3rd Edition

INVESTMENT VALUATION

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Tools and Techniques for Determining the Value of Any Asset

ASWATH DAMODARAN

CHAPTER 1

Introduction to Valuation

Every asset, financial as well as real, has a value. The key to successfully investing in and managing these assets lies in understanding not only what the value is, but the sources of the value. Every asset can be valued, but some assets are easier to value than others, and the details of valuation will vary from case to case. Thus, valuing of a real estate property will require different information and follow a different format than valuing a publicly traded stock. What is surprising, however, is not the differences in techniques across assets, but the degree of similarity in the basic principles of valuation. There is uncertainty associated with valuation. Often that uncertainty comes from the asset being valued, though the valuation model may add to that uncertainty.

This chapter lays out a philosophical basis for valuation, together with a discussion of how valuation is or can be used in a variety of frameworks, from portfolio management to corporate finance.

A PHILOSOPHICAL BASIS FOR VALUATION

It was Oscar Wilde who described a cynic as one who "knows the price of everything, but the value of nothing." He could very well have been describing some analysts and many investors, a surprising number of whom subscribe to the "bigger fool" theory of investing, which argues that the value of an asset is irrelevant as long as there is a "bigger fool" around willing to buy the asset from them. While this may provide a basis for some profits, it is a dangerous game to play, since there is no guarantee that such an investor will still be around when the time to sell comes.

A postulate of sound investing is that an investor does not pay more for an asset than it's 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 eye 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 investors do not (and should not) buy most assets for aesthetic or emotional reasons; financial assets are acquired for the cash flows expected on them. Consequently, perceptions of value have to be backed up by reality, which implies that the price that is paid 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 and expected growth of these cash flows.

There are many areas in valuation where there is room for disagreement, including how to estimate true value and how long it will take for prices to adjust to 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 willing to pay those prices.

GENERALITIES ABOUT VALUATION

Like all analytical disciplines, valuation has developed its own set of myths over time. This section examines and debunks some of these myths.

Myth 1: Since valuation models are quantitative, valuation is objective.

Valuation is neither the science that some of its proponents make it out to be nor the objective search for true value that idealists would like it to become. The models that we use in valuation may be quantitative, but the inputs leave plenty of room for subjective judgments. Thus, the final value that we obtain from these models is colored by the bias that we bring into the process. In fact, in many valuations, the price gets set first and the valuation follows.

The obvious solution is to eliminate all bias before starting on a valuation, but this is easier said than done. Given the exposure we have to external information, analyses, and opinions about a firm, it is unlikely that we embark on most valuations without some bias. There are two ways of reducing the bias in the process. The first is to avoid taking strong public positions on the value of a firm before the valuation is complete. In far too many cases, the decision on whether a firm is under- or overvalued precedes the actual valuation,[1] leading to seriously biased analyses. The second is to minimize, prior to the valuation, the stake we have in whether the firm is under- or overvalued.

Institutional concerns also play a role in determining the extent of bias in valuation. For instance, it is an acknowledged fact that equity research analysts are more likely to issue buy rather than sell recommendations[2] (i.e., they are more likely to find firms to be undervalued than overvalued). This can be traced partly to the difficulties analysts face in obtaining access and collecting information on firms that they have issued sell recommendations on, and partly to pressure that they face from portfolio managers, some of whom might have large positions in the stock. In recent years, this trend has been exacerbated by the pressure on equity research analysts to deliver investment banking business.

When using a valuation done by a third party, the biases of the analyst(s) should be considered before decisions are made on its basis. For instance, a self-valuation done by a target firm in a takeover is likely to be positively biased. While this does not make the valuation worthless, it suggests that the analysis should be viewed with skepticism.

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[1]This is most visible in takeovers, where the decision to acquire a firm often seems to precede the valuation of the firm. It should come as no surprise, therefore, that the analysis almost invariably supports the decision.

[2]In most years buy recommendations outnumber sell recommendations by a margin of 10 to 1. In recent years this trend has become even stronger.

BIAS IN EQUITY RESEARCH

The lines between equity research and salesmanship blur most in periods that are characterized by "irrational exuberance." In the late 1990s, the extraordinary surge of market values in the companies that comprised the new economy saw a large number of equity research analysts, especially on the sell side, step out of their roles as analysts and become cheerleaders for these stocks. While these analysts might have been well-meaning in their recommendations, the fact that the investment banks that they worked for were leading the charge on initial public offerings from these firms exposed them to charges of bias and worse.

In 2001, the crash in the market values of new economy stocks and the anguished cries of investors who had lost wealth in the crash created a firestorm of controversy. There were congressional hearings where legislators demanded to know what analysts knew about the companies they recommended and when the knew it, statements from the Securities and Exchange Commision (SEC) about the need for impartiality in equity research, and decisions taken by some investment banks to create at least the appearance of objectivity. Investment banks even created Chinese walls to separate their investment bankers from their equity research analysts. While that technical separation has helped, the real source of bias—the intermingling of banking business, trading, and investment advice—has not been touched.

Should there be government regulation of equity research? It would not be wise, since regulation tends to be heavy-handed and creates side costs that seem quickly to exceed the benefits. A much more effective response can be delivered by portfolio managers and investors. Equity research that creates the potential for bias should be discounted or, in egregious cases, even ignored. Alternatively, new equity research firms that deliver only investment advice can meet a need for unbiased valuations.

Myth 2: A well-researched and well-done valuation is timeless.

The value obtained from any valuation model is affected by firm-specific as well as marketwide information. As a consequence, the value will change as new information is revealed. 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. This information may be specific to the firm, affect an entire sector, or alter expectations for all firms in the market.

The most common example of firm-specific information is an earnings report that contains news not only about a firm's performance in the most recent time period but, even more importantly, about the business model that the firm has adopted. The dramatic drop in value of many new economy stocks from 1999 to 2001 can be traced, at least partially, to the realization that these firms had business models that might deliver customers but not earnings, even in the long term. We have seen social media companies like Linkedin and Zynga received enthusiastic market responses in 2010, and it will be interesting to see if history repeats itself.

These companies offer tremendous promise because of their large member bases, but they are still in the nascent stages of commercializing that promise.

In some cases, new information can affect the valuations of all firms in a sector. Thus, financial service companies that were valued highly in early 2008, on the assumption that the high growth and returns from the prior years would continue into the future, were valued much less in early 2009, as the banking crisis of 2008 laid bare the weaknesses and hidden risks in their businesses.

Finally, information about the state of the economy and the level of interest rates affects all valuations in an economy. A weakening in the economy can lead to a reassessment of growth rates across the board, though the effect on earnings is likely to be largest at cyclical firms. Similarly, an increase in interest rates will affect all investments, though to varying degrees.

When analysts change their valuations, they will undoubtedly be asked to justify them, and in some cases the fact that valuations change over time is viewed as a problem. The best response is the one that John Maynard Keynes gave when he was criticized for changing his position on a major economic issue: "When the facts change, I change my mind. And what do you do, sir?"

Myth 3: A good valuation provides a precise estimate of value.

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. It is unrealistic to expect or demand absolute certainty in valuation, since cash flows and discount rates are estimated. This also means that analysts have to give themselves a reasonable margin for error in making recommendations on the basis of valuations.

The degree of precision in valuations is likely to vary widely across investments. The valuation of a large and mature company with a long financial history will usually be much more precise than the valuation of a young company in a sector in turmoil. If this latter company happens to operate in an emerging market, with additional disagreement about the future of the market thrown into the mix, the uncertainty is magnified. Later in this book, in Chapter 23, we argue that the difficulties associated with valuation can be related to where a firm is in the life cycle. Mature firms tend to be easier to value than growth firms, and young start-up companies are more difficult to value than companies with established products and markets. The problems are not with the valuation models we use, though, but with the difficulties we run into in making estimates for the future. Many investors and analysts use the uncertainty about the future or the absence of information to justify not doing full-fledged valuations. In reality, though, the payoff to valuation is greatest in these firms.

Myth 4: The more quantitative a model, the better the valuation.

It may seem obvious that making a model more complete and complex should yield better valuations; but it is not necessarily so. As models become more complex, the number of inputs needed to value a firm tends to increase, bringing with it the potential for input errors. These problems are compounded when models become so

complex that they become "black boxes" where analysts feed in numbers at one end and valuations emerge from the other. All too often when a valuation fails, the blame gets attached to the model rather than the analyst. The refrain becomes "It was not my fault. The model did it."

There are three important points that need to be made about all valuation. The first is to adhere to the principle of parsimony, which essentially states that you do not use more inputs than you absolutely need to value an asset. The second is to recognize that there is a trade-off between the additional benefits of building in more detail and the estimation costs (and error) with providing the detail. The third is to understand that models don't value companies—*you* do. In a world where the problem that you often face in valuations is not too little information but too much, and separating the information that matters from the information that does not is almost as important as the valuation models and techniques that you use to value a firm.

Myth 5: To make money on valuation, you have to assume that markets are inefficient (but that they will become efficient).

Implicit in the act of valuation is the assumption that markets make mistakes and that we can find these mistakes, often using information that tens of thousands of other investors have access to. Thus, it seems reasonable to say that those who believe that markets are inefficient should spend their time and resources on valuation whereas those who believe that markets are efficient should take the market price as the best estimate of value.

This statement, though, does not reflect the internal contradictions in both positions. Those who believe that markets are efficient may still feel that valuation has something to contribute, especially when they are called on to value the effect of a change in the way a firm is run or to understand why market prices change over time. Furthermore, it is not clear how markets would become efficient in the first place if investors did not attempt to find under- and over-valued stocks and trade on these valuations. In other words, a precondition for market efficiency seems to be the existence of millions of investors who believe that markets are not efficient.

On the other hand, those who believe that markets make mistakes and buy or sell stocks on that basis must believe that ultimately markets will correct these mistakes (i.e., become efficient), because that is how they make their money. This is therefore a fairly self-serving definition of inefficiency—markets are inefficient until you take a large position in the stock that you believe to be mispriced, but they become efficient after you take the position.

It is best to approach the issue of market efficiency as a skeptic. Recognize that on the one hand markets make mistakes but, on the other, finding these mistakes requires a combination of skill and luck. This view of markets leads to the following conclusions: First, if something looks too good to be true—a stock looks obviously undervalued or overvalued—it is probably *not* true. Second, when the value from an analysis is significantly different from the market price, start off with the presumption that the market is correct; then you have to convince yourself that this is not the case before you conclude that something is over- or undervalued. This higher standard may lead you to be more cautious in following through on valuations, but given the difficulty of beating the market, this is not an undesirable outcome.

Myth 6: The product of valuation (i.e., the value) is what matters; the process of valuation is not important.

As valuation models are introduced in this book, there is the risk of focusing exclusively on the outcome (i.e., the value of the company and whether it is under- or overvalued), and missing some valuable insights that can be obtained from the process of the valuation. The process can tell us a great deal about the determinants of value and help us answer some fundamental questions: What is the appropriate price to pay for high growth? What is a brand name worth? How important is it to improve returns on projects? What is the effect of profit margins on value? Since the process is so informative, even those who believe that markets are efficient (and that the market price is therefore the best estimate of value) should be able to find some use for valuation models.

THE ROLE OF VALUATION

Valuation is useful in a wide range of tasks. The role it plays, however, is different in different arenas. The following section lays out the relevance of valuation in portfolio management, in acquisition analysis, and in corporate finance.

Valuation in Portfolio Management

The role that valuation plays in portfolio management is determined in large part by the investment philosophy of the investor. Valuation plays a minimal role in portfolio management for a passive investor, whereas it plays a larger role for an active investor. Even among active investors, the nature and the role of valuation are different for different types of active investment. Market timers should use valuation much less than investors who pick stocks for the long term, and their focus is on market valuation rather than on firm-specific valuation. Among stock pickers valuation plays a central role in portfolio management for fundamental analysts and a peripheral role for technical analysts.

Fundamental Analysts The underlying theme in fundamental analysis is that the true value of the firm can be related to its financial characteristics—its growth prospects, risk profile, and cash flows. Any deviation from this true value is a sign that a stock is under- or overvalued. It is a long-term investment strategy, and the assumptions underlying it are:

- The relationship between value and the underlying financial factors can be measured.
- The relationship is stable over time.
- Deviations from the relationship are corrected in a reasonable time period.

Valuation is the central focus in fundamental analysis. Some analysts use discounted cash flow models to value firms, while others use multiples such as the price-earnings and price–book value ratios. Since investors using this approach hold a large number of undervalued stocks in their portfolios, their hope is that, on average, these portfolios will do better than the market.

Franchise Buyers The philosophy of a franchise buyer is best expressed by an investor who has been very successful at it—Warren Buffett. "We try to stick to businesses we believe we understand," Mr. Buffett writes.[3] "That means they must be relatively simple and stable in character. If a business is complex and subject to constant change, we're not smart enough to predict future cash flows." Franchise buyers concentrate on a few businesses they understand well and attempt to acquire undervalued firms. Often, as in the case of Mr. Buffett, franchise buyers wield influence on the management of these firms and can change financial and investment policy. As a long-term strategy, the underlying assumptions are that:

- Investors who understand a business well are in a better position to value it correctly.
- These undervalued businesses can be acquired without driving the price above the true value and sometimes at a bargain.

Valuation plays a key role in this philosophy, since franchise buyers are attracted to a particular business because they believe it is undervalued. They are also interested in how much additional value they can create by restructuring the business and running it right.

Chartists Chartists believe that prices are driven as much by investor psychology as by any underlying financial variables. The information available from trading—price movements, trading volume, short sales, and so forth—gives an indication of investor psychology and future price movements. The assumptions here are that prices move in predictable patterns, that there are not enough marginal investors taking advantage of these patterns to eliminate them, and that the average investor in the market is driven more by emotion than by rational analysis.

While valuation does not play much of a role in charting, there are ways in which an enterprising chartist can incorporate it into analysis. For instance, valuation can be used to determine support and resistance lines[4] on price charts.

Information Traders Prices move on information about the firm. Information traders attempt to trade in advance of new information or shortly after it is revealed to financial markets, buying on good news and selling on bad. The underlying assumption is that these traders can anticipate information announcements and gauge the market reaction to them better than the average investor in the market.

For an information trader, the focus is on the relationship between information and changes in value, rather than on value per se. Thus an information trader may

[3]This is extracted from Mr. Buffett's letter to stockholders in Berkshire Hathaway for 1993.
[4]On a chart, the support line usually refers to a lower bound below which prices are unlikely to move, and the resistance line refers to the upper bound above which prices are unlikely to venture. While these levels are usually estimated using past prices, the range of values obtained from a valuation model can be used to determine these levels (i.e., the maximum value will become the resistance line and the minimum value will become the support line).

buy stock in even an overvalued firm if he or she believes that the next information announcement is going to cause the price to go up because it contains better than expected news. If there is a relationship between how undervalued or overvalued a company is and how its stock price reacts to new information, then valuation could play a role in investing for an information trader.

Market Timers Market timers note, with some legitimacy, that the payoff to calling turns in markets is much greater than the returns from stock picking. They argue that it is easier to predict market movements than to select stocks and that these predictions can be based on factors that are observable.

While valuation of individual stocks may not be of any use to a market timer, market timing strategies can use valuation in at least two ways:

1. The overall market itself can be valued and compared to the current level.
2. A valuation model can be used to value all stocks, and the results from the across all stocks be used to determine whether the market is over- or undervalued. For example, as the number of stocks that are overvalued, using a discounted cash flow model, increases relative to the number that are undervalued, there may be reason to believe that the market is overvalued.

Efficient Marketers Efficient marketers believe that the market price at any point in time represents the best estimate of the true value of the firm, and that any attempt to exploit perceived market efficiencies will cost more than it will make in excess profits. They assume that markets aggregate information quickly and accurately, that marginal investors promptly exploit any inefficiencies, and that any inefficiencies in the market are caused by friction, such as transaction costs, and cannot be arbitraged away.

For efficient marketers, valuation is a useful exercise to determine why a stock sells for the price that it does. Since the underlying assumption is that the market price is the best estimate of the true value of the company, the objective becomes determining what assumptions about growth and risk are implied in this market price, rather than on finding under- or overvalued firms.

Valuation in Acquisition Analysis

Valuation should play a central part in acquisition analysis. The bidding firm or individual has to decide on a fair value for the target firm before making a bid, and the target firm has to determine a reasonable value for itself before deciding to accept or reject the offer.

There are also special factors to consider in takeover valuation. First, the effects of synergy on the combined value of the two firms (target plus bidding firm) have to be considered before a decision is made on the bid. Those who suggest that synergy is impossible to value and should not be considered in quantitative terms are wrong. Second, the effects on value of changing management and restructuring the target firm will have to be taken into account in deciding on a fair price. This is of particular concern in hostile takeovers.

Finally, there is a significant problem with bias in takeover valuations. Target firms may be overly optimistic in estimating value, especially when the takeovers are hostile and they are trying to convince their stockholders that the offer prices

are too low. Similarly, if the bidding firm has decided for strategic reasons to do an acquisition, there may be strong pressure on the analyst to come up with an estimate of value that backs up the acquisition.

Valuation in Corporate Finance

If the objective in corporate finance is the maximization of firm value,[5] the relationship between financial decisions, corporate strategy, and firm value has to be delineated. In recent years, management consulting firms have started offering companies advice on how to increase value.[6] Their suggestions have often provided the basis for the restructuring of these firms.

The value of a firm can be directly related to decisions that it makes—on which projects it takes, on how it finances them, and on its dividend policy. Understanding this relationship is key to making value-increasing decisions and to sensible financial restructuring.

CONCLUSION

Valuation plays a key role in many areas of finance—in corporate finance, in mergers and acquisitions, and in portfolio management. The models presented in this book will provide a range of tools that analysts in each of these areas will find of use, but the cautionary note sounded in this chapter bears repeating. Valuation is not an objective exercise, and any preconceptions and biases that an analyst brings to the process will find their way into the value. And even the very best valuation will yield an estimate of the value, with a substantial likelihood of you being wrong in your assessment.

QUESTIONS AND SHORT PROBLEMS

In the problems following, use an equity risk premium of 5.5 percent if none is specified.

1. The value of an investment is:
   a. The present value of the cash flows on the investment.
   b. Determined by investor perceptions about it.
   c. Determined by demand and supply.
   d. Often a subjective estimate, colored by the bias of the analyst.
   e. All of the above.
2. There are many who claim that value is based on investor perceptions, and perceptions alone, and that cash flows and earnings do not matter. This argument is flawed because:
   a. Value is determined by earnings and cash flows, and investor perceptions do not matter.
   b. Perceptions do matter, but they can change. Value must be based on something more substantial.

[5]Most corporate financial theory is constructed on this premise.

[6]The motivation for this has been the fear of hostile takeovers. Companies have increasingly turned to "value consultants" to tell them how to restructure, increase value, and avoid being taken over.

c. Investors are irrational. Therefore, their perceptions should not determine value.
d. Value is determined by investor perceptions, but it is also determined by the underlying earnings and cash flows. Perceptions must be based on reality.

3. You use a valuation model to arrive at a value of $15 for a stock. The market price of the stock is $25. The difference may be explained by:
   a. A market inefficiency; the market is overvaluing the stock.
   b. The use of the wrong valuation model to value the stock.
   c. Errors in the inputs to the valuation model.
   d. All of the above.

CHAPTER 2

Approaches to Valuation

Analysts use a wide range of models in practice, ranging from the simple to the sophisticated. These models often make very different assumptions, 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 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 (DCF) valuation, relates the value of an asset to the present value (PV) 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 such as 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. Some of these assets are traded financial assets like warrants, and some of these options are not traded and are based on real assets, (projects, patents, and oil reserves are examples). The latter are often called real options. There can be significant differences in outcomes, depending on which approach is used. One of the objectives in this book is to explain the reasons for such differences in value across different models, and to help in choosing the right model to use for a specific task.

DISCOUNTED CASH FLOW VALUATION

While discounted cash flow valuation is only one of the three ways of approaching valuation and most valuations done in the real world are relative valuations, it is the foundation on which all other valuation approaches are built. To do relative valuation correctly, we need to understand the fundamentals of discounted cash flow valuation. To apply option pricing models to value assets, we often have to begin with a discounted cash flow valuation. This is why so much of this book focuses on discounted cash flow valuation. Anyone who understands its fundamentals will be able to analyze and use the other approaches. This section considers the basis of this approach, a philosophical rationale for discounted cash flow valuation, and an examination of the different subapproaches to discounted cash flow valuation.

Basis for Discounted Cash Flow Valuation

This approach has its foundation in the present value rule, where the value of any asset is the present value of expected future cash flows on it.

$$\text{Value} = \sum_{t=1}^{t=n} \frac{CF_t}{(1+r)^t}$$

where n = Life of the asset
CF_t = Cash flow in period t
r = Discount rate reflecting the riskiness of the estimated cash flows

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 real project. 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 projects.

You can in fact think of discounted cash flow valuation on a continuum. At one end of the spectrum you have the default-free zero coupon bond, with a guaranteed cash flow in the future. Discounting this cash flow at the riskless rate should yield the value of the bond. A little further up the risk spectrum are corporate bonds where the cash flows take the form of coupons and there is default risk. These bonds can be valued by discounting the cash flows at an interest rate that reflects the default risk. Moving up the risk ladder, we get to equities, where there are expected cash flows with substantial uncertainty around the expectations. The value here should be the present value of the expected cash flows at a discount rate that reflects the uncertainty.

Underpinnings of Discounted Cash Flow Valuation

In discounted cash flow valuation, we try to estimate the intrinsic value of an asset based on its fundamentals. What is intrinsic value? For lack of a better definition, consider it the value that would be attached to the firm by an unbiased analyst, who not only estimates the expected cash flows for the firm correctly, given the information available at the time, but also attaches the right discount rate to value these cash flows. Hopeless though the task of estimating intrinsic value may seem to be, especially when valuing young companies with substantial uncertainty about the future, making the best estimates that you can and persevering to estimate value can still pay off because markets make mistakes. While market prices can deviate from intrinsic value (estimated based on fundamentals), you are hoping that the two will converge sooner rather than later.

Categorizing Discounted Cash Flow Models

There are literally thousands of discounted cash flow models in existence. Investment banks or consulting firms often claim that their valuation models are better or more sophisticated than those used by their contemporaries. Ultimately, however, discounted cash flow models can vary only a couple of dimensions.

Equity Valuation and Firm Valuation There are two paths to valuation in a business: The first is to value just the equity stake in the business, while the second is to value the entire business, which includes, besides equity, the other claimholders in the firm (bondholders, preferred stockholders). While both approaches discount expected cash flows, the relevant cash flows and discount rates are different under each. Figure 2.1 captures the essence of the two approaches.

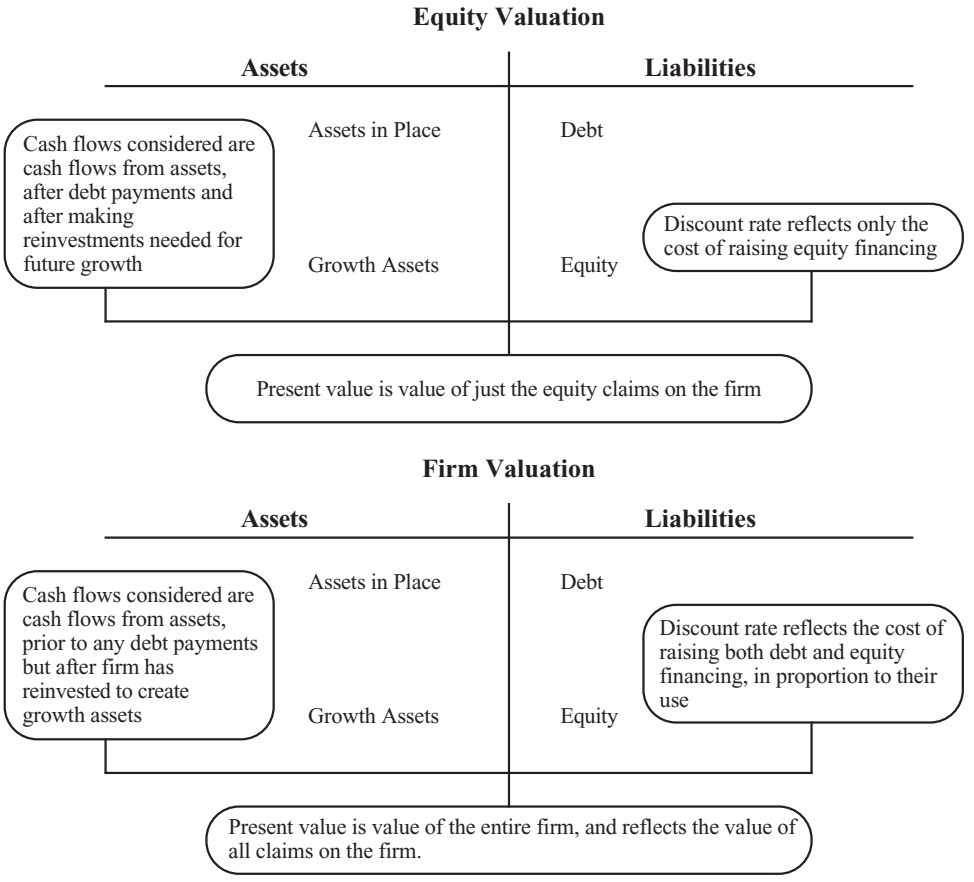

FIGURE 2.1 Equity versus Firm Valuation

The value of equity is obtained by discounting expected cash flows to equity (i.e., the residual cash flows after meeting all expenses, reinvestment needs, tax obligations, and interest and principal payments) at the cost of equity (i.e., the rate of return required by equity investors in the firm).

$$\text{Value of equity} = \sum_{t=1}^{t=n} \frac{\text{CF to equity}_t}{(1+k_e)^t}$$

where n = Life of the asset
CF to equity_t = Expected cash flow to equity in period t
k_e = Cost of equity

The dividend discount model is a special case of equity valuation, where the value of equity is the present value of expected future dividends.

The value of the firm is obtained by discounting expected cash flows to the firm (i.e., the residual cash flows after meeting all operating expenses, reinvestment needs, and taxes, but prior to any payments to either debt or equity

holders) at the weighted average cost of capital (WACC), which is the cost of the different components of financing used by the firm, weighted by their market value proportions.

$$\text{Value of firm} = \sum_{t=1}^{t=n} \frac{\text{CF to firm}_t}{(1+\text{WACC})^t}$$

where n = Life of the asset
CF to firm_t = Expected cash flow to firm in period t
WACC = Weighted average cost of capital

While these approaches use different definitions of cash flow and discount rates, they will yield consistent estimates of value for equity as long as you are consistent in your assumptions in valuation. The key error to avoid is mismatching cash flows and discount rates, since discounting cash flows to equity at the cost of capital will lead to an upwardly biased estimate of the value of equity, while discounting cash flows to the firm at the cost of equity will yield a downwardly biased estimate of the value of the firm. Illustration 2.1 shows the equivalence of equity and firm valuation.

ILLUSTRATION 2.1: Effects of Mismatching Cash Flows and Discount Rates

Assume that you are analyzing a company with the following cash flows for the next five years. Assume also that the cost of equity is 13.625% and the firm can borrow long term at 10%. (The tax rate for the firm is 50%.) The current market value of equity is $1,073, and the value of debt outstanding is $800.

Year	*Cash Flow to Equity*	*Interest (Long-Term)*	*Cash Flow to Firm*
1	$ 50	$40	$ 90
2	$ 60	$40	$ 100
3	$ 68	$40	$ 108
4	$ 76.2	$40	$ 116.2
5	$ 83.49	$40	$ 123.49
Terminal value	$1603.008		$2363.008

The cost of equity is given as an input and is 13.625%, and the after-tax cost of debt is 5%.

Cost of debt = Pretax rate(1 – Tax rate) = 10%(1 – .5) = 5%

Given the market values of equity and debt, we can estimate the cost of capital.

WACC = Cost of equity[Equity/(Debt + Equity)] + Cost of debt[Debt/(Debt + Equity)]
= 13.625%(1,073/1,873) + 5%(800/1,873) = 9.94%

METHOD 1: DISCOUNT CASH FLOWS TO EQUITY AT COST OF EQUITY TO GET VALUE OF EQUITY

We discount cash flows to equity at the cost of equity:

$$\text{PV of equity} = 50/1.13625 + 60/1.13625^2 + 68/1.13625^3 + 76.2/1.13625^4 + (83.49 + \$1{,}603)/1.13625^5 = \$1{,}073$$

Method 2: Discount Cash Flows to Firm at Cost of Capital to Get Value of Firm

$$\text{PV of firm} = 90/1.0994 + 100/1.0994^2 + 108/1.0994^3 + 116.2/1.0994^4 + (123.49 + \$2{,}363)/1.0994^5 = \$1{,}873$$

$$\text{PV of equity} = \text{PV of firm} - \text{Market value of debt} = \$1{,}873 - \$800 = \$1{,}073$$

Note that the value of equity is $1,073 under both approaches. It is easy to make the mistake of discounting cash flows to equity at the cost of capital or the cash flows to the firm at the cost of equity.

Error 1: Discount Cash Flows to Equity at Cost of Capital to Get Too High a Value for Equity

$$\text{PV of equity} = 50/1.0994 + 60/1.0994^2 + 68/1.0994^3 + 76.2/1.0994^4 + (83.49 + \$1{,}603)/1.0994^5 = \$1{,}248$$

Error 2: Discount Cash Flows to Firm at Cost of Equity to Get Too Low a Value for the Firm

$$\text{PV of firm} = 90/1.13625 + 100/1.13625^2 + 108/1.13625^3 + 116.2/1.13625^4 + (123.49 + \$2{,}363)/1.13625^5 = \$1{,}613$$

$$\text{PV of equity} = \text{PV of firm} - \text{Market value of debt} = \$1{,}612.86 - \$800 = \$813$$

The effects of using the wrong discount rate are clearly visible in the last two calculations (Error 1 and Error 2). When the cost of capital is mistakenly used to discount the cash flows to equity, the value of equity increases by $175 over its true value ($1,073). When the cash flows to the firm are erroneously discounted at the cost of equity, the value of the firm is understated by $260. It must be pointed out, though, that getting the values of equity to agree with the firm and equity valuation approaches can be much more difficult in practice than in this example. We return to this subject in Chapters 14 and 15 and consider the assumptions that we need to make to arrive at this result.

Cost of Capital versus APV Approaches In Figure 2.1, we noted that a firm can finance its assets, using either equity or debt. What are the effects of using debt on value? On the plus side, the tax deductibility of interest expenses provides a tax subsidy or benefit to the firm, which increases with the tax rate faced by the firm on its income. On the minus side, debt does increase the likelihood that the firm will default on its commitments and be forced into bankruptcy. The net effect can be positive, neutral or negative. In the cost of capital approach, we capture the effects of debt in the discount rate:

$$\text{Cost of capital} = \text{Cost of equity}(\text{Proportion of equity used to fund business}) + \text{Pretax cost of debt}\,(1 - \text{Tax rate})\,(\text{Proportion of debt used to fund business})$$

The cash flows discounted are predebt cash flows and do not include any of the tax benefits of debt (since that would be double counting).

In a 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. Thus, we start by valuing the business as if it were all equity funded and assess the