up with an equation that precisely computes the value of the option under our assumptions. Second, we avoid having to forecast a potentially long series of dividend payments. In addition, the error we introduce tends to be small, particularly for options on stocks that do not have an especially high dividend yield.

To a certain extent, the continuous-dividends approach is intuitive. As we noted earlier, dividends have a negative impact on stock prices on the dates that they are paid. Continuously paid dividends have a negative impact each instant. This effectively means that continuously paid dividends act as a drag on the growth of the stock price. We can capture this drag by multiplying the stock price (in the Black-Scholes formula) by e^{-qT_m}, where q is the company's annual dividend yield (i.e., the expected annual dividend divided by the stock price). This adjustment gives us a formula for a Black-Scholes valuation of a European call option on an asset that pays continuous dividends,

$$C = S_0 e^{-qT_m} N(d_1) - \frac{X}{e^{R_f T_m}} N(d_2),$$

where

$$d_1 = \frac{\ln\left(\frac{S_0 e^{-qT_m}}{X}\right) + \left(R_f + \frac{\sigma^2}{2}\right) T_m}{\sigma\sqrt{T_m}} \tag{8.5}$$

and

$$d_2 = d_1 - \sigma\sqrt{T_m}.$$

To apply the formula, we need only estimate the company's dividend yield in addition to the usual variables. For stable companies, the recent historical dividend yield provides the basis for a reasonable forecast. For others, we may choose to adjust the historical dividend yield to adjust for current conditions.

Consider the following example, in which we use the continuous-dividend approach to value a call option on a stock that pays discrete dividends.

Example 8.4: A company has common stock that is currently trading for \$45 per share. A European call option on the stock has an exercise price of \$44 and a maturity of 5 years. The expected volatility of the stock over the next 5 years is 38% per year. In the last 3 years, the company's dividend yield (which is defined as the ratio of the dividend paid to the stock price) has been 3.2%, 4.1%, and 2.9%. In addition, the company will pay a dividend of \$1.65 this year, distributed quarterly, with the next dividend to be paid in 3 months. Finally, the continuously compounded risk-free rate is 3.4%. What is the value of the call option?

To begin, we must forecast the company's dividend yield over the next 5 years. The historical dividend yields, along with year's numbers (which give a dividend yield of \$1.65/\$45 = 3.67%), have an average of 3.47%. There is no evident trend, and we have no other information on which to base our forecast, so we will forecast a dividend yield of 3.47%. Plugging into Equation 8.5 gives us \$12.69, which is the value of the call option, given our assumptions.

In this example (but not in all situations), our value estimate is a lower bound on the true value of the call option. To see this, note that the continuous-dividend assumption implies that dividend payments begin now, rather than in 3 months, as is the case for our company. Because we implicitly assume that the dividends will be paid earlier than they will be in reality, we slightly overestimate the impact of the drag on the stock price that is created by the dividends. Alternatively, if the next dividends were to be paid quite soon (in the next few weeks, for example), we would slightly underestimate the impact of the drag because the continuous-dividend assumption spreads the dividend out over time. Thus, we would be assuming that the dividend would be received later than it would be in reality.

To get a general idea of the impact of our variables on the Black-Scholes valuation, consider Figures 8.3, 8.4, and 8.5. The x axis represents the exercise price as a fraction of the current stock price, so values on the left side are for options that are very much in the money, whereas values on the right side are for options that are very much out of the money. The y axis is the option value as a fraction of the current stock price. Recall that if a stock pays dividends, we can substitute $S_0 e^{-qT_{\mathrm{m}}}$ for S_0 in the Black-Scholes equation. This applies for Figures 8.3, 8.4, and 8.5 as well. In those figures, we define S^* to be the dividend-adjusted stock price. Each figure shows four curves, one each for different values of the chosen parameter. For example, Figure 8.3 shows the impact of volatility on option values. The figure shows curves for volatilities of 20%, 40%, 60%, and 80%. The lowest curve represents a volatility of 20%, and the highest curve represents a volatility of 80%. A simple example illustrates how we can use graphs such as those depicted in Figures 8.3, 8.4, and 8.5.

Example 8.5: Suppose that a company has an option outstanding with an exercise price of \$20 and 5 years to maturity. The company's stock is currently trading at \$50 per share *after adjusting for dividends* and has a volatil-

FIGURE 8.3

Black-Scholes Valuation
Risk-free rate: 5%. Time-to-maturity: 5 years.
Volatility (top to bottom): 80%, 60%, 40%, 20%.

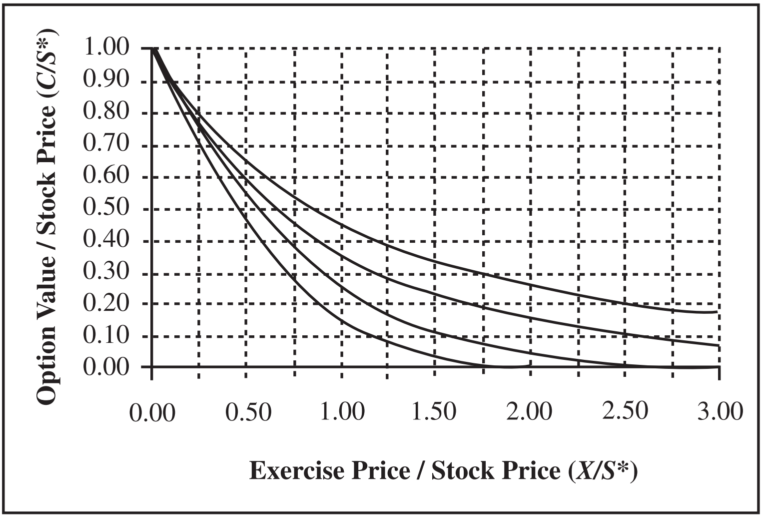


FIGURE 8.4

Black-Scholes Valuation
Risk-free rate: 5%. Volatility: 50%.
Time-to-maturity (top to bottom): 10%, 5%, 2%, 1 years.

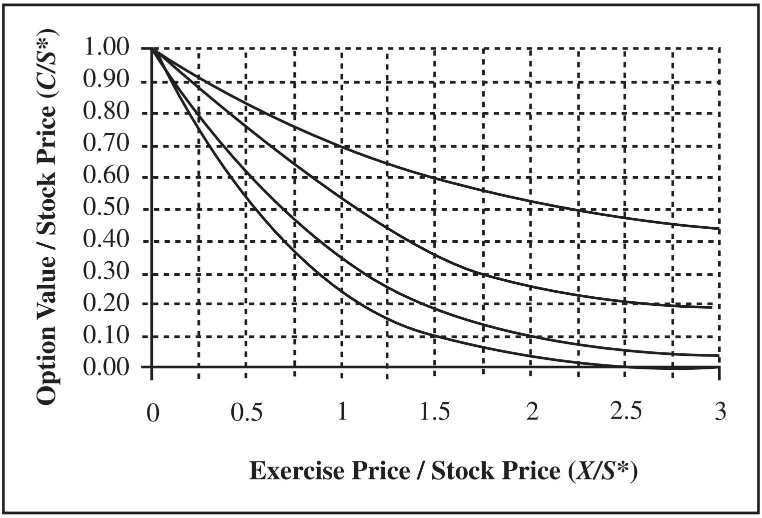
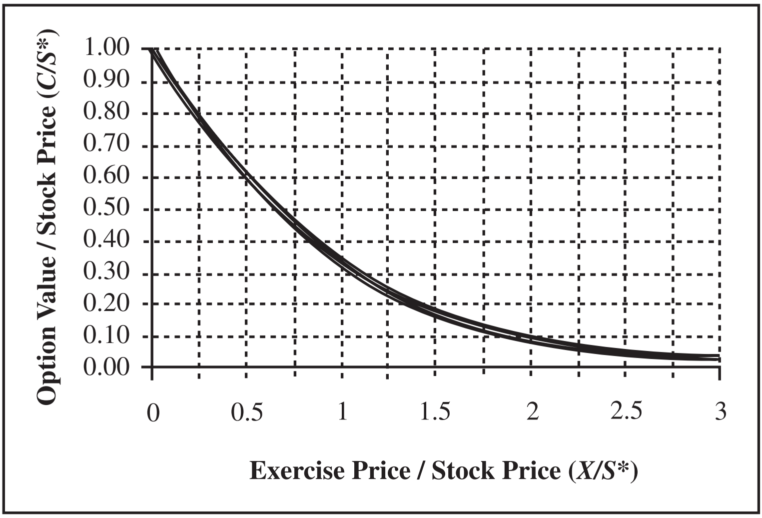


FIGURE 8.5

Black-Scholes Valuation
Time-to-maturity: 5 years. Volatility: 50%.
Risk-free rate (top to bottom): 10%, 8%, 6%, 4%.



ity of 80% per year. The risk-free rate is 5% and the company pays no dividends. These assumptions correspond to those used to generate Figure 8.3. The ratio of the exercise price to the stock price is 0.4. Looking at the upper curve of Figure 8.3 (which reflects the value of options with volatilities of 80%), we see that 0.4 corresponds to a ratio of option value to stock price of about 0.7, so the option is worth roughly 70% of the dividend-adjusted stock price, or 0.7 × $50 = $35.

Suppose instead that the exercise price of the option is $100 per share and that the volatility is 50%. The ratio of the exercise price to the current stock price is 2. At a volatility of 40%, the option value would be about 6% of the stock price. At a volatility of 60%, the option value would be about 15% of the stock. We can interpolate between these to see that our option is worth about 10.5% of the stock price, or $10.50.

From a look at Figure 8.3, the impact of volatility is obvious. Higher volatilities lead to dramatically higher option values. It follows that for younger companies with volatile stocks, options will have a much larger impact than, say, for older companies in stable industries. Also notice that all of the curves approach 1 as we move to the left. If the option is very much *in-the-money* (i.e., the exercise price is quite low relative to the stock price), owning the option is almost the same as owning the stock. Suppose, for example, that an option has an exercise price of $0.01 and that the underlying stock is trading at $30. The penny is meaningless and the option will almost surely be exercised, so the option is equivalent to the stock and therefore should have virtually the same value. At the other end of the graphs, we see the curves decreasing toward zero. If we extended the graphs to higher values of the exercise price (relative to the stock price), we would see all the curves get very close to zero. In these situations, the exercise price is so far above the current stock price that it is virtually impossible for the stock to increase to the point where the option would be exercised. In those situations, the option is essentially worthless.

Figure 8.4 is similar to Figure 8.3, except that the four curves correspond to different times-to-maturity. We see that like volatility, the time-to-maturity is an important factor in option valuation. In fact, option values can be surprisingly large when there is a long time until the option expires. For example, suppose that the exercise price is double the current stock price, which implies that the option will not be exercised unless the stock more than doubles in price. With a 10-year maturity, the option is worth nearly 55% of the current stock price! It is clear from Figures 8.3 and 8.4 that option values can be quite large in some circumstances. Figure 8.5 is similar to Figures 8.3 and 8.4, except that the four curves correspond to different risk-free rates. We see that the four curves, which represent risk-free rates ranging from 4% to 10%, are nearly coincident. We correctly conclude that option values are relatively insensitive to the risk-free rate.

Early Exercise: Black's Approximation Unfortunately, the ESO world is more complicated than the options world envisioned by Black and Scholes. After vesting, ESOs may be exercised early, so we must consider the impact of early exercise on the value of the ESO. Hull (2000) and others argue that there are three realistic scenarios in which it is optimal to exercise an American call option on a dividend-paying stock. First, we might exercise immediately before the next dividend payment if the dividend yield is very high. In those circumstances, the benefit from capturing the dividend is greater than the potential benefit from waiting in hopes that the stock price will increase substantially. Although this scenario is feasible, it is also quite rare, because the dividend yield would have to be quite high to justify the early exercise. Second, we might choose to exercise immediately before the last dividend prior to expiration. If the expiration date of the option is only a short time after that dividend, then there would be little time for the stock price to increase enough to offset the effect of the dividend payment. In Figure 8.2, for example, we see that it takes roughly 30 days after the first dividend is paid for the stock price to rebound to its level immediately prior to the dividend. If a call option on the stock expired any time during that 30-day period, we would have been better off if we had exercised early, right before the dividend was paid. Third and finally, we might choose to hold the option until the expiration date. In this scenario, we believe that the potential growth in the stock price more than offsets the effect of the dividend payments and that it is therefore optimal to hold the option rather than exercise it early.

Fisher Black (of Black-Scholes fame) notes that there is a simple way to adjust for the possibility of exercise prior to the last dividend payment.[5] He suggests the following three-step process (which we will later expand upon):

Step 1: Compute the value of a European call option with the same characteristics as the American option we are valuing.

Step 2: Compute the value of a European call option with the same characteristics as the American option we are valuing, except that we assume the option expires immediately prior to the last dividend payment.

Final Step: Take the greater of these two values as our estimate of the value of the American call option.

In a few minutes, we will modify this process to adjust for the possibility that we will want to exercise before the first dividend payment. Before doing that, consider the following example, which illustrates the three-step process.

Example 8.6: Let us now return to Example 8.3, but instead assume that the option is American. In Example 8.3, we computed the value of the option to be $5.42 under the assumption that the option was European, which is precisely Step 1 in Black's Approximation. To complete step 2, we as-

5. See Black (1975).

sume that the option expires in 5 months, immediately before the second (and last) dividend. In that case, we use a stock price of $29.005, which is the $30 price less the present value of the first dividend payment. In that case, we find that the Black-Scholes value of the option is $5.90. In the final step, we simply compare this to the $5.42 value we obtained in Step 1, and, because $5.90 is the higher of the two, we estimate the value of the option to be $5.90.

We stress that Black's approximation is necessarily a lower bound on the true value of the option. If we choose the value from Step 1, we fail to value the possibility (however unlikely) that the company's stock price will change to a point where we would prefer to exercise early. If we choose the value from Step 2, we fail to value the possibility that the company's stock price will be low at the time of the last dividend (in which case the option would not be exercised), but will recover to make the option worth something on the expiration date. These possibilities are generally unlikely, so the error from not addressing them tends to be small.

As we mentioned earlier, Hull and others argue that in *most* cases, we will only optimally exercise at expiration or immediately prior to the last dividend payment. There are scenarios, however, in which we would want to exercise immediately prior to the first dividend payment. We can therefore modify Black's approximation to adjust for the possibility of exercise prior to the first dividend payment.

Step 3: Compute the value of a European call option with the same characteristics as the American option we are valuing, except that we assume the option expires immediately prior to the first dividend payment.

Final Step: Compare the values computed in Steps 1–3 and take the greatest as our estimate of the value of the American call option.

Example 8.7: Returning again to our example, we complete Step 3 by computing the Black-Scholes value of the option under the assumption that it matures in 2 months. When we do this, we find that the option is worth $5.61. Since this is less than the $5.90 we computed in Step 2, we conclude that an optimal exercise at 2 months is unlikely and that our best estimate of the option's value is still $5.90.

To get a better feel for what circumstances would lead us to exercise prior to the first dividend, consider the following slight variation of our previous example.

Example 8.8: Let us return to our previous example, but instead assume that the expected dividends are \$2 in 2 months and \$2.20 in 5 months.

Step 1: We compute the option value under the assumption that it is a European option that expires in 6 months. The dividends are exactly double what they were in Example 8.3, so we know that the present value of the two dividends is \$4.16. We therefore plug \$30 − \$4.16 = \$25.84 into the Black-Scholes formula. This gives us a value of \$4.04.

Step 2: We compute the option value under the assumption that it is a European option that expires in 5 months immediately prior to the dividend payment on that date (i.e., we plug in a stock price of $S_0 = \$30 - \$1.99 = \$28.01$). This gives us a value of \$5.17.

Step 3: We compute the option value under the assumption that it is a European option that expires in 2 months immediately prior to the dividend payment on that date. This gives us a value of \$5.61.

Final Step: We choose the highest of these, \$5.61, as our value. In doing so, we recognize that it is highly likely that the option will be exercised immediately prior to the first dividend payment.

Why is it that we will likely choose to exercise early in this example? The dividends are so high that there is little chance that the stock price will increase enough to overcome the effect of those dividend payments.

Adjusting Black-Scholes for ESO Characteristics

As we mentioned above, the Black-Scholes formula was developed for options, not ESOs. There are several key differences between the two. First, when ESOs are exercised, the number of shares outstanding increases, which dilutes the value of previously outstanding shares. Second, the company receives money in exchange for the shares, so the value of the company increases when ESOs are exercised. Third, some ESOs are forfeited, even if they have value. Fourth and finally, the company receives a tax benefit when an ESO is exercised. Of course, we need to make adjustments for these simultaneously so that we incorporate not only the impact of each of the additional variables, but the relationships between those variables.

At first glance, it may seem to be easy to adjust for these differences. Increasing the number of shares outstanding simply scales the value per share downward in a very predictable way. The cash inflow from exercise is known, so we know the impact on company value precisely. Forfeiture rates can be estimated with the use of historical data, and the tax effect is relatively straightforward. The same cannot be said of the dilution effect and the cash inflow upon exercise. We are tempted to simply add the expected cash inflow to the value of the company, compute the Black-Scholes value, and then use a scale factor to adjust for dilution. Though intuitive, this approach only partially incorporates the characteristics of ESOs. The cash inflow may or may not occur, so we would somehow need to factor in the probability that the ESOs would be exercised. The real difficulty we face is that we must incorporate all of these effects at once. Fortunately, we do have a solution,[6] although it requires numerical techniques to find our estimate of ESO value. In this section, we will discuss the theoretical model for valuing ESOs, which is far from being trivial. Later in the chapter, we will discuss the application of the theory.

We begin by briefly discussing the basic intuition behind our treatment of the four characteristics unique to ESOs. We will ignore dividends for the purposes of this discussion, but will include them in our final formula. The impact of forfeitures is easy to incorporate, given that we can estimate the forfeiture rate. We can simply treat the forfeitures as if the ESOs never existed in the first place. If N_{ESO} is the number of ESOs outstanding and F is the fraction of those that we expect to be forfeited, we compute the total value of outstanding ESOs based on there being $N_{ESO}(1 - F)$ ESOs outstanding.

The impact of the cash flows that occur when ESOs are exercised is also relatively easy to incorporate. At that time, the company receives a cash inflow in the amount of the number of ESOs exercised multiplied by the exercise price of an ESO. The total value of the company's equity (including the ESOs, which are contingent equity claims) increases by $(N_{ESO}(1 - F)X$ when the ESOs are exercised. Similarly, the tax benefit the

6. See Hull (2000, 253–254) for a partial development of the ideas presented here.

company receives increases the total value of the company's equity by $N_{ESO}(1-F)(S_{T_m}-X)T$, where S_{T_m} is the stock price at the expiration date, and T is the company's marginal tax rate. Putting these together, we see that the value of equity increases by

$$\text{Increase in Equity Value} = N_{ESO}\left(1-F\right)\left(X+\left(S_{T_m}-X\right)T\right). \tag{8.6}$$

when the ESOs are exercised. This increase in value is shared by both previously outstanding shareholders and the new ones that are created. We can simply treat this as a cash flow to the company when the ESOs are exercised. This is a nontrivial task because we must somehow consider all possible values of S_{T_m} along with the likelihoods that they will occur. Furthermore, we must consider the impact of that cash inflow on the exercise decision itself. It may be the case, for example, that the stock is currently trading at a price slightly below the exercise price. In this case, a call option would not be exercised, but the ESO might be exercised because the tax break would cause the company's stock to rise in value. Fortunately for us, we can adapt the Black-Scholes formula to accommodate this idea.

Finally, we can also incorporate the impact of dilution by noting that when an ESO is exercised, each share of stock makes up a slightly smaller portion of the company. This contrasts with the implicit assumption of the Black-Scholes model that the number of shares is constant. Consider the following simple example.

Example 8.9: Consider the following scenarios, the first of which is an option exercise and the second of which is the exercise of an ESO.

> *Scenario 1*: The company has 100 shares outstanding. There are 25 options outstanding in the secondary options market. When those options are exercised, the holder receives 25 shares, which represent 25% of the company's stock.
>
> *Scenario 2*: The company has 100 shares outstanding and has issued 25 ESOs. In all other respects, the company is identical to the company described in Scenario 1. When those options are exercised, the holder receives 25 shares, but there are then 125 shares outstanding. Thus the holder's shares represent only 20% of the company's stock. In that case, however, the value of the company has increased because the ESO holder had to pay for the shares.

It follows that the ESOs (i.e., warrants) in Scenario 2 are worth only 80% of the value of the options in Scenario 1, again assuming that we ignore the cash inflow to the company from ESO holders who exercise. In general, we can take the Black-Scholes valuation and multiply it by the ratio of shares outstanding before the ESO exercise to shares outstanding after the ESO exercise. In the above situation, we would multiply the Black-Scholes valuation by 100/125, or 80%.

For most companies, this adjustment has only a small impact on ESO value (and hence on stock value) because the number of ESOs outstanding is substantially lower than the number of shares outstanding. For other companies, however, the adjustment is meaningful.

Our task is now to incorporate these effects at once. From a theoretical perspective, we approach the problem by considering the value of the company's equity after the ESOs are exercised and then considering how the exercise decision compares with the decision under the assumptions of the Black-Scholes model. Immediately prior to the exercise decision, the total value of the company's equity consists of the value of the company's common stock *and* the value of the outstanding ESOs (which are contingent equity claims). When the ESOs are exercised, the total value of the company's equity increases by the amount of the cash inflow from the exercise of the ESOs and the amount of the tax benefit the company receives due to the exercise. Thus, the total value of the company's equity immediately following the exercise of the ESOs is

$$\text{Total Equity Value} = N_s S_{T_m} + N_{ESO}(1-F)V_{ESO} + N_{ESO}(1-F)\left(X+\left(S_{T_m}-X\right)T\right), \tag{8.7}$$

where N_s is the number of shares outstanding prior to the ESO exercise and V_{ESO} is the value of a single, nonforfeited ESO. The first term in the equation is the value of the company's outstanding shares immediately prior to the ESO exercise. The second term is the value of the company's ESOs immediately prior to the ESO exercise. The third term is the benefit received by the company when the ESOs are exercised. That benefit consists of two elements. First, the company receives a cash inflow from ESO holders in the amount $N_{ESO}(1-F)X$. Second, the company receives a tax break in the amount of $N_{ESO}(1-F)(S_{T_m}-X)T$, which is the number of ESOs exercised multiplied by the accounting loss on the exercise (since shares are sold for a price below their value) and multiplied by the tax rate. This term then reflects the reduction in the company's tax bill due to the exercise of ESOs.

We are tempted to question this by asking how it is that the value of equity after the exercise is dependent on the value of the ESOs. After all, those ESOs no longer exist after they are exercised. Effectively, however, the value of those ESOs is transferred into the value of the company's common stock, so that the total value of equity after the exercise consists of three components: the value of common stock before exercise, the value of the ESOs immediately prior to the exercise, and the cash inflows that occur when the ESOs are exercised.

Now, consider the ESO holders who must decide whether or not to exercise the ESOs. If they do exercise them, they will own a fraction of the company's equity, the value of which is specified in Equation (8.7). At that time, there would be $N_s + N_{ESO}(1 - F)$ shares outstanding, so the ESO holder would own a share of stock that is worth.

$$V_s^+ = \frac{N_s S_{T_m} + N_{ESO}(1-F)V_{ESO}N_{ESO}(1-F)\left(X+(S_{T_m}-X)T\right)}{N_s + N_{ESO}(1-F)}. \tag{8.8}$$

The decision of an ESO holder depends on whether or not this value is greater than the cost of the share, which is X. Equivalently, the holder will exercise if the payoff, $V_s^+ - X$, is positive. Rearranging this, we see that the exercise payoff can be written

$$\text{Exercise Payoff} = \frac{N_s T N_{ESO}(1-F)}{N_s + N_{ESO}(1-F)}[V_s^+ - X]. \tag{8.9}$$

It is important that we express the payoff in this way because it is analogous to the payoff on the call option envisioned by Black and Scholes. The call option payoff is $S_0 - X$ (multiplied by 1 if you will) whereas the ESO payoff is $V_s^+ - X$ multiplied by

$$\frac{N_s + TN_{ESO}(1-F)}{N_s + N_{ESO}(1-F)}.$$

It follows that one ESO is equivalent to $\frac{N_s + TN_{ESO}(1-F)}{N_s + N_{ESO}(1-F)}$ call options on a security that today is worth

$$\frac{N_s S_0 + N_{ESO}(1-F)(V_{ESO} + TS_0)}{N_s + TN_{ESO}(1-F)}.$$

If the stock pays dividends and we assume that they are continuous, today the security would be worth

$$V_s^+ = \frac{N_s S_0 e^{-qT_m} + N_{ESO}(1-F)(V_{ESO} + TS_0 e^{-qT_m})}{N_s + TN_{ESO}(1-F)}. \tag{8.10}$$

This gives us a basis for valuing an ESO. We can simply use the basic Black-Scholes approach with three adjustments:

1. S_0 is replaced by V_s^+ (defined in Equation 8.10). That is, instead of using the current stock price, we use a function of the current stock price that adjusts the formula for the unique characteristics of ESOs.
2. The volatility of the company's common stock is replaced by the volatility of the company's total equity, including outstanding ESOs.
3. The option value we obtain is multiplied by $\frac{N_s + TN_{ESO}(1-F)}{N_s + N_{ESO}(1-F)}$.

In reality, we have no easy way to estimate the volatility in Step 2, so we generally ignore it. These adjustments give us a rather cumbersome equation for the value of an ESO,

$$V_{ESO} = \frac{N_s + TN_{ESO}(1-F)}{N_s + N_{ESO}(1-F)} \left[V_s^- N(d_1) - \frac{X}{e^{R_f T_m}} N(d_2) \right],$$

where

$$d_1 = \frac{\ln\left(\frac{V_s^-}{X}\right) + \left(R_f + \frac{\sigma^2}{2}\right) T_m}{\sigma\sqrt{T_m}} \tag{8.11}$$

and

$$d_2 = d_1 - \sigma\sqrt{T_m}.$$

The net value of the company's outstanding ESOs would simply be this value multiplied by ($N_{ESO}(1 - F)$. We see in the equation that the ESO value appears on both sides of the equation. We cannot solve the equation for that value analytically, so we are forced to use numerical techniques to solve for the ESO value. Although we could use trial and error to solve Equation 8.11

for V_{ESO}, it is far easier to rely on computers to do the work for us. In particular, the Excel Solver feature makes solving such equations quite simple.

At this point, it is useful to consider how our ESO-adjusted formula compares to the basic call option formula. Table 8.2 shows the values of ESOs compared with the value of call options for different parameters. The first nine rows of the table show different sets of parameter assumptions. For all the scenarios, we use a tax rate of 40%. The last three rows show the value of the ESO obtained with the ESO-adjusted Black-Scholes formula, the value obtained with the basic Black-Scholes formula, and the error we produce if we choose to use the basic formula. Scenario 1 represents a baseline with which we can compare the results obtained with the use of other assumptions. In each of the other columns, one and only one parameter differs from those in the first scenario. In Scenario 1, we see that using the Black-Scholes formula results in an error of only −1.85%, meaning that we would underestimate the value of the ESO by 1.85%. In nearly every other scenario, the error is of this magnitude. We do see, however, that the error increases substantially when the number of ESOs is higher relative to the number of shares outstanding. This is seldom the case for mature companies, but we often do see large numbers of ESOs in relatively young companies. In addition, we see that the higher the exercise price is, the lower is the error obtained with the basic Black-Scholes formula. It follows that we should be especially careful whenever a company has a large number of ESOs outstanding with very low exercise prices. In such cases, we might significantly underestimate the value of the ESOs.

Valuing Yet-to-Be-Issued Employee Stock Options

Equation 8.11 gives us an approach we can use to value ESOs the company has already issued, but many companies maintain a regular policy of issuing ESOs each year. For example, the CEO's annual compensation package might include a base salary plus additional ESOs. In such cases, we must not only value the existing ESOs, but must estimate the value of ESOs yet to be issued. Fortunately, companies provide a historical record (in the annual reports) of ESOs granted along with the company's estimate of the value of those ESOs at the time they were issued. A simple approach is to then consider the historical ratio of the value of ESOs granted to sales, and use that ratio as a basis for forecasting future issuances. This makes some sense intuitively because the company must hire additional people to generate the growth in sales. At least some of those new employees would likely receive

TABLE 8.2

Black-Scholes Adjusted for ESOs

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8
N_s	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000	10,000,000
F	6.00%	6.00%	1.00%	6.00%	6.00%	6.00%	6.00%	6.00%
N_{ESO}	500,000	4,000,000	500,000	500,000	500,000	500,000	500,000	500,000
S_0	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00
T_m	8	8	8	2	8	8	8	8
σ	60.00%	60.00%	60.00%	60.00%	100.00%	60.00%	60.00%	60.00%
X	$1.00	$1.00	$1.00	$1.00	$1.00	$10.00	$30.00	$1.00
R_f	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	8.00%
V_{ESO}	$19.71	$22.25	$19.73	$19.45	$19.99	$15.97	$12.01	$19.87
C	$19.35	$19.35	$19.35	$19.09	$19.62	$15.72	$11.90	$19.50
Error	−1.85%	−13.05%	−1.95%	−1.87%	−1.85%	−1.55%	−0.95%	−1.88%

ESOs. Although this is decidedly only a rough approach for estimating the value of future ESOs to be granted, there is little else we can do.

Before considering the realities of applying our formulas in the real world, let us consider a simple example that ties together much of our discussion to this point.

Example 8.10: Suppose that a company has 5,000,000 shares of common stock outstanding. The current market price of a share of that stock is $16. The company currently has a dividend yield of 2%, and that yield is a reasonable estimate of the future dividend yield. The company has 500,000 2-year ESOs outstanding with an exercise price of $11, and 390,000 1-year ESOs outstanding with an exercise price of $14. The 2-year ESOs were just issued, and the 1-year ESOs were issued 1 year ago (the company's policy is to issue 2-year ESOs once per year). We observe that the company has historically seen forfeitures of 2.6% each year. The company's tax rate is 35%. The continuously compounded yield-to-maturity on 1-year and 2-year zero coupon Treasury bonds are 2.9% and 3.1%, respectively. These give us estimates of the risk-free rates of return for 1 year and 2 years, respectively. Recently, the volatility of the company's stock has been about 64%, and we believe this is a fair estimate of what the future volatility will be. The company reports historical ESOs issued, and those numbers lead us to believe that the company will continue to issue ESOs annually in an amount approximately equal to 6% of annual sales. The company's trailing 12-month sales were $14,300,000, and sales are forecasted to grow at a rate of 8% per year for the next 10 years, followed by constant annual growth of 2%. The company's weighted average cost of capital is 7%. These assumptions are summarized in Table 8.3. What is our estimate of the value of outstanding and expected ESOs?

The computation of the value of outstanding ESOs is depicted in Table 8.4. We begin by considering the two classes of ESOs the company has outstanding. Since the company does not pay dividends, we need not worry about early exercise. We can therefore rely on the Black-Scholes formula for valuing call options. The values of ESOs from the two classes are shown in the table, along with the parameter assumptions we used in the Black-Scholes calculations and the values of other variables we estimate. We see that the 1-year call options are worth about $4.83 each, and the 2-year options are worth about $7.51 each. These values may seem awfully high for the stock. The stock, for example, would have to reach

TABLE 8.3

Assumptions, Example 8.10

Variable	Value
Shares outstanding	5,000,000
Current market price	$16
Dividend yield	2%
Tax rate	35%
No. of 1-year ESOs	390,000
Exercise price of 1-year ESOs	$14
No. of 2-year ESOs	500,000
Exercise price of 2-year ESOs	$11
Annual forfeiture rate	2.6%
1-Year risk-free rate	2.9%
2-Year risk-free rate	3.1%
Stock volatility	64%
Sales growth forecast	8% for 10 years, 2% annually thereafter
WACC	7%

TABLE 8.4

Value of Outstanding ESOs, Example 8.10

	Class 1	Class 2
Stock price (S_0)	$16	$16
Exercise price (X)	$14	$11
Time-to-maturity in years (T_m)	1	2
Volatility (σ)	0.64	0.64
Risk-free rate (R_f)	2.9%	3.1%
Forfeiture rate (F)	2.60%	5.27%
Tax rate (T)	35%	35%
Number of ESOs (N_{ESO})	390,000	500,000
Expected no. of shares outstanding prior to exercise (N_s)	5,000,000	5,379,860
Value of one ESO	$4.83	$7.51
Value of all outstanding ESOs	$1,883,700	$3,755,000

\$18.93 (a return of 18.3%) over the next year in order to even get a payoff of \$4.83 on the 1-year ESO. Although this may seem unlikely, given that the market's expected return is probably less than 10%, the stock is extremely volatile, and it is therefore entirely possible that the stock price will increase by much more than that. This is the key factor that drives the high valuations we observe.

After computing the option values, we must estimate the forfeiture rate. In this case, we can rely on the historical data, which suggest a 2.6% forfeiture rate on the 1-year ESOs. For 2-year ESOs, that rate would be compounded, giving us an estimated forfeiture rate of $1.026^2 - 1 = 5.27\%$ on those 2-year ESOs. We also need to estimate the number of shares outstanding at the time the ESOs would be exercised, so that we can adjust for the dilution of shares. Recall from our earlier discussion that ESOs are different from the options envisioned by Black and Scholes, in that new shares are issued when ESOs are exercised. For the 1-year ESOs, we can use the current number of shares outstanding. For the 2-year ESOs, we must take into account that the 1-year ESOs would likely have been exercised, thereby increasing the number of shares outstanding. We expect $390{,}000 \times (1 - 0.026) = 379{,}860$ of the 1-year ESOs to be exercised, which will increase the expected number of shares outstanding to 5,379,860. Note that in most real-world situations, this adjustment is not of consequence because the number of ESOs outstanding is far less than the number of shares outstanding. In addition, it may very well be the case that the 1-year ESOs are not exercised because the stock price is below \$14 in one year. There are more accurate ways to estimate the expected number of ESOs that would be exercised, but they are beyond the scope of this book. Because the adjustment is typically of little consequence, many investment professionals ignore the adjustment entirely.

Using Equation 8.11, we estimate that the 1-year ESOs have a value today of \$1,883,700, and the 2-year ESOs have a value today of \$3,755,000, for a total value of outstanding ESOs of \$5,638,700. To estimate the value of ESOs we expect to be issued in the future, we first forecast sales and then use those forecasts to estimate the expected ESOs. This is depicted in Table 8.5. In the table, we forecast sales to grow at 8% each year and then forecast that ESOs will be issued at 6% of sales. For the ESOs to be issued beyond 10 years, we apply our perpetual growth formula from Chapter 3 to estimate the value of those ESOs. We then discount all of the forecasts at the WACC to get the estimated value today of \$28,431,508. Finally, we conclude that the net value of outstanding and to-be-issued ESOs is

TABLE 8.5

Estimated Value of ESOs to be Issued, Example 8.10

Year	Sales	Value of ESOs	Discounted value
1	$15,444,000	$926,640	$866,019
2	$16,679,520	$1,000,771	$874,112
3	$18,013,882	$1,080,833	$882,282
4	$19,454,992	$1,167,300	$890,527
5	$21,011,391	$1,260,683	$898,850
6	$22,692,303	$1,361,538	$907,250
7	$24,507,687	$1,470,461	$915,729
8	$26,468,302	$1,588,098	$924,288
9	$28,585,766	$1,715,146	$932,926
10	$30,872,627	$1,852,358	$941,645
Terminal value at year 10		$38,158,568	$19,397,881
Total			$28,431,508

$28,431,508 + $5,638,700 = $34,070,208. This value and the values of debt and preferred stock would then be subtracted from our estimate of the value of the company to get the value of common stock.

The example above shows the basic approach we can use to determine the impact of ESOs on stock value. In practice, however, many investment professionals use simpler techniques to approximate the impact.

IN PRACTICE . . .

ESOs are completely ignored by some investment professionals. Those professionals may regard ESOs as having only a minor impact on stock value, so ignoring them would not greatly bias their results. This logic is decidedly faulty, as we will demonstrate a bit later. In other cases, there seems to be a lack of understanding of how to properly value them. Other professionals use rules of thumb to estimate the value of ESOs, whereas still others use dilution-based approaches that we will discuss shortly. For those who truly understand ESOs and who want to value them with some accuracy, the Black-Scholes model is preferred.

As we have seen, valuing call options can be an involved process. We face even more difficulties when we try to properly value real-world ESOs. Despite these difficulties, we do have some help in that each publicly traded company is required to provide a good bit of information about the ESOs the company has outstanding. In addition, each company is required to provide estimates of the risk-free rate, the volatility of the company's common stock, and even an estimate of the value of ESOs issued during the reporting period. The reporting requirements are specified in the Statement of Financial Accounting Standards (SFAS) No. 123R, which we discussed earlier (see, for example, Chapter 4).

A Note on Dilution-Based Approaches

At this point, it is useful to discuss a class of popular methods for dealing with ESOs. We did not discuss them earlier because the methods have no solid theoretical basis to support them. In dilution-based approaches, we do not actually value the ESOs, but instead treat them as if they had already been exercised. We simply adjust the number of shares outstanding to account for the dilution from ESOs. In Example 8.1, for example, we would simply assume that the company already has 110 shares outstanding. Once we compute the total value of equity, we would divide it by 110 to obtain the share value today. In a second approach, each expected cash flow is forecasted on a per-share basis based on the number of outstanding shares we expect the company to have at that time. In our example, we would divide all cash flows prior to December 31 by 100 and divide all cash flows after December 31 by 110. There is no theoretical basis for either approach. Furthermore, dilution-based approaches are inherently flawed because we implicitly assume that the ESOs will be exercised even if the stock price is below the exercise price. Although this would be great for current shareholders (who would see their shares increase in value when employees pay more for their shares than the market price), it will not happen in equilibrium. As such, typical dilution-based approaches tend to bias our estimate of share value upward. These approaches are also flawed in that they ignore both the cash inflow associated with ESO exercise and the tax deduction the company receives upon exercise.

The advantage of dilution-based approaches is of course their simplicity. Although they are not theoretically sound, they can provide a simple means of loosely approximating the impact of ESOs on stock value. In particular, if the exercise price on the ESOs is well below the current market price, we can be reasonably certain that they will be exercised. In such cases, using a dilution-based approach may be reasonable. We can simply assume that the company will receive the specified cash flow when the ESOs are exercised and at the same time assume that the number of shares outstanding includes the ESOs we expect to be exercised.

Different Contracts and Lack of Complete Information

The biggest difficulty we face in valuing ESOs is a lack of recent and complete information. Companies are required to report ESO information in their annual reports, which must be filed within 90 days of the end of the fiscal year. This means that we are typically dealing with rather old information. Suppose, for example, that a company has a fiscal year that corresponds with the calendar year, and that it is now March. If the company has not yet filed its annual report, our most recent information would be nearly 15 months old. This is precisely the situation we face with O'Charley's.

To make matters worse, the information provided by companies is only a summary. Our task would be relatively simple if the company's ESOs all had the same exercise price and the same expiration date, but this is seldom if ever the case. Instead, we find that companies have ESOs outstanding with many different exercise prices and many different expiration dates. Companies are not required to disclose a complete list of all outstanding ESOs but instead are required to report a summary in which ESOs are classified into different ranges. Consider, for example, the 2003 Annual Report for UTStarcom (UTSI), which includes the information shown in Table 8.6. Notice first that all of the ESOs outstanding with low exercise prices are exercisable (meaning that the holder is vested), and many of the ones outstanding with high exercise prices are not yet exercisable. This is a typical pattern for a relatively young company like UTStarcom. When ESOs are issued, they will typically have an exercise price equal to the market value of the stock at the time of issuance. It follows that if the company's stock price has increased over time, ESOs with low exercise prices will tend to be the ones that were issued long. The long time period since issuance allows all of the ESOs to be either vested or forfeited. In contrast (again assuming that the stock price has increased over time), ESOs with high exercise prices tend to be ones that were issued more recently. As such, many of them have not yet become vested.

TABLE 8.6

Outstanding ESOs for UTStarcom as of December 31, 2003

	Options outstanding			*Options exercisable*	
Range of exercise price	**Outstanding (in thousands)**	**Weighted average exercise price**	**Weighted average remaining contractual life**	**Exercisable (in thousands)**	**Weighted average exercise price**
$0.06 – $0.06	36,519	$0.06	4.8	36,519	$0.06
$0.25 – $ 0.25	27,764	$0.25	5.1	27,764	$0.25
$0.85 – $ 0.85	88,885	$0.85	1.8	88,885	$0.85
$1.71 – $ 2.50	197,303	$2.28	3.8	197,054	$2.28
$3.39 – $ 4.71	920,116	$4.30	5.4	920,116	$4.30
$5.65 – $ 5.65	5,785	$5.65	4.4	5,785	$5.65
$9.38 – $13.61	1,660,131	$11.74	6.5	1,269,637	$11.47
$14.23 – $21.31	7,534,310	$18.34	8.2	2,368,827	$17.79
$21.85 – $32.67	3,657,867	$26.23	8.6	779,747	$24.44
$34.40 – $45.21	488,449	$39.23	9.6	33,958	$42.91
$0.06 – $45.21	14,617,129	$18.97	7.9	5,728,292	$14.27

Source: UTStarcom Annual Report, March 8, 2004.

Table 8.7 shows the ESO table provided by H. J. Heinz (HNZ) in its 2003 annual report. H. J. Heinz is a much older company than UTStarcom, and this is evident in the ESO table. We see no ESOs outstanding with exercise prices below $25. It has been nearly 10 years since the H. J. Heinz stock price was last under $25, so any ESOs issued before then have all apparently been forfeited or exercised. In addition to providing a table describing outstanding ESOs, companies must provide other information of relevance to us. Table 8.8 shows recent ESO activity as provided by H. J. Heinz in its annual report. This table gives us a good picture of the annual turnover in ESOs and helps us to estimate the future forfeiture rate and the future grants of new ESOs. In addition, companies are required to provide estimates of the inputs to the Black-Scholes formula (or to another model if the company has chosen to use something else) along with their estimates of the value of new ESOs granted. The information provided by H. J. Heinz is shown in Table 8.9.

Early Exercise

As we discussed earlier in the chapter, American call options (and ESOs) may be exercised early, so that dividends may be captured. In the case of ESOs, there are other circumstances under which a holder might choose to exercise early. First, when an employee leaves a company, the company often requires the employee to exercise the employee's ESOs or return them to the company. Some of these employees might choose to exercise their ESOs rather than forfeit them. Second and less commonly, ESOs might be exercised early, so that the holder can gain greater control over the company. Consider, for example, a simple company in which there are two shareholders. One has 1,000,000 shares and the other has 900,000 shares and 200,000 ESOs. The ESOs expire some time well in the future. Currently, the former shareholder has complete control over the company because of having the majority of the votes. If and when the latter shareholder exercises the ESOs, all of the power will shift to that shareholder and away from the other shareholder.

Earlier in the chapter, we discussed ways in which we might deal with early exercise of ESOs on dividend-paying stocks, but we have no easy way to deal with early exercise for other reasons. Investment professionals tend to disregard these possibilities, and we will do the same. Although most professionals seem to use the Black-Scholes formula without adjusting for ESO characteristics, we will use the both the ESO formula

TABLE 8.7

Outstanding ESOs for H. J. Heinz as of April 28, 2004

	Options outstanding			Options exercisable	
Range of exercise price	**Outstanding**	**Weighted average exercise price**	**Weighted average remaining contractual life**	**Exercisable**	**Weighted average exercise price**
$25.00 – $34.00	19,091,529	$31.58	6.07	10,666,559	$30.42
$34.01 – $43.25	8,579,974	$38.19	5.82	3,355,478	$37.30
$43.26 – $54.00	9,813,261	$48.36	4.43	7,272,262	$47.38
$25.00 – $54.00	37,484,764	$37.49	5.59	21,294,299	$37.29

Source: H. J. Heinz Annual Report, June 17, 2004.

TABLE 8.8

Recent ESO Activity for H. J. Heinz as of April 28, 2004

Shares under option May 2, 2001	30,241,345	$39.04
Options granted	4,712,000	$43.16
Options exercised	(2,555,999)	$24.93
Options surrendered	(1,088,250)	$51.01
Shares under option May 1, 2002	31,309,096	$40.39
Options granted	3,711,410	$35.43
Options exercised	(311,376)	$33.03
Options surrendered	(402,306)	$42.75
Spin off of SKF Foods	3,594,203	—
Shares under option April 30, 2003	37,901,027	$36.02
Options granted	4,770,584	$34.08
Options exercised	(4,774,004)	$22.30
Options surrendered	(412,843)	$35.57
Shares under option April 28, 2004	37,484,764	$37.49
Options exercisable at:		
May 1, 2002	19,087,840	$38.40
April 30, 2003	21,234,857	$34.87
April 28, 2004	21,294,299	$37.29

Source: H. J. Heinz Annual Report, June 17, 2004.

TABLE 8.9

Other ESO-Related Information Provided by H. J. Heinz as of April 28, 2004

	2004	2003	2002
Dividend yield	3.3%	4.3%	3.9%
Volatility	20.1%	25.2%	23.3%
Risk-free interest rate	3.7%	4.0%	4.6%
Expected term (years)	6.5	6.5	6.5
Weighted average value of options granted (per share)	$5.90	$6.86	$8.54

Source: H. J. Heinz Annual Report, June 17, 2004.

specified in Equation 8.11 and the basic Black-Scholes formula specified in Equation 8.3. This will further our understanding of the potential errors we introduce by not adjusting for ESO characteristics.

Case Study: O'Charley's

We now return to our case study of O'Charley's. In doing so, we hope to assess how the company's ESO program effects the value of the company's common stock. Table 8.10 shows the outstanding ESOs for O'Charley's as of the end of 2003. Table 8.11 shows the recent activity on the ESOs, including forfeitures. Table 8.12 shows the company's estimates of the inputs to the Black-Scholes model. Although the tables differ in appearance from those of H. J. Heinz, for our purposes they provide the same information.

Table 8.10 shows that O'Charley's reported six classes of ESOs. We will treat each class separately and treat the ESOs within each class as if they all have the same characteristics. For example, we will assume that the company has 267,075 ESOs outstanding, each with an exercise price of $7.67 and an expiration in of 1.2 years. Table 8.11 gives us information that will help us estimate the forfeiture rate on those ESOs. In 2001, 173,919/3,850,872 = 4.52% of the outstanding ESOs were forfeited. In 2002 and 2003, the forfeiture rates (also called the *churn rates*) were 2.82% and 2.87%, respectively. We will opt to rely on the most recent 2 years and will estimate that the churn rate will be 2.85% per year. That is, for each

TABLE 8.10

Outstanding ESOs for O'Charley's as of December 28, 2003

Exercise price	Number	Weighted average remaining contractual life	Weighted average exercise price
$7.00 to $7.99	267,075	1.20	$7.67
$8.00 to $10.99	210,555	2.70	$9.08
$11.00 to $13.99	499,760	5.10	$12.15
$14.00 to $15.99	826,447	5.50	$15.08
$16.00 to $18.99	491,495	7.70	$17.98
Over $18.99	1,419,172	8.80	$21.21
$7.00 to $25.00	3,714,504	6.50	$16.54

TABLE 8.11

Recent ESO Activity for O'Charley's as of December 28, 2003

	No. of shares	Weighted average exercise price
Balance at December 31, 2000	3,850,872	$9.67
Granted	514,550	$17.84
Exercised	(593,285)	$6.64
Forfeited	(173,919)	$14.49
Balance at December 30, 2001	3,598,218	$11.11
Granted	392,500	$21.67
Exercised	(366,101)	$8.51
Forfeited	(101,293)	$13.67
Balance at December 29, 2002	3,523,324	$12.43
Granted	1,261,722	$18.60
Exercised	(969,511)	$6.45
Forfeited	(101,031)	$18.86
Balance at December 28, 2003	3,714,504	$16.54

year left until an ESO expires, there will be 2.85% fewer ESOs. Table 8.12 shows that the company estimated a common stock volatility of 46.7% at the end of 2003. Although we could use historical data to come up with a more recent estimate of the volatility, we will opt to use the company's estimate. It is unlikely that a more recent estimate would differ greatly from the historical number. The table also shows the risk-free rate at the end of

TABLE 8.12

Other ESO-Related Information Provided by O'Charley's as of December 28, 2003

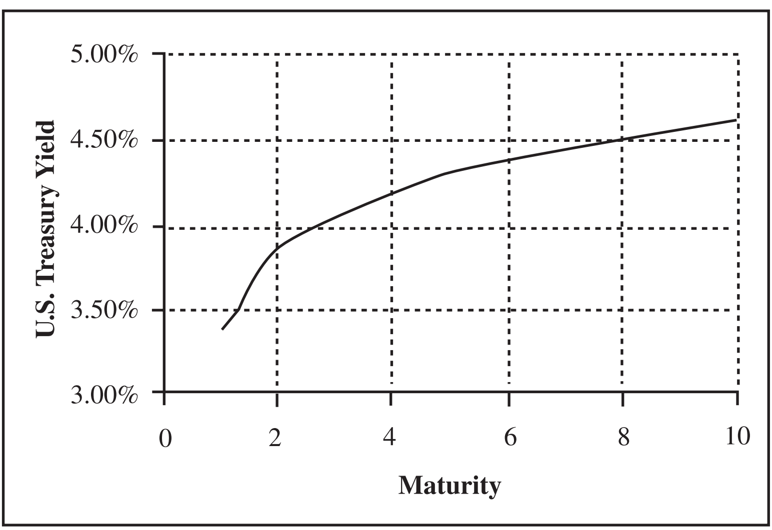
	2003	2002	2001
Risk-free investment interest	4.0%	4.7%	5.5%
Expected life in years	5.3	4.9	6.1
Expected volatility	46.7%	50.7%	49.6%
Fair value of options granted (per share)	9.68	10.69	9.78
No. of options granted	1,261,722	392,500	514,550

the calendar years. Our desire is to estimate the value of the ESOs today, so we prefer a more recent estimate. In addition, we prefer to have a risk-free rate that has the same maturity as the ESOs we are valuing. We can do just that, but recall that ESO values are very insensitive to changes in the risk-free rate. As such, our choice of risk-free rate is of little importance as long as we are not too far off. Still, it cannot hurt to be more precise, so we will use different rates for the different times-to-maturity. Figure 8.6 shows the Treasury yield curve as of March 23, 2005 (the date of this analysis). We will use this curve as a basis for estimating the risk-free rates for our calculations.

Table 8.13 shows our estimate of the value of the company's outstanding ESOs. In that table, we assume that the current stock price is \$22.31 and that the company's tax rate is 35%. Note that the number of shares outstanding differs for each ESO class because we expect it to increase as ESOs are exercised. For example, we expect 267,075 × (1 − 0.342) = 257,941 ESOs in the first category to be exercised. This would increase the number of shares outstanding by that amount, so we expect that there will be 22,855,308 shares outstanding when the category 2 ESOs are exercised.

FIGURE 8.6

U.S. Treasury Yield Curve



Source: Federal Reserve Economic Data, http://research.stlouisfed.org/fred2/data/

TABLE 8.13

Value of Outstanding ESOs, O'Charley's

ESO category	No. of shares outstanding	No. of ESOs	Weighted average maturity	Weighted average exercise price	Forfeiture rate	Risk-free rate	Value of ESO	Total value
1	22,597,367	267,075	1.2	$7.67	3.42%	3.45%	$15.05	$3,882,013
2	22,855,308	210,555	2.7	$9.08	7.70%	4.00%	$14.64	$2,845,325
3	23,049,661	499,760	5.1	$12.15	14.54%	4.30%	$14.40	$6,150,526
4	23,476,781	826,447	5.5	$15.08	15.68%	4.35%	$13.42	$9,352,417
5	22,779,879	491,495	7.7	$17.98	21.95%	4.50%	$13.97	$5,359,401
6	23,163,516	1,419,172	8.8	$21.21	25.08%	4.60%	$13.95	$14,832,249
							Total	$42,421,931

The table shows that the company currently has over $42 million worth of ESOs outstanding, which is roughly 8.4% of the market value of the company's common stock. Table 8.14 compares the values we obtain with the ESO-Adjusted Black-Scholes approach with the values we obtain with the Black-Scholes call option formula. We see that the values are nearly identical, which is consistent with our observations early in the chapter. Since the number of ESOs is small relative to the total number of shares outstanding, very little bias is introduced if we simply use the basic Black-Scholes formula.

Table 8.13 provides an estimate of how much value the outstanding ESOs take away from the value of the company's common stock, but there is another issue of importance. If the company continues to grant ESOs, the new issuances will drain additional value over time. We therefore must estimate the value of future ESOs to be issued. Table 8.12 gives us the company's estimate of the value of ESOs issued during the 2001, 2002, and 2003 fiscal years. We can use that information in conjunction with the company's historical sales figures to come up with an estimate of the value of ESOs the company is likely to issue in the future. Table 8.15 shows the calculations of the company's historical ratio of the value of ESOs granted to the company's sales. We see that over the 3 years covered in the table, the company issued ESOs that had a value in the neighborhood of 1% of the company's sales for the year (the average is 1.19%). This may seem like a negligible amount, but it is far from that. Keep in mind that the company's profit margin has been under 4% for each of the past 3 years, so the company's ESO program has effectively given away over a fourth of the company's profits. How much value current shareholders lose

TABLE 8.14

Black-Scholes vs. ESO-Adjusted Black-Scholes

ESO category	Value of ESO	Value of call option
1	$15.05	$14.99
2	$14.64	$14.60
3	$14.40	$14.33
4	$13.42	$13.33
5	$13.97	$13.91
6	$13.95	$13.82

TABLE 8.15

Historical ESO Issuances, O'Charley's

	2003	2002	2001
Fair value of options granted (per share)	9.68	10.69	9.78
No. granted	1,261,722	392,500	514,550
Total value granted	$12,213,469	$4,195,825	$5,032,299
Sales	$759,011,000	$499,912,000	$444,931,000
Value of ESOs granted/sales	1.61%	0.84%	1.13%

because of this is a question we will address in Chapter 10. For now, we will close the chapter by noting that if the company continues its ESO program as is, current shareholders will see their shares diluted at a rate of about 1% per year.

SUMMARY

In this chapter, we explored a difficult part of stock valuation. When ESOs are exercised, new shareholders are able to buy shares from the company at a price below the market price of the stock. This effectively creates a wealth transfer from old shareholders to new ones. In some cases, the effect can be rather dramatic. We discussed the basic intuition behind ESOs and introduced the Black-Scholes option pricing model, which is easily the most popular model used to value call options on stock. Because ESOs differ slightly from call options, we discussed how we might go about adjusting the Black-Scholes formula to account for these differences. We found that the basic Black-Scholes formula provides reasonable estimates of the value of a company's ESOs as long as the number of ESOs outstanding is not large relative to the number of shares outstanding. Since this is the case for most publicly traded companies, we can usually rely on the basic Black-Scholes formula when we estimate the value of ESOs.

We then discussed the realities of valuing ESOs in practice. Although we have limited information from companies, we can use that information to obtain a reasonable estimate of not only the value of outstanding ESOs, but also of the value of ESOs we expect the company to issue in the future.

We concluded the chapter by returning to our case study of O'Charley's. In doing so, we were able to estimate the value of ESOs currently outstanding. We were also able to estimate the percentage of the company's sales we expect managers to give away each year in the form of ESOs. This will be important later when we finally attempt to estimate a dollar value for the company's stock.

CHAPTER 9

Relative Valuation and Screening

PURPOSE AND SCOPE

In this chapter, we discuss the concept of relative valuation, which is a general class of models in which we compare the market valuations of similar stocks. Our purpose in doing so is to develop a basic understanding of what the market expects of the companies we consider. If we are able to get such an understanding, then our task becomes one of evaluating how the expectations of the market are likely to change over time. This is critically important.

> **Unless market expectations change in a predictable way, we will not be able to earn abnormally high returns.**

Relative valuation models lend themselves nicely to screening, which is a process by which we reduce the set of stocks to some manageable number for further investigation. Since there are thousands of publicly traded stocks, we cannot begin to conduct an in-depth investigation of each of them. We would therefore like to find some way to identify and concentrate on a smaller set of stocks. There are many different approaches we might use, some of which depend on technical indicators and some on fundamental factors. In fact, there are so many approaches that we cannot begin to describe them all, let alone discuss them all in any meaningful way. We will therefore focus on a few models that are either widely used or that have a strong basis in theory.

We begin the chapter with what is perhaps the most commonly used technique in the investment world. In *comparables analysis* (or simply *comps*), we choose a set of similar companies and compare the multiples of those companies. In its purest sense, we simply compute the value of a given stock under the assumption that it should be trading at the same multiple as an average company in the industry. In a looser sense, we simply list the multiples of the company and its peers and qualitatively compare them based on what we expect of the companies. To compute an average industry multiple, we will of course need to identify a set of comparable companies. Unfortunately, this is often a difficult task because companies want to be distinctive rather than be clones of each other. We will therefore consider how we might modify the basic comps approach to come up with more meaningful ways to examine the data we have. These modifications are specifically designed to adjust for various ways in which peer companies differ. For example, we will consider how to incorporate differences in growth expectations into the basic comps framework. Specifically, we will consider a more complex model proposed by Burton Malkiel many years ago (see Malkiel 1963). In that model, we consider a variation of comps in which we forecast earnings (or some other variable) and then apply the basic comps intuition to the forecasted earnings. There are several interesting implications of this model, and they provide us with additional evidence concerning what the market expects of companies.

As with all financial models, we must be careful when we interpret the results we generate with the use of comps. Multiples are an *outcome* of a valuation process rather than an *input* to that process. This is a subtle but important distinction. Naïve investors cite a lower-than-average P/E ratio as evidence that a stock is undervalued. Instead, investors should interpret a lower-than-average P/E ratio as evidence that the market believes the company's prospects are less attractive than average. We can only interpret a low P/E as evidence of underpricing if we develop *independent* evidence that the company's future prospects are more attractive than the market believes they are.

We close the chapter by considering the difficulties we face when applying the various techniques to the real world. In doing so, we will return to our case study of O'Charley's so that we can understand how the company compares with its peers, and therefore what the market expects of the company.

IN THEORY . . .

Our ultimate desire is to develop a framework for valuing stocks that is both theoretically sound *and* applicable in the real world. There are several angles from which we can address the problem. First, we might treat the company as a black box in which we as shareholders put in money and the box spits a series of dividends back out. In this approach, our task is to forecast what the company's dividends will be in the future. We call approaches of this sort *external valuation* models because they focus on the cash flows between the company and its financiers rather than on operational cash flows (such as salaries and payments for raw materials). Such models are unlikely to provide meaningful results because they are quite simple and they ignore a great deal of information that is readily available. Second, we might step inside the black box and analyze the internal cash flows of the company (payments for inventory, etc.) in an attempt to figure out what the whole company is worth. We call approaches of this sort *internal valuation* models.

A second way we might describe valuation models is by the output they generate. In *absolute valuation* models, we generate an estimated dollar value for the stock (which we hope is an accurate assessment of the true value). In *relative valuation* models, we do not seek to estimate the dollar value of the stock, but rather to determine whether a stock appears to be a better or worse buy than other, similar stocks. The implications of the two frameworks are quite different. In the former, we might conclude that a stock is undervalued. In the latter, we cannot conclude that a stock is undervalued, but we might conclude that a stock is undervalued *relative to its peers*. We must be careful to interpret the models in this light. As we will see in this chapter and the next, relative valuation models are far easier to implement than absolute valuation models, but the conclusions we can draw are weaker.

A Note on Model Error

Before we investigate some specific models, it is worth spending a few minutes thinking about model error, which is the error introduced into our analysis due to the structure of theoretical models and their application to the real world. The world is sufficiently complex that any model we might create will at best be a very simplified version of reality. Although we talk about using models to help us value stocks, they are in fact only useful in helping us understand the circumstances of the company under consideration.

> **Valuation models are nothing more than a gross oversimplification of reality. They only serve to help us understand the situation.**
> **—Bill Miller**

As we consider models in this chapter and the next, we must interpret them simply as tools that help us understand how the market views the companies. More importantly, they serve two other functions. First, they help us understand which factors have the greatest influence on stock value. Second, they help us identify the areas we must investigate further in order to better understand the nature of the company being considered.

As far as screening is concerned, one source of model error involves the choice of peer companies. In most situations, we sill have to make a qualitative judgment about which companies to include in a peer group and which to leave out. In some cases, the decision is easy. For example, Computer Associates International (CA) reported earnings per share of $0.04 for the year ending March 31, 2004. At that time, the company's stock was trading at about $27 per share, giving it a P/E ratio of about 675. If we were to include the company in some peer group, the industry average P/E ratio would be affected in a dramatic way. In fact, the inclusion would render the information collected from other peers to be relatively meaningless. We therefore would not have wanted to include Computer Associates in a peer group if we were examing P/E ratios, although we likely would have included it if we were examining price-to-sales ratios. In each case we examine, we must be careful to consider the possibility that some of the financial variables of companies may be outliers and that those companies should be removed from the peer group when we examine those variables.

Screening

Conducting a thorough analysis of an investment opportunity is quite time-consuming. We might spend a large amount of time investigating an opportunity only to find that the asset appears to be properly priced, and therefore that the asset is not the especially profitable opportunity that we seek. In addition, there are literally thousands of publicly traded stocks along with thousands of privately traded stocks and other nonstock opportunities, so we cannot possibly conduct a thorough analysis of all of the possible opportunities. It follows that we need some process to reduce the set of opportunities to a manageable number for in-depth investigation. We call this process *screening*.

The principle objective of screening is to identify those stocks that have the highest probability of allowing us to earn abnormally high returns. We then investigate those stocks in more depth in hopes of finding a profitable investment. In most cases, screening involves a simple evaluation of the prices of stocks relative to performance metrics such as sales, earnings, free cash flow, and so on. This evaluation is conducted relative to a carefully chosen peer group so that we have an appropriate baseline with which we can compare the measures we select. There are of course other screenings techniques we might use that do not depend on comparison with a peer group. Momentum investors often screen by selecting stocks with prices that have increased substantially over some recent period of time. They argue that in some identifiable circumstances, stock prices have momentum, and that those prices are likely to continue moving higher. In essence, such investors believe that the market is slow to incorporate the impact of favorable news. Contrarian investors are in many respects the opposite of momentum investors. They might screen by selecting stocks with prices that have dropped substantially, relying on their belief that the market often overreacts to bad news. Our purpose is not to debate whether such screens are worthwhile, but rather is to consider *valuation* metrics that might be worthwhile in the screening process.

As we continue our discussion, we will focus on one hypothetical company, XYZ, as it relates to a set of seven peer companies. Information about Company XYZ and its peers is shown in Table 9.1. For each company, the table includes the current share price, the current earnings per share, the current P/E ratio, a historical average P/E ratio, the after-tax interest rate on the company's outstanding debt (i.e., the after-tax cost of debt), the company's debt ratio (which is computed with the use of market values and which assumes there is no preferred stock), and the expected annual growth in earnings over the next 5 years. Although for expositional purposes we focus on earnings, we note that the techniques we discuss can easily be applied to other fundamental variables. In par-

TABLE 9.1

Selected Data for Company XYZ and its Peers

Company	Share price	Earnings per share	P/E ratio	Historical P/E	After-tax interest rate	Debt ratio	Expected earnings growth
XYZ	$27.00	$2.50	10.80	13.47	5.17%	72.30%	6.93%
Peer A	$35.07	$1.20	29.23	26.10	4.44%	49.71%	9.62%
Peer B	$62.83	$4.92	12.77	11.23	8.20%	70.83%	16.24%
Peer C	$48.03	$2.84	16.91	16.13	6.78%	32.98%	10.31%
Peer D	$54.27	$3.35	16.20	11.54	7.68%	43.43%	16.95%
Peer E	$39.18	$2.42	16.19	11.69	5.52%	62.29%	5.07%
Peer F	$8.12	$0.28	29.00	26.20	6.83%	28.86%	12.43%
Peer G	$89.72	$6.68	13.43	13.43	6.19%	69.91%	5.32%

ticular, we note that sales, EBITDA, and free cash flow are rather important variables in the screening process. For example, a company may be suffering from temporarily high expenses. If we only focus on profit-based numbers, we may eliminate a stock that could generate very high returns when those expenses decline. In such cases, sales become very important in the valuation process. We will return to this idea later in the chapter when we revisit our case study of O'Charley's.

Comparables ("Comps") Analysis

Perhaps the simplest way that we might evaluate the pricing status of a stock is to examine simple market multiples in relation to the multiples of peers, or in relationship to historical levels. That is, we look at the ratio of stock price (or company value) to some company-specific financial variable and then consider that ratio on an industry-wide basis. There are a variety of multiples we might choose to examine. Typically, the numerator of a multiple is the current value of the security being considered. The denominator is some factor that contributes to that value. For example, we might examine price-to-earnings, price-to-sales, or price-to-cash-flow ratios. Alternatively, we might consider the *enterprise value* of a company, which is the total value of the company's common stock, preferred stock, and interest-bearing debt, less the company's cash and cash equivalents (i.e., it is the actual capital invested). We could then look, for example, at the ratio of enterprise value to sales, EBITDA, or free cash flow. The important characteristic of an informative ratio is that the numerator be consistent with the denominator. It would not make sense, for example, for us to look at the ratio of enterprise value to earnings. Enterprise value reflects the value of the claims of all of the company's investors, whereas earnings reflect the profits available to only common stockholders.

In its purest sense, the comps model is rather easy to implement. Consider the following example.

Example 9.1: In Table 9.1, we see that Company XYZ is currently trading at \$27 per share with earnings per share of \$2.50, but our desire is to understand how the company is being priced relative to its peers. The average P/E ratio of the peer companies is 17.04. Applying this to our company, we see that if the company traded at the average multiple, its current stock price would be $17.04 \times \$2.50 = \$38.04$. This is the value of a share of XYZ stock based on the comps model as applied to earnings.

Since the stock of Company XYZ is trading for much less than the comps model suggests, we might be tempted to argue that the stock is undervalued. This argument is reasonable if and only if we believe the stock is truly at least an average company in the industry. It follows that the comps model alone cannot tell us whether a stock is under- or overvalued. Rather, it can only tell us what the market thinks of the stock. In this case, we conclude that the market views the company less favorably than it does the company's peers. If we are to conclude anything about potential mispricings in the marketplace, we must develop additional, independent evidence. In addition, the very simplicity of comps suggests that it is unlikely that we will be able to use comps alone to identify mispriced companies (the market surely would not miss something as simple as comps). We can make the following general statement.

If something is easy to compute and understand, it is extremely unlikely that the market will misinterpret it. Therefore, such information will not, by itself, provide evidence of mispricing.

If this is the case, why would we use something as simple as the comps model in the first place? The answer is that comps add value to our analysis, but the value they add comes from what they tell us about the market's assessment of the company. In Example 9.1, we would not immediately conclude that the stock is undervalued. Rather, we would conclude that the market believes the company is substantially below average for the industry. This fact and others we might generate help us understand what the market expects of the company. Our task can then be viewed as one of trying to understand if and when those expectations are likely to change.

The comps model is intuitive, but it also suffers from its simplicity. Because we consider only current multiples, we ignore such things as strategic position and growth expectations. For example, Target (TGT) may be very similar to Walmart (WMT), but Walmart has far more stores in operation. This gives Walmart a strategic advantage in that it has had the opportunity to "pick first," thereby ensuring that the company gets the best sites for its stores. If Target tries to compete in those markets, it must choose second-best store locations, which leaves it at a strategic disadvantage to Walmart. This suggests that, all else being equal, Walmart stock would trade at a higher P/E ratio than Target. One way we might adjust for these sorts of scenarios involves relying on the historical multiples of the companies. If the market has consistently priced one company at a higher P/E than a peer company, we might use that information as a basis for adjusting the comps model.

Adjusting for Historical Levels

We can adjust for at least some strategic elements by simply conducting comps with specific regard to the historical levels of the multiples we consider. Consider the following example.

Example 9.2: Let us return to Example 9.1, but we will now do so in light of historical levels of the P/E ratio. Table 9.1 shows the historical average P/E ratio for each company. For each company, we can compute the ratio of the current P/E to its historical level. For example, we see that Peer A is currently trading at a P/E ratio that is 1.12 times its historical level. The peer group average of these ratios is 1.17, so we conclude that the industry is currently trading at a P/E ratio that is about 17% higher than its historical level. Company XYZ has a historical P/E ratio of 13.47. Applying the industry average, we would expect our company to be trading at a multiple of $13.47 \times 1.17 = 15.80$. Since the company has earnings of \$2.50, we would expect the company to be trading at a price of $15.80 \times \$2.50 = \$39.50$. This is an estimate of the value of a share of XYZ stock based on comparison with its historical level.

The fact that the stock is trading at \$27 again tells us that the market seems to have more pessimistic expectations for the company than it had previously. Our task then becomes one of trying to understand why the market is so pessimistic and whether the market's expectations are reasonable.

A simple approach such as this can be valuable in helping us understand what the market is thinking, but we need to be careful whenever we rely on historical numbers. In particular, we implicitly assume that the competitive structure of the industry is the same now as it was previously. In addition, to compute historical average P/E ratios in the first place, we must arbitrarily choose some time period over which we will compute the averages. Obviously, these observations suggest that such models are prone to error.

Adjusting for Differences in Product Mix

It perhaps goes without saying that we want to choose peer companies that sell the same set of products in the same proportions. In the oil and gas industry, for example, we would like to choose a set of companies that have, say, 40% of their business from natural gas and 60% from oil. Of course, no two companies are exactly alike, so we must use our best judgment as to what is "close enough." Also, we must recognize that some companies have no close peers. For example, there are really no companies similar enough to Microsoft (MSFT) to justify calling them peers. We must also recognize that companies in different industries may in fact be quite similar. Bill Miller, for example, makes a strong case that Dell (DELL) and Amazon (AMZN) are very much alike, despite the fact that they are in very different industries. Their similarities lie in what really matters to both companies: the economic framework. Both companies sell products and collect the money right away, then fulfill orders quickly without holding much inventory, and then typically pay their suppliers at some later date. It is these similarities that lead Miller to believe that we can better understand Amazon by looking at how Dell developed.[1]

1. See Lowe (2002, 115–119) for a more detailed look at how Miller compares Amazon and Dell.

At times we may be faced with companies that operate in multiple industries. Although we do not investigate the technique in great depth here, we can sometimes adjust for differences in product mix by using a *pure play approach*. If, for example, we are considering a company that produces both automobiles and concrete, we can treat the company's two divisions as being two separate companies. We choose two separate peer groups and do two separate analyses. Finally, we combine the results of those analyses to determine our comps estimate of stock value. A simple example illustrates the technique.

Example 9.3: Suppose that Company XYZ has two divisions. One produces automobiles and has current earnings of $3.2 million. The other produces concrete and has current earnings of $1.6 million. The company has 1,920,000 shares outstanding (which gives us earnings per share of $2.50). A set of companies that produces only automobiles has an average P/E ratio of 10. A set of companies that produces only concrete has an average P/E ratio of 15. What is the value of the company according to the comps approach?

The automobile division has a value of $10 \times \$3.2 = \$32$ million. The concrete division has a value of $15 \times \$1.6 = \$24$ million. Thus, the firm has a total value (according to the comps approach) of $56 million, or $29.17 per share.

This technique is simple and intuitive, but it is often difficult to implement because we may not be able to find companies that are truly comparable. Still, doing a careful analysis of a multi-industry company sometimes requires that we somehow price the different divisions separately.

Adjusting for Differences in Capital Structure

Of course, companies may differ in ways other than product mix. For example, one company may have substantially more debt than a peer company has. If this is the case, we would not generally expect them to trade at the same multiples. We know from Chapters 4 and 5 that interest payments on debt reduce the cash flows available for shareholders. We also know from Chapter 6 that more debt implies a higher discount rate for a company's stock. It follows that companies with different levels of debt will tend to have different multiplies, at least for some of the ratios. We therefore want to choose peer companies that have debt structures similar to that of to the company we are evaluating. To do this, we must first consider what makes debt structures similar. Our first inclination is to look at the companies' debt ratios (ratios of the market value of debt to the market value of the entire company assets), which is a reasonable place to start. This allows us to choose peers that are at least similar in the amounts of debt they have issued. We might also consider the companies' capacity to repay the debt, although this is often reserved for a more in-depth analysis.

Of course, we may very well find that there are few (if any) peers that have debt ratios similar to that of the company we are valuing. It is therefore useful to think about how we might adjust the basic comps approach to account for differences in leverage. To understand the theoretical relationship between capital structure and the P/E ratio, let us consider a levered firm. The total earnings of the firm are the market value of equity divided by the P/E ratio. The net interest paid on debt is the value of the debt multiplied by the after-tax interest rate. If all of the company's debt were replaced by equity, the total earnings of the unlevered firm would be

$$Earnings_U = \frac{1}{Q_L} \times Equity + R_d^* \times Debt \tag{9.1}$$

where Q_L is the P/E ratio for the levered firm and R_d^* is the company's after-tax cost of debt. The first term on the right-hand side of Equation 9.1 (the company's equity multiplied by E/P) is simply the total earnings of the levered firm. The second term is the additional earnings the company would have if it did not have debt (i.e., the savings from not making interest payments). Now, Modigliani and Miller (1958) argue that the value of the firm should be independent of capital structure. Although we know that this is not true universally, we do know that it is approximately true for companies that are operating close to their optimal level of debt. An implication of this idea is that replacing debt with equity will tend to have very little impact on the total value of the company. We can then divide Equation 9.1 by the total market value of the company (which will be the same whether or not the company changes its level of debt) to obtain

$$\frac{1}{Q_U} = \frac{1}{Q_L} \times \frac{Equity}{Company\ Value} + R_d^* \times \frac{Debt}{Company\ Value}, \tag{9.2}$$

where Q_U is the P/E ratio of the unlevered firm. Of course, the value of the company is just the debt plus the equity (assuming there is no preferred stock), so we have

$$\frac{1}{Q_U} = \frac{1}{Q_L} \times \frac{Equity}{Debt + Equity} + R_d^* \times \frac{Debt}{Debt + Equity}. \tag{9.3}$$

When we divide Equation 9.1 by the total value of the company, the left-hand side becomes $Earnings_U/(Debt + Equity)$, but this is just E/P (the inverse of the P/E ratio, which is the company's *earnings yield*) if the company did not have debt. Hence, the left-hand side of Equation 9.3 is simply the inverse of the P/E ratio for the unlevered company. Similar logic gives us Q_L on the right-hand side of the equation.

Equation 9.3 gives us the basis for a technique we can use to adjust comps for differences in leverage. In particular, we can use the following four-step process.

1. Compute the unlevered P/E for each company in the peer group. To do this, we rearrange Equation 9.3 to get

$$Q_U = \frac{1}{\frac{1}{Q_L} \times \frac{Equity}{Debt + Equity} + R_d^* \times \frac{Debt}{Debt + Equity}}. \tag{9.4}$$

   This gives us the P/E ratio each peer company would have if it had no debt.

2. Compute the industry average unlevered P/E ratio.
3. Relever this industry average ratio with the use of information about the capital structure of the company we are valuing. To do this, we rearrange Equation 9.3 to get

$$Q_L = \frac{\frac{Equity}{Debt + Equity}}{\frac{1}{Q_U^I} - R_d^* \times \frac{Debt}{Debt + Equity}}, \tag{9.5}$$

   where Q_U^I is the industry average unlevered P/E ratio. This gives us the P/E ratio our company would have if it were an average company in the industry.

4. Multiply the relevered P/E ratio by the company's earnings to get our estimate of the value of the company's stock.

As with the basic comps model, this adjustment is based on the implicit assumption that the company's stock should trade at the industry average P/E ratio. The following example illustrates the process.

Example 9.3: Let us return to Company XYZ. Table 9.1 shows that the company has a debt ratio of 72.3% and an after-tax interest rate on its debt of 5.17%. Table 9.2 shows the unlevered P/E ratios for the peer companies, which are computed with Equation 9.4. We see that the peer group has an average unlevered P/E ratio of 17.68. We then relever this with Equation 9.5 in conjunction with the company's debt ratio (72.3%) and after-tax interest rate on debt (5.17%) to get a levered P/E of 14.44. Since the company has earnings per share of \$2.50, we conclude that if the company is of average quality, its stock should trade for $\$2.50 \times 14.44 = \$36.10$. This is above the market price, so we once again infer that the market is more pessimistic about the company than it is about the average company in the industry.

We can draw some general conclusions by examining Equation 9.2. First, notice that if the after-tax interest rate on debt is equal to the inverse of the P/E ratio, exchanging debt for equity will have no impact on the company's P/E ratio. In this situation, the basic comps model is unbiased. If, however, the company being valued has an after-tax interest rate on debt

TABLE 9.2

Unlevered P/E Ratios, Example 9.3

Company	P/E ratio	After-tax interest rate	Debt ratio	Unlevered P/E
Peer A	29.23	4.44%	49.71%	25.48
Peer B	12.77	8.20%	70.83%	12.36
Peer C	16.91	6.78%	32.98%	16.13
Peer D	16.20	7.68%	43.43%	14.65
Peer E	16.19	5.52%	62.29%	17.34
Peer F	29.00	6.83%	28.86%	22.60
Peer G	13.43	6.19%	69.91%	15.23
Average				17.68

that is greater than the inverse of the P/E ratio, the basic comps model will overestimate the value if the company has low debt and will underestimate it if the company has high debt. Similarly, if the after-tax interest rate on debt is less than the inverse of the P/E ratio, the basic comps model will underestimate the value of the stock if the company has low debt and will overestimate the value if the company has high debt. In Example 9.1, we estimated the value of XYZ stock to be $38.04. When we adjusted for debt in Example 9.3, we estimated the value to be $36.10, so the basic comps model gave us a slightly higher estimate (as we would expect). This occurred because the company's after-tax interest rate on debt is below the inverse of the industry average unlevered P/E ratio (i.e., $5.17\% < 1/17.68$) and the company has a high level of debt.

Adjusting for Growth: PEG Ratios

Perhaps the biggest problem with the comps approach and variations of it is that the model values stocks based on recent history (earnings from the last company report, for example), when we should really be concerned about profitability well into the future.

> **We do not buy the past; we buy the future.**

Many professionals choose to look at "forward earnings," which are analysts' earnings forecasts for the current period, but this is not much of an improvement. In order for comps to provide meaningful information, we must choose peer companies with growth expectations that are similar to that of the company we are valuing. If not, then we introduce a bias into our analysis. If our company has lower growth expectations than the peer group, the comps approach would overestimate the value of our company. If our company has higher growth expectations than the peer group, the comps approach would underestimate the value of our company. The implication of this is that we should conduct at least a cursory analysis of each company's ability to grow *before* we do a comps analysis. But if we are to go to all that trouble, then we should take advantage of the information we generate. We do this by using more complicated models that specifically incorporate growth. Peter Lynch suggests one such model.[2]

2. See Lynch (2000).

He argues that a company's P/E ratio should be directly related to the expected growth of the company's earnings. He further argues that we can simply consider the ratio of P/E to g (called the PEG ratio), where g is the expected growth in earnings. Consider the following example.

Example 9.5: Let us consider again Company XYZ and its peers. Table 9.1 shows expected growth rates for the companies, and we can use those to compute the PEG ratios for each company. Those are shown in Table 9.3. Notice that to compute a PEG ratio, we first divide the P/E ratio by the expected growth rate and then divide by 100 to make the numbers a bit easier to deal with (i.e., we ignore the percent sign). For example, Company A has a PEG ratio of 29.23/9.62 = 3.04. In the table, we see that companies are trading at an average PEG of 2.07. Noting that the expected growth for Company XYZ is 6.93% per year, we would consequently expect the company to trade at a P/E ratio of $2.07 \times 6.93 = 14.35$. Since the company has earnings of $2.50, this implies a value today of $\$2.50 \times 14.35 = \$35.85$.

Lynch suggests that the PEG ratio should be equal to 1 in equilibrium, so stocks trading at PEG ratios less than 1 are more likely to be undervalued, and stock trading at PEG ratios greater than 1 are more likely to be overvalued. In our situation, the company is trading at a PEG of ($27/$2.50)/6.93 = 1.56, suggesting that the company is overvalued in an absolute

TABLE 9.3

PEG Ratios, Example 9.4

Company	P/E ratio	Expected growth (%)	PEG ratio
Peer A	29.23	9.62	3.04
Peer B	12.77	16.24	0.79
Peer C	16.91	10.31	1.64
Peer D	16.20	16.95	0.96
Peer E	16.19	5.07	3.19
Peer F	29.00	12.43	2.33
Peer G	13.43	5.32	2.53
Average			2.07

sense. The industry, with an average PEG of 2.07, would also be overvalued in an absolute sense, but Company XYZ would seem to be undervalued relative to its peers.

Although the PEG ratio is intuitive and has gained some popularity, it has no solid basis in theory. To see this, let us consider an extremely simple case in which a company pays out all of its earnings as dividends. Suppose further that the earnings (and dividends) are expected to grow at the rate g forever. If the appropriate discount rate for the company's stock is R, we see (using our perpetual growth formula from Chapter 3) that the company's stock has a value (price) of

$$P = \frac{D}{R-g} = \frac{E_1}{R-g}, \tag{9.6}$$

where E_1 is the expected earnings in 1 year (i.e., the *forward earnings*). Rearranging the equation and using our definition of the PEG ratio, we see that the company should have a PEG ratio of

$$PEG = \left(\frac{P/E_1}{100g} \right) = \frac{1}{100g(R-g)}. \tag{9.7}$$

We conclude that the company would have a PEG ratio of 1 in equilibrium if and only if $g(R - g) = 1/100$. Since this makes little sense (even for the simplest of cases), it is unlikely that the PEG ratio can be used effectively in the way that Lynch suggests. This does not mean, however, that the ratio has no value. Rather, it means that we should consider it only as a very rough measure of market valuation.

The Fed Model: Stock Earnings Yields vs. 10-Year Treasury Yields

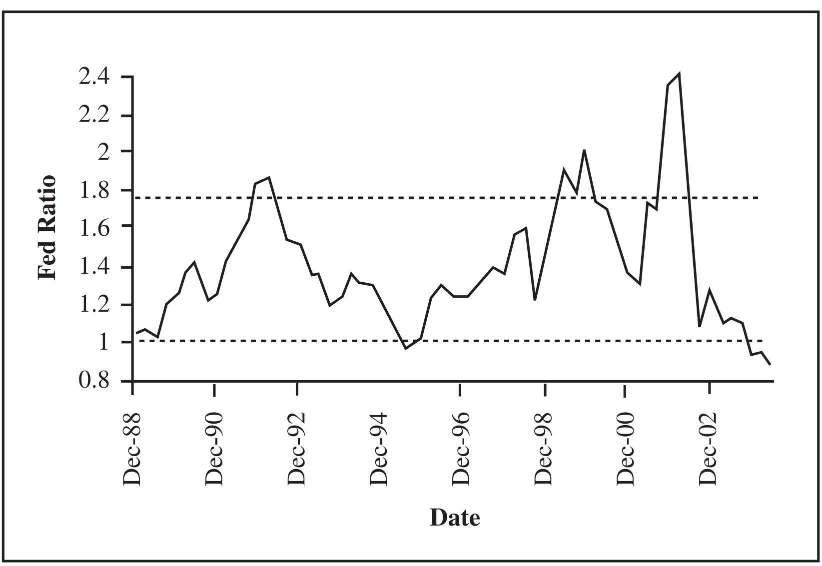
The desire for a simple way to incorporate growth, which leads to PEG ratios, also leads us to consider slightly more complicated models that might help us understand how growth expectations are incorporated into market prices. We will revisit this idea a bit later in the chapter. Before doing so, it is worthwhile to spend a few minutes discussing another popular model. Although the model is not intended to help us screen individual stocks, its proponents argue that it can help us screen the entire market and help us decide whether to be invested in stocks to begin with.

These proponents argue that we can examine the average earnings yield (i.e., the ratio of earnings to stock price) on the S&P 500 index in comparison with the yield on 10-year U.S. Treasury bonds. When the earnings yield is high relative to the Treasury yield, it is thought to be a good time to be in the stock market. When the earnings yield is low relative to the Treasury yield, it is thought to be a good time to be out of the stock market. This particular model has been termed the "Fed Model" (by former Prudential financial strategist Ed Yardeni) because members of the Federal Reserve Board are believed to use the model to get a feel for whether the stock market is undervalued or overvalued. Brokerage houses in particular often use the Fed Model as support when discussing investment decisions with clients. In addition, financial commentators often refer to it on television.

To understand how the model is applied, consider the ratio of the yield on 10-year U.S. Treasury securities to the average S&P 500 earnings yield (i.e., the inverse of the P/E ratio). That ratio, which we will call the Fed Ratio, is plotted against time in Figure 9.1. To use the graph, investors choose arbitrary cutoffs and then draw conclusions based on whether the Fed ratio is outside these cutoffs. In Figure 9.1, the upper line corresponds

FIGURE 9.1

The Fed Model



to a Fed ratio of 1.75 and the lower line corresponds to a ratio of 1. Proponents of the Fed Model point out that whenever the ratio has become "high" (above 1.75, for example), it was not long before the ratio quickly fell back to "normal" levels. A drop in the ratio occurs when stock prices decrease (or alternatively when the Treasury yield decreases), so high levels of the ratio are thought to predict lower future returns in the stock market. Whenever this ratio has become "low" (below 1, for example), the ratio has quickly risen back to "normal" levels. An increase in the ratio occurs when stock prices increase (or alternatively when the Treasury yield increases), so low levels of the ratio are thought to predict higher future returns in the stock market. As of June of 2004 (the last date in Figure 9.1), the ratio is about 0.9, which is below our arbitrary cutoff of 1. The model then predicts that stock prices will rise substantially in a short period of time.

It is easy to see that the model's predictions have held true historically, but that does not necessarily imply that it will be true in the future. This is particularly evident when we note that there have only been a few times in recent history in which the ratio has taken on extreme values. Given that there is limited historical evidence for the predictability of the model, can we reasonably expect to gain useful information from it?

To a certain extent, we can evaluate the model by examining its theoretical underpinnings. Consider the simple scenario we discussed earlier in which a company pays out all of its earnings as dividends. The earnings are expected to grow at the rate g each year forever, and the appropriate discount rate is R. From Chapter 3, we know that the value of the stock (which is equal to the stock price in equilibrium) is

$$V = P = \frac{E_1}{R - g}. \tag{9.8}$$

Rearranging Equation 9.8, we see that

$$\frac{R}{E/P} = 1 + g\frac{P}{E}. \tag{9.9}$$

The left side of this equation is approximately equal to the ratio specified in the Fed Model. The only difference between the two is that in our scenario there is a risk premium embedded in the discount rate, whereas in the Fed Model the interest rate depends only on the Treasury yield. The important aspect of Equation 9.9 is that the right side is not constant, but rather depends on the expected growth rate. This suggests that the Fed Model is flawed in that it does not incorporate differences in expected growth. As we know from the lessons of Chapter 3, higher expected growth leads to higher prices and therefore to higher P/E ratios in equilibrium. It might therefore be completely rational for the market to choose extreme values (high or low) for the ratio we plotted in Figure 9.1. It follows that the Fed Model is insufficient to adequately determine under- or overvaluations in the marketplace.

To this point, it should be apparent that although the various models we have discussed are intuitively appealing, they lack the sophistication to provide truly meaningful results. In particular, each model we have discussed either does not incorporate differences in growth expectations or does not incorporate those differences correctly. As such, we will now consider how we might create a growth-based, theoretically appealing method for screening stocks.

Discounted Dividends and the Malkiel Model

External models start with the premise that the actual cash flows to shareholders take the form of dividends. Thus, the value of a share of stock should be the present value of the expected dividends, or

$$V_0 = \frac{D_1}{(1+R_e)} + \frac{D_2}{(1+R_e)^2} + \frac{D_3}{(1+R_e)^3} + \dots, \tag{9.10}$$

where V_0 is the value of the company's stock (equity) today, D_t is the expected dividend to be paid in t years (t takes on the values 1, 2, 3, . . .), and R_e is the appropriate discount rate for the company's stock. For simplicity in writing the above equation, we assume that the company pays dividends once per year and that the next dividend will be paid in exactly 1 year. In reality, companies usually pay dividends on a quarterly basis, and the next dividend payment will rarely be exactly one full dividend period from now, but it is a simple matter to adjust the equation for these factors.

We call the model depicted in Equation 9.10 (and variations of it) a Discounted Dividends Model. As depicted in the equation, the model is generally difficult to implement for several reasons. First, we must estimate the expected dividends forever. In practice, we have a hard time estimating dividends for even the next few years, so it is rather absurd to try to forecast them forever. Second, it is often the case that companies do not pay dividends. Of course, if the stock has positive value, then there must be an expectation that the company will eventually pay dividends (or distribute money to shareholders in some other way). Otherwise, the stock would have no value. Our task would then become one of forecasting when the company will begin paying dividends, how much they will pay, and how the dividends will change in subsequent periods. Clearly, such a task is next to impossible to complete with any accuracy. (For example, how would we go about forecasting the time at which Google will begin paying dividends and how large those dividends will be?) For these reasons, we conclude that the rather intuitive Equation 9.10 is generally not applicable in practice.

One variation of the Discounted Dividend Model is of particular interest because its principles are applied in other models of importance. In 1963,[3] Burton Malkiel presented a simple model that addresses the basic problems with Equation 9.10. As Malkiel presented it, the model is an external absolute valuation model, but we will see that it is useful to apply it in a relative valuation framework. The specific form of the Malkiel equation follows from two observations. First, we need not estimate an infinite stream of future cash flows. Instead, we can assume that we plan to sell the stock at some specified future date. In that case, the expected cash flows to shareholders consist of a finite stream of dividends along with the sale price of the stock at that specified future date. We call that future price the *terminal value* of the stock and denote it as TV. Second, we can estimate that terminal value (which we would receive when selling) by applying something like the comps model to future earnings rather than current earnings. This gives us the basic equation

$$\begin{aligned} V_0 &= \frac{D_1}{1+R} + \frac{D_2}{(1+R)^2} + \cdots + \frac{D_T}{(1+R)^T} + \frac{TV_T}{(1+R)^T} \\ &= \frac{D_1}{1+R} + \frac{D_2}{(1+R)^2} + \cdots + \frac{D_T}{(1+R)^T} + \frac{E_T Q_T}{(1+R)^T}, \end{aligned} \tag{9.11}$$

where E denotes the company's earnings, Q denotes the P/E ratio, and T denotes the number of years until we plan to sell the stock. The last term of the equation is the present value of the expected earnings in T years

3. See Malkiel (1963).

multiplied by the expected P/E ratio in T years (which is simply the present value of the price we expect to receive when we sell the stock in T years). The other terms are simply the present value of the dividends we expect to receive prior to selling the stock.

Suppose then that we hold a stock that currently has earnings of E_0 and that just paid a dividend of D_0 dollars. Earnings are expected to grow at the annual rate g for each of the next T years. We know that there is a general tendency for dividends and earnings to grow together, so we will assume that the growth rate for earnings will be the same as the growth rate for dividends. As we will see later, this is a relatively harmless assumption because the terminal value calculation tends to contribute the bulk of the value in such models. We can then write

$$E_T = E_0(1+g)^T \tag{9.12}$$

and

$$D_t = D_0(1+g)^t, \tag{9.13}$$

where t is any of dates 1, 2, . . . , T. Substituting these into Equation 9.10 gives us the fundamental equation

$$V_0 = \frac{D_0(1+g)}{1+R} + \frac{D_0(1+g)^2}{(1+R)^2} + \cdots + \frac{D_0(1+g)^T}{(1+R)^T} + \frac{E_0(1+g)^T Q_T}{(1+R)^T}, \tag{9.14}$$

which is the full expression of the Malkiel Model as applied to earnings.

To understand how to apply this equation, consider the following simple example.

Example 9.6: A company just reported earnings of \$5 per share and paid a dividend of \$2 per share. Earnings are expected to grow at 6% per year for the next 5 years, and dividends are expected to be paid annually during that period. The expected P/E ratio in 5 years is 15. The stock has a beta of 0.8, the risk-free rate of interest is 5%, and the expected return on the market portfolio is 9%. What is the value of the company today?

Using the CAPM, we see that the appropriate discount rate for the stock is $R = 5\% + 0.8 \times (9\% - 5\%) = 8.2\%$. The earnings of \$5 today are expected to grow to $E_5 = E_0(1 + g)^5 = \$5 \times 1.06^5 = 6.69$ over the next 5 years. The expected value of the stock in 5 years is $V_5 = E_5Q_5 = \$6.69 \times$

15 = \$100.35. Dividends are expected to be $D_t = D_0(1 + g) = \$2 \times 1.06 =$ \$2.12 per share next year, followed by \$2.25, \$2.38, \$2.52, and \$2.68 in subsequent years. Plugging into Equation 9.14, we see that the value of the stock today would be

$$V_0 = \frac{\$2.12}{1.082} + \frac{\$2.25}{1.082^2} + \frac{\$2.38}{1.082^3} + \frac{\$2.52}{1.082^4} + \frac{\$2.68}{1.082^5} + \frac{\$100.35}{1.082^5} = \$77.09. \tag{9.15}$$

We can then compare this with the current stock price so that we can understand how our view of the stock differs from the market's view.

To summarize, we can describe the Malkiel Model as an eight-step process as follows.

1. Collect the current dividends per share and earnings per share for the company.
2. Estimate the future annual growth in earnings per share for the company over some specified forecast period (5 years, for example). (Note that analysts provide their growth estimates, which are available on many websites.)
3. Forecast the company's dividends over the forecast period.
4. Forecast the company's earnings per share at the end of the forecast period.
5. Estimate what the company's P/E ratio will be at the end of the forecast period. (This is clearly a troublesome step.)
6. Estimate the value of the stock at the end of the forecast period by multiplying the expected earnings by the expected P/E ratio.
7. Estimate the appropriate discount rate for the company's stock (using the CAPM or some other methodology).
8. Discount the expected dividends and the expected stock price to obtain an estimate the value of the stock today.

Other Underlying Variables

At this point, it is natural to ask whether this equation applies only to earnings. After all, we know that earnings are easily manipulated and are not necessarily representative of cash flow. There are many other variables we might use. For example, we might use sales instead of earnings and use the equation

$$V_0 = \frac{D_0(1+g)}{1+R} + \frac{D_0(1+g)^2}{(1+R)^2} + \cdots + \frac{D_0(1+g)^T}{(1+R)^T} + \frac{S_0(1+g)^T Q_T^s}{(1+R)^T}, \qquad (9.16)$$

where S_0 is the current sales per share for the company and Q_T^s is the expected price-to-sales ratio in T years. In fact, many believe that sales may provide a better basis than earnings. Imagine, for example, that a company has strong sales but has outdated equipment that reduces efficiency. As a result, the company's current earnings are poor. If new equipment is purchased and the company's profit margin increases to a normal level, then earnings would suddenly be strong. The point here is that companies may go through periods of time in which their profit margins are unusually high or low. During those periods, current earnings are likely to be a poor measure of the future profitability of the company, and in fact sales might be a better indicator. We might consider other variables as well. For example, we might consider cash flow, operating income, or some other variable related to stock value.

Terminal Value Estimation

The biggest difficulty we face in applying the Malkiel model is the estimation of the terminal value. This difficulty carries over to other models (such as the Discounted Cash Flow Model) that include terminal values as part of their basic valuation equation. The difficulty arises because we must estimate value at some future date in order to find the value today. In Example 9.5, we simply assumed that the company's P/E ratio would be 15 in 5 years. This is at best arbitrary, but in reality, estimating terminal values is not as difficult as we might imagine. To estimate those values, we rely on something called *mean reversion*. Loosely speaking, a variable is mean-reverting if it tends to fluctuate about some "normal" level indefinitely. If the value of a mean-reverting variable becomes very high, we know it will, at some point, decrease back to the normal level. If it becomes very low, we know it will increase. Temperatures, for example, are mean reverting. Although we often see extremely high or extremely low temperatures outside, we know that those temperatures will eventually return to normal levels. In contrast, the S&P 500 index is not mean reverting, but rather tends to drift upward over time. As such, there is no number such that we can be confident that the index will fluctuate about that number indefinitely.

So why do we care about mean reversion? It turns out that market multiples and growth rates tend to be mean reverting. For example, a company may be growing at a very fast pace now, but we know that pace cannot continue indefinitely. We can therefore say with great confidence that the company's growth rate will drop at some point in the future. P/E ratios act in much the same way. For example, suppose that a company has a P/E ratio of 4. That ratio is so low (for any industry) that we know with great confidence that it will increase at some point in the future (barring bankruptcy or some other unusual event). Although companies can have unusually high or low P/E ratios at times, in most cases those P/E ratios will return to normal within a few years, particularly as the business cycle changes. This is precisely the reasoning we use in estimating terminal values. We do not claim to be able to accurately predict a future P/E ratio. Rather, we simply recognize that because of mean reversion and if we choose the forecast period to be long enough, our best guess will be that the expected P/E ratio will be "normal" at date T. Of course, this means that we will have to figure out what "normal" is and assess the accuracy of our estimate. A bit later in the chapter, we will discuss how applying the Malkiel Model in a relative valuation framework helps us estimate the future multiples.

Although Malkiel envisioned using market multiples to estimate terminal values, we can alternatively rely on the perpetual growth formula we developed in Chapter 3. To do this, we must first make some assumption about the long-run, infinite life growth in dividends. If we assume a 3% long-term growth rate, we literally assume that cash flows will increase by 3% each year beginning in year T. Recall from our perpetual growth formula that the value of a constant-growth, infinite life stream of cash flows is

$$V_T = \frac{C_{T+1}}{R - g}, \tag{9.17}$$

where C_{T+1} is the expected cash flow at date $T + 1$, g is the expected growth rate for each subsequent year, and R is the appropriate discount rate for the investment. We stress that the value we obtain with Equation 9.17 is the value as of date T of all cash flows beginning at date $T + 1$. A simple example illustrates the technique.

Example 9.7: Suppose that dividends are expected to be \$3.25 per share in 5 years. We wish to estimate the value of the stock in 5 years. Suppose also that the appropriate discount rate for the stock is 8% and that we believe the dividends will grow at 3.6% per year indefinitely. We can then estimate the terminal value of our stock to be

$$TV_5 = \frac{C_6}{R-g} = \frac{C_5(1+g)}{R-g} = \frac{\$3.25 \times 1.036}{0.08-0.036} = \$76.52. \tag{9.18}$$

Said differently, this is our forecast of what the stock will be worth 5 years from today.

Notice carefully what we have done. Equation 9.17 requires that we have the expected cash flow one period after the date for which we wish to value the stock. In this case, we wish to estimate the value in 5 years, so we need the cash flow in 6 years. To get this, we simply multiply the expected dividend in 5 years by one plus the growth rate. Once we have estimated the value of the stock in 5 years, we can discount that and the expected cash flows for the next 5 years to get our estimate of stock value today. The following example illustrates the complete process.

Example 9.8: We forecast that a given company will have the dividends depicted in Table 9.4. The appropriate discount rate for a company's stock is 11%. Since constant annual growth begins after 5 years, we wish to estimate the company's terminal value as of that date. The terminal value of the stock will be

$$TV_5 = \frac{D_6}{R-g} = \frac{D_5(1+g)}{R-g} = \frac{\$3.12 \times 1.03}{0.11-0.03} = \$40.17. \tag{9.19}$$

We can then discount this along with the free cash flows for the next 5 years to get our estimate of stock value,

$$V_0 = \frac{\$1.66}{1.11} + \frac{\$1.91}{1.11^2} + \frac{\$2.34}{1.11^3} + \frac{\$2.69}{1.11^4} + \frac{\$3.12}{1.11^5} + \frac{\$40.17}{1.11^5} \tag{9.20}$$
$$= \$32.22.$$

TABLE 9.4

Forecasted Dividends, Example 9.7

Date	Dividends
1	$1.66
2	$1.91
3	$2.34
4	$2.69
5	$3.22
6–∞	3% annual growth

This calculation is quite simple, but the real difficulty lies in accurately forecasting the dividends. This is complicated by the fact that cash flows paid in the distant future often contribute heavily toward the bottom-line value estimate. In our example, the terminal value has a present value of about $23.80, which is 74% of our total estimate. We can often estimate cash flows in the immediate future with strong confidence, but it seems that those cash flows have little bearing on the stock's value. It is worth mentioning that some experts believe that we should extend the forecast period so that the terminal value is of less importance. Some recommend, for example, that we choose the forecast period so that the terminal value comprises less than one-third of our estimate of stock value. Rappaport and Mauboussin (2001) take a different approach and argue that we can estimate the forecast period by using the market price of the stock. We will discuss this idea in a bit more depth in the next chapter.

Regardless of the forecast period we choose, we would typically need to estimate a long-term growth rate for use in the terminal-value calculation. Estimating the long-term growth rate for the terminal-value calculation is perhaps not as difficult as it might seem. Even the best companies eventually stabilize into situations in which they grow at consistent but relatively low rates. These companies essentially track along with the economy, and the long-term growth rate mirrors that. Some argue that we should assume zero long-term growth, but this ignores the fact that cash flows will still tend to grow at a rate at least equal to the inflation rate. Others argue that the long-term growth rate should be something greater than the inflation rate. After all, increases in populations should result in more customers for each company. Still, our models implicitly assume that the company will exist forever, so we would be wise to be conservative in our estimate. Rather than debate the merits of these arguments (which will not bring us to a definitive conclusion), we will simply assume that the long-term growth rate for companies will be roughly equal to the expected inflation rate. The average inflation rate in the United States was 2.98% over the period from 1988 to 2003.[4] Although this period is somewhat arbitrary in nature, it does seem to be representative of the current level of modernization in the financial markets. We will therefore assume a long-term growth rate of 3% for a company's cash flows.

A Relative Version of the Malkiel Model: Growth-Adjusted Comps

Although Malkiel does not address the idea in his paper, his model can be applied in a relative valuation framework. There are two primary advantages to this approach. First, we can use current market prices to help us estimate the terminal values of stocks. Second, we can compute the *implied growth rates* for stocks, which are the growth rates that the market is implicitly using to value the stocks. Both of these pieces of information can be quite useful as part of a screening process and, if the inputs to the model are accurate, can provide us with evidence of mispricings in the marketplace.

Implied Multiples

To apply the Malkiel Model on a relative basis, we choose a set of similar stocks for consideration and then estimate the expected growth in earnings (or in a number of other variables such as sales) for those stocks. For example, we might use the consensus analyst growth forecasts, which are available on many financial websites. We also choose an expected P/E ratio for the stocks. Since we have chosen peer companies based on their similarity to our company, we will assume that this expected P/E ratio is the same for all of the stocks. (Of course, we could scale this ratio up or down if we like. For example, we might follow an approach similar to the one we used in Example 9.2.) We can then compute the misvaluation for a

4. The inflation rates were calculated from CPI data collected from the Federal Reserve Economic Data website: http://research.stlouisfed.org/fred2/.

stock as the percentage difference between the current stock price and our estimate of the stock's value, or

$$\text{Misvaluation} = \frac{P_0 - V_0}{V_0}. \tag{9.21}$$

To choose the expected P/E ratio, we simply find the number that gives us an average misvaluation of zero. In making this choice, we implicitly assume that the market will price the stocks in our set accurately on average, but may misprice individual stocks. A simple example illustrates the process.

Example 9.9: Suppose that a set of peer companies has the characteristics listed in Table 9.5. The growth rates in those tables are assumed to be for the next 5 years. Suppose that we initially choose an expected P/E ratio for the industry of 18.00. The calculations and value estimates are shown in Table 9.6. As the table shows, we estimate dividends for the next 5 years, the earnings in 5 years, and the expected stock price in 5 years. The dividends and the expected stock price in 5 years are then discounted back to the present to find our estimate of stock value. The apparent misvaluation for each stock is listed in the last row. Notice first that stock B appears to be the best buy, followed in order by stocks, E, A, F, D, G, and C, which appears to be the worst buy.

Now, as we discussed earlier, we can choose the expected P/E ratio so that the average misvaluation is zero. In this example, a P/E of 14.72

TABLE 9.5

Selected Information, Example 9.8

Company	P_0	R	D_0	E_0	g
A	$18.02	10.06%	$0.56	$1.44	7.12%
B	$53.54	8.62%	$1.14	$4.39	6.91%
C	$28.00	9.59%	$0.36	$1.06	10.63%
D	$29.65	9.54%	$1.31	$1.97	7.20%
E	$21.78	7.13%	$0.29	$1.85	4.78%
F	$54.37	8.00%	$2.47	$3.10	8.79%
G	$58.32	8.24%	$1.62	$2.81	9.41%

TABLE 9.6

Valuations with P/E = 18.00, Example 9.8

Company	A	B	C	D	E	F	G
D_1	\$0.60	\$1.22	\$0.40	\$1.40	\$0.30	\$2.69	\$1.78
D_2	\$0.64	\$1.30	\$0.44	\$1.50	\$0.32	\$2.93	\$1.94
D_3	\$0.69	\$1.39	\$0.49	\$1.61	\$0.33	\$3.19	\$2.13
D_4	\$0.74	\$1.49	\$0.54	\$1.73	\$0.35	\$3.47	\$2.33
D_5	\$0.79	\$1.59	\$0.60	\$1.85	\$0.36	\$3.77	\$2.55
E_5	\$2.04	\$6.13	\$1.76	\$2.78	\$2.34	\$4.72	\$4.41
V_5	\$36.63	\$110.41	\$31.76	\$50.08	\$42.11	\$85.03	\$79.36
V_0	\$25.27	\$78.44	\$21.94	\$37.89	\$31.19	\$70.52	\$61.81
Misval.	−28.69%	−31.75%	27.59%	−21.74%	−30.16%	−22.90%	−5.65%

gives us an average misevaluation of zero. The calculations for this scenario are shown in Table 9.7. Notice that the best buy is B, followed by E, A, F, D, G, and C. This is the exact rank ordering we saw when we used a P/E of 18.00 (we will return to this observation in a moment). If our growth estimates reflect the expectations of the market, the implied P/E ratio (14.72 in this case) will be roughly equal to the P/E that the market expects for the industry in 5 years. We might then be able to use this as evidence that the market might be under- or overpricing the industry

TABLE 9.7

Valuations with P/E = 14.72, Example 9.8

Company	A	B	C	D	E	F	G
D_1	\$0.60	\$1.22	\$0.40	\$1.40	\$0.30	\$2.69	\$1.78
D_2	\$0.64	\$1.30	\$0.44	\$1.50	\$0.32	\$2.93	\$1.94
D_3	\$0.69	\$1.39	\$0.49	\$1.61	\$0.33	\$3.19	\$2.13
D_4	\$0.74	\$1.49	\$0.54	\$1.73	\$0.35	\$3.47	\$2.33
D_5	\$0.79	\$1.59	\$0.60	\$1.85	\$0.36	\$3.77	\$2.55
E_5	\$2.04	\$6.13	\$1.76	\$2.78	\$2.34	\$4.72	\$4.41
V_5	\$29.97	\$90.32	\$25.98	\$40.97	\$34.45	\$69.56	\$64.92
V_0	\$21.14	\$65.15	\$18.29	\$32.11	\$25.76	\$59.99	\$52.09
Misval.	−14.76%	−17.83%	53.10%	−7.66%	−15.44%	−9.36%	11.96%

itself. For example, suppose that the historical average P/E for our industry is 22.4. Suppose further that the industry is a mature, stable one and that we expect that to continue for quite some time. The fact that the implied P/E ratio is well less than the historical average tells us that, for whatever reason, the market is not so optimistic about the future of the industry. If we believe otherwise, we might ultimately decide to increase our holdings in the industry.

In the example, we saw that changing our estimate of the expected P/E ratio had no affect on the rank orderings of the stocks. This is no coincidence. Changing the expected P/E ratio will generally not affect the rank orderings of stocks in terms of apparent misvaluation. Since the expected P/E affects each stock in much the same way, the misevaluations also change in much the same way. (In cases in which the misevaluations of two stocks are very close to begin with, changing the P/E estimate may change the rank orderings, but this is of no real consequence because the model provides only one small piece of the valuation puzzle.) We can extend this intuition about the expected P/E ratio to other industry-wide or market-wide factors.

When using relative valuation models, errors in our estimates of industry-wide or market-wide factors will generally have little or no impact on our rank orderings of stocks within an industry.

This is a powerful result because it allows us not to worry so much about variables such as the level of interest rates. This is precisely what makes relative valuation models so attractive as screening mechanisms. Because we do not need precise estimates of many parameters, we can conduct relative valuation analyses quickly and efficiently, thereby greatly reducing our time commitment.

Implied Growth Rates

We can glean another piece of information from the Relative Malkiel Model by considering what growth rates the companies would have to achieve in order to justify their current stock prices. To do this, we use precisely the same approach we have been using, except that we first compute the implied P/E ratio and then choose the growth rate for each company so that the misevaluation of that company's stock is zero. Table 9.8 shows the implied growth rates for the companies we studied in Example 9.8. We see that at the extremes, the market is pricing stock C as if the company's earnings will grow at 20.85% per year for the next 5 years, and stock E as if the company's earnings will grow at only 1.25% per year for the next 5 years. We can use this information in conjunction with our own expectations about the companies as evidence of potential mispricing in the marketplace. We might believe, for example, that the earnings of stock E will likely grow at 8–10% per year for the foreseeable future. If so, we might ultimately conclude that stock E is a good buy.

At this point, we are tempted to screen out all stocks with high implied growth rates and consider only those with low implied growth rates. Although this might not be a bad idea, doing so would specifically preclude us from investing in some very high-quality companies. The point is not whether the P/E ratio is high or low, or whether the implied growth rate is high or low. Rather, it is whether they are *too* high or *too* low.

A Note on the Importance of Free Cash Flow Yield

Before we discuss some potential biases inherent in relative valuation models, it is worthwhile to briefly discuss the importance of the company's *free cash flow yield*, which is the company's unlevered free cash flow divided by the total capital invested (i.e., the company's enterprise value). As we will see in the next chapter, the free cash flow yield is critically

TABLE 9.8

Implied Growth Rates

Company	Implied growth rate (%)
A	3.57
B	2.65
C	20.85
D	5.36
E	1.25
F	6.47
G	12.08

important because it is the actual return generated to satisfy investors. If the free cash flow yield is below the company's WACC, then the company did not generate a high enough return to satisfy its investors. Since shareholders are paid last, this specifically means that the stock underperformed on a risk-adjusted basis. Because of the importance of the free cash flow yield, it should be considered at both the screening stage and at the valuation stage. For example, we might screen by looking at the ratio of free cash flow yield to WACC. The higher this ratio is, the better is the stock's performance.

Potential Biases

If we think carefully about the Malkiel Model applied in a relative valuation framework, we see that there are a few ways that biases might be introduced. First, we might have biased discount rates. Suppose, for example, that we underestimate the beta of a stock and then use the CAPM to estimate the discount rate. A mistakenly lower discount rate effectively means that we give the company too much credit for its future prospects. This would tend to make the implied P/E ratio lower than it should be, thereby making the industry appear to be more attractive than it really is. The impact of this on implied growth rates is indeterminate. The lower beta would cause lower implied growth rates (all else being equal), but the lower implied P/E would cause higher implied growth rates (all else being equal). Second, our initial growth estimates may be biased. For example, we might choose to use the consensus analysis forecast for earnings growth. Those forecasts are notoriously optimistic, and they consistently overestimate the true expected growth rate. As with a lower β, higher growth rates give the company too much credit for its earnings, which in turn decreases the implied P/E ratio. When we compute the implied growth rate, some but not all of this effect is eliminated. Because the implied P/E ratio is too low, our implied growth rates (which depend on the implied P/E ratio) would be higher than they should be. Thus, we would tend to think that the industry was more attractive than it should be, but individual stocks might appear to be less attractive.

IN PRACTICE . . .

Despite their simplistic appearance, screening models can be somewhat difficult if we take the approach seriously. As we have seen, the key to making such models meaningful is to identify a proper set of peer companies. Identifying and understanding those peers takes more work than many investors realize. Unfortunately, we very often find that a company has no peers that are close enough to justify inclusion in a comps analysis. This should not be surprising, since companies do not want to be like each other. Of course, this should cause us to wonder why such simple approaches are used in the first place. It is therefore useful to spend a few minutes talking about how comps are used by investment professionals.

Equity Research and Investment Banking

Stock analysts often cite P/E and other ratios in support of their recommendations for stocks. This has likely contributed to the misconception that P/E ratios are an input to the valuation process rather than an outcome of it. We regularly hear analysts seem to cite a company's low P/E ratio as evidence that the company is undervalued, but what has really happened is that the market, in its collective wisdom, has evaluated the stock and has assigned it an equilibrium P/E ratio that is low. The P/E ratio gives us the *result* of the market's evaluation of the company; it does not by itself give us any information about the possible under- or overpricing of the stock.

So why do analysts cite P/E ratios in this manner? One role of the analysts is to provide information to brokers, who then use that information to advise individual clients. Many of those clients have very little (if any) experience in valuing stocks, so the broker must be able to communicate ideas in simple terms. Furthermore, most brokers themselves have had no extensive training in stock valuation. An implication of this is that the brokerage industry has at least in part given rise to the misconceptions about P/E ratios and other similar ratios.

For similar reasons, investment bankers rely heavily on comps. Bankers may have only a few minutes to make a pitch to a potential client, so comps provide a quick and easy means of communicating information about the value of company. If the client chooses to proceed (to buy another company, for example), more detailed models come into play.

What Stocks Can We Include?

Our largely theoretical development earlier in the chapter raises a few questions. Can we apply the model to all stocks in an industry? What if a company has very low or negative earnings? Do we really have to estimate growth rates for each company in our set?

To begin, let us consider the obvious question about earnings. Many companies have negative earnings. If we include such a company in the analysis, the forecasted earnings are also negative. Assuming that the expected P/E ratio is positive, we would generally end up with a negative estimate of stock value (which is clearly absurd). So how do we handle this situation? The answer is that we don't. Some companies simply cannot be included in an earnings-based analysis of this nature. The same can often be said if we are using free cash flow, operating cash flow, or some other profit-based number. This obviously reduces the completeness of our analysis, but always keep in mind that models based on sales can be applied to virtually any stock you can find. One approach is to first apply the model to all of the companies in the industry using sales as the underlying variable. We then apply the model, using earnings (and other variables) as the underlying variable, but include only those companies whose inclusion is reasonable.

Outliers

Once we have determined which stocks to include and have run the chosen model, we sometimes find outliers. They are usually evident when, for example, we see one stock that appears to be dramatically overvalued while the rest of the industry appears to be undervalued. Upon investigation, we usually find that the earnings (or other variable) of the firm are not at all representative of the current status of the company. For example, an oil company may have current earnings of $2 per share, but news has just come out that the company has discovered a massive oil field in a very accessible location. The market responds and the stock price shoots up, but earnings do not increase right away. This leads to a current P/E that is way too high in comparison with its historical level. What do we do? There are two possibilities. The first (and recommended) approach is to reassess the growth estimate for the company and try to fully incorporate the information we have about the new discovery. This is often quite difficult, particularly in the early days, as information is slowly leaking out about the discovery. The second approach is to simply remove the stock from the analysis.

Analyst Growth Rates

It is one thing to spend the time and effort to estimate the future growth of a company. It is quite another to do so for a possibly large group of companies. Suppose, for example, that the industry we are considering has 20 companies that we deem to be similar enough for comparison. Is there a shortcut that we might use, particularly in light of the suggestion that the relative version of the Malkiel Model is best used as a screening tool? One possibility is to rely on analyst growth estimates that we might purchase from a specific research firm or composite estimates that are posted on a number of websites. Several times in this book we have discussed the tendency of analysts to overestimate future growth. As the theoretical discussion of this chapter suggests, if the analysts consistently overestimate growth for the stocks in the industry, we might still expect to get a reasonable rank ordering of those stocks. Roughly speaking, what we need is for the analysts to provide growth estimates that are not biased in favor of or against one company (or a few). If, for example, analysts consistently forecast growth rates that are 5% higher than they should be, or perhaps double what they should be, then using them in the relative Malkiel framework will likely still produce meaningful results.

CASE STUDY

We can now return to our case of study of O'Charley's. Table 9.9 shows a small comps table for our restaurant companies. For brevity's sake, we

TABLE 9.9

Comps, Restaurants

	Applebee's	O'Charley's	Darden	Outback	Ruby Tuesday	Average
P/sales	2.12	0.52	0.85	1.06	1.44	1.20
P/E	21.13	22.25	35.28	20.76	14.28	22.74
P/FCF	48.27	31.00	13.36	68.66	47.06	41.67
EV/EBITDA	10.26	7.09	9.57	9.61	8.87	9.08
EV/sales	2.02	0.68	1.17	1.05	1.93	1.37

include only a few of the common multiples we might see in a comps table. In every instance, we see that O'Charley's is trading at prices that are below the industry average. This further confirms our observation in earlier chapters that the company is struggling. The price-to-sales ratio is especially interesting because it gives us an idea of how the stock price might react if the company is able to solve its expense problems (which as we recall arise from not getting enough traffic into its restaurants). If the company is able to solve those problems and become an "average" company in the industry, the stock would presumably trade at an average price-to-sales ratio. As the table shows, the average company is currently trading at a multiple that is more than double that of O'Charley's. This suggests that if the problems can be solved, the stock has the potential to more than double in a short period of time.

Table 9.10 shows the Relative Malkiel Model with sales as the underlying variable. In that table, we have used the consensus analyst growth forecasts as an estimate of the sales growth rates for the next 5 years. In addition, we have assumed a risk-free rate of 4.64% and a market risk premium of 4%. Inputs to the model are shown in regular font, and the results are highlighted in bold. We see clearly that O'Charley's appears to be the best buy, based on its level of sales. That is, the market is giving O'Charley's little credit for its level of sales and the anticipated growth in sales. This makes sense, of course, because O'Charley's is not currently converting those sales into profits as efficiently as its peers are doing. We also

TABLE 9.10

Relative Malkiel Model with Sales as the Underlying Variable, Restaurants

	Applebee's	O'Charley's	Darden	Outback	Ruby Tuesday
Stock price	\$28.46	\$20.76	\$27.49	\$45.36	\$24.00
Sales per share	\$13.43	\$39.88	\$32.16	\$42.92	\$16.72
Dividends per share	\$0.048	\$0.000	\$0.080	\$0.524	\$0.046
β	0.374	0.516	0.377	0.391	0.443
Analyst growth estimate, 5 years	15.0%	16.0%	12.0%	15.0%	16.5%
Value estimate	**\$16.35**	**\$48.44**	**\$34.12**	**\$54.46**	**\$21.34**
Misvaluation	**74.0%**	**−57.1%**	**−19.4%**	**−16.7%**	**12.5%**
Implied growth rate	**28.5%**	**−2.1%**	**7.2%**	**10.5%**	**19.2%**

TABLE 9.11

Relative Malkiel Model with Earnings as the Underlying Variable, Restaurants

	Applebee's	O'Charley's	Darden	Outback	Ruby Tuesday
Stock price	$28.46	$20.76	$27.49	$45.36	$24.00
Earnings per share	$1.35	$0.93	$0.78	$2.18	$1.68
Dividends per share	$0.048	$0.000	$0.080	$0.524	$0.046
β	0.374	0.516	0.377	0.391	0.443
Analyst growth estimate, 5 years	15.0%	16.0%	12.0%	15.0%	16.5%
Misvaluation	**−9.0%**	**−4.9%**	**70.1%**	**−15.1%**	**−41.5%**
Value estimate	**$31.28**	**$21.82**	**$16.16**	**$53.43**	**$41.03**
Implied growth rate	**12.8%**	**14.9%**	**24.6%**	**10.9%**	**4.6%**

see that the current stock price of O'Charley's represents an implied growth rate of −2.1%. This has little meaning for O'Charley's, because the model implicitly assumes that the company is not unusual in other respects.

Table 9.11 shows the model with earnings as the underlying variable. Here, we see that O'Charley's stock seems to be roughly fairly priced based on its current level of earnings and expectations for future earnings. Putting this together with our observations above, it is clear that the stock of O'Charley's is priced based on the presumption that the company will not be able to correct its problems to any great extent. If we find evidence to the contrary, then O'Charley's might just be a good stock to purchase. This is the essence of stock valuation. We simply figure out what the market expects of the company, and we then generate our own expectations by carefully evaluating the company's future prospects. If our expectations do not match those of the market, then we might invest on that basis.

SUMMARY

In this chapter, we consider broad classes of screening models that are used to help us choose stocks for in-depth examination. The premise behind most screening models is that a company can be compared with its peers so that we can understand the expectations that are embedded in market prices. If our expectations differ, then we may have a profitable investment opportunity.

We discussed the comps model, which is easily the most widely used model in the investment world. Although the model is useful in helping us understand the company, it is often misapplied as evidence of mispricing in the marketplace. It is important to note that the model is so simple that virtually anyone can execute it. As such, it is unlikely that comps will provide us with anything more than general descriptive information about a company.

We also discussed several popular models in an effort to evaluate their credibility. In particular, we discussed Peter Lynch's thoughts on the PEG ratio and discussed the Fed Model, both of which have little basis in theory.

We then dealt specifically with the idea of incorporating growth into our screening models. To do so, we adapted a model first proposed by Burton Malkiel in 1963. We found that the model is quite useful in that it allows us to specifically incorporate growth expectations into the valuation process. This in turn allows us to compare companies that may be alike in many ways, but may have different growth prospects.

CHAPTER 10

The Discounted Cash Flow Model

PURPOSE AND SCOPE

In the last chapter, we discussed screening models, which are tools we can use to quickly examine a set of stocks and reduce them to some manageable number for further investigation. The models are simplistic by design, and they ignore much of the information we have about the company and its future prospects. In this chapter, we consider a model that is designed to specifically incorporate that information. In particular, we seek to value the company by looking at what goes on inside the company. To do this, we forecast the internal cash flows of the company and then discount them to determine the value of the company today. We call this approach the *Discounted Cash Flow* (*DCF*) *Model*. In a sense, nearly everything we have discussed up to this point is designed to build a basis for the model. We discussed price formation and market efficiency (Chapter 2), which help us understand how information is translated into prices in the marketplace. We discussed how to compute the present value of cash flows (Chapter 3) with the use of appropriate discount rates (Chapter 6), which provides the basis for the core DCF calculation. We discussed financial statements (Chapter 4) and how to analyze them (Chapter 5), which helps us understand how to forecast (Chapter 7) the cash flows of the company. We discussed the importance of ESO valuation (Chapter 8), which is an important part of any competent DCF analysis. Finally, we discussed simple valuation models that help us screen stocks for further investigation (Chapter 9).

We begin the chapter by discussing the theoretical concepts behind the DCF model, nearly all of which has been laid out in earlier chapters. We first discuss the basic intuition we exploit when using the DCF model, and we consider different variations of the model. In theory, these variations will all lead to precisely the same value estimate, but in practice, the estimates may differ because of our ability (or lack thereof) to estimate some variables accurately. We then lay out and discuss the free cash flow equation that we developed in Chapter 4. We also spend a few minutes reviewing the discount rate and how we should estimate an appropriate one for the DCF model. We then walk through a simple example to illustrate the DCF process and take an in-depth look at the realities associated with using the DCF model to value real-world stocks. In particular, we continue our case study of O'Charley's in an attempt to understand the potential value of the company's stock as well as the downside risk. As part of this discussion, we consider how sensitive our valuation is to the estimates of various parameters. This is a critical part of any valuation process. If we estimate the value of a stock with the use of only one set of parameter values, we have only learned what the stock would be worth in one specific scenario. It is of course very unlikely that the one scenario we forecast would happen to be the one that ultimately occurs, so we must consider many different scenarios to get a reasonable understanding of the situation. Finally, we conclude our study by returning to the ideas of Warren Buffett so that we might discuss O'Charley's on a more qualitative level.

Before beginning our discussion, we need to be aware that although the DCF model is quite intuitive, it is also quite difficult to implement. There are numerous opportunities to make mistakes, and many of those mistakes can dramatically alter our estimate of the value of the company's stock. Having said that, there is probably no better way to understand what really matters in stock valuation than to become proficient at executing the DCF model.

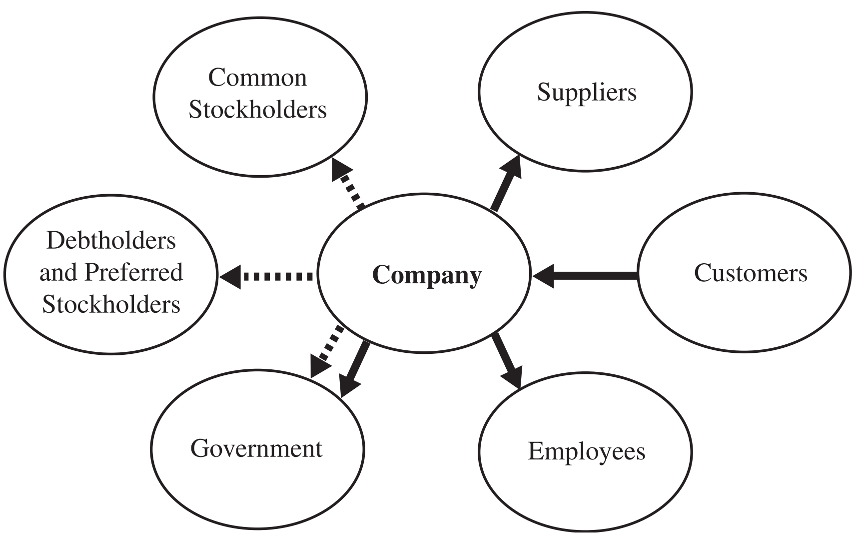
IN THEORY . . .

The Discounted Cash Flow (DCF) model is an internal, absolute valuation model. By "absolute valuation," we mean that we seek to establish what the stock is worth rather than whether it is a better or worse buy than its peers. By "internal" we mean that we examine the operational activities and cash flows of the company rather than simply examine the cash flows that are paid directly from the company to investors. The premise behind the DCF model is that the value of the entire company can be determined by computing the present value of the expected cash flows of the company. We then simply subtract the values of debt, preferred stock, and employee stock options (ESOs) to get the value of the company's stock.

Although the DCF concept is often applied in slightly different ways by investment professionals, the basic intuition is the same—we simply discount the expected cash flows of the company. There are two main approaches we can use, although one is generally preferred. In the first and preferred approach, we forecast all of the cash flows of the company except for those related to financing (i.e., dividends, interest payments, and money received from investors, along with any tax effects of those payments). We then discount those cash flows (which we call the *unlevered free cash flows* of the company) using the company's weighted average cost of capital (WACC). The company's cash flows are depicted in Figure 10.1. Solid arrows depict cash flows that we explicitly forecast, and dashed lines

FIGURE 10.1

Company Cash Flows, Unlevered DC Approach

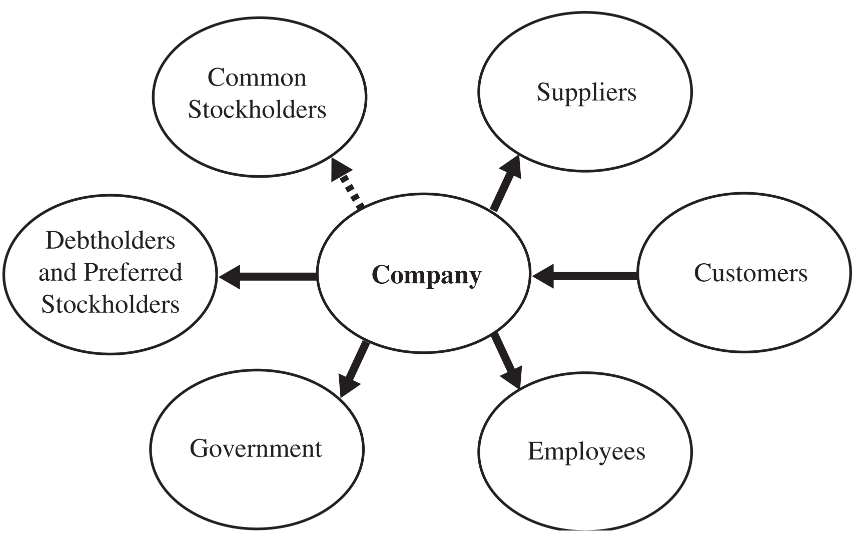


depict cash flows that we implicitly account for through the discount rate. As the figure shows, cash is used to buy goods and services from suppliers (including the suppliers of capital equipment). The company then adds value to the product and sells it to customers. With the proceeds, the company pays its employees, debtholders, and preferred stockholders. Whatever is left belongs to shareholders. Note that we forecast the taxes the company would pay if it had no debt (thus the solid arrow to "Government"), but not the tax deduction the company receives from holding debt (thus the dashed arrow to "Government"). The WACC takes into account the cash flows depicted with dashed arrows.

The second approach is illustrated in Figure 10.2. In that approach, we forecast all of the cash flows of the company except for those related to the company's common stock (i.e., common stock dividends). We then discount those cash flows (which we call the *levered cash flows* of the company) by using the company's cost of equity instead of its WACC. The two approaches are theoretically equivalent (and give precisely the same value in theory) because discounting is equivalent to explicitly forecasting the financing cash flows. To see this, consider the following simple example.

FIGURE 10.2

Company Cash Flows, Levered DCF Approach



Example 10.1: A company is formed with the objective of executing one simple project. To finance the project, the company raises \$100 from investors who require a return of 10% per year (this is the company's WACC). The \$100 is invested and the project is expected to pay off \$60 in 1 year and \$70 in 2 years. What is the value of the company today?

Using the standard DCF approach, we would discount the expected unlevered free cash flows of the company. That is, we use cash flow forecasts that ignore all financing-related cash flows. In this approach, we see that the value of the company is

$$V = \frac{\$60}{1.1} + \frac{\$70}{1.1^2} = \$112.40. \tag{10.1}$$

The value consists of the \$100 initial investment plus \$12.40 in additional value that comes from a value-adding project. Now, suppose instead that we explicitly forecast the cash flows to investors. In 1 year, we would owe investors \$110. We can then use the \$60 cash inflow to retire part of that obligation, leaving us owing \$50. In 2 years, we will owe investors \$55. The project pays \$70 at that time, giving us \$15 in excess cash flow beyond repaying investors \$100 in value. The value of the excess \$15 today is $\$15/1.1^2 = \$12.40$, so the company has a total value today of \$112.40. The value is again composed of the \$100 initial investment plus \$12.40 in additional value from the project.

The point of this simple example is that from a theoretical perspective, it does not matter whether we forecast the payments to investors or not. As such, we should choose the technique that gives us the most reliable results in real-world situations. In practice, it is difficult to forecast explicit payments to investors. As we discussed in the last chapter, dividend payments are extremely difficult to forecast beyond the next few years. Even debt, which has prespecified cash flows, is difficult to deal with because debt matures and is replaced with new debt. In those circumstances, we would have to forecast the interest rate and maturity of the new debt. Furthermore, the company might have floating rate debt with cash flows that vary with some variable such as the prime rate. To forecast cash flows for debt of that nature, we would need to monitor current macroeconomic variables and perhaps develop models to forecast future macroeconomic conditions. The difficulty is that, in contrast to our simple Example 10.1, the actual payments to investors are not a constant percentage of the amount invested. Instead, they tend to fluctuate based on economic conditions. Rather than attempt to deal with that framework, we generally prefer to just discount the company's unlevered free cash flows at the weighted average cost of capital. In doing so, we assume a constant discount rate which, if estimated properly, effectively takes into account the future variation in the company's financing-related cash flows. This makes our task much easier without sacrificing accuracy. For the remainder of the chapter, we will focus on the unlevered free cash flow approach, which we will simply call the DCF Model.

The DCF Model

The basic idea behind the DCF Model is that the value of the company is the present value of the expected unlevered free cash flows of the company. Recall from Chapter 4 that those cash flows can be forecasted with the equation

$$\boxed{FCF = NOPAT - \Delta NWC - CapEx + D\&A + \text{Other Effects.}} \qquad (10.2)$$

The equation reflects all of the company's cash flows except those related to financing (such as interest and dividends payments, and money raised from investors). Intuitively, the free cash flow equation is based on the idea that the income statement does not adequately capture the actual cash flows of the company. The equation can therefore be viewed as a series of adjustments to the income statement. The free cash flow equation is built on NOPAT, which is the company's net operating profit after taxes (i.e., the company's earnings before interest and taxes less the taxes that would be paid if the company had no debt). We adjust NOPAT by subtracting the change in the company's net working capital and the company's capital expenditures, both of which reflect cash flows that do not appear on the company's income statement. In the case of net working capital, we capture cash flows related to short-term assets and liabilities that do not appear on the income statement, and we correct for short-term items that appear on the income statement even though there was no actual cash flow during the period. In the case of capital expenditures, we capture money spent by the company for long-term assets. Those expenditures are expensed on the income statement gradually over time through the depreciation account, but the actual cash flows occur at the time of purchase. To adjust for the depreciation on the income statement (which appears as an expense despite the fact that the cash flow did not occur during that period), we simply add the depreciation back into the free cash flow formula. (We treat amortization in the same way and lump it together with the depreciation.)

Once we have forecasted the company unlevered free cash flows and have discounted them with the use of the WACC, we have an estimate of the total value of the company. The accounting balance sheet identity tells us that the value of the company (i.e., the assets) should be equal to the value of debt plus the value of preferred stock plus the value of common stock, but recall from Chapter 8 that employee stock options (ESOs) are effectively a form of common stock. Like other investors, they derive value from the cash flows of the company, and we must therefore specifically account for the value they take away from other investors. Thus, the finance balance sheet identity differs slightly from the accounting balance sheet identity. As Figure 10.3 shows, the finance identity reflects the fact that there are four claimants on company cash flows. It follows that the value of the company's common stock will be the value of the company

FIGURE 10.3

The Value Identities

The Accounting Balance Sheet Identity

Total Assets =		
Debt	Preferred Stock	Common Stock

The Finance Balance Sheet Identity

Company Value =			
Debt	Preferred Stock	Common Stock	Outstanding and Expected ESOs

less the values of debt and preferred stock, *and* less the value of outstanding and expected ESOs. This gives us the fundamental relationship

$$\begin{aligned} \text{Value of Equity} = {} & \text{Total Company Value} \\ & - \text{Value of Debt} \\ & - \text{Value of Preferred Stock} \\ & - \text{Value of Outstanding and Expected ESOs} \end{aligned} \tag{10.3}$$

In applying this equation, we have four tasks:

1. Estimate the value of the entire company by forecasting and discounting the company's unlevered free cash flows.
2. Estimate the value of the company's interest-bearing debt (we do not include payables, which are part of working capital rather than invested capital).
3. Estimate the value of the company's preferred stock.
4. Estimate the value of the company's outstanding ESOs and those we expect the company to issue in the future.

From our work in Chapters 3 and 6, we know how to estimate the values of debt and preferred stock (although we might just pull those numbers from the company's balance sheet). From our work in Chapter 8, we know how to estimate the value of outstanding ESOs and those we expect the company to issue in the future. To estimate the value of the entire company, we must piece together what we have learned throughout the book.

To do this, we write the value of the company as

$$\begin{aligned} V_0^C = {} & Excess\ Cash + \frac{FCF_1}{(1+WACC)} + \frac{FCF_2}{(1+WACC)^2} \\ & + \frac{FCF_3}{(1+WACC)^3} + \cdots, \end{aligned} \tag{10.4}$$

where V_0^C is the value of the entire company and WACC is the company's weighted average cost of capital we discussed in Chapter 6. In this representation, we include a special category known as *excess cash*, which we discussed in Chapter 5 and which captures cash holdings that are not being used to support operations. Equation 10.4 is similar to the discounted dividends approach (which we discussed in the previous chapter) in that implementing it requires us to estimate an infinite series of free cash flows. The practical impossibility of doing so leads us to rewrite the equation as

$$V_0^C = Excess\ Cash + \frac{FCF_1}{(1+WACC)} + \frac{FCF_2}{(1+WACC)^2} + \cdots + \frac{FCF_T}{(1+WACC)^T} + \frac{TV_T^C}{(1+WACC)^T}, \qquad (10.5)$$

where TV_T^C is the terminal value of the entire company in T years.

Choosing the Forecast Period

One difficulty we face involves choosing the basic forecast framework. The DCF approach has a solid basis in theory, but a few elements of the process are inherently subjective. The choice of forecast period is one of these elements. Since the terminal value tends to contribute a large percentage of the value of the company, this choice can be quite important. As we discussed in the last chapter, one approach is to simply extend the forecast period so that the terminal value is a lower percentage of company value. In fact, it is not uncommon for fund managers to maintain a policy of extending the forecast period until the terminal value is less than a specified fraction (one-third perhaps) of company value. Others argue that the forecast period should be chosen based on how confident we are in our projections. Still others argue that we should forecast out to the point where we believe the company will have reached some long-term equilibrium (i.e., where the company will be out of any abnormal growth phase). At some point, the company will reach a stable maturity in which its projects no longer earn returns above the cost of capital. If we believe this will happen in 10 years, then we should forecast free cash flows for 10 years. This is certainly wise advice, but it may not be feasible to apply that intuition in a real-world analysis. Rappaport and Mauboussin (2001) argue that we can let the market tell us the appropriate forecast period. Their procedure involves collecting consensus analyst forecasts (of sales growth and other relevant variables) for the company and then computing how many years of free cash flows it would take to justify the current stock price of the company. This requires us to execute two DCF analyses, one using the consensus forecasts and one using our own forecasts. With spreadsheet programs such as Excel, this is an easy matter, but it is not clear how useful this approach really is. The growth forecasts of analysts are notorious for being overly optimistic. If we were to use growth estimates that are too high and then apply the intuition of Rappaport and Mauboussin, we would ultimately choose a forecast period that is too short. This does not mean that we discard the approach altogether. Rather, it means that we should be careful to use unbiased growth forecasts.

Estimating the Terminal Value

Once we have chosen the forecast period, we must consider how to estimate the terminal value of our free cash flow forecasts. As we discussed in the previous chapter, this can be accomplished in one of two ways. First, we can forecast the company's financial statements at date *T* and then apply some value multiple to get our estimate of the value of the company at that date. For example, we might note that the ratio of company value to free cash flow has been 3.1 historically. We could then multiply our forecasted free cash flow by 3.1 to get our estimate of company value on that date, which is the terminal value for the DCF model. Most investment professionals frown on this approach because it is difficult to estimate a reasonable value for that ratio. If our forecast period is, say, 10 years, then we need an estimate of what the company value/free cash flow ratio will be in 10 years. For mature, stable industries, we might be able to do this, but what about evolving industries such as online music services? Such industries are likely to mature dramatically over the next 10 years, resulting in significant changes to industry multiples.

The second approach, which is widely preferred for the DCF Model, is to rely on the perpetual growth formula we developed in Chapter 3. If we have chosen our forecast period so that we believe the company will be stable at the end of that period, we can simply assume that free cash flows will grow at some small rate indefinitely. From a theoretical perspective, we know that the long-term growth rate for a company cannot exceed the growth in the overall economy. If were to, the company would become a bigger and bigger fraction of the economy until it eventually became the entire economy. At that point, the growth of the company would be precisely equal to the growth in gross domestic product. As we discussed in the previous chapter, a reasonable long-term growth forecast is probably in the neighborhood of 3%, although there seems to be no real consensus among investment professionals.

Using the DCF Approach to Value Common Stock

At this point, it is useful to consider a simple example in which we apply the DCF approach to a hypothetical company. Later in the chapter, we will return to our case study of O'Charley's and see what the DCF Model tells us about the value of its stock.

TABLE 10.1

Selected Financial Items (millions of dollars), Example 10.2

Income statement		Balance sheet	
Sales	$8.612	Cash	$14.973
Costs	$5.399	Receivables	$0.428
Depreciation	$0.260	Inventory	$0.993
EBIT	$2.953	PPE	$4.213
EBIT(1-T)	$1.919	Accumulated depreciation	$2.210
		Net PPE	$2.003

Example 10.2: Table 10.1 shows selected information taken from the most recent income statement and balance sheet for the hypothetical company XYZ. The table shows only those items that are directly used to forecast the company's free cash flows. In addition, we have estimated the amount of cash needed by the company to be $1.752 million, so we believe the company is currently holding excess cash in the amount of $13.221 million. We have also analyzed the company's future prospects and have developed forecasts for various financial variables. Those forecasts are shown in Table 10.2.

Table 10.3 shows information about the capital structure of the company and about ESOs outstanding. In addition, we know that the company has a history of issuing 1-year ESOs to its top managers each year.

TABLE 10.2

Forecast Assumptions, Example 10.2

Variable	Forecast
Sales	6.0% for each of the next 10 years
Costs	83.0% of sales
Depreciation	12.5% of beginning of year net PPE
Tax rate	35.0%
Needed NWC	28.0% of sales
Net PPE	22.0% of sales

TABLE 10.3

Selected Information, Example 10.2

Taxes	
Tax rate	35%
Long-term growth	
Expected annual rate	3%
Debt	
Face value	$5.452 million
Annual coupons	6.20%
Yield-to-maturity	6.92%
Preferred stock	
Shares outstanding	100,000
Annual dividend	$1.25
Yield	7.27%
Common stock	
Shares outstanding	1,000,000
Share price	$7.62
β	1.29
Estimated volatility	31%
Annual dividend	$0.00
Employee stock options	
Number outstanding	40,000
Exercise price	$8.00
Expiration	1 year
Expected forfeiture rate	2.2%
Grant value of an ESO	$1.10
Policy	Issues 1-year ESOs each year

TABLE 10.4

Market Information, Example 10.2

Parameter	Value
1-Year U.S. Treasury yield	3.11%
10-Year U.S. Treasury yield	3.82%
Expected market risk premium	3.60%

We expect this activity to continue. Table 10.4 shows other information we will need in order to estimate the company's WACC, which is where we will begin our analysis.

Weighted Average Cost of Capital: Recalling our discussions in Chapter 6, we estimate the cost of debt to be 6.92%, the cost of preferred stock to be 7.27%, and the cost of equity to be 3.82% + 1.29 × 3.60% = 8.464%. To estimate the weights on each of these costs, we must first determine the market value of each security class. We are tempted to simply use the face value of the company's debt as an estimate of its market value. In fact, this assumption is commonly used by investment professionals. However, if the yield on the debt differs substantially from the coupon rate, then we would substantially misestimate the market value of debt. Given that we have the yield-to-maturity, it is wise to err on the side of more precision and go ahead and compute the market value of debt. With \$5.452 million in face value and a 6.2% annual coupon rate, the company would pay annual coupons totaling 6.2% × 5.452 = \$0.338 million. We can then estimate the market value of debt by using the annuity formula we developed in Chapter 3,

$$\text{Market Value of Debt} = \$0.338 \times PVIFA_{6.92\%,7} + \frac{\$5.452}{1.0692^7} = \$5.240\,\text{million} \qquad (10.6)$$

We estimate the market value of preferred stock proceeds similarly, but we use the perpetuity formula instead of the annuity formula,

$$\text{Market Value of Preferred Stock} = 100{,}000 \times \frac{\$1.25}{0.0727} = \$1.719 \text{ million} \qquad (10.7)$$

The market value of equity is easily computed by multiplying the number of shares outstanding by the market price:

$$\begin{aligned}\text{Market Value of Equity} &= 1{,}000{,}000 \times \$7.62 \\ &= \$7.62 \text{ million}\end{aligned} \tag{10.8}$$

The total capitalization is the sum of these, or \$14.579 million. This allows us to compute the weights for the WACC calculation, which are 35.94%, 11.19%, and 52.27% for debt, preferred stock, and equity, respectively. Now that we have the weights, we estimate the WACC to be

$$\begin{aligned}\text{WACC} &= w_d R_d (1 - T) + w_{ps} R_{ps} + w_e R_e \\ &= 0.3594 \times 6.92\% \times (1 - 0.35) + 0.1119 \times 7.27\% \\ &\quad + 0.5227 \times 8.464\% \\ &= 6.898\%,\end{aligned} \tag{10.9}$$

which provides the appropriate discount rate for computing the present value of the company's free cash flows.

Forecasted Free Cash Flows: Using the forecasts from Table 10.2 in conjunction with the selected financial statement items from Table 10.1, we can forecast the free cash flows for the company. Those forecasts and the variables used to build the free cash flows are shown in Table 10.5. In that table, CY-1 represents the numbers for the most recent year ("a" denotes actual results), and CY, CY + 1, and so on represent forecasted years ("p" denotes projected results). We will base our forecasts on these numbers. To understand how the table was built, let's walk through the Year 1 calculations.

- The sales figure for year 1 (\$9.129 million) is 6% higher than the \$8.612 million in sales reported on the company's latest income statement.
- Year 1 costs are \$7.577 million, which is 83% of year 1 sales.
- The depreciation figure of \$0.250 million is 12.5% of the net PPE from the prior year (CY-1 in the table).
- EBIT is determined by subtracting costs and depreciation from sales (\$9.129 − \$7.577 − \$0.250 = \$1.302), and NOPAT is simply EBIT multiplied by 0.65 (1 minus the assumed tax rate of 35%). This gives us a NOPAT of \$1.302 × (1 − 0.35) = \$0.846 for year 1.
- NWC* in the table is the level of *needed* net working capital, which *excludes* any excess cash the company may be holding.

TABLE 10.5

Free Cash Flow Forecasts, Example 10.2

Year	Sales	Costs	Depr.	EBIT	NOPAT	NWC*	PPE	Accum. depr.	Net PPE	CapEx	Change in NWC*	FCF
CY-1(a)	*$8.612*	*$5.399*	*$0.260*	*$2.953*	*$1.919*	*$2.551*	*$4.213*	*$2.210*	*$2.003*			
CY(p)	$9.129	$7.577	$0.250	$1.302	$0.846	$2.556	$4.468	$2.460	$2.008	$0.255	$0.005	$0.836
CY+1(p)	$9.676	$8.031	$0.251	$1.394	$0.906	$2.709	$4.840	$2.711	$2.129	$0.372	$0.153	$0.632
CY+2(p)	$10.257	$8.513	$0.266	$1.478	$0.960	$2.872	$5.234	$2.978	$2.257	$0.394	$0.163	$0.670
CY+3(p)	$10.872	$9.024	$0.282	$1.566	$1.018	$3.044	$5.652	$3.260	$2.392	$0.417	$0.172	$0.710
CY+4(p)	$11.525	$9.566	$0.299	$1.660	$1.079	$3.227	$6.094	$3.559	$2.535	$0.443	$0.183	$0.753
CY+5(p)	$12.216	$10.140	$0.317	$1.760	$1.144	$3.421	$6.563	$3.876	$2.688	$0.469	$0.194	$0.798
CY+6(p)	$12.949	$10.748	$0.336	$1.865	$1.213	$3.626	$7.060	$4.211	$2.849	$0.497	$0.205	$0.846
CY+7(p)	$13.726	$11.393	$0.356	$1.977	$1.285	$3.843	$7.587	$4.568	$3.020	$0.527	$0.218	$0.897
CY+8(p)	$14.550	$12.076	$0.377	$2.096	$1.362	$4.074	$8.146	$4.945	$3.201	$0.559	$0.231	$0.951
CY+9(p)	$15.423	$12.801	$0.400	$2.222	$1.444	$4.318	$8.738	$5.345	$3.393	$0.592	$0.244	$1.008

That is, we differentiate between cash that the company needs for operational purposes and cash that the company is holding for some other (perhaps as yet unknown) purpose. We will deal with the excess cash a bit later. The $2.556 million figure in year 1 is 28% of year 1 sales.

- Accumulated depreciation in year 1 ($2.460 million) is the accumulated depreciation from the prior year ($2.210 million) plus the new depreciation in year 1 ($0.250 million).
- The net PPE of $2.008 million is 22% of year 1 sales.
- The PPE for year 1 is inferred from the accumulated depreciation and net PPE, which gives us a PPE of $2.460 + $2.008 = $4.468 million.
- If we assume that no fixed assets are sold (which is a typical assumption for forecasting), the capital expenditures for year 1 are simply the change in the company's PPE, or $4.468 − $4.213 = $0.255 million.
- The change in NWC* for year 1 is the difference between year 1 NWC* and the previous year's NWC*, or $2.556 − $2.551 = $0.005 million.
- These calculations give us all the elements needed to compute free cash flow, which is NOPAT + Depreciation − Capital Expenditures − Change in NWC*, which is $0.836 million for year 1.

This process is repeated for each of the 10 years in the forecast period.

In examining the unlevered free cash flows, we see that the forecast for year 1 is less than the free cash flow for the current year. This occurs because the base year for our projections (CY in the table) does not conform to our assumptions for subsequent years. For example, we assume that needed net working capital will be 28% of sales in the future, but in the base year, it is 29.6% of sales. So, as far as our forecasts are concerned, the company gets an added benefit in year 1 because it does not have to create a lot of net working capital. This translates into a higher free cash flow in year 1. In more complicated models, we might see these sorts of phenomena occurring well into the future.

Value of Free Cash Flows and the Terminal Value: We can now compute the present value of the expected free cash flows shown in Table 10.5, but we must also compute the terminal value, which is the value of the expected free cash flows beyond those shown in the table. To compute the terminal value, we rely on the perpetual growth formula developed in Chapter 3. In our example, we will assume that the free cash flows grow at the long-term growth rate of 3%. We wish to value the free cash flows from years 11 on, so we compute the year 11 free cash flow to be \$1.008 × 1.03 = \$1.038 million (i.e., we take the year 10 free cash flow and multiply it by 1 plus the expected growth rate). We can then compute the terminal value to be

$$TV_{10} = \frac{FCF_{11}}{R-g} = \frac{\$1.038}{0.06898 - 0.03} = \$26.627 \text{ million.} \tag{10.10}$$

Recall that this formula is based on the assumption that the first cash flow occurs one period from the date of valuation. Since we use the free cash flow from year 11, the formula specifically gives us the value at year 10. To compute the present terminal value, we must discount the terminal value by 10 years. This gives us

$$PV(TV_{10}) = \frac{\$26.627}{1.06898^{10}} = \$13.666 \text{ million,} \tag{10.11}$$

which is our estimate of the value today of all free cash flows from year 11 on. We can now estimate the value of the company (using Equation 10.5) to be

$$V_0^C = \$13.221 + \frac{\$0.836}{1.06898} + \frac{\$0.632}{1.06898^2} + \ldots + \frac{\$0.951}{1.06898^9} + \frac{\$1.008}{1.06898^{10}} + \$13.666 = \$32.484 \text{ million.} \tag{10.12}$$

The first term of the equation is our estimate of the level of excess cash being held by the company. The discounted terms are the present values of the expected free cash flows over the next 10 years. The last term is the present value of the terminal value.

Now that we have estimated the value of the entire company, we must estimate the remaining terms in Equation 10.3. Specifically, we must value the company's debt, preferred stock, and ESOs (both outstanding ones and those we expect the company to issue). Since we have already estimated the values of debt and preferred stock in our WACC analysis, all that remains is to evaluate the company's ESO program.

Value of ESOs: Recall from Chapter 8 that we can estimate the value of existing ESOs with the Black-Scholes option pricing formula adjusted for ESOs. Specifically, we can use numerical techniques (trial and error or Excel's Solver function, for example) to solve Equation 8.11 for the value of the company's outstanding ESOs. Although that equation gives us a relatively precise way to estimate the value of ESOs, investment professionals typically opt for the basic Black-Scholes formula. As we mentioned in the last chapter, this is a reasonable approximation as long as the company does not have a large number of ESOs outstanding. In this example, the company has only 40,000 ESOs outstanding with 1,000,000 shares outstanding, so the basic Black-Scholes formula (Equation 8.5 in Chapter 8) is a reasonable choice.

Recall from Chapter 8 that the Black-Scholes formula requires a continuously compounded risk-free rate, but that ESO values are very insensitive to changes in the risk-free rate. Because of this, it seems that most investment professionals do not convert Treasury yields into continuously compounded interest rates. Although the conversion is simple, our purpose is to describe and discuss how various valuation models are used in the investment world. Thus we will simply use the Treasury yield (3.11%) as our estimate of the continuously compounded risk-free rate. Using the Black-Scholes formula, we find that the value of a nonforfeited ESO is \$0.881. With 40,000 ESOs outstanding and an expected forfeiture rate of 2.2%, we estimate the value of the outstanding ESOs to be $40{,}000 \times (1 - 0.022) \times \$0.881 = \$34{,}465$. This is very small relative to the market value of the company's common stock (which is some \$7.62 million), so the currently outstanding ESOs will have only a very small impact on the stock value. This does not necessarily mean, however, that we can ignore ESOs altogether. Remember that the company may issue additional ESOs in the future, and they might have a significant impact on common stock value. We must therefore consider the likelihood that the company will issue additional ESOs in the future and must estimate the present value of those issuances.

Typically and unless we have reason to believe otherwise, we estimate the value of future issuances as a percentage of the company's sales. In a real-world example (such as O'Charley's, which was considered at the end of the last chapter), we would examine the historical data provided by the company in its annual reports. That data would provide a basis for estimating the ratio of the value of ESOs granted to the company's sales each year historically. That in turn would give us a basis for estimating the future ratio of the value of ESOs granted to the company's sales. In our simple example here, we only have the company's estimate of the value of an ESO at the time it was granted ($1.10 from Table 10.3). With 40,000 ESOs and an expected forfeiture rate of 2.2%, we see that the company issued ESOs that were worth 40,000 × (1 − 0.022) × $1.10 = $43,032 at the time they were issued. That represents $43,032/$8,612,000 = 0.5% of sales, which gives us an idea of what the company might do in the future. Let us assume that the company will issue ESOs during each of the next 10 years and that those ESOs will have a value equal to 0.5% of the sales for that year. For all subsequent years, we will assume that the value of ESOs granted will grow at the long-term growth rate of 3%. Table 10.6 shows the resulting values. Our desire is to determine how these future issuances will affect the value of the company's common stock today, so we need to discount the ESO values to the present. To do this, we must first calculate

TABLE 10.6

Value of ESOs to be Issued, Example 10.2

Year	Value of ESOs
1	$0.0482
2	$0.0540
3	$0.0605
4	$0.0665
5	$0.0725
6	$0.0783
7	$0.0838
8	$0.0889
9	$0.0933
10	$0.0970
11 − ∞	3% growth

a terminal value to capture the value of ESOs to be granted from year 11 on. This terminal value is

$$\text{Terminal Value of ESOs to be Granted} = \frac{\$0.0970 \times 1.03}{0.06898 - 0.03} = \$2.563 \text{ million.} \tag{10.13}$$

We can now compute the impact of the ESOs by adding the value of outstanding ESOs to the present value of ESOs to be granted. This gives us

$$\text{Total ESO Value} = 0.03446 + \frac{\$0.0482}{1.06898} + \mathbf{L} + \frac{\$0.0970}{1.06898^{10}} + \frac{\$2.563}{1.06898^{10}} = \$1.818 \text{ million.} \tag{10.14}$$

After taxes, we see that the total impact of ESOs on the value of the company's common stock is \$1.818(1 − 0.35) = \$1.182 million. The first term on the right side of Equation 10.14 is the value of the company's outstanding ESOs. The remaining terms are the present value of the ESOs we expect the company to issue in the next 10 years and the present terminal value (which is the value of ESOs to be granted from year 11 on). With 1,000,000 shares outstanding, we see that the ESO impact is about \$1.18 per share.

Value of Equity: We are now in a position to estimate the value of the company's common stock. Using Equation 10.3 and substituting the values we have computed above, we find that the value of equity is \$32.484 − \$5.240 − \$1.719 − \$1.182 = \$24.343 million, or \$24.34 per share! Given that the current stock price is only \$7.62, we *tentatively* conclude that the stock is substantially undervalued. We might be tempted to hurry out and buy the stock at this point. After all, our estimate of stock value is so far above the market price that even if some of our forecasts are off, we would still likely find that the stock is undervalued. This argument is a bit presumptuous, however. We have analyzed information that is readily available to the market, yet we arrive at a valuation that is entirely different from that made by the market. Who is missing something, us or the market? Could it be, for example, that we have missed a news report indicating that the company is under investigation by the SEC or that the company is being sued for a large sum? Alternatively, it might be something as simple as overly optimistic growth forecasts. To get a better feel for what the numbers really tell us, we should conduct sensitivity analysis so that we can understand the importance of our assumptions in terms of how they affect our value estimate.

Sensitivity Analysis: There are many ways in which we might evaluate how sensitive our valuation is to changes in our assumptions. At the simple end of the spectrum, we might simply change the value of an assumption to see how much our value estimate changes. At the complex end of the spectrum, we might conduct a *Monte Carlo analysis*, which involves assuming random distributions on the unknown variables and then computing a distribution of value estimates. Intuitively, this approach is quite appealing because once we have the distribution of our value estimate, we can compute statistics, such as the probability that the stock will outperform the market. There are, however, some drawbacks. First, although the process itself is quite simple for an experienced analyst with exceptional computer skills, it is extremely difficult for the vast majority of people. Second, the quality of the analysis depends on the quality of the inputs, and estimating the distributions of the unknown variables is far from trivial. As such, it is not clear how much value would be added by a Monte Carlo analysis in this framework. Although such approaches are not unheard of in the investment world, most investment professionals do not bother with Monte Carlo analysis but instead rely on scenario analysis to increase their understanding of the company.

Table 10.7 shows three panels that depict one way to visualize scenario analysis. In two-factor sensitivity panels of this sort, we simply choose two variables and then investigate how changes in those variables affect our estimate of stock value. In the first panel of Table 10.7, we investigate the effects of the WACC and our sales growth estimate. Looking down any column, we see that our value estimate is relatively insensitive to changes in our sales growth estimate but is quite sensitive to our estimate of the WACC (look across any row). Similarly, the second panel shows that our value estimate is relatively insensitive to our assumption on net PPE but relatively sensitive to our costs assumption. There are several points to consider in examining these panels. First, in this example the choice of what numbers to use is somewhat arbitrary, but in reality it would be based on how confident we are in our parameter estimates. For example, we have chosen to let the costs/sales ratio vary between 79% and 87%. Presumably, we have chosen these numbers because we believe 79% is a worst-case scenario and 87% is a best-case scenario. If we believe otherwise, then we should change our parameter assumptions accordingly. Second, this example is overly simplistic in that we have lumped all

TABLE 10.7

Sensitivity Analysis, Example 10.2

		WACC				
		5.898%	6.398%	6.898%	7.398%	7.898%
	0%	$27.19	$24.24	$22.05	$20.35	$18.99
	3%	$29.01	$25.70	$23.23	$21.33	$19.81
Annual sales growth	6%	$30.36	$26.75	**$24.07**	$22.00	$20.35
	9%	$30.87	$27.10	$24.30	$22.14	$20.43
	12%	$30.04	$26.33	$23.57	$21.45	$19.77

		Costs/sales				
		79%	81%	83%	85%	87%
	20%	$32.57	$28.78	$24.99	$21.20	$17.42
	21%	$32.11	$28.32	$24.53	$20.74	$16.95
Net PPE/sales	22%	$31.64	$27.86	**$24.07**	$20.28	$16.49
	23%	$31.18	$27.39	$23.61	$19.82	$16.03
	24%	$30.72	$26.93	$23.14	$19.35	$15.57

		WACC				
		5.898%	6.398%	6.898%	7.398%	7.898%
	79%	$40.65	$35.48	$31.64	$28.68	$26.33
	81%	$35.50	$31.11	$27.86	$25.34	$23.34
Costs/sales	83%	$30.36	$26.75	**$24.07**	$22.00	$20.35
	85%	$25.22	$22.38	$20.28	$18.66	$17.36
	87%	$20.07	$18.02	$16.49	$15.31	$14.38

of the costs together and have not parsed sales into more meaningful categories. In reality, we would want to examine these categories in as much depth as possible so that we understand what really drives the value of the company. Third, notice that each value estimate in the table is well above the current stock price of $7.62. This is not sufficient to justify buying the stock, but it is a good start.

The third panel explores the two most sensitive factors, the WACC and the costs/sales ratio. This panel is important because the WACC and costs/sales ratio seem to be the most important factors (of the four we are considering here). It follows that the third panel gives us good information about the distribution of possible stock values. If, for example, we believe that the worst-case costs/sales ratio is around 87% and the worst-case WACC around 7.9%, then the third panel suggests that the true value of the stock is likely to be above $14.38. Similarly, we might conclude that the stock is not likely to be worth more than $40.65. Of course, this analysis is a bit superficial in that it ignores the correlation between some variables. For example, a high costs/sales ratio would generally be associated with lower sales. Two-factor sensitivity tables are typically not sophisticated enough to capture these correlations, but we can address those issues separately by developing realistic scenarios based on our beliefs about the potential values for each parameter and how they are related to each other.

Ultimately, we would couple what we learn here with relative valuation results (which we discussed in the last chapter) and with our qualitative understanding of what is really going on at the company. Only then could we begin to make a decision on potentially buying the stock.

IN PRACTICE . . .

When conducted by investment professionals, DCF analysis proceeds in much the way that we have described here. There is one minor difference that is worthy of mention. In our development, we separated excess cash from needed (or operational) cash. We then captured changes in the needed cash in our forecasts of the company's changes in net working capital. In practice, many professionals leave cash out of the net working capital equation entirely and instead handle it through something called *net debt*. Intuitively, they explain, cash can be used to pay down the debt at any point, so we can simply subtract the company's cash on hand from the value of debt. We call the result the company's *net debt*. This approach is roughly equivalent to what we have discussed here. In our approach, we include cash as part of the Total Company Value in Equation 10.3. In the net debt approach, we subtract it from the Value of Debt in that equation. Of course, we then subtract the value of debt, so the cash is effectively added in that approach as well. Thus, the distinction is largely one of semantics. There is, however, a subtle issue in that with the net debt approach, we do not evaluate the amount of cash the company really needs. It follows that the approach we have outlined throughout this book is a bit more descriptive.

CASE STUDY

We can now return to our case study of O'Charley's. Fortunately, nearly all of the work has already been done. We estimated the company's WACC in Chapter 6, and we forecasted the company's unlevered free cash flows in Chapter 7. We also evaluated the company's ESO program in Chapter 8, so the pieces are ready to be put together. Table 10.8 recaps much of the information we have generated about O'Charley's. Since we have already walked through the free cash flow forecasts, we will not repeat that discussion here. Instead, we will simply focus on how our estimate of stock value changes when various parameters change. Table 10.9 shows the value of a share of O'Charley's stock based on different parameter assumptions. Scenario 1 is a bit misleading in that we estimate a stock value of $0.36. We are right to be suspicious here. The scenario is rather pessimistic, and we implicitly assume that the company's problems will continue indefinitely. In such a scenario, the company's ESOs would be essentially worthless, yet in this DCF approach, we would still subtract a large number ($42 million from outstanding ESOs alone) to compensate for the effect of the ESOs. In such scenarios, we must use common sense

TABLE 10.8

Summary Information, O'Charley's

Financial statement analysis	The company is struggling to control its expenses because customer visits per restaurant are low
Cost of capital	The WACC is about 6.34% according to our calculations, but something a bit higher is probably more accurate.
Forecasting	Currently, the company's sustainable growth rate is about 5.34% and the company plans to expand at a pace of about 7%. With only a small improvement in efficiency, the company can expand at that rate without raising additional funds.
ESO program	The company's outstanding ESO have a value of roughly $42 million. Future issuances likely to be about 1% of annual sales.
Relative valuation	Market does not seem to believe that O'Charley's problems will be corrected. If the market is wrong, the stock could easily double in a short period of time.

TABLE 10.9

Value Estimates using the DCF Model, O'Charley's

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
WACC	6.30%	6.30%	6.30%	7.50%	7.50%
Growth in revenues	7.00%	7.00%	12.00%	12.00%	20.00%
F&B costs/sales	30.00%	30.00%	30.00%	30.00%	30.00%
Labor costs/sales	32.00%	30.00%	30.00%	30.00%	29.00%
Other costs of sales/sales	18.80%	18.80%	18.80%	18.80%	18.80%
SG&A/sales	7.20%	7.20%	7.20%	7.20%	7.20%
Other income (expense)/sales	−5.40%	−5.40%	−5.40%	−5.40%	−5.40%
Depreciation/net PPE	9.00%	9.00%	9.00%	9.00%	9.00%
Growth in net PPE	7.00%	7.00%	12.00%	10.00%	17.00%
NWC/sales	−3.75%	−3.75%	−3.75%	−3.75%	−3.75%
ESOs granted/sales	1.00%	1.00%	1.00%	1.00%	1.00%
Value per share	$0.36	$23.01	$52.49	$34.92	$102.17

and adapt our process to what we know to be true. In this case, we would recognize that the ESO program would have a much smaller effect than we have assumed. We might revisit our assumptions and come up with new estimate for the value of those ESOs, or we might just make a note that in such a scenario, the company's stock would be worth very little.

Scenario 2 shows a more optimistic situation in which the company's labor costs drop to 30% of sales. In that case the stock would be worth about $23 per share, which is about the price at which it currently trades. This scenario is, to a certain extent, a bit unrealistic because if the company gets its costs under control, it can return to a more aggressive expansion plan. Scenario 3 shows one such situation. Here we assume that the company will expand at 12% per year for the next 10 years. Notice that we also assumed that the company's net PPE (i.e., the fixed assets) will grow at only 10% per year. In doing so, we incorporate the idea we discussed in Chapter 7—that if the company is able to attract more customers to its restaurants, it will have two sources of growth. In this case, we implicitly assume that the company will increase the number of its restaurants by about 10% per year, but will get an additional 2% in sales due to more visits at existing restaurants. In that case, the value of the company's stock is over $52 per share, which would constitute a sizable return on an investment in the company.

Recall from Chapter 6 that our estimate of the company's WACC was a bit suspect. Scenario 4 shows what might be a more reasonable scenario in which the WACC is 7.5%. In that case, the stock is worth about $25 per share, which is in line with the current price. We can (and should) continue playing around with the number to get a good feel for how the different variables affect the stock's value, but we have already developed a reasonable understanding. We know, for example, that future movements in the stock price depend heavily on the ability to attract more customers to existing stores. At this point, we would typically shift our focus to an evaluation of how likely it is that the company's initiatives will succeed. To understand the potential a bit better, let us consider one final scenario. In Scenario 5, we see what the company is really trying to achieve. We have high sales growth (20% per year), part of which is due to expansion and part to more customer visits per restaurant (i.e., we have assumed that the company's fixed assets will grow at only 17% per year). We have also assumed that the labor costs will be only 29% of sales. In this scenario, we estimate that the stock would be worth a whopping $102.17. Is it really worth that much? At this point, we simply do not know. Unfortunately, the quantitative analysis presented here is only part of the story, and we are now left with the problem of assessing what is going on with the company qualitatively. We will leave much of that for readers to complete on their own, but it is fitting that we close this book by thinking about how Warren Buffett would likely view O'Charley's.

Buffettology

As Robert Hagstrom carefully relates in his book *The Warren Buffett Way* (which is a must-read for anyone interested in stock valuation), Buffett subscribes to 12 basic tenets. To close our study of O'Charley's we will briefly discuss the company in light of these tenets.

1. Business Tenet 1: *Is the business simple and understandable?*
   The restaurant business is quite easy to understand (which is one reason we examined O'Charley's in the first place), so the company certainly satisfies this tenet.
2. Business Tenet 2: *Does the business have a consistent operating history?*
   For brevity's sake, we consider only the last 3 years of the company's history, but suffice it to say that the operating history has not been consistent. We did see some evidence of this in

our financial statement analysis, in which we saw the company's costs creep up over the last few years.

3. Business Tenet 3: *Does the business have favorable long-term prospects?* The answer depends on whether we believe the company can get more people to eat at its restaurants. If it can, then the company represents a potential turnaround story.
4. Management Tenet 1: *Is management rational?* Because our focus here was on specific valuation approaches, we paid little attention to the actions of company managers. Still, there is evidence that they are indeed rational. Recall that managers have chosen to slow down the company's expansion plans while they try to increase customer visits per restaurant. This is precisely the right response, given our observations concerning the company's problems.
5. Management Tenet 2: *Is management candid with shareholders?* Management has been quite forthcoming about the company's problems (interested readers can evaluate this for themselves by reading through the Management Discussion sections of the company's reports), so there is evidence that indicates that they are being candid.
6. Management Tenet 3: *Does management resist the institutional imperative?* (That is, does management act as a leader or as a follower in the industry?) Overall, we might reasonably conclude that O'Charley's is interested in being another Applebee's. Thus there is some evidence that management does not resist the institutional imperative.
7. Financial Tenet 1: *Focus on return on equity, not earnings per share.* Certainly, a large portion of our focus has been on ROE (recall our DuPont discussion, for example). In the case of O'Charley's, we see a company with an ROE that trails the rest of the industry. Unless we believe that situation will change, the company would likely fail this tenet.
8. Financial Tenet 2: *Calculate "owner earnings" to get a true reflection of value* (note that "owner earnings" are equivalent to our free cash flows). As with ROE, the company is struggling to generate adequate owner earnings.

9. Financial Tenet 3: *Look for companies with high profit margins.*
   As we have already discussed at length, the company has a rather low profit margin and would therefore fail this tenet as things currently stand.
10. Financial Tenet 4: *For every dollar retained, make sure the company has created at least one dollar of market value* (note that this is equivalent to saying that the free cash flow yield must exceed the company's WACC).
    As we discussed earlier, the company's free cash flow yield is currently below the WACC, which means that for every dollar invested, the company is currently receiving less than a dollar in value.
11. Market Tenet 1: *What is the value of the business?*
    This and the twelfth tenet go hand in hand, but we do note that the entire purpose of this book is to consider how to answer this particular question.
12. Market Tenet 2: *Can the business be purchased at a significant discount to its value?*
    As we indicated a bit earlier, we simply do not know the answer to this yet.

So, would Warren Buffett be interested in a company like O'Charley's? The answer is almost certainly no. In thinking through his investment tenets, we see that the company lacks the stability and the profitability that Buffett values so highly. As such, it would be quite surprising if he were to buy a company of this nature. Interestingly, O'Charley's is precisely the type of company that intrigues Bill Miller, who firmly believes that the messier a situation is, the greater is his advantage. As he would certainly point out, to beat the market we must identify stocks for which the market expectations are likely to change in a predictable way. Clearly, O'Charley's has the potential to do just that, but much work remains before we can make that determination.

OTHER RECOMMENDED READINGS

Understanding stock valuation can be viewed as a continual and never-ending learning experience. As such, we would be remiss if we did not mention a few books that anyone interested in stock valuation should read.

Analysis for Financial Management by Robert C. Higgins is a superb, atypical academic text that addresses corporate financial management from a realistic and practical viewpoint. *Expectations Investing* by Alfred Rappaport and Michael Mauboussin (who now works with Bill Miller at Legg Mason) is an exceptional book for helping us understand that stock valuation is really about understanding how market expectations are likely to change. There are numerous books on Warren Buffett, but *The Warren Buffett Way* by Robert Hagstrom is especially good at giving us a flavor for how Buffett thinks. Hagstrom has also written a book called *Latticework*, which looks at stock valuation from a liberal arts perspective. More than I think any other book, *Latticework* gives great insight into how Bill Miller thinks about stocks. Finally, Peter Lynch has written several books (including *One Up On Wall Street*) in which he discusses some of the stocks he purchased and why he purchased them. All of these books are highly recommended for anyone interested in stock valuation.

This page intentionally left blank

BIBLIOGRAPHY

Asness, Clifford. "Fight the Fed Model." *The Journal of Portfolio Management* 30 (Fall 2003): 11–24.

Bernstein, Peter L. *Portfolio Management and Efficient Markets: Theoretical Relevance and Practical Applications*. New York: Institutional Investor Books, 1977.

Bernstein, Peter L. *Capital Ideas: The Improbable Origins of Modern Wall Street*. New York: The Free Press, 1992.

Black, Fisher. "Fact and Fantasy in the Use of Options." *Financial Analysts Journal* 31 (July–August 1975): 36–72.

Black, Fisher. "The Pricing of Options and Corporate Liabilities." *Journal of Political Economy* 81 (May–June 1973): 637–59.

Copeland, Thomas E. and J. Fred Weston. *Financial Theory and Corporate Policy*, 2nd ed. Reading, MA: Addison-Wesley Publishing Company, 1988.

Copeland, Tom, Tim Koller, and Jack Murrin. *Valuation: Measuring and Managing the Value of Companies*, 2nd ed. New York: John Wiley & Sons, 1995.

Damodaran, Aswath. *Investment Valuation*. New York: John Wiley and Sons, 2002.

Daves, Phillip R., Michael C. Ehrhardt, and Ronald E. Shrieves. *Corporate Valuation: A Guide for Managers and Investors*. Mason, OH: Thomson Southwestern, 2004.

Ellis, Charles D. *Winning the Loser's Game*, 4th ed. New York: McGraw-Hill, 2002.

Fama, Eugene F. and Kenneth R. French. "The Cross-Section of Expected Stock Returns." *Journal of Finance* 47 (June 1992): 427–65.

Geske, Robert. "A Note on an Analytic Valuation Formula for Unprotected American Call Options on Stocks with Known Dividends." *Journal of Financial Economics* 7 (1979): 375–80.

Geske, Robert. "Comments on Whaley's Note." *Journal of Financial Economics* 9, (June 1981): 213–15.

Graham, Benjamin. *The Intelligent Investor*, 4th rev. ed. New York: Harper Business Essentials, 2003.

Graham, Benjamin and David L. Dodd. *Security Analysis: Principles and Techniques*, 2nd ed. New York and London: McGraw-Hill, 1940.

Grossman, Sanford J. and Joseph E. Stiglitz. "On the Impossibility of Informationally Efficient Markets." *American Economic Review* 70 (June 1980): 393–408.

Hagstrom, Robert G. *The Warren Buffett Way*. New York: John Wiley and Sons, 1995.

Hagstrom, Robert G. *Latticework: The New Investing*. New York: Texere, 2000.

Haugen, Robert A. *The Inefficient Stock Market: What Pays Off and Why*. Upper Saddle River, NJ: Prentice Hall, 1999.

Haugen, Robert A. *The New Finance: The Case Against Efficient Markets*, 2nd ed. Upper Saddle River, NJ: Prentice Hall, 1999.

Haugen, Robert A. *The New Finance: Overreaction, Complexity, and Uniqueness*, 2nd ed. Upper Saddle River, NJ: Prentice Hall, 2004.

Higgins, Robert C. *Analysis for Financial Management*, 7th ed. New York: McGraw-Hill, 2003.

Hoover, Scott A. "Inflation-Adjusted Retirement Planning." *Advances in Financial Education* (Fall 2004): 99–112.

Hoover, Scott A. and Frederic P. Sterbenz. "A Reality-Based Method of Valuing Stocks." *Journal of Financial Education* (Spring 2003): 49–65

Hull, John C. *Options, Futures, and Other Derivatives*, 4th ed. Upper Saddle River, NJ: Prentice Hall, 2000.

Ingersoll, Jonathan E., Jr. *Theory of Financial Decision Making*. Savage, MD: Rowman and Littlefield, 1987.

Jegers, Marc. "A Generalized Expression for the Sustainable Growth Rate of a Firm." *RISEC: International Review of Economics and Business* 46 (January 2000): 13–34.

Kester, George W., Scott A. Hoover, and Kipling M. Pirkle. "How Much Debt Can Your Borrower Afford?" *The RMA Journal* (November 2004): 40–45.

Kester, George W. and Scott A. Hoover. "FRICTO Analysis: A Framework for Making Capital Structure and Financing Decisions." *Journal of Financial Education* 31 (Summer 2005): 61–68.

Lowe, Janet. *The Man Who Beats the S&L: Investing with Bill Miller*. New York: John Wiley and Sons, 2002.

Lowenstein, Roger. *Buffett: The Making of an American Capitalist*. New York: Main Street Books, 1995.

Lynch, Peter. *One Up On Wall Street*, 1st Fireside ed. New York: Simon and Schuster, 2000.

Malkiel, Burton G. "Equity Yields, Growth, and the Structure of Share Prices." *American Economic Review* 53 (December 1963): 1004–31.

Malkiel, Burton G. *A Random Walk Down Wall Street*. New York and London: W.W. Norton & Company, 1999.

Merton, Robert C. "Theory of Rational Option Pricing." *Bell Journal of Economics and Management Science* 4 (Spring 1973): 141–83.

Modigliani, Franco and Merton H. Miller. "The Cost of Capital, Corporation Finance, and the Theory of Investment." *American Economic Review* (June 1958): 261–97.

Modigliani, Franco and Merton H. Miller. "Debt and Taxes." *Journal of Finance* 32 (May 1977): 261–75.

Myers, Stewart C. and Nicholas S. Majluf. "Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have." *Journal of Financial Economics* 13 (June 1984): 187–221.

Rappaport, Alfred, and Michael J. Mauboussin. *Expectations Investing: Reading Stock Prices for Better Returns*. Boston: Harvard Business School Press, 2001.

Roll, Richard. "An Analytic Formula for Unprotected American Call Options on Stocks with Known Dividends." *Journal of Financial Economics* 5 (1977): 251–58.

Schilit, Howard. *Financial Shenanigans: How to Detect Accounting Gimmicks & Fraud in Financial Reports*, 2nd ed. New York: McGraw-Hill, 2002.

Shiller, Robert J. *Irrational Exuberance*. Princeton, NJ: Princeton University Press, 2000.

Whaley, Robert E. "On the Valuation of American Call Options on Stocks with Known Dividends." *Journal of Financial Economics* 9 (June 1981): 2017–211.

This page intentionally left blank

INDEX