WILEY FINANCE

Damodaran on Valuation

SECOND EDITION

SECURITY ANALYSIS FOR INVESTMENT AND CORPORATE FINANCE

Aswath Damodaran

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John Wiley & Sons, Inc.

Published by John Wiley & Sons, Inc., Hoboken, New Jersey.
Published simultaneously in Canada.

Library of Congress Cataloging-in-Publication Data:

Damodaran, Aswath.
Damodaran on valuation : security analysis for investment and corporate finance / Aswath Damodaran.—2nd ed.
p. cm.—(Wiley finance series)
Includes index.
ISBN-13 978-0-471-75121-2 (cloth)
ISBN-10 0-471-75121-9 (cloth)
1. Corporations—Valuation—Mathematical models. 2. Capital assets pricing model. 3. Investment analysis. I. Title. II. Series.
HG4028.V3D35 2006
658.15—dc22

2006004905

Printed in the United States of America.

10 9 8 7 6 5 4 3 2 1

To all those people with whom
I have debated valuation issues over time
and who have pointed out the errors
(or at least the limitations)
of my ways

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Preface

There is nothing so dangerous as the pursuit of a rational investment policy in an irrational world.

—John Maynard Keynes

Lord Keynes was not alone in believing that the pursuit of true value based on financial fundamentals is a fruitless one in markets where prices often seem to have little to do with value. There have always been investors in financial markets who have argued that market prices are determined by the perceptions (and misperceptions) of buyers and sellers, and not by anything as prosaic as cash flows or earnings. I do not disagree with them that investor perceptions matter, but I do disagree with the notion that they are *all* that matter. It is a fundamental precept of this book that it is possible to estimate value from financial fundamentals, albeit with error, for most assets, and that the market price cannot deviate from this value in the long term.[1] From the tulip bulb craze in Holland in the early seventeenth century to the South Sea Bubble in England in the 1800s to the stock markets of the present, markets have shown the capacity to correct themselves, often at the expense of those who believed that the day of reckoning would never come.

The first edition of this book was my first attempt at writing a book, and hopefully I have gained from my experiences since. In fact, this edition is very different from the prior edition for a simple reason. My other book on investment valuation, also published by John Wiley & Sons, was designed to be a comprehensive valuation book, and repeating what was said in that book here, in compressed form, strikes me as a waste of time and resources.

This book has three parts to it. The first two parts, which stretch through the first nine chapters, provide a compressed version of both discounted cash flow and relative valuation models and should be familiar territory for anyone who has done or read about valuation before. The third part, which comprises the last nine chapters, is dedicated to looking at what I call the loose ends in valuation that get short shrift in both valuation books and discussions. Included here are topics like liquidity, control, synergy, transparency, and distress, all of which affect valuations significantly but either are dealt with in a piecemeal fashion or take the form of arbitrary premiums and discounts. You will notice that this section has more references to prior work in the area and is denser, partly because there is more debate about what the evidence is and what we should do in valuation. I do not claim to

[1]But then again, as Keynes would have said, "In the long term, we are all dead."

have the answer to what the value of control should be in a firm, but the chapter on control should give you a road map that may help you come up with the answer on your own.

The four basic principles that I laid out in the Preface to the first edition continue to hold on this one. First, I have attempted to be as comprehensive as possible in covering the range of valuation models that are available to an analyst doing a valuation, while presenting the common elements in these models and providing a framework that can be used to pick the right model for any valuation scenario. Second, the models are presented with real-world examples, warts and all, so as to capture some of the problems inherent in applying these models. There is the obvious danger that some of these valuations will appear to be hopelessly wrong in hindsight, but this cost is well worth the benefits. Third, in keeping with my belief that valuation models are universal and not market-specific, illustrations from markets outside the United States are interspersed through the book. Finally, I have tried to make the book as modular as possible, enabling a reader to pick and choose sections of the book to read, without a significant loss of continuity.

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New York, New York
June 2006

CHAPTER 1

Introduction to Valuation

Knowing what an asset is worth and what determines that value is a prerequisite for intelligent decision making—in choosing investments for a portfolio, in deciding on the appropriate price to pay or receive in a takeover, and in making investment, financing, and dividend choices when running a business. The premise of this book is that we can make reasonable estimates of value for most assets, and that the same fundamental principles determine the values of all types of assets, real as well as financial. Some assets are easier to value than others, the details of valuation vary from asset to asset, and the uncertainty associated with value estimates is different for different assets, but the core principles remain the same. This chapter lays out some general insights about the valuation process and outlines the role that valuation plays in portfolio management, in acquisition analysis, and in corporate finance. It also examines the three basic approaches that can be used to value an asset.

A PHILOSOPHICAL BASIS FOR VALUATION

A postulate of sound investing is that an investor does not pay more for an asset than it is worth. This statement may seem logical and obvious, but it is forgotten and rediscovered at some time in every generation and in every market. There are those who are disingenuous enough to argue that value is in the eyes of the beholder, and that any price can be justified if there are other investors willing to pay that price. That is patently absurd. Perceptions may be all that matter when the asset is a painting or a sculpture, but we do not and should not buy most assets for aesthetic or emotional reasons; we buy financial assets for the cash flows we expect to receive from them. Consequently, perceptions of value have to be backed up by reality, which implies that the price we pay for any asset should reflect the cash flows it is expected to generate. The models of valuation described in this book attempt to relate value to the level of, uncertainty about, and expected growth in these cash flows.

There are many aspects of valuation where we can agree to disagree, including estimates of true value and how long it will take for prices to adjust to that true value. But there is one point on which there can be no disagreement. Asset prices cannot be justified by merely using the argument that there will be other investors around who will pay a higher price in the future. That is the equivalent of playing a very expensive game of musical chairs, where every investor has to answer the question "Where will I be when the music stops?" before playing. The problem with investing with the expectation that when the time comes there will be a bigger fool around to whom to sell an asset is that you might end up being the biggest fool of all.

INSIDE THE VALUATION PROCESS

There are two extreme views of the valuation process. At one end are those who believe that valuation, done right, is a hard science, where there is little room for analyst views or human error. At the other are those who feel that valuation is more of an art, where savvy analysts can manipulate the numbers to generate whatever result they want. The truth does lies somewhere in the middle, and we use this section to consider three components of the valuation process that do not get the attention they deserve—the bias that analysts bring to the process, the uncertainty that they have to grapple with, and the complexity that modern technology and easy access to information have introduced into valuation.

Value First, Valuation to Follow: Bias in Valuation

We almost never start valuing a company with a blank slate. All too often, our views on a company are formed before we start inputting the numbers into the models that we use, and, not surprisingly, our conclusions tend to reflect our biases. We begin by considering the sources of bias in valuation and then move on to evaluate how bias manifests itself in most valuations. We close with a discussion of how best to minimize or at least deal with bias in valuations.

Sources of Bias The bias in valuation starts with *the companies we choose to value*. These choices are almost never random, and how we make them can start laying the foundation for bias. It may be that we have read something in the press (good or bad) about the company or heard from an expert that it was undervalued or overvalued. Thus, we already begin with a perception about the company that we are about to value. We add to the bias when we *collect the information* we need to value the firm. The annual report and other financial statements include not only the accounting numbers but also management discussions of performance, often putting the best possible spin on the numbers. With many larger companies, it is easy to access *what other analysts following the stock think about these companies*. Zacks, IBES, and First Call, to name three services among many, provide summaries of how many analysts are bullish or bearish about the stock, and we can often access their complete valuations. Finally, we have *the market's own estimate of the value of the company*—the market price—adding to the mix. Valuations that stray too far from this number make analysts uncomfortable, since they may reflect large valuation errors (rather than market mistakes).

In many valuations, there are *institutional factors* that add to this already substantial bias. For instance, equity research analysts are more likely to issue buy rather than sell recommendations; that is, they are more likely to find firms to be undervalued than overvalued.[1] This can be traced partly to the difficulties analysts face in obtaining access to and collecting information on firms on which they have issued sell recommendations, and partly to pressure that they face from portfolio managers, some of whom might have large positions in the stock, and from their

[1]There are approximately five times as many buy recommendations issued by analysts on Wall Street as there are sell recommendations.

own firm's investment banking arms, which have other profitable relationships with the firms in question.

The *reward and punishment structure* associated with finding companies to be undervalued and overvalued is also a contributor to bias. Analysts whose compensation is dependent upon whether they find firms to be under- or overvalued will be biased in their conclusions. This should explain why acquisition valuations are so often biased upward. The analysis of the deal, which is usually done by the acquiring firm's investment banker, who also happens to be responsible for carrying the deal to its successful conclusion, can come to one of two conclusions. One is to find that the deal is seriously overpriced and recommend rejection, in which case the analyst receives the eternal gratitude of the stockholders of the acquiring firm but little else. The other is to find that the deal makes sense (no matter what the price is) and to reap the ample financial windfall from getting the deal done.

Manifestations of Bias There are three ways in which our views on a company (and the biases we have) can manifest themselves in value. The first is in the *inputs* that we use in the valuation. When we value companies, we constantly come to forks in the road where we have to make assumptions to move on. These assumptions can be optimistic or pessimistic. For a company with high operating margins now, we can assume either that competition will drive the margins down to industry averages very quickly (pessimistic) or that the company will be able to maintain its margins for an extended period (optimistic). The path we choose will reflect our prior biases. It should come as no surprise then that the end value that we arrive at is reflective of the optimistic or pessimistic choices we made along the way.

The second is in what we will call *postvaluation tinkering*, where analysts revisit assumptions after a valuation in an attempt to get a value closer to what they had expected to obtain starting off. Thus, an analyst who values a company at $15 per share, when the market price is $25, may revise his growth rates upward and his risk downward to come up with a higher value, if he believed that the company was undervalued to begin with.

The third is to leave the value as is but attribute the difference between the value we estimate and the value we think is the right one to a *qualitative factor* such as synergy or strategic considerations. This is a common device in acquisition valuation where analysts are often called upon to justify the unjustifiable. In fact, the use of premiums and discounts, where we augment or reduce estimated value, provides a window on the bias in the process. The use of premiums—control and synergy are good examples—is commonplace in acquisition valuations, where the bias is toward pushing value upward (to justify high acquisition prices). The use of discounts—illiquidity and minority discounts, for instance—are more typical in private company valuations for tax and divorce court, where the objective is often to report as low a value as possible for a company.

What to Do about Bias Bias cannot be regulated or legislated out of existence. Analysts are human and bring their biases to the table. However, there are several ways in which we can mitigate the effects of bias on valuation:

1. *Reduce institutional pressures.* As we noted earlier, a significant portion of bias can be attributed to institutional factors. Equity research analysts in the 1990s,

for instance, in addition to dealing with all of the standard sources of bias had to grapple with the demand from their employers that they bring in investment banking business. Institutions that want honest sell-side equity research should protect their equity research analysts who issue sell recommendations on companies, not only from irate companies but also from their own salespeople and portfolio managers.

2. *Delink valuations from reward/punishment.* Any valuation process where the reward or punishment is conditional on the outcome of the valuation will result in biased valuations. In other words, if we want acquisition valuations to be unbiased, we have to separate the deal analysis from the deal making.
3. *No precommitments.* Decision makers should avoid taking strong public positions on the value of a firm before the valuation is complete. An acquiring firm that comes up with a price prior to the valuation of a target firm has put analysts in an untenable position in which they are called upon to justify this price. In far too many cases, the decision on whether a firm is undervalued or overvalued precedes the actual valuation, leading to seriously biased analyses.
4. *Self-awareness.* The best antidote to bias is awareness. An analyst who is aware of the biases he or she brings to the valuation process can either actively try to confront these biases when making input choices or open the process up to more objective points of view about a company's future.
5. *Honest reporting.* In Bayesian statistics, analysts are required to reveal their priors (biases) before they present their results from an analysis. Thus, an environmentalist will have to reveal that he or she strongly believes that there is a hole in the ozone layer before presenting empirical evidence to that effect. The person reviewing the study can then factor that bias in while looking at the conclusions. Valuations would be much more useful if analysts revealed their biases up front.

While we cannot eliminate bias in valuations, we can try to minimize its impact by designing valuation processes that are more protected from overt outside influences and by reporting our biases with our estimated values.

It Is Only an Estimate: Imprecision and Uncertainty in Valuation

Starting early in life, we are taught that if we do things right, we will get the right answers. In other words, the precision of the answer is used as a measure of the quality of the process that yielded the answer. While this may be appropriate in mathematics or physics, it is a poor measure of quality in valuation. Barring a very small subset of assets, there will always be uncertainty associated with valuations, and even the best valuations come with a substantial margin for error. In this section, we examine the sources of uncertainty and the consequences for valuation.

Sources of Uncertainty Uncertainty is part and parcel of the valuation process, both at the point in time when we value a business and in how that value evolves over time as we obtain new information that impacts the valuation. That informa-

tion can be specific to the firm being valued, can be more generally about the sector in which the firm operates, or can even be general market information (about interest rates and the economy).

When valuing an asset at any point in time, we make forecasts for the future. Since none of us possess crystal balls, we have to make our best estimates given the information that we have at the time of the valuation. Our estimates of value can be wrong for a number of reasons, and we can categorize these reasons into three groups.

1. *Estimation uncertainty.* Even if our information sources are impeccable, we have to convert raw information into inputs and use these inputs in models. Any mistakes or misassessments that we make at either stage of this process will cause estimation error.
2. *Firm-specific uncertainty.* The path that we envision for a firm can prove to be hopelessly wrong. The firm may do much better or much worse than we expected, and the resulting earnings and cash flows will be very different from our estimates.
3. *Macroeconomic uncertainty.* Even if a firm evolves exactly the way we expected it to, the macroeconomic environment can change in unpredictable ways. Interest rates can go up or down, and the economy can do much better or worse than expected. These macroeconomic changes will affect value.

The contribution of each type of uncertainty to the overall uncertainty associated with a valuation can vary across companies. When valuing a mature cyclical or commodity company, it may be macroeconomic uncertainty that is the biggest factor causing actual numbers to deviate from expectations. Valuing a young technology company can expose analysts to far more estimation and firm-specific uncertainty. Note that the only source of uncertainty that can be clearly laid at the feet of the analyst is estimation uncertainty.

Even if we feel comfortable with our estimates of an asset's values at any point in time, that value itself will change over time as a consequence of new information that comes out both about the firm and about the overall market. Given the constant flow of information into financial markets, a valuation done on a firm ages quickly and has to be updated to reflect current information. Thus, technology companies that were valued highly in late 1999, on the assumption that the high growth from the 1990s would continue into the future, would have been valued much less in early 2001, as the prospects of future growth dimmed. With the benefit of hindsight, the valuations of these companies (and the analyst recommendations) made in 1999 can be criticized, but they may well have been reasonable given the information available at that time.

Responses of Uncertainty Analysts who value companies confront uncertainty at every turn in a valuation and they respond to it in both healthy and unhealthy ways. Among the healthy responses are:

- *Better valuation models.* Building better valuation models that use more of the information that is available at the time of the valuation is one way of attacking the uncertainty problem. It should be noted, though, that even the

best-constructed models may reduce estimation uncertainty but they cannot reduce or eliminate the very real uncertainties associated with the future.

- *Valuation ranges.* A few analysts recognize that the value that they obtain for a business is an estimate and try to quantify a range on the estimate. Some use simulations and others derive best-case and worst-case estimates of value. The output that they provide therefore yields both their estimates of value and their uncertainty about that value.
- *Probabilistic statements.* Some analysts couch their valuations in probabilistic terms to reflect the uncertainty that they feel. Thus, an analyst who estimates a value of $30 for a stock that is trading at $25 will state that there is a 60 or 70 percent probability that the stock is undervalued rather than make the categorical statement that it is undervalued. Here again, the probabilities that accompany the statements provide insight into the uncertainty that the analyst perceives in the valuation.

In general, healthy responses to uncertainty are open about its existence and provide information on its magnitude to those using the valuation. These users can then decide how much caution they should exhibit while acting on the valuation.

Unfortunately, not all analysts deal with uncertainty in ways that lead to better decisions. The unhealthy responses to uncertainty include:

- *Passing the buck.* Some analysts try to pass on responsibility for the estimates by using other people's numbers in the valuations. For instance, analysts will often use the growth rate estimated by other analysts valuing a company as their estimate of growth. If the valuation turns out to be right, they can claim credit for it, and if it turns out wrong, they can blame other analysts for leading them down the garden path.
- *Giving up on fundamentals.* A significant number of analysts give up, especially on full-fledged valuation models, unable to confront uncertainty and deal with it. All too often, they fall back on more simplistic ways of valuing companies (multiples and comparables, for example) that do not require explicit assumptions about the future. A few decide that valuation itself is pointless and resort to reading charts and gauging market perception.

It is natural to feel uncomfortable when valuing equity in a company. We are after all trying to make our best judgments about an uncertain future. The discomfort will increase as we move from valuing stable companies to valuing growth companies, from valuing mature companies to valuing young companies, and from valuing developed market companies to valuing emerging market companies.

What to Do about Uncertainty The advantage of breaking uncertainty down into estimation uncertainty, firm-specific uncertainty, and macroeconomic uncertainty is that doing so gives us a window on what we can manage, what we can control, and what we should just let pass through into the valuation. Building better models and accessing superior information will reduce estimation uncertainty but will do little to reduce exposure to firm-specific or macroeconomic risk. Even the best-constructed model will be susceptible to these uncertainties.

In general, analysts should try to focus on making their best estimates of firm-

specific information—How long will the firm be able to maintain high growth? How fast will earnings grow during that period? What type of excess returns will the firm earn?—and steer away from bringing in their views on macroeconomic variables. To see why, assume that you believe that interest rates today are too low and that they will go up by about 1.5 percent over the next year. If you build the expected rise in interest rates into your discounted cash flow (DCF) valuations, they will all yield low values for the companies that you are analyzing. People using these valuations will be faced with a conundrum because they will have no way of knowing how much of each valuation is attributable to your macroeconomic views and how much to your views of the company.

In summary, analysts should concentrate on building the best models they can with as much information as they can legally access, trying to make their best estimates of firm-specific components and being as neutral as they can be on macroeconomic variables. As new information comes in, they should update their valuations to reflect the new information. There is no place for false pride in this process. Valuations can change dramatically over time, and they should if the information warrants such a change.

Payoff to Valuation Even at the end of the most careful and detailed valuation, there will be uncertainty about the final numbers, colored as they are by assumptions that we make about the future of the company and the economy in which it operates. It is unrealistic to expect or demand absolute certainty in valuation, since the inputs are only estimates. This also means that analysts have to give themselves reasonable margins for error in making recommendations on the basis of valuations.

The corollary to this statement is that a valuation cannot be judged by its precision. Some companies can be valued more precisely than others simply because there is less uncertainty about the future. We can value a mature company with relatively few assumptions and be reasonably comfortable with the estimated value. Valuing a technology firm will require far more assumptions, as will valuing an emerging market company. A scientist looking at the valuations of these companies (and the associated estimation errors) may very well consider the mature company valuation the better one, since it is the more precise, and the technology firms and emerging market company valuations to be inferior because there is more uncertainty associated with the estimated values. The irony is that the payoff to valuation will actually be highest when you are most uncertain about the numbers. After all, it is not how precise a valuation is that determines its usefulness but how precise the value is relative to the estimates of other investors trying to value the same company. Anyone can value a zero coupon default-free bond with absolute precision. Valuing a young technology firm or an emerging market firm requires a blend of forecasting skills, tolerance for ambiguity, and willingness to make mistakes that many analysts do not have. Since most analysts tend to give up in the face of such uncertainty, the ones who persevere and makes their best estimates (error-prone though they might be) will have a differential edge.

We do not want to leave the impression that we are completely helpless in the face of uncertainty. Later in the book, we look at simulations, decision trees, and sensitivity analyses as tools that help us deal with uncertainty but not eliminate it.

Are Bigger Models Better? Valuation Complexity

Valuation models have become more and more complex over the past two decades as a consequence of two developments. On the one side, computers and calculators have become far more powerful and accessible. With technology as our ally, tasks that would have taken us days in the precomputer era can be accomplished in minutes. On the other side, information is both more plentiful and easier to access and use. We can download detailed historical data on thousands of companies and use the data as we see fit. The complexity, though, has come at a cost. In this section, we consider the trade-off on complexity and how analysts can decide how much to build into models.

More Detail or Less Detail A fundamental question that we all face when doing valuations is how much detail we should break a valuation down into. There are some who believe that more detail is always better than less detail and that the resulting valuations are more precise. We disagree. The trade-off on adding detail is a simple one. On the one hand, more detail gives analysts a chance to use specific information to make better forecasts on each individual item. On the other hand, more detail creates the need for more inputs, with the potential for error in each one, and generates more complicated models. Thus, breaking working capital down into its individual components—accounts receivable, inventory, accounts payable, supplier credit, and the like—gives an analyst the discretion to make different assumptions about each item, but this discretion has value only if the analyst has the capacity to differentiate between the items.

Cost of Complexity A parallel and related question to how much detail there should be in a valuation is the one of how complex a valuation model should be. There are clear costs that we pay as models become more complex and require more information.

- *Information overload.* More information does not always lead to better valuations. In fact, analysts can become overwhelmed when faced with vast amounts of conflicting information, and this can lead to poor input choices. The problem is exacerbated by the fact that analysts often operate under time pressure when valuing companies. Models that require dozens of inputs to value a single company often get short shrift from users. A model's output is only as good as the inputs that go into it; it is garbage in, garbage out.
- *Black box syndrome.* The models become so complicated that the analysts using them no longer understand their inner workings. They feed inputs into the model's black box and the box spits out a value. In effect, the refrain from analysts becomes "The model valued the company at $30 a share" rather than "We valued the company at $30 a share." Of particular concern should be models where portions of the models are proprietary and cannot be accessed (or modified) by analysts. This is often the case with commercial valuation models, where vendors have to keep a part of the model out of bounds to make their services indispensable.
- *Big versus small assumptions.* Complex models often generate voluminous and detailed output and it becomes very difficult to separate the big assumptions

from the small assumptions. In other words, the assumption that pretax operating margins will stay at 20 percent (a big assumption that doubles the value of the company) has to compete with the assumption that accounts receivable will decline from 5 percent of revenues to 4 percent of revenues over the next 10 years (a small assumption that has almost no impact on value).

The Principle of Parsimony In the physical sciences, the principle of parsimony dictates that we try the simplest possible explanation for a phenomenon before we move on to more complicated ones. We would be well served adopting a similar principle in valuation. When valuing an asset, we want to use the simplest model we can get away with. In other words, if we can value an asset with three inputs, we should not be using five. If we can value a company with three years of cash flow forecasts, forecasting 10 years of cash flows is asking for trouble.

The problem with all-in-one models that are designed to value all companies is that they have to be set up to value the most complicated companies that we will face and not the least complicated. Thus, we are forced to enter inputs and forecast values for simpler companies that we really do not need to estimate. In the process, we can mangle the values of assets that should be easy to value. Consider, for instance, the cash and marketable securities held by firms as part of their assets. The simplest way to value this cash is to take it at face value. Analysts who try to build discounted cash flow or relative valuation models to value cash often misvalue it, either by using the wrong discount rate for the cash income or by using the wrong multiple for cash earnings.[2]

APPROACHES TO VALUATION

Analysts use a wide spectrum of models, ranging from the simple to the sophisticated. These models often make very different assumptions about the fundamentals that determine value, but they do share some common characteristics and can be classified in broader terms. There are several advantages to such a classification: It makes it is easier to understand where individual models fit into the big picture, why they provide different results, and when they have fundamental errors in logic.

In general terms, there are three approaches to valuation. The first, discounted cash flow valuation, relates the value of an asset to the present value of expected future cash flows on that asset. The second, relative valuation, estimates the value of an asset by looking at the pricing of comparable assets relative to a common variable like earnings, cash flows, book value, or sales. The third, contingent claim valuation, uses option pricing models to measure the value of assets that share option characteristics. While they can yield different estimates of value, one of the objectives of this book is to explain the reasons for such differences, and to help in picking the right model to use for a specific task.

[2]The income from cash is riskless and should be discounted back at a riskless rate. Instead, analysts use risk-adjusted discount rates (costs of equity or capital) to discount the cash income, thus resulting in a discount on face value. When analysts use multiples, they often use the average price-earnings (P/E) ratio of peer group companies as the multiple for cash income.

Discounted Cash Flow Valuation

In discounted cash flow (DCF) valuation, the value of an asset is the present value of the expected cash flows on the asset, discounted back at a rate that reflects the riskiness of these cash flows. This approach gets the most play in classrooms and comes with the best theoretical credentials. In this section, we will look at the foundations of the approach and some of the preliminary details on how we estimate its inputs.

Basis for Approach We buy most assets because we expect them to generate cash flows for us in the future. In DCF valuation, we begin with a simple proposition. The value of an asset is not what someone perceives it to be worth, but rather it is a function of the expected cash flows on that asset. Put simply, assets with high and predictable cash flows should have higher values than assets with low and volatile cash flows. In DCF valuation, we estimate the value of an asset as the present value of the expected cash flows on it.

$$\text{Value of asset} = \frac{E(CF_1)}{(1+r)} + \frac{E(CF_2)}{(1+r)^2} + \frac{E(CF_3)}{(1+r)^3} \cdots + \frac{E(CF_n)}{(1+r)^n}$$

where $E(CF_t)$ = Expected cash flow in period t
r = Discount rate reflecting riskiness of estimated cash flows
n = Life of asset

The cash flows will vary from asset to asset—dividends for stocks, coupons (interest) and the face value for bonds, and after-tax cash flows for a business. The discount rate will be a function of the riskiness of the estimated cash flows, with higher rates for riskier assets and lower rates for safer ones.

Using DCF models is in some sense an act of faith. We believe that every asset has an intrinsic value and we try to estimate that intrinsic value by looking at an asset's fundamentals. What is intrinsic value? Consider it the value that would be attached to an asset by an all-knowing analyst with access to all information available right now and a perfect valuation model. No such analyst exists, of course, but we all aspire to be as close as we can be to this perfect analyst. The problem lies in the fact that none of us ever gets to see what the true intrinsic value of an asset is and we therefore have no way of knowing whether our DCF valuations are close to the mark.

Classifying Discounted Cash Flow Models There are three distinct ways in which we can categorize DCF models. In the first, we differentiate between valuing a business as a going concern as opposed to a collection of assets. In the second, we draw a distinction between valuing the equity in a business and valuing the business itself. In the third, we lay out two different and equivalent ways of doing DCF valuation in addition to the expected cash flow approach—a value based on excess returns and the adjusted present value (APV).

Going Concern versus Asset Valuation The value of an asset in the DCF framework is the present value of the expected cash flows on that asset. Extending this

proposition to valuing a business, it can be argued that the value of a business is the sum of the values of the individual assets owned by the business. While this may be technically correct, there is a key difference between valuing a collection of assets and a business. A business or a company is an ongoing entity with assets that it already owns and assets it expects to invest in in the future. This can be best seen when we look at the financial balance sheet (as opposed to an accounting balance sheet) for an ongoing company in Figure 1.1. Note that investments that have already been made are categorized as assets in place, but investments that we expect the business to make in the future are growth assets.

A financial balance sheet provides a good framework to draw out the differences between valuing a business as a going concern and valuing it as a collection of assets. In a going concern valuation, we have to make our best judgments not only on existing investments but also on expected future investments and their profitability. While this may seem to be foolhardy, a large proportion of the market value of growth companies comes from their growth assets. In an asset-based valuation, we focus primarily on the assets in place and estimate the value of each asset separately. Adding the asset values together yields the value of the business. For companies with lucrative growth opportunities, asset-based valuations will yield lower values than going concern valuations.

One special case of asset-based valuation is liquidation valuation, where we value assets based on the presumption that they have to be sold now. In theory, this should be equal to the value obtained from DCF valuations of individual assets, but the urgency associated with liquidating assets quickly may result in a discount on the value. How large the discount will be will depend on the number of potential buyers for the assets, the asset characteristics, and the state of the economy.

Equity Valuation versus Firm Valuation There are two ways in which we can approach DCF valuation. The first is to value the entire business, with both assets in place and growth assets; this is often termed firm or enterprise valuation. (See Figure 1.2.) The cash flows before debt payments and after reinvestment needs are called *free cash flows to the firm*, and the discount rate that reflects the composite cost of financing from all sources of capital is called the *cost of capital*.

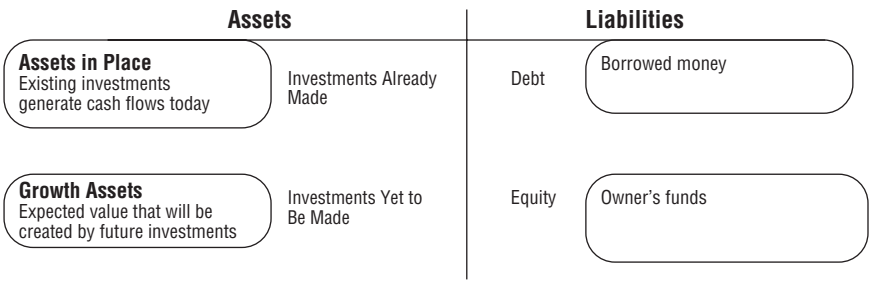

FIGURE 1.1 Simple View of a Firm

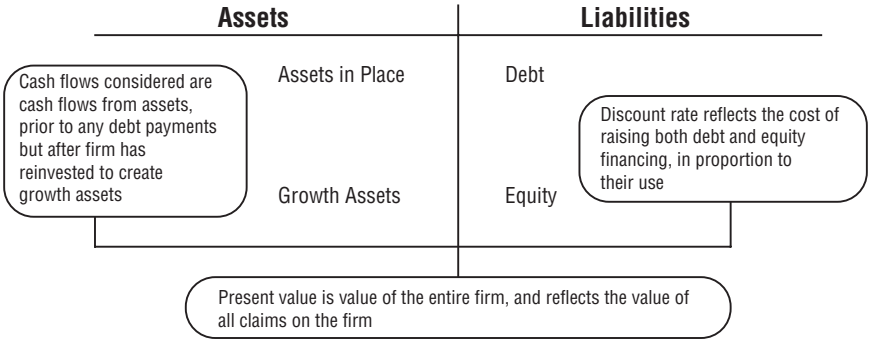

FIGURE 1.2 Firm Valuation

The second way is to just value the equity stake in the business, and this is called equity valuation. (See Figure 1.3.) The cash flows after debt payments and reinvestment needs are called *free cash flows to equity*, and the discount rate that reflects just the cost of equity financing is the *cost of equity*.

Note also that we can always get from the former (firm value) to the latter (equity value) by netting out the value of all nonequity claims from firm value. Done right, the value of equity should be the same whether it is valued directly (by discounting cash flows to equity at the cost of equity) or indirectly (by valuing the firm and subtracting out the value of all nonequity claims). We will return to discuss this proposition in far more detail in Chapter 6.

Variations on Discounted Cash Flow Models The model that we have presented in this section, where expected cash flows are discounted back at a risk-adjusted discount rate, is the most commonly used DCF approach, but there are two widely used variants. In the first, we separate the cash flows into excess return cash flows and normal return cash flows. Earning the risk-adjusted required return (cost of capital or equity) is considered a normal return cash flow, but any cash flows above or below this number are categorized as excess returns; excess returns can therefore

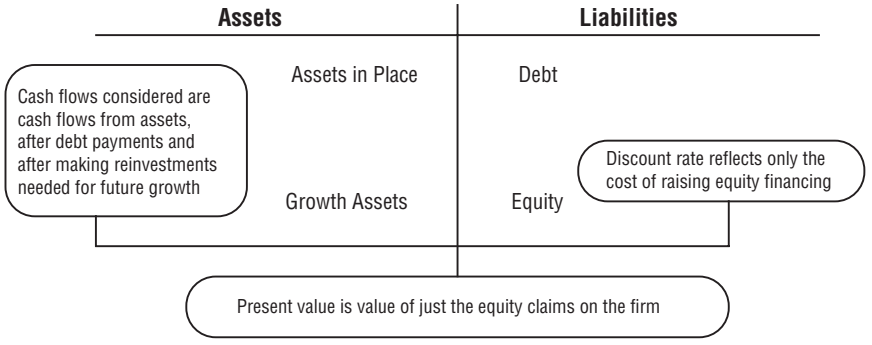

FIGURE 1.3 Equity Valuation

be either positive or negative. With the *excess return valuation* framework, the value of a business can be written as the sum of two components:

Value of business = Capital invested in firm today + Present value of excess return cash flows from both existing and future projects

If we make the assumption that the accounting measure of capital invested (book value of capital) is a good measure of capital invested in assets today, this approach implies that firms that are expected to earn positive excess return cash flows will trade at market values higher than their book values and that the reverse will be true for firms that are expected to earn negative excess return cash flows.

In the second variation, called the *adjusted present value (APV)* approach, we separate the effects on value of debt financing from the value of the assets of a business. In general, using debt to fund a firm's operations creates tax benefits (because interest expenses are tax deductible) on the plus side and increases bankruptcy risk (and expected bankruptcy costs) on the minus side. In the APV approach, the value of a firm can be written as follows:

Value of business = Value of business with 100% equity financing + Present value of expected tax benefits of debt – Expected bankruptcy costs

In contrast to the conventional approach, where the effects of debt financing are captured in the discount rate, the APV approach attempts to estimate the expected dollar value of debt benefits and costs separately from the value of the operating assets.

While proponents of each approach like to claim that their approach is the best and most precise, we will show later in the book that the three approaches yield the same estimates of value if we make consistent assumptions.

Inputs to Discounted Cash Flow Models There are three inputs that are required to value any asset in this model—the *expected cash flow*, the *timing* of the cash flow, and the *discount rate* that is appropriate given the riskiness of these cash flows. We look at discount rate and cash flow estimation in far more detail in the coming chapters, but lay out the fundamentals in this section.

Discount Rates In valuation, we begin with the fundamental notion that the discount rate used on a cash flow should reflect its riskiness, with higher-risk cash flows having higher discount rates. There are two ways of viewing risk. The first is purely in terms of the likelihood that an entity will default on a commitment to make a payment such as interest or principal due, and this is called *default risk*. When looking at debt, the *cost of debt* is the rate that reflects this default risk. Since interest expenses are tax-deductible, the after-tax cost of debt will be lower for most firms.

The second way of viewing risk is in terms of the *variation of actual returns around expected returns*. The actual returns on a risky investment can be very different from expected returns; the greater the variation, the greater the risk. When looking at equity, we tend to use measures of risk based on return variance. The next chapter looks at the different models that attempt to do this in far more detail,

but there are some basic points on which these models agree. The first is that risk in an investment has to be perceived through the eyes of the marginal investor in that investment (the investor most likely to be trading), and this marginal investor is assumed to be well diversified across multiple investments. Therefore, the risk in an investment that should determine discount rates is the nondiversifiable or market risk of that investment. The second is that the expected return on any investment can be obtained starting with the expected return on a riskless investment, and adding to it a premium to reflect the amount of market risk in that investment. This expected return yields the cost of equity.

The cost of capital can be obtained by taking an average of the cost of equity, estimated as just described, and the after-tax cost of borrowing, based on default risk, and weighting by the proportions used of each. We argue that the weights used, when valuing an ongoing business, should be based on the market values of debt and equity. While there are some analysts who use book value weights, doing so violates a basic principle of valuation, which is that at a fair value,[3] one should be indifferent between buying and selling an asset.

Expected Cash Flows In the strictest sense, the only cash flow an equity investor gets out of a publicly traded firm is the dividend; models that use the dividends as cash flows are called *dividend discount models*. A broader definition of cash flows to equity would be the cash flows left over after the cash flow claims of nonequity investors in the firm have been met (interest and principal payments to debt holders and preferred dividends) and after enough of these cash flows has been reinvested into the firm to sustain the projected growth in cash flows. This is the free cash flow to equity (FCFE), and models that use these cash flows are called *FCFE discount models*.

The cash flow to the firm is the cumulated cash flow to all claim holders in the firm. One way to obtain this cash flow is to add the free cash flows to equity to the cash flows to lenders (debt) and preferred stockholders. A far simpler way of obtaining the same number is to estimate the cash flows prior to debt and preferred dividend payments, by subtracting from the after-tax operating income the net investment needs to sustain growth. This cash flow is called the free cash flow to the firm (FCFF) and the models that use these cash flows are called *FCFF models*.

Expected Growth It is while estimating the expected growth in cash flows in the future that analysts confront uncertainty most directly. There are three generic ways of estimating growth. One is to look at a company's past and use the historical growth rate posted by that company. The peril is that past growth may provide little indication of future growth. The second is to obtain estimates of growth from more informed sources. For some analysts, this translates into using the estimates

[3]When book value weights are used, the costs of capital tend to be much lower for many U.S. firms, since book equity is lower than market equity. This then pushes up the value for these firms. While this may make the asking price attractive to the sellers of these firms, very few buyers would be willing to pay this price for the firm, since it would require that the debt that they use in their financing would have to be based on the book value, often requiring tripling or quadrupling the dollar debt in the firm.

provided by a company's management, whereas for others it takes the form of using consensus estimates of growth made by others who follow the firm. The bias associated with both these sources should raise questions about the resulting valuations.

In this book, we promote a third way, where the expected growth rate is tied to two variables that are determined by the firm being valued—how much of the earnings is reinvested back into the firm and how well those earnings are reinvested. In the equity valuation model, this expected growth rate is a product of the retention ratio—that is, the proportion of net income not paid out to stockholders, and the return on equity on the projects undertaken with that money. In the firm valuation model, the expected growth rate is a product of the reinvestment rate, which is the proportion of after-tax operating income that goes into net new investments and the return on capital earned on these investments. The advantages of using these fundamental growth rates are twofold. The first is that the resulting valuations will be internally consistent and companies that are assumed to have high growth are required to pay for the growth with more reinvestment. The second is that it lays the foundation for considering how firms can make themselves more valuable to their investors.

Discounted Cash Flow Valuation: Pluses and Minuses To true believers, DCF valuation is the only way to approach valuation, but the benefits may be more nuanced that they are willing to admit. On the plus side, DCF valuation, done right, requires analysts to understand the businesses that they are valuing and ask searching questions about the sustainability of cash flows and risk. Discounted cash flow valuation is tailor-made for those who buy into the Warren Buffett adage that what we are buying are not stocks but the underlying businesses. In addition, DCF valuation is inherently contrarian in the sense that it forces analysts to look for the fundamentals that drive value rather than what market perceptions are. Consequently, if stock prices rise disproportionately relative to the underlying earnings and cash flows, DCF models are likely to find stocks to be overvalued, and if they fall disproportionately, DCF models find stocks to be undervalued.

There are, however, limitations with DCF valuation. In the hands of sloppy analysts, DCF valuations can be manipulated to generate estimates of value that have no relationship to intrinsic value. We also need substantially more information to value a company with DCF models, since we have to estimate cash flows, growth rates, and discount rates. Finally, DCF models may very well find every stock in a sector or even a market to be overvalued if market perceptions have run ahead of fundamentals. For portfolio managers and equity research analysts, who are required to find equities to buy even in the most overvalued markets, this creates a conundrum. They can go with their DCF valuations and conclude that everything is overvalued, which may put them out of business, or they can find an alternate approach that is more sensitive to market moods. It should come as no surprise that many choose the latter course.

Relative Valuation

While the focus in classrooms and academic discussions remains on DCF valuation, the reality is that most assets are valued on a relative basis. In relative valuation, we

value an asset by looking at how the market prices similar assets. Thus, when determining what to pay for a house, we look at what similar houses in the neighborhood sold for rather than doing an intrinsic valuation. Extending this analogy to stocks, investors often decide whether a stock is cheap or expensive by comparing its pricing to that of similar stocks (usually in its peer group). In this section, we consider the basis for relative valuation, ways in which it can be used, and its advantages and disadvantages.

Basis for Approach In relative valuation, the value of an asset is derived from the pricing of comparable assets, standardized using a common variable. Included in this description are two key components of relative valuation. The first is the notion of *comparable or similar assets*. From a valuation standpoint, this would imply assets with similar cash flows, risk, and growth potential. In practice, it is usually taken to mean other companies that are in the same business as the company being valued. The other is a *standardized price*. After all, the price per share of a company is in some sense arbitrary since it is a function of the number of shares outstanding; a two-for-one stock split would halve the price. Dividing the price or market value by some measure that is related to that value will yield a standardized price. When valuing stocks, this essentially translates into using multiples where we divide the market value by earnings, book value, or revenues to arrive at an estimate of standardized value. We can then compare these numbers across companies.

The simplest and most direct applications of relative valuations are with real assets where it is easy to find similar assets or even identical ones. The asking price for a Mickey Mantle baseball card or a 1965 Ford Mustang is relatively easy to estimate given that there are other Mickey Mantle cards and 1965 Ford Mustangs out there and that the prices at which they have been bought and sold can be obtained. With equity valuation, relative valuation becomes more complicated by two realities. The first is the absence of similar assets, requiring us to stretch the definition of comparable to include companies that are different from the one that we are valuing. After all, what company in the world is remotely similar to Microsoft or General Electric? The other is that different ways of standardizing prices (different multiples) can yield different values for the same company.

In our earlier discussion of DCF valuation, we argued that DCF valuation was a search (albeit unfulfilled) for intrinsic value. In relative valuation, we have given up on estimating intrinsic value and essentially put our trust in markets getting it right, at least on average.

Variations on Relative Valuation In relative valuation, the value of an asset is based on how similar assets are priced. In practice, there are three variations on relative valuation, with the differences primarily in how we define comparable firms and control for differences across firms:

1. *Direct comparison.* In this approach, analysts try to find one or two companies that look almost exactly like the company they are trying to value and estimate the value based on how these similar companies are priced. The key part in this analysis is identifying these similar companies and getting their market values.
2. *Peer group average.* Analysts compare how their company is priced (using a multiple) with how the peer group is priced (using the average for that multi-

ple). Thus, a stock is considered cheap if it trades at 12 times earnings and the average price-earnings ratio for the sector is 15. Implicit in this approach is the assumption that while companies may vary widely across a sector, the average for the sector is representative for a typical company.

3. *Peer group average adjusted for differences.* Recognizing that there can be wide differences between the company being valued and other companies in the comparable firm group, analysts sometimes try to control for differences between companies. In many cases, the control is subjective: A company with higher expected growth than the industry will trade at a higher multiple of earnings than the industry average but how much higher is left unspecified. In a few cases, analysts explicitly try to control for differences between companies either by adjusting the multiple being used or by using statistical techniques. As an example of the former, consider price-earnings/growth (PEG) ratios. These ratios are computed by dividing P/E ratios by expected growth rates, thus controlling (at least in theory) for differences in growth and allowing analysts to compare companies with different growth rates. For statistical controls, we can use multiple regressions where we can regress the multiple that we are using against the fundamentals that we believe cause that multiple to vary across companies. The resulting regressions can be used to estimate the value of individual companies. In fact, we argue later in this book that statistical techniques are powerful enough to allow us to expand the comparable firm sample to include the entire market.

Applicability of Multiples and Limitations The allure of multiples is that they are simple and easy to relate to. They can be used to obtain estimates of value quickly for firms and assets, and are particularly useful when a large number of comparable firms are being traded on financial markets, and the market is, on average, pricing these firms correctly. In fact, relative valuation is tailor-made for analysts and portfolio managers who not only have to find undervalued equities in any market no matter how overvalued, but also get judged on a relative basis. An analyst who picks stocks based on their P/E ratios relative to the sectors in which they operate will always find undervalued stocks in any market; if entire sectors are overvalued and his stocks decline, he will still look good on a relative basis since his stocks will decline less than comparable stocks (assuming the relative valuation is right).

By the same token, multiples are also easy to misuse and manipulate, especially when comparable firms are used. Given that no two firms are exactly alike in terms of risk and growth, the definition of comparable firms is a subjective one. Consequently, a biased analyst can choose a group of comparable firms to confirm his or her biases about a firm's value. While this potential for bias exists with DCF valuation as well, the analyst in DCF valuation is forced to be much more explicit about the assumptions that determine the final value. With multiples, these assumptions are often left unstated.

The other problem with using multiples based on comparable firms is that it builds in errors (overvaluation or undervaluation) that the market might be making in valuing these firms. If, for instance, we find a company to be undervalued because it trades at 15 times earnings and comparable companies trade at 25 times earnings, we may still lose on the investment if the entire sector is overvalued. In

relative valuation, all that we can claim is that a stock looks cheap or expensive relative to the group we compared it to; we do not make an absolute judgment about value. Ultimately, relative valuation judgments depend on how well we have picked the comparable companies and how good a job the market has done in pricing them.

Contingent Claim Valuation

There is little in either DCF or relative valuation that can be considered new and revolutionary. In recent years, though, analysts have increasingly used option pricing models, developed to value listed options, to value assets, businesses, and equity stakes in businesses. These applications are often categorized loosely as real options, but as we will see later in this book, they have to be used with caution.

Basis for Approach A contingent claim or option is an asset that pays off only under certain contingencies—if the value of the underlying asset exceeds a prespecified value for a call option, or is less than a prespecified value for a put option. Much work has been done in the past few decades in developing models that value options, and these option pricing models can be used to value any assets that have optionlike features.

Figure 1.4 illustrates the payoffs on call and put options as a function of the value of the underlying asset. An option can be valued as a function of the following variables: the current value and the variance in value of the underlying asset, the strike price and the time to expiration of the option, and the riskless interest rate. This was first established by Black and Scholes (1972)[4] and has been extended and refined subsequently in numerous variants. While the Black-Scholes option pricing model ignored dividends and assumed that options would not be exercised early, it can be modified to allow for both. A discrete-time variant, the binomial option pricing model, has also been developed to price options.

An asset can be valued as a call option if the payoffs on it are a function of the value of an underlying investment; if that value exceeds a prespecified level, the asset is worth the difference; if not, it is worth nothing. It can be valued as a put option if it gains value as the value of the underlying investment drops below a prespecified level, and it is worth nothing when the underlying investment's value exceeds that specified level. There are many assets that generally are not viewed as options but still share option characteristics. A patent can be analyzed as a call option on a product, with the investment outlay needed to get the project going considered the strike price and the patent life becoming the life of the option. An undeveloped oil reserve or gold mine provides its owner with a call option to develop the reserve or mine, if oil or gold prices increase.

The essence of the real options argument is that DCF models understate the value of assets with option characteristics. The understatement occurs because DCF models value assets based on a set of expected cash flows and do not fully consider the possibility that firms can learn from real-time developments and respond to that

[4]F. Black and M. Scholes, "The Valuation of Option Contracts and a Test of Market Efficiency," *Journal of Finance* 27 (1972): 399–417.