9

Valuing Firms

INTRODUCTION

Valuation is one of the key business skills, not just because it is a primary concern in mergers and acquisitions, but also because an understanding of valuation can guide managerial action in a wide variety of business dilemmas. Unfortunately, valuation is not easy, for reasons this chapter illuminates. Entire industries (investment banking, consulting, and securities analysis) have grown prosperous providing valuation services to managers and investors. Today, leading corporations are internalizing these valuation skills in recognition of the importance of valuation to daily management, and out of a desire to be more knowledgeable consumers of the more advanced valuation advisory work provided by outsiders. Forward-thinking managers and analysts should have a good understanding of valuation techniques and processes.

The aim of this chapter is to give a general grounding in valuation, but in sufficient detail as to help the reader recognize important nuances, limitations, and opportunities to improve valuation estimates. This survey assumes some modest grounding in finance concepts. Also, this chapter offers a recommended *process* for valuing the firm. It surveys a number of valuation approaches, highlighting their relative strengths and weaknesses. In addition, the chapter discusses eight practical rules or tips for excellent valuation work.

In truth, this chapter tells only part of the valuation story. It surveys techniques for valuing the firm on a *stand-alone* basis only. It leaves the valuation of jointly created gains, or synergies, for Chapter 11, "Valuing Synergies." Also, it leaves for later chapters important valuation problems regarding options (Chapters 10 and 14), cross-border considerations (Chapter 12), financing choices (Chapter 13), and liquidity and control issues (Chapter 15). This chapter is a foundation for all of those elaborations. Valuation is a huge topic. But as the Chinese proverb says, "A walk of a thousand miles begins with a single step." The first step for the mastery of valuation begins with the following extremely important admonition, or rule:

RULE #1: THINK LIKE AN INVESTOR

To implement the rule to *think like an investor* means merely to ask whether one will be wealthier or not as a result of a transaction, or after adopting a strategy or

managerial policy. Rational investors participate in transactions that they believe will make them better off. They want to *create value*. If valuation analysis is careful and comprehensive, it can shed light on the reasonable course of action for participants in M&A transactions. But successful investors go further: They think about *intrinsic value* very carefully. Here are the most important elements of their view of value.

Look to the Future, Not the Past

Investors make decisions based on expectations of future performance. Obviously, the past might be a fair indicator of the future, though many sadder but wiser investors have been burned by simply extrapolating from the past. The most important implication of this for valuation is that the analyst should base estimates on forecasts of the future, rather than on past results.

Focus on *Economic* Reality

Seasoned investors pay attention to the *flows of cash*, rather than accounting profits. The reason for this is that financial performance described under a system of generally accepted accounting principles (GAAP) is, in the words of one textbook, "not the result of natural laws, but, instead, is the result of ongoing research, experimentation, debate, and compromise."[1] Another text described GAAP as "a humanly devised arbitrary system of measurement and presentation."[2] Warren Buffett, who has perhaps the best investment record of any living corporate manager, wrote:

> *Because of the limitations of conventional accounting, consolidated reported earnings may reveal relatively little about our true economic performance. Charlie and I, both as owners and managers, virtually ignore such consolidated numbers. . . . Accounting consequences do not influence our operating or capital-allocation process.*[3]

Buffett and others rely instead on cash flow as an estimate of the economically realistic performance of a firm. Cash flow may be measured from several perspectives, including all providers of capital (this is "free cash flow") or only the common stockholders ("residual cash flow"). But the generic definition of cash flow is:

$$\text{Cash flow} = \text{Earnings} + \text{Noncash charges} - \text{Investments}$$

Get Paid for the Risks You Take

The more risk you accept, the more return you should require from an investment. Each day, investors in the capital markets demonstrate this simple but profound idea. This is seen in Exhibit 9.1 in the yields available on corporate bonds: As you go from the least risky (U.S. Treasuries and AAA bonds) to the more risky (B bonds), yields rise unerringly. In results like these, the market tells us that investors require more return for more risk.

EXHIBIT 9.1 Yields on Five-Year Corporate and U.S. Government Bonds by Credit Ratings, May 28, 2002

Bond Quality Grade	Annual Yield to Maturity
U.S. Treasuries Commonly regarded as the least-risky bond investment.	4.45%
AAA "Capacity to pay interest and repay principal is extremely strong."	5.40%
AA "... very strong capacity ..."	5.52%
A "... strong capacity ... somewhat more susceptible to the adverse effects of changes in circumstances and economic conditions."	5.87%
BBB "... adequate capacity ... adverse economic conditions or changing circumstances are more likely to lead to a weakened capacity."	6.79%
BB+	8.40%
BB/BB–	8.67%
B "... regarded as predominantly speculative with respect to capacity to pay ... outweighed by large uncertainties or major risk exposures to adverse conditions."	10.82%

Source: Standard & Poor's *Current Statistics*, June 2003. Rating definitions are quoted from Standard & Poor's *Ratings Guide*, New York: McGraw-Hill, 1979, pages 327–328. Reprinted by permission of Standard & Poor's, a division of the McGraw-Hill Companies.

Value Creation: Time Is Money

To think like an investor is to recognize the *time value of money*—that a dollar you will receive in a year is worth less to you now than a dollar received today. This implies that one should make business decisions based on *present values* of future expectations, rather than on undiscounted future values. Warren Buffett assesses intrinsic value as the present value of future expected performance and argues that it is the best method for determining whether

> *an investor is indeed buying something for what it is worth and is therefore truly operating on the principle of obtaining value for his investments. . . . Irrespective of whether a business grows or doesn't, displays volatility or smoothness in earnings, or carries a high price or low in relation to its current earnings and book value, the investment shown by the discounted-flows-of-cash calculation to be the cheapest is the one that the investor should purchase.*[4]

Remember "Opportunity Cost"

One of the most important lessons of the field of economics is that the best decision making takes into account alternative courses of action. That is, one should avoid go/no-go decisions, and instead try to frame acquisition analyses as either/or decisions.

Doing so accounts for alternative opportunities the decision maker should face. The concept of *opportunity cost* has at least two important implications for M&A analysis.

First, opportunity cost is helpful for defining the kinds of deals a firm will or will not do. Exhibit 9.2 reproduces the statement of acquisition goals of Berkshire Hathaway written by Warren Buffett. What motivates this list is an understanding of Berkshire's own competencies; it is prepared to do on its own the kinds of deals that are not generally available in the stock market. Then the statement bluntly concludes with, "*We are not interested, however, in receiving suggestions about purchases we might make in the general stock market.*" Buffett understands oppor-

EXHIBIT 9.2 Berkshire Hathaway Acquisition Criteria

We are eager to hear about businesses that meet all of the following criteria:

1. Large purchases (at least $10 million of after-tax earnings),
2. Demonstrated consistent earning power (future projections are of no interest to us, nor are "turnaround" situations),
3. Businesses earning good returns on equity while employing little or no debt,
4. Management in place (we can't supply it),
5. Simple businesses (if there's lots of technology, we won't understand it),
6. An offering price (we don't want to waste our time or that of the seller by talking, even preliminarily, about a transaction when the price is unknown).

The larger the company, the greater will be our interest: we would like to make an acquisition in the $2–3 billion range.

We will not engage in unfriendly takeovers. We can promise complete confidentiality and a very fast answer customarily within five minutes as to whether we're interested. We prefer to buy for cash, but will consider issuing stock when we receive as much in intrinsic business value as we give.

Our favorite form of purchase is one fitting the pattern through which we acquired Nebraska Furniture Mart, Fechheimer's, Borsheim's, and Central States Indemnity. In cases like these, the company's owner-managers wish to generate significant amounts of cash, sometimes for themselves, but often for their families or inactive shareholders. At the same time, these managers wish to remain significant owners who continue to run their companies just as they have in the past. We think we offer a particularly good fit for owners with such objectives and we invite potential sellers to check us out by contacting people with whom we have done business in the past.

Charlie and I frequently get approached about acquisitions that don't come close to meeting our tests: We've found that if you advertise an interest in buying collies, a lot of people will call hoping to sell you their cocker spaniels. A line from a country song expresses our feeling about new ventures, turnarounds, or auction-like sales: "When the phone don't ring, you'll know it's me."

Besides being interested in the purchase of businesses as described above, we are also interested in the negotiated purchase of large, but not controlling, blocks of stock comparable to those we hold in Capital Cities, Salomon, Gillette, USAir, and Champion. *We are not interested, however, in receiving suggestions about purchases we might make in the general stock market.*

Source: Berkshire Hathaway Annual Report, 1994, page 21. Copyright © 1994 by Berkshire Hathaway. Reprinted by permission of Warren E. Buffett.

tunity cost: By simply making random purchases in the stock market, he would be doing nothing for shareholders that they cannot do themselves.

Second, in an M&A setting, the concept of opportunity cost should direct the analyst to consider alternative strategies for the buyer and seller, including the use of alternative assets and the development of alternative transactions. For instance, the value of a target to the *buyer* should reflect the buyer's plans for operating the target (i.e., not the seller's plans), as well as the possibility that the buyer may be able to obtain the same economic benefits more cheaply from another firm or in a different kind of deal (joint venture, strategic alliance, etc.). An example would be that a buyer might seek to obtain manufacturing capacity. The value of that capacity to the buyer should be worth no more than the maximum of cost of alternatives such as leasing other facilities, establishing a joint venture, or outsourcing production. All of these alternatives can be valued using the techniques summarized in this chapter.

For simplicity, the balance of this chapter will assume that acquisition is the cheapest course of action for the buyer—but every analyst should test this assumption early in any acquisition analysis process. The value of the target to the *seller* should be the target's value in its highest alternative deployment. This should include possible payments by other bidders, liquidation of the firm, and simply continuing to operate it as is. Both the seller and buyer should consider synergies realized in an acquisition by the buyer—though, as discussed in Chapters 11 and 21, the division of these joint benefits is always uncertain, and determined largely by the relative bargaining power of the buyer and seller.

Information Is the Core Source of Advantage in Identifying Value-Creating Investments

A great deal of research suggests that on average and over time security prices reflect what is known about a company—this supports the hypothesis of efficient capital markets. The phrase "on average and over time" is intentionally ambiguous, to allow for the fact that there have been exceptions[5] that make it profitable for professional money managers to do what they do. The general point is, *focus on what you know about a target company that the market does not already know*—this was a key point emphasized in Chapter 8. Warren Buffett has said, "Anyone not aware of the fool in the market probably is the fool in the market."[6] Buffett was fond of repeating a parable told him by Benjamin Graham:

> *There was a small private business and one of the owners was a man named Market. Every day Mr. Market had a new opinion of what the business was worth, and at that price stood ready to buy your interest or sell you his. As excitable as he was opinionated, Mr. Market presented a constant distraction to his fellow owners. "What does he know?" they would wonder, as he bid them an extraordinarily high price or a depressingly low one. Actually, the gentleman knew little or nothing. You may be happy to sell out to him when he quotes you a ridiculously high price, and equally happy to buy from him when his price is low. But the rest of the time you will be wiser to form your own ideas of the value of your holdings, based on full reports from the company about its operations and financial position.*[7]

Diversification Is Good

The Nobel prize in economics for 1990 went to Harry Markowitz for his theoretical work on portfolio optimization, which founded the theory of diversification. The core idea is that spreading wealth across a number of assets reduces the risk of loss—as long as the returns on those assets are less than perfectly correlated. An extreme example of negatively correlated investments would be shares in an umbrella manufacturer and a suntan lotion manufacturer: No matter whether the climate is sunny or rainy, the portfolio of the two kinds of shares can be constructed in a way to yield an expected return at much less risk than could be obtained by concentrating one's wealth in either company alone. Buying the shares of two steel companies does not provide much risk reduction because both companies are likely to be affected by the same economic forces. But diversifying across industries reduces the correlation of possible investment outcomes, and increases the benefits of diversification. Risk reduction through diversification is the principle underlying the insurance industry. A very important implication of diversification for M&A deal doers is that investments should be evaluated in terms of the risk they add to your existing portfolio, rather than the total risk the investment offers on a stand-alone basis.

These seven points summarize what it means to think like an investor and can help the decision maker work through fairly knotty problems by going back to basics. Sensible analysis and action almost always arise from considering a merger or acquisition proposal in light of these issues.

RULE #2: INTRINSIC VALUE IS UNOBSERVABLE; WE CAN ONLY ESTIMATE IT

An important point of departure in all valuation analysis appears at first to be an exercise in semantics, a mincing of definitions of "value." The analyst has, after all, numerous points of reference, such as *book value*, *liquidation value*, replacement value, present value, and multiples value. These many approaches to value generate confusion or false confidence, the rock and the hard place of M&A. The novice may well wonder which value is "right." Conversely, with an abundance of definitions, the novice may conclude that valuation is really a very straightforward process of generating numbers. It is only the concept of intrinsic value that can help steer between these twin threats of confusion and false confidence.

The aim of all valuation analysis is to assess the true or intrinsic value of an asset. Unfortunately, intrinsic value is unobservable. All of the "values" listed here are merely vantage points from which to assess intrinsic value: These values are not necessarily "intrinsic." Virtually every number you use in valuation is *measured with error*, either because of flawed methods to describe the past or because of uncertainty about the future. This simple fact has several important implications for valuation analysis:

- The results of valuation analysis are *estimates*. To label the valuation results this way is gently to remind the user of these results that intrinsic value is unobservable, a subtle kind of "truth in valuation" disclaimer.

- The entire process of valuation analysis should be structured as a *triangulation* from several vantage points. To triangulate is to measure something indirectly based on different points of observation. As a general matter this would suggest that more points of observation are better in valuation analysis (up to a limit imposed by one's time and budget). The larger implication is that one should work with many estimates and *estimators*.
- Do not work with point estimates of value; work with ranges. If intrinsic value is unobservable, then producing point estimates of value creates false precision. Professionalism lies in identifying the range within which intrinsic value reasonably resides. Through careful analysis, one should aim to narrow the range, but not eliminate it.

RULE #3: AN OPPORTUNITY TO CREATE VALUE EXISTS WHERE PRICE AND INTRINSIC VALUE DIFFER

The whole aim of valuation is to find, and exploit, profit-making opportunities. Value is created (profit is "made") where you sell something for more than it is worth to you, or buy something for less than it is worth—in these two instances, price and intrinsic value differ. Cast in the context of M&A, the *rules for creating value* may be summarized as:

Rules for Creating Value and Avoiding Value Destruction

Buyer's view:	Accept the proposed deal if: Intrinsic value of target to the buyer > Payment.
Seller's view:	Accept the proposed deal if: Payment > Intrinsic value of target to the seller.

These rules embody the simple logic that *rational businesspeople do not want to be worse off after the deal than they were before.* In simple terms, investors want to create value, or at the very least, conserve it; this is the fundamental quality of thinking like an investor.

Why intrinsic value and price may differ is in a sense the focus of this book, and a subject worth very lengthy discussion. Virtually all strategic buyers illustrate this rule at work: The target company has an intrinsic worth to them that is higher than acquisition price because of possible economies of scale and scope, various synergies, and opportunities for cost cutting.

A very important offshoot of this rule is the concept of *value additivity*. This concept says that in perfect circumstances, the value of the whole should equal the sum of the values of the parts.

$$\text{Value}_{\text{Enterprise}} = \Sigma(\text{Value of business units}) = \text{Equity} + \text{Debt} \qquad (1)$$

The radical idea here is the notion that these three quantities should be equal. This follows intuition: If markets work well, one will not be willing to pay more for a basket of 10 apples than one could pay for 10 individually. In addition, the idea

that the enterprise value should be equal to the value of all the firm's securities is just another expression of the basic idea that the whole should equal the sum of the parts. Also, this equality is reflected in the basic accounting identity that Assets = Debt + Equity.

Our interest, however, is not in the theory premised on perfect conditions, but rather in departures from it. In other words, value additivity gives us a framework for testing for deviations of price from intrinsic value: Simply value the parts, and see whether the sum differs from the value of the whole. This is a steady practice among securities analysts, and was the underlying analysis of the "bust-up" acquisitions of the 1980s and 1990s.

The idea of value additivity highlights one final important detail: When we talk about value, we must be clear about *what* it is we are valuing. Specifically, in valuation work one finds two sorts of valuations:

1. ***Enterprise value.*** This is the value of the whole firm, the intrinsic value of the firm's net assets. The convention of most M&A analysts is to work with net assets (which equals total assets less current liabilities) in recognition of the fact that accounts payable and accruals arise in the ordinary course of generating current assets.
2. ***Equity value.*** This is the value of the residual claim on the firm's assets, typically the intrinsic value of the firm's common stock.

These two types of value are related by the economic identity that:

$$\text{Enterprise value} = \text{Value of debt} + \text{Value of equity} \tag{2}$$

RULE #4: SO MANY ESTIMATORS, SO LITTLE TIME— IT HELPS TO HAVE A VIEW

There are, by conservative count, nine approaches to valuing a firm:

1. Book value of the target firm.
2. Liquidation value of the target firm.
3. *Replacement cost* of the target firm.
4. *Current market value* of the target firm.
5. *Trading multiples* of comparable firms applied to the target.
6. *Transaction multiples* of comparable acquisitions applied to the target.
7. *Discounted cash flow* of the target firm.
8. Venture capital/private equity approach.
9. Option theory valuation of the target firm.

Not all these estimators carry equal influence in the field of M&A valuation. To some extent, the problem of many estimators can be mitigated by understanding their relative strengths and weaknesses, and weighting the estimates according to your view of the method. To appreciate the importance of Rule #4 requires a survey of the essential points of these various methods.

Estimates Based on Accounting Book Value

Book values are estimated by auditors based on GAAP and techniques of sampling and transaction analysis that auditors use. This approach is dominated by the principle of conservatism that tends to reflect only what has already happened, and ignore most assets or values that are not tangible. This is one of the easiest approaches available to any analyst of a company with audited financial statements. These estimates carry the imprimatur of the certified public accountant, which lends an aura of certitude and is influential with some segments of the public who have no familiarity with financial ideas.

The important defects of this approach stem from its reliance on accounting practices. Book values ignore intangible assets like brand names, patents, technical know-how, and managerial competence. The method ignores price appreciation due, for instance, to inflation. It invites disputes about types of liabilities. For instance, are deferred taxes equity or debt? Most importantly, the book value method is *backward looking*. It ignores the positive or negative operating prospects of the firm. If "think like an investor" means anything, it surely means that one should make financial decisions based on expectations about the future rather than knowledge about the past.

Book value has rather limited significance as an estimator of the value of healthy, growing firms. These estimates may be appropriate for firms with no intangible assets, commodity-type assets valued at market, and stable operations.

Liquidation Value of the Target Firm

This is perhaps the most conservative valuation approach, as it simply sums the values that might be realized in a liquidation of the firm today. Estimates of these values are developed from a blend of the methods surveyed in this chapter. But the fundamental question asked in valuing the various assets always is, "What will this asset fetch in an auction?" Experienced liquidation analysts typically assess these values as a percentage of the book value of the asset.

Exhibit 9.3 gives an example in which an analyst assumes that the liquidation of ABC Corp. would result in realization of all of its cash, 80 percent of its receivables, 60 percent of its inventory, and 40 percent of the book value of its plant and equipment. Note that in this example, liquidation value is considerably smaller than book value. This is usually the case, since the accounting conventions that produce book value assume that the firm is a *going concern* that will live indefinitely. In contrast, a liquidating firm has a short life remaining. Receivables thought to be collectible in the fullness of time may be uncollectible at liquidation; some kinds of inventory like intermediate manufacturing products may be valuable only if converted to a finished product; finished goods inventory may be worth much less to the customer if there will be no company to stand behind product warranties. Plant and equipment may be so specialized that they have little value to other firms.

The weaknesses of this approach are manifest in the methodology just illustrated. First, liquidation values tend to be highly appraiser-specific. One should look for reasonable rules of thumb or recovery ratios based on comparable liquidations as foundations for the analyst's work. Second, estimates under this method are highly influenced by judgments about how finely one might break up the company: Will one

EXHIBIT 9.3 Liquidation Estimate of Value of ABC Corp.

	Book Value	Assumed Percentage of Book Value Collected in Liquidation	Liquidation Value
Cash	$ 10	100%	$10
Receivables	$ 30	80%	$24
Inventory	$ 25	60%	$15
Plant and equipment	$ 35	40%	$14
Total	$100		$63
Debt	$ 50	100%	$50
Equity	$ 50		$13

sell a fully stocked plant, or sell the assets individually down to the nails? Third, physical condition of the assets will affect values significantly; the auditor's estimate of remaining book value in an asset category may not reflect real economic wear on machinery, the longevity of products, or the obsolescence of inventory. There can be no substitute for an on-site assessment of a company's assets. Fourth, this method easily ignores the value of hidden rights (or "options," as discussed later), growth opportunities, and valuable intangible assets such as patents and brand names.

Practiced at its most conservative level, this method probably is not useful for analysts in an M&A setting. However, it will be appropriate for firms in financial distress, or more generally, for firms whose operating prospects are very cloudy. This method of valuation requires the skills of an experienced asset valuation expert rather than an operating manager.

A variation of liquidation value, commonly known as *bust-up value*, is estimated in M&A by opportunistic investors (commonly called "hostile raiders"), by financial investors seeking to take firms private, and by industry consolidators. One classic example of this valuation approach was UV Industries in which the raider, Victor Posner, took an unsolicited investment position in 1978. The company's market value of equity was trading near its book value of equity, $266 million. UV Industries was a conglomerate consisting of business units in electrical equipment manufacturing, railroad transportation, extraction of coal, copper, gold, oil and gas, steel manufacturing, and copper and brass fabrication. Valuing these pieces independently and then summing the pieces, UV's common equity was estimated conservatively to be worth $470 million.[8] This disparity between price and estimated intrinsic value constituted a value-creating opportunity (see Rule #3). The board of UV ordered the firm to be liquidated rather than permit a takeover by Posner. Within 18 months the pieces had been sold and the shareholders had received total liquidating dividends of $806 million.

Replacement Cost Valuation

Replacement cost values of firms are estimated by determining the cost to replace the assets of the firm piecemeal today. In the 1970s and early 1980s, during the era

of high inflation in the United States, the Securities and Exchange Commission required public corporations to estimate replacement values and report them annually. This method has been less useful in recent years. But generally, replacement cost valuation will give valuable insights in any high-inflation setting, and would be of particular value today in some developing countries.

This valuation approach has one important virtue over the ordinary accounting book value approach: It reflects current conditions rather than past experience. A convention in accounting is to carry assets at a value that is the lower of cost or market. Fixed asset values in healthy firms reflect original investment outlays rather than current replacement values. In an inflationary environment, historical cost will be a poor indication of current value.

But replacement cost valuation has several potential weaknesses. First, it is often unclear what is to be replaced. Realistically, many managers would not replace an old and inefficient plant with the same design. Instead they would use the replacement opportunity to streamline the manufacturing process and incorporate advances in technology and manufacturing concepts. Analysts and decision makers should determine *which* replacement value is to be estimated: old plant or new plant? Second, replacement cost estimation is relatively highly subjective, often relying on rules of thumb. Third, these estimates ignore the uses to which the assets will be applied, and the resulting expectations of future performance. Fourth, some intangible assets may be difficult if not impossible to value under this method—some replacement cost valuations ignore them altogether.

In short, this method may have limited usefulness in low-inflation environments. But it remains a potentially useful tool for special circumstances.

Current Trading Value or Market Value

The current market value of an enterprise is simply the sum of the market values of its debt and equity. The value of equity is simply share price times the number of shares. The value of debt can be estimated by literally estimating the present value of debt cash flows, though ordinarily book value will be close to market value unless the firm's credit rating has changed or the general level of interest rates has moved since the debt was issued.

In estimating the market value of "debt," two kinds of liabilities are ignored. First, deferred taxes are viewed as a government subsidy (these taxes will not be paid by a growing firm), and thus are captured in the market value of equity. Second, current liabilities are seen as a claim against current assets: Positive or negative working capital is reflected in the market value of equity.

The current market value of the firm's securities is an extremely important reference point to the valuation of the public corporation, because we can reasonably assume that *market prices reflect what is known about a firm.* To think like an investor is to know that information is a key source of economic advantage; one must concentrate on identifying what one knows relative to what is known broadly in the market. Current market value can help the analyst focus attention on possible information asymmetries, on private information known only to insiders or acquirers who may see a special economic opportunity in the target company.

These prices will be relatively more useful if the target firm's securities are actively traded, followed by professional securities analysts, and if the market efficiently

impounds all public information about the company and its industry. This approac is less helpful for less well-known companies with thinly or intermittently trade stock. It is simply not applicable to privately held companies—see Chapter 15 fc more on the impact of illiquidity on valuation.

Current market value is a useful reference in merger negotiations. Very rarel do merger terms settle at prices below current market value. One recent exceptio was Bell Atlantic's merger with GTE announced in July 1998. The terms called fo an exchange of shares that valued GTE at 6 percent less than the price prevailin before the announcement. One investor said, "It unnerves me that they offered below-market price."[9] In this case, as in the few other memorable instances, ob servers point to the overriding influence of "social issues" such as the distributio of power between the bidder and target CEOs and/or the possibility that the *e. ante* target price was unduly inflated by market rumors that did not reflect the rea ity of the impending deal.

Trading Multiples of Peer Firms

This approach estimates a target's value by applying the valuation multiples of pee firms to the target. The assumption is that these multiples reflect the general out look for an industry or a group of firms. Exhibit 9.4 lists multiples one may en counter in practice. As this exhibit shows, *the analyst must remember that som multiples estimate the value of the whole enterprise, while others estimate the valu of equity only.*

Valuation by multiples is widely used in the financial community. The artistr of this method lies in selecting the sample of peer firms on which to base the valua tion of the target. Ideally, one would use only those firms that matched the targe on the basis of current lines of business, outlook for the future, financial policy, an size. Finance theory suggests that the size of a multiple is driven by two main fac tors: risk and expected growth. For instance, the widely used price/earnings (P/E multiple can be decomposed into two factors:

$$\frac{\text{Stock price}}{\text{E(EPS)}} = \frac{1}{r} + \frac{\text{PVGO}}{\text{E(EPS)}} \qquad (3$$

EXHIBIT 9.4 Classic Valuation Multiples

Multiples That Value the Enterprise	Multiples That Value Equity
Enterprise value/EBIT	Stock price/earnings per share
Enterprise value/EBITDA	Stock price/book value of equity per share
Enterprise value/sales	
Enterprise value/book value of assets	

Note: Enterprise value equals the market value of equity (calculated as share price time number of shares) plus market value of debt (for which book value is usually a reasonabl approximation). EBIT stands for earnings before interest and taxes. EBITDA stands fo earnings before interest, taxes, depreciation, and amortization.

E(EPS) is the earnings per share expected to be reported next year. The factor "r" is the required return on equity, which is determined by risk. And PVGO is the present value of growth opportunities per share, an estimate of today's value of investments expected to be made in the future.[10] The term "growth company" is not defined by the growth rate of sales, earnings, or assets, but by the size of PVGO relative to the market value of equity. In other words, the P/E ratios of growth firms are typically sizable and driven significantly by attractive future growth opportunities. One can decompose other ratios in a similar fashion. But the key idea is that multiples reflect important economic phenomena. To judge whether a multiple is appropriate, one should look into the underlying economic fundamentals.

Although widely used and simple to use, valuation by the multiples approach is vulnerable to several potential problems. First, rarely does one find a "pure play" peer on which to base a valuation. How far to stray from the narrow profile of the target company in choosing peers is a major point of judgment.

A second possible weakness is the dependence of this method on accounting practices. Generally accepted accounting principles (GAAP) afford managers rather wide latitude in reporting the financial results of the firm. In using this method, the analyst must scrutinize the accounting practices of the target and peer firms to determine the comparability of their reporting policies and their results.

A third caveat concerns when the multiple is computed: Multiples are often based on the financial performance for the fiscal year just completed. But some analysts quote multiples based on *expected* performance for the year ahead. Lagging multiples (based on the prior calendar year's, fiscal year's, or 12 months' financial performance) will usually be larger than leading multiples (based on a forecast of the next year's performance). For growing firms, the difference in financial performance between the year just past and the year ahead will be material. Another manifestation of this timing problem is that fiscal year-ends may vary among the target firm and the peers. In industries experiencing some volatility, a difference of one or two quarters in the reporting of year-end results may result in rather different multiples. Further, firms in the same peer group may end their fiscal years at different times. If an industry has any cyclicality or business surprises, these different fiscal year-ends could create large variances in the resulting P/Es.

Fourth, this method focuses on proxies for cash flow, rather than cash flow itself. Thus, it ignores important effects of capital investment, investment in working capital, and depreciation. Also, it may naively discriminate against targets currently losing money or with negative equity—for instance, in the 1990s many cable television companies fell into this category. The ignorance of factors such as taxes, depreciation, and investment has led some analysts to reject the use of multiples. Others look toward specialized multiples such as revenues/enterprise value, price/cash flow, or price/EBITDA (earnings before interest, taxes, depreciation, and amortization)—but these alternatives suffer many of the same flaws as P/E. One money manager said, "EBITDA is like Alice in Fantasyland. It should be outlawed from securities analysis."[11]

Finally, multiples are "opaque boxes," abstractions of investment value. It is challenging under this method to conduct a meaningful sensitivity analysis, for instance to test the impact of different future expectations and scenarios on the value of the firm.

Transaction Multiples for Peer Firms

In an M&A setting, valuation analysts will look to comparable transactions as an additional benchmark against which to assess the target firm. This approach harnesses many of the same multiples mentioned earlier, adapted to the *actual prices* paid for the firms. The caveats for this approach are the same as those discussed in the preceding section. The chief difference between transaction multiples and peer multiples is that the former will reflect a *control premium*, typically of 30 to 50 percent, that is not present in the ordinary trading multiples of firms' securities. The premium for control is discussed further in Chapter 15.

Discounted Cash Flow Values

This approach calculates the present value of cash flows using an estimated cost of capital. The result will be the present value of the enterprise. Finding the present value of a stream of cash (or "discounting") is arithmetically the opposite process of compounding. One divides an individual flow of cash (CF) by a factor $(1 + K)^N$, reflecting the number of years into the future (N) and one's impatience for receiving the cash (reflected by K, called "cost of capital"). The formula for valuing a stream with an infinite life is:

$$\text{DCF value} = \frac{CF_1}{(1+K)} + \frac{CF_2}{(1+K)^2} + \frac{CF_3}{(1+K)^3} + \ldots + \frac{CF_\infty}{(1+K)^\infty} \tag{4}$$

While most firms have infinite lives, actually valuing such a stream would be impossible. Therefore, analysts typically forecast cash flows out to a reasonable horizon such as five or at most 10 years, and then add a *terminal value* or *continuing value* to the final flow, reflecting the firm's value at that date of all the cash flows occurring thereafter. This simplifies the formula considerably; here is an example of the formula for a five-year forecast. Note that the last term values the cash flows in the fifth year plus the value of the firm as of the end of that year (TV_5).

$$\text{DCF value} = \frac{CF_1}{(1+K)} + \frac{CF_2}{(1+K)^2} + \frac{CF_3}{(1+K)^3} + \frac{CF_4}{(1+K)^4} + \frac{CF_5 + TV_5}{(1+K)^5} \tag{5}$$

KEY PRINCIPLE: USE A DISCOUNT RATE CONSISTENT WITH THE RISK OF THE CASH FLOW BEING VALUED Remember that one can value the enterprise or equity. Discounted cash flow (DCF) can value both. A common mistake of novices is to mix the two in estimating DCFs. Instead, one needs to be consistent throughout the analysis, discounting cash flows to all providers of capital (also known as free cash flows) at a blended cost of capital reflecting the required returns of all providers of capital, also known as *weighted average cost of capital* (WACC). This approach values the enterprise. Alternatively, one can value equity by discounting cash flows to equity (also known as residual cash flows) at the cost of equity. These are the correct pairings of discount rates and cash flows. *Do not mix the pairings.*

The large implication of this is that we need to be careful about how we define "cash flow" and "cost of capital." Generally, cash flow will be the sum of after-tax earnings, plus depreciation and noncash charges, less investment. But from an enterprise valuation standpoint, "earnings" must be earnings after taxes available to *all* providers of capital or EBIAT (earnings before interest and after taxes). From an equity standpoint, earnings must be net income. A useful acid test in determining where one is working with equity or enterprise cash flows is to ask, "Are the cash flows net of interest and principal payments?" If so, they are equity flows; if not, they are enterprise flows. A similar careful distinction must be drawn with respect to discount rate and terminal value. The distinctions are summarized in Exhibit 9.5.

CAVEATS ABOUT TERMINAL VALUE Terminal value is typically a large component of the present value of a company. Exhibit 9.6 shows that for a dart-selected sample of stocks on the New York Stock Exchange, terminal value accounts for about 90 percent of the share price. The overwhelming influence of terminal value is troublesome to many executives, who ask why something so far off in the future should have such a big impact today. Intuitively, the answer is that terminal value matters so much because it capitalizes the long-term growth prospects of the firm. Growth is the "big enchilada" of valuation. Thus, in view of its importance, the first caveat here is: *Pay careful attention to terminal value.*

A range of residual values can be estimated using the various estimation

EXHIBIT 9.5 Properly Match Discount Rates and Cash Flows

Value of:	Cash Flow	Terminal Value	Discount Rate
Firm or assets	Free cash flow (FCF) (i.e., before servicing debt, preferred, or common equity) FCF = [EBIT × (1 – t)] + Depreciation – Capex – ΔNWC + ΔDefTax	Firm or asset value $TV_{Firm}\ \frac{FCF \cdot (1+g_{FCF})}{WACC - g_{FCF}}$	Weighted average cost of capital
Equity	Dividends or residual cash flow (RCF) (i.e., after servicing debt): RCF = Net Income + Depreciation – Capex – ΔNWC + ΔDefTax + ΔDebt	Value of equity $TV_{Equity} = \frac{RCF \cdot (1+g_{RCF})}{K_e - g_{RCF}}$	Cost of equity
Debt	Interest, fees, principal	Principal outstanding at maturity	Cost of debt

Capex—Capital expenditures
NWC—Net working capital
DefTax—Deferred taxes

EXHIBIT 9.8 Dart-Selected Sample of Firms with Analysis of Five-Year Dividends as a Percent of Stock Price, 1996

Company	Recent Price	Annual Dividend	Five-Year Dividend Growth	Beta	Equity Cost	Present Value of Five Years' Dividends	Percent of Market Price Not Attributable to Dividends
AlliedSignal	$42.00	$0.78	14.5%	1.15	12.3%	$4.14	90%
Burlington Northern	78.00	1.20	0.0	1.15	12.3	4.30	94
Caterpillar	57.00	1.20	30.0	1.25	12.8	9.37	84
Cooper Industies	34.00	1.32	2.5	1.15	12.3	5.06	85
Cummins Engine	35.00	1.00	26.0	1.10	12.0	7.22	79
Delux Corp.	28.00	1.48	1.5	0.90	10.9	5.71	80
R.R. Donnelley	39.00	0.68	16.0	1.05	11.7	3.81	90
Dun & Bradstreet	62.00	2.63	4.0	1.00	11.5	10.73	83
Eaton Corp.	51.00	1.50	6.5	1.05	11.7	6.51	87
Emerson Electric	71.00	1.75	9.5	1.05	11.7	8.24	88
Equifax	20.00	0.32	6.5	1.25	12.8	1.35	93
Federal Express	82.00	0.00	0.0	1.35	13.4	0.00	100
Fluor Corp.	58.00	0.60	11.5	1.25	12.8	2.90	95
Honeywell	44.00	1.01	11.5	1.10	12.0	4.98	89
Illinois Tool Works	59.00	0.62	10.5	1.10	12.0	2.98	95
Kelly Services	28.00	0.78	11.0	1.10	12.0	3.80	86
Owens-Corning	44.00	0.00	0.0	1.50	14.2	0.00	100
Raychem	57.00	0.32	4.5	1.30	13.1	1.27	98
ServiceMaster	30.00	0.95	2.5	0.80	10.4	3.82	87
Sherwin-Williams	40.00	0.64	6.5	1.10	12.0	2.76	93
Stone Container	18.00	0.15	7.0	2.25	18.2	0.56	97
Tenneco	47.00	1.60	6.0	1.15	12.3	6.75	86
WMX Technologies	30.00	0.60	5.5	1.20	12.6	2.48	92
Westinghouse	16.00	0.20	0.0	1.15	12.3	0.72	96
							Average 90%

Note: To illustrate the estimate of 90% for AlliedSignal, the annual dividend of $0.78 was projected to grow at 14.5% per year to $0.89 in 1997, $1.02 in 1998, $1.17 in 1999, $1.34 in 2000, and $1.54 in 2001. The present value of these dividends discounted at 12.3% is $4.14. This equals about 10% of AlliedSignal's stock price, $42.00. The complement, 90%, is the portion of market price not attributable to dividends.

Source of data: Value Line *Investment Survey* for prices, dividends, growth rates, and betas. Other items calculated by the author.

procedures summarized in this chapter. A standard estimator of terminal value is the constant growth valuation formula:

$$\text{Terminal value} = \frac{\text{CF} \cdot (1+g^{\infty})}{K-g^{\infty}} \tag{6}$$

Two of the variables in this model are relatively straightforward. Cash flow (CF) is taken from the final year of the financial forecast. The cost of capital (K) is estimated using the techniques described in the following section. The third item, g^{∞}, is the compound average growth rate of the cash flows to infinity, and is the "tail that wags the dog"—typically small changes in g^{∞} will produce relatively large changes in terminal value and DCF value. This motivates the second caveat: *Take care in estimating* g^{∞}.

There are two classic approaches for estimating a growth rate to use in the constant growth formula. The first is to use the self-sustainable growth rate formula:

$$g^{\infty} = \text{ROE} \times (1 - \text{DPO}) \tag{7}$$

This assumes that the firm can grow only as fast as it adds to its equity capital base through the return on equity (ROE) less any dividends paid out, indicated through the dividend payout (DPO) ratio. Novices may simply extrapolate *past* ROE and DPO without really thinking about the future. Also, it relies on accounting ROE and can give some unusual results. For a full discussion and critique of the self-sustainable growth model, see Appendix 6.1 in Chapter 6.

The second approach assumes that nominal growth of a business is the product of *real growth* and *inflation*. In more proper mathematical notation the formula is:

$$g^{\infty}_{\text{Nominal}} = [(1 + g^{\infty}_{\text{Units}}) \times (1 + g^{\infty}_{\text{Inflation}})] - 1 \tag{8}$$

This formula uses the economist's notion[12] that the nominal rate of growth is the product of the rate of inflation and the "real" rate of growth. We commonly think of real growth as a percentage increase in units shipped. But in rare instances, real growth could come from price increases due, for instance, to a monopolist's power over the market. For simplicity, many analysts just use a short version of the model (less precise, though the difference in precision is usually not material):

$$g^{\infty}_{\text{Nominal}} = g^{\infty}_{\text{Units}} + g^{\infty}_{\text{Inflation}} \tag{9}$$

Both variations of the equation focus on two interesting issues: the real growth rate (that is, the growth rate in units shipped) in the business, and the ability of the business to pass along the effects of inflation. The consensus inflation outlook in the United States today calls for an inflation rate between 1 and 3 percent indefinitely. The real growth rate is bound to vary by industry. Growth in U.S. unit demand of consumer staple products (like Band-Aids) is probably determined by growth rate of the population—less than 1 percent in the United States. Growth in demand for industrial commodities like steel is probably about equal to the real rate of growth of gross national product (GNP)—about 2.5 percent on average through time. In any event, all of these are small numbers.

The sum of the real growth rate and the expected inflation rate today yields a small number; this is intuitively appealing since over the very long run, the increasing maturity of a company will tend to drive its growth rate toward the average for the economy. This leads to the third caveat: *Growth to infinity is likely to be a small number; avoid "irrational exuberance" in estimating these growth rates.*

The fourth caveat addresses a final issue about growth: *Assuming a growth rate*

greater than WACC gives a negative terminal value. This is an instance in which you cannot use the constant growth model. However, WACC less than g cannot happen; a company cannot grow to infinity at a rate greater than its cost of capital. To illustrate why, let's rearrange the constant growth formula to solve for WACC:

$$\text{WACC} = \frac{\text{FCF}_{\text{Next period}}}{\text{Value of firm}_{\text{Current period}}} + g^{\infty}_{\text{FCF}} \tag{10}$$

If WACC were less than g, then the ratio of FCF divided by value of the firm would have to be *negative*. Since the value of the healthy firm to the investors cannot be less than zero,[13] the source of negativity must be FCF—that means the firm is absorbing rather than throwing off cash. Recall that in the familiar constant growth terminal value formula, FCF is the flow that compounds to infinity at the rate g. Thus, if FCF is negative, then the entire stream of FCFs must be negative—such a company is like Peter Pan: *It never grows up*; it never matures to the point where it throws off positive cash flow. This makes no sense, for investors would not buy securities in a firm that never paid a cash return. In short, you cannot use the constant growth model where WACC is less than g, because of the unbelievable implications of that assumption.

WHERE DISCOUNT RATES COME FROM The discount rate should reflect the investor's opportunity cost, the rate of return required on assets of comparable risk. For free cash flows (that is, flows to all providers of capital), the appropriate rate will be a blend of the required rates of return on debt and equity, weighted by the proportion of those sources of capital in the firm's market value capital structure. The result is the weighted average cost of capital, or WACC. The equation for this is:

$$\text{WACC} = i_d(1 - t)\, W_d + K_e W_e \tag{11}$$

where i_d = expected yield (internal rate of return—IRR) on target's new debt after merger.

K_e = Current cost of target's equity capital (see below).

W_d, W_e = Debt and equity as percentages of the target firm's *market value* capital structure after merger. The market values should be estimated from current market prices of the debt and equity. For private firms, estimates by DCF or other methods must suffice.

t = Marginal (not average) tax rate of the target firm.

Bradley and Jarrell (2003) have argued that this standard WACC formula understates the true nominal WACC in the presence of taxes and inflation. They show that an alternative formulation of WACC by Miles and Ezzell (1980) (M&E) correctly adjusts for taxes and inflation. The M&E WACC model is:

$$\text{WACC} = K_U - \frac{t i_d \dfrac{D}{V_L}(1 + K_U)}{(1 + i_d)} \tag{12}$$

where i_d = Expected yield (IRR) on target's new debt after merger.
K_U = Cost of target's equity capital *as if unlevered* (i.e., computed using an unlevered beta).
D = Market value of the target's debt.
V_L = Enterprise value of the target, levered. The market value should be estimated from current market prices of the debt and equity. For private firms, estimates by DCF or other methods must suffice.
t = Marginal (not average) tax rate of the target firm.

Bradley and Jarrell find that at higher levels of inflation the traditional WACC model produces material (greater than 15 percent) valuation errors. At low levels of inflation (such as 1 to 3 percent during the 1998–2003 period in the United States) and conventional levels of debt, the difference in WACC estimates is small and within what a practical analyst would call the "noise level" of valuation. Given widespread familiarity with the traditional model and low prevailing inflation rates, this book applies the traditional WACC model rather than the M&E model. Nevertheless, the careful analyst should apply the M&E model under conditions of higher inflation.

There are two general approaches to estimating the cost of equity: the *dividend growth model* and the *capital asset pricing model* (*CAPM*).

Dividend Growth Model of the Cost of Equity

$$K_e = \frac{\mathrm{DIV}_1}{P_0} + g^{\infty} \tag{13}$$

where DIV_1/P_0 = Current dividend yield.
g^{∞} = Constant expected growth rate of dividends to infinity.

This model is best used in estimating the equity costs for firms in stable industries, such as public utilities. The caveat in using this model is that it implies that growth drives the cost of equity, when there is no obvious reason why this should be so. Some analysts will argue that rapidly growing firms are riskier, thus necessitating higher cost of equity. If this is so, then the capital asset pricing model (CAPM) is better to use since it explicitly models the risk-return relationship.

Capital Asset Pricing Model of Cost of Equity

$$K_e = R_f + \beta(R_m - R_f) \tag{14}$$

where R_f = The expected return on risk-free securities over a time horizon consistent with your investment in the target. Generally use long-term government bond rates.
$R_m - R_f$ = The risk premium for common stocks. From 1926 to 2000, the risk premium for common stocks has averaged about 6 percent when measured geometrically, and about 7.5 percent when measured arithmetically.[14]
β = *Beta*, a measure of the systematic risk of a firm's common stock. Estimates of beta are available from Bloomberg, Value Line, and

Merrill Lynch. Alternatively, it can be estimated by regression; most analysts use at least 60 observations of prices. If beta is greater than 1.0, the target's stock is more volatile than the market; if less than 1.0, the stock is less volatile.

If the acquirer intends to change the financial leverage of the target significantly, beta should be adjusted.

Step 1: Unlever the beta. This *unlevered beta* captures the degree of risk in the firm's operations, before financing:

$$\beta_{\text{Unlevered}} = \frac{\beta_{\text{Levered}}}{1+(1-t)\text{D/E}} \tag{15}$$

where D/E is the target's market value debt-equity ratio *before* acquisition, and t is the marginal tax rate of the firm.

Step 2: Relever the beta:

$$\beta_{\text{Levered}} = \beta_{\text{Unlevered}}[1 + (1 - t)\ \text{D/E}] \tag{16}$$

where D/E is the target's debt-equity ratio *after* relevering, and t is the target's marginal tax rate.

An alternative formula for the unlevered or *asset beta* of a firm holds that the unlevered beta is a weighted average of the firm's debt and equity betas. This unlevered beta is also called the enterprise beta or asset beta:

$$\beta_{\text{Unlevered}} = \beta_{\text{Debt}}\left(\frac{\text{Debt}}{\text{Debt}+\text{Equity}}\right)+\beta_{\text{Equity}}\left(\frac{\text{Equity}}{\text{Debt}+\text{Equity}}\right) \tag{17}$$

Note that in this alternative model of the unlevered beta, there is no provision for the impact of taxes. This model assumes that through homemade leverage, investors can appropriate for themselves the benefits of debt tax shields and that the tax impact of leverage is neutralized.[15] This implies that the levered beta (that is, equity beta) formula will be:

$$\beta_{\text{Levered}} = \beta_{\text{Asset}} + (\beta_{\text{Asset}} - \beta_{\text{Debt}})\frac{\text{Debt}}{\text{Equity}} \tag{18}$$

This alternative version of the levered beta formula is useful because it permits the analyst to assume that the firm has risky debt outstanding, meaning that the debt bears some degree of default risk of the enterprise. The debt betas of corporate bonds are typically in the range of 0.15 to 0.25 for investment grade issues. But for non–investment grade debt (so-called "junk" debt) the betas will be materially higher. By subtracting the debt beta, this formula recognizes that the creditors bear some of the risk of the enterprise.

If, in this second formula, you assume debt free of default risk (i.e., the debt

beta has a value of zero) and a world in which corporate taxes do matter—that is, $(1 - t)$ is reinserted into the formula—then it boils down to the same formula as the first:

$$\beta_{\text{Levered}} = \beta_{\text{Asset}} + (\beta_{\text{Asset}} - \beta_{\text{Debt}})(1-t)\frac{\text{Debt}}{\text{Equity}} \tag{19}$$

This formula reduces to:

$$\beta_{\text{Levered}} = \beta_{\text{Unlevered}}[1 + (1 - t)\text{D/E}] \tag{20}$$

DEBATE OVER CAPITAL ASSET PRICING MODEL Since its founding in 1963, CAPM has provoked considerable debate within the financial community. The chief lines of attack are these:

- Nothing in the theory of CAPM says how the inputs are to be derived. Thus, the model is applied in a plethora of ways, none of which is certifiably "right."
- R_m, the return on the market of all assets, is simply unobservable. This means that there exists no pure test of the adequacy of CAPM.
- Beta is an objectionable measure of risk. It is unstable over time, though it tends to drift to the overall average of 1.0. Some practitioners will argue that beta's focus, undiversifiable risk, is inappropriate since it implies that the market compensates investors only for systematic risk. These practitioners will claim that investors bear unsystematic, diversifiable risks, too. This may be true for targets whose common stock is thinly traded or closely held—in these cases one must rely on a beta estimated from a sample of comparable companies.
- CAPM really is not that powerful; R-squares are typically low, suggesting that beta does not explain much of the variation in returns from one stock to the next.
- Other, more recent, models are better; CAPM simply does not explain much.[16] More recent studies[17] suggest that size and growth opportunities should be added to CAPM as worthwhile predictors of required returns. For instance, some large asset managers use multifactor arbitrage pricing models to generate benchmarks for investment decision making. These enhanced models rely on specialized data sets for which the estimated coefficients are usually not publicly available.

These objections notwithstanding, the actual practices of leading-edge firms suggest that CAPM has strong intuitive appeal: It embodies the risk-return logic at the heart of investment decision making. Surveys[18] of practitioners find that CAPM is the dominant method of estimating equity capital costs.

PROS AND CONS OF DISCOUNTED CASH FLOW VALUATION APPROACH The DCF method of valuation has several strengths. It is not tied to historical accounting values and is forward-looking. It focuses on cash flow, not profits, and therefore reflects noncash charges and investment inflows and outflows. It recognizes the time value of

Merrill Lynch. Alternatively, it can be estimated by regression; most analysts use at least 60 observations of prices. If beta is greater than 1.0, the target's stock is more volatile than the market; if less than 1.0, the stock is less volatile.

If the acquirer intends to change the financial leverage of the target significantly, beta should be adjusted.

Step 1: Unlever the beta. This *unlevered beta* captures the degree of risk in the firm's operations, before financing:

$$\beta_{\text{Unlevered}} = \frac{\beta_{\text{Levered}}}{1+(1-t)\,\text{D/E}} \tag{15}$$

where D/E is the target's market value debt-equity ratio *before* acquisition, and t is the marginal tax rate of the firm.

Step 2: Relever the beta:

$$\beta_{\text{Levered}} = \beta_{\text{Unlevered}}[1 + (1 - t)\,\text{D/E}] \tag{16}$$

where D/E is the target's debt-equity ratio *after* relevering, and t is the target's marginal tax rate.

An alternative formula for the unlevered or *asset beta* of a firm holds that the unlevered beta is a weighted average of the firm's debt and equity betas. This unlevered beta is also called the enterprise beta or asset beta:

$$\beta_{\text{Unlevered}} = \beta_{\text{Debt}}\left(\frac{\text{Debt}}{\text{Debt}+\text{Equity}}\right) + \beta_{\text{Equity}}\left(\frac{\text{Equity}}{\text{Debt}+\text{Equity}}\right) \tag{17}$$

Note that in this alternative model of the unlevered beta, there is no provision for the impact of taxes. This model assumes that through homemade leverage, investors can appropriate for themselves the benefits of debt tax shields and that the tax impact of leverage is neutralized.[15] This implies that the levered beta (that is, equity beta) formula will be:

$$\beta_{\text{Levered}} = \beta_{\text{Asset}} + (\beta_{\text{Asset}} - \beta_{\text{Debt}})\frac{\text{Debt}}{\text{Equity}} \tag{18}$$

This alternative version of the levered beta formula is useful because it permits the analyst to assume that the firm has risky debt outstanding, meaning that the debt bears some degree of default risk of the enterprise. The debt betas of corporate bonds are typically in the range of 0.15 to 0.25 for investment grade issues. But for non–investment grade debt (so-called "junk" debt) the betas will be materially higher. By subtracting the debt beta, this formula recognizes that the creditors bear some of the risk of the enterprise.

If, in this second formula, you assume debt free of default risk (i.e., the debt

beta has a value of zero) and a world in which corporate taxes do matter—that is, $(1 - t)$ is reinserted into the formula—then it boils down to the same formula as the first:

$$\beta_{\text{Levered}} = \beta_{\text{Asset}} + (\beta_{\text{Asset}} - \beta_{\text{Debt}})(1-t)\frac{\text{Debt}}{\text{Equity}} \tag{19}$$

This formula reduces to:

$$\beta_{\text{Levered}} = \beta_{\text{Unlevered}}[1 + (1 - t)\text{D/E}] \tag{20}$$

DEBATE OVER CAPITAL ASSET PRICING MODEL Since its founding in 1963, CAPM has provoked considerable debate within the financial community. The chief lines of attack are these:

- Nothing in the theory of CAPM says how the inputs are to be derived. Thus, the model is applied in a plethora of ways, none of which is certifiably "right."
- R_m, the return on the market of all assets, is simply unobservable. This means that there exists no pure test of the adequacy of CAPM.
- Beta is an objectionable measure of risk. It is unstable over time, though it tends to drift to the overall average of 1.0. Some practitioners will argue that beta's focus, undiversifiable risk, is inappropriate since it implies that the market compensates investors only for systematic risk. These practitioners will claim that investors bear unsystematic, diversifiable risks, too. This may be true for targets whose common stock is thinly traded or closely held—in these cases one must rely on a beta estimated from a sample of comparable companies.
- CAPM really is not that powerful; R-squares are typically low, suggesting that beta does not explain much of the variation in returns from one stock to the next.
- Other, more recent, models are better; CAPM simply does not explain much.[16] More recent studies[17] suggest that size and growth opportunities should be added to CAPM as worthwhile predictors of required returns. For instance, some large asset managers use multifactor arbitrage pricing models to generate benchmarks for investment decision making. These enhanced models rely on specialized data sets for which the estimated coefficients are usually not publicly available.

These objections notwithstanding, the actual practices of leading-edge firms suggest that CAPM has strong intuitive appeal: It embodies the risk-return logic at the heart of investment decision making. Surveys[18] of practitioners find that CAPM is the dominant method of estimating equity capital costs.

PROS AND CONS OF DISCOUNTED CASH FLOW VALUATION APPROACH The DCF method of valuation has several strengths. It is not tied to historical accounting values and is forward-looking. It focuses on cash flow, not profits, and therefore reflects noncash charges and investment inflows and outflows. It recognizes the time value of

Exhibit 9.7 gives an illustration of the equivalence of the three approaches. Assume that you are planning to acquire a company for $2,000. You will finance the purchase half with debt (at an interest rate of 10 percent, reflecting a debt beta of 0.75), and half with equity (at a cost of equity of 14.8 percent, and an equity beta of 1.3). You intend to maintain the present mix of capital in perpetuity. The debt is rolled over to infinity. The firm does not grow. Depreciation equals $500 per year, as does replacement investment. The pretax net operating income is $2,000 per year. The tax rate equals 35 percent. Given these assumptions, what is the net present value of the investment?

EXHIBIT 9.7 Example of the Equivalence of Results from the Three DCF Valuation Approaches

	Residual Cash Flow	Free Cash Flow	Adjusted Present Value
1 Net operating income	2,000	2,000	2,000
2 Depreciation	500	500	500
3 Interest	100	—	—
4 Subtotal	1,400	EBIT 1,500	EBIT 1,500
5 Tax (@ .35)	(490)	(525)	(525)
6 Net income	910	EBIAT 975	EBIAT 975
7 + Depreciation	500	500	500
8 – Investment	(500)	(500)	(500)
9 Cash flow	RCF 910	FCF 975	FCF 975
10 Discount rate	K_e 14.8%	WACC 13.6%	WACC (Unlevered) 14.3%
11 Value of unlevered firm			6,799
12 PV debt tax shields			350
13 Value of levered firm		7,149	7,149
14 – Value of debt		(1,000)	(1,000)
15 Value of equity	6,149	6,149	6,149
16 – Equity investment	(1,000)	(1,000)	(1,000)
17 Net present value	5,149	5,149	5,149
18 Risk-free rate	7.0%	7.0%	7.0%
19 Equity beta	1.3	1.3	1.3
20 Debt beta			0.752
21 Asset beta ("unlevered beta")			1.223
22 Equity market premium	6.0%	6.0%	6.0%
23 Cost of equity, levered firm	14.8%	14.8%	14.8%
24 Cost of equity, unlevered firm			14.3%
25 Market yield on debt	10.0%	10.0%	10.0%
26 Tax rate	35.0%	35.0%	35.0%
27 After-tax cost of debt	6.5%	6.5%	6.5%
28 Weight of market value debt	14.0%	14.0%	14.0%
29 Weight of market value equity	86.0%	86.0%	86.0%
30 Weighted average cost of capital	13.6%	13.6%	13.6%

First, the exhibit shows that the NPV (line 17) is the same regardless of valuation approach. Second, the exhibit shows the distinctive features of each approach. RCF is characterized by discounting residual flows at the cost of equity, and yielding the value of equity. FCF is characterized by discounting flows before interest expense at the weighted average cost of capital. Under the FCF approach, the impact of debt financing is reflected in the discount rate (WACC) rather than in the cash flows. APV is distinguished by isolating the debt tax shield effect entirely into a separate term (seen in line 12), for neither the free cash flows nor the discount rate for those flows reflects the tax shield.

Intuitively, we should not be surprised by the equivalence result. All APV does is slice the firm along different lines. But if in well-functioning capital markets the whole should equal the sum of the parts, then no matter how we slice up the enterprise, we should always arrive back at the same aggregate value. This argument implies the equivalence of the three approaches:[20]

$$\text{Value}_{\text{Enterprise}} = (\text{Value}_{\text{Equity}} + \text{Value}_{\text{Debt}}) = (\text{Value}_{\text{Unlevered Ent.}} + \text{PV}_{\text{Tax shields}}) \quad (23)$$

$$\begin{aligned}[\text{FCF} \text{ @ } \text{WACC} &= [(\text{RCF} \text{ @ } K_e + (\text{Interest} \text{ @ } K_d)] \\ &= [(\text{FCF} \text{ @ } \text{WACC}_{\text{Unlevered}}) + (\text{Tax savings} \text{ @ } K_d)] \end{aligned} \quad (24)$$

DO YOU *REALLY* GET THE SAME ANSWER UNDER ALL THREE APPROACHES? In practice one rarely obtains the same exact answer under all three approaches. But done carefully, the three approaches will yield estimates that are close to each other. The illustration just given is premised on well-functioning capital markets and very simple assumptions about the growth and future financing of the firm. Departures from these require nettlesome variations in the approaches, which may not be worth the analyst's time. Professionalism in the use of DCF approaches requires choosing the approach best suited for the problem—and applying that approach carefully, rather than producing estimates under all three approaches and then hunting for causes of variation among the estimates.

Venture Capital/Private Equity Approach

Analysts in the world of private equity investment avoid the detailed DCF valuation analyses described in the preceding section in favor of an approach that focuses on the practicalities of risk capital investing, especially entry, exit, and interim rounds of financing. Analysis for second and later round valuations can be complicated.[21] In its simplest terms, the *venture capital approach* is a stripped-down variant of the DCF methods. First, the analyst projects the performance of the firm into the future, and assumes that the private equity investor will exit typically in three to five years. Second, the exit value at that horizon is estimated using an exit multiple. Third, that exit value is discounted to the present, using a discount rate in a range from 30 to 75 percent. Alternatively, the analyst would calculate the internal rate of return of these flows and compare them to a targeted rate of return.

The virtue of this approach is its simplicity and focus. The analyst assumes that interim cash flows (i.e., before the exit date) will be nil, which is not unreasonable for investments of the venture capital/private equity type. The venture analyst typically uses an arbitrarily high discount rate rather than an estimate

derived from capital market models—the analyst will defend this practice on the ground that capital market expectations are simply unobservable for this class of (private) investment: The typical venture capital target is on the fringe of its industry, without peers, without a public market for its securities, and working under significant capital market information asymmetries. Finally, this approach rivets the analyst's attention on *exit value* and *timing*, the two crucial drivers of the venture capitalist's returns.

To the sophisticated analyst, this technique will appear to assume away a great deal of detail. The venture capitalist's discount rates will appear to be arbitrary and too high relative to returns on other mainstream investments. Interim cash flows may be positive and large enough to drive present values significantly. At its most simplistic, the venture capital approach seems to ignore debt financing, and supposes that the firm will be financed entirely with equity; more mature firms will draw on debt financing. More mature firms will have growth trajectories that are easy to model over long periods. Patient investors will remain with the company for the long run. Mature firms often have securities traded in the capital markets and are followed by securities analysts, which suggests that those prices might in some sense be trusted.

Option Valuation Approach

The final approach in this survey draws on what is perhaps the most important theoretical development in finance of the past 30 years, option pricing theory. A deeper presentation of this theory is given in Chapter 10 ("Valuing Options"), and therefore will only be sketched here for the sake of comparison with other methods.

In essence, the *option valuation approach* views the equity in a levered firm as equivalent to a call option on the asset value of the firm. This recognizes the logic of most owners of a mortgaged home who claim that they don't own the house, the creditor does. But the equity holder (homeowner) retains the right (the option) to reclaim the ownership of the asset (the home) by repaying the firm's debt (the home mortgage).

If the equity in a firm is like a call option, then techniques for valuing call options can be applied to the valuation of equity stakes. Valuing a call option requires knowing at least five parameters:

1. The value of the underlying asset. In the case of firms, this is enterprise value.
2. The exercise price of the call option. In the case of firms, this is the par value of debt outstanding.
3. The term of the option. In the case of firms, this is the duration (or roughly average expected life) of the debt outstanding.
4. The risk-free rate. In the case of firms, this is yield to maturity on government securities with a life equal to the duration of the firm's debt outstanding.
5. The volatility of returns on the underlying asset. Volatility is measured as the standard deviation of the price changes on the underlying asset. For firms, this can be approximated by a weighted average of the volatilities of the firm's debt and equity.

To illustrate this, consider the problem of valuing Chrysler Corporation's equity in May of 1980, at the nadir of its fortunes when it required a loan guarantee

by the U.S. government. Many observers claimed that the firm was bankrupt, since its asset value was at most equal to the value of debt outstanding.

- Let us assume that the enterprise value of Chrysler was $1.5 billion, equal to the par value of debt outstanding (and to be guaranteed).
- Exercise price equaled par value or $1.5 billion.
- The duration of this debt (assuming rollovers) was 10 years.
- The risk-free rate was 10.52 percent, the yield of 10-year U.S. Treasury bonds.
- The volatility, a weighted average of Chrysler's debt and equity volatilities, was 100.5 percent.

The resulting option value estimate of Chrysler's equity value is $1.4 billion.[22] This is large in absolute terms, owing particularly to the long term and very high volatility of the underlying asset. The option pricing approach tells us that the equity of firms—even those that are highly levered and in financial distress—may be valuable because of the probability (even small) of a large payoff in the future.

This example illustrates important advantages and disadvantages of the option pricing approach. First, the approach is especially useful where the firm is highly levered and the equity is of doubtful value. In short, this approach helps us value "out of the money" firms. However, the approach is broadly applicable to firms carrying *any* debt. Second, the main disadvantage of this approach is that one must have a view about the enterprise value of the firm to begin with—isn't this where one wants to end up?

But the theory of option pricing is important beyond its usefulness in valuing the firm. It is doubtful that the DCF estimators of intrinsic value reflect hidden "rights" embedded in the firm. The implication of this is that in estimating the value of a firm, the DCF value should be adjusted upward for any long option positions, and adjusted downward for any short option positions:

$$V_{\text{Enterprise, option-adjusted}} = V_{\text{DCF of enterprise}} + V_{\text{Long options}} - V_{\text{Short options}} \qquad (25)$$

This implies a four-step approach to valuing the firm:

1. Estimate the DCF value of the firm using the techniques outlined earlier.
2. Identify *significant* option positions of the firm: long versus short, put versus call. A moment's reflection will suggest that the firm contains a very large number of rights. The analyst will not be rewarded for valuing the vast majority of these rights. The option positions of a firm should be screened for materiality.
3. The option positions should be valued. This is accomplished either by building a specially tailored option valuation model or by mapping the option position onto the parameters of a simple model, such as the Black-Scholes option pricing model. The specially tailored approach is more precise, but quite a bit more expensive and time-consuming to implement—there exist no off-the-rack models for common situations such as sequential investment over time, nonnormal distribution of outcomes, and changing uncertainty. The simple approach assumes that the standard Black-Scholes model gets one close enough to what will be an imprecise estimate of value, anyway. Some practitioners will use the

simple approach first, as a way of determining the materiality of the size of the option position, and then try a specially tailored solution if warranted.
4. Sum the DCF value and the estimated option values.

Forward-thinking firms are applying option pricing techniques with greater frequency. It would not be unreasonable to expect that in the course of time, option pricing-adjusted estimates of intrinsic value will become the norm. See Chapter 14 for more detailed discussion of real options.

RULE #5: EXERCISE ESTIMATORS OF INTRINSIC VALUE TO FIND KEY VALUE DRIVERS AND BETS

Novices assume that point estimates of value are sufficient to drive M&A decision making. As stated earlier, these estimates ignore uncertainty. Consistent with the earlier advice to work with ranges of value instead of point estimates, analysts should exercise the estimators to define the reasonable range of value and to identify the key value drivers or assumptions to which the estimates are most sensitive. There are four classic approaches:

1. ***Univariate and bivariate sensitivity analysis.*** *Sensitivity analysis* is based on one-way and two-way tables that give the estimate of firm value as it changes with key assumptions. Spreadsheet programs, such as Microsoft Excel, contain features that easily generate one-way and two-way data tables. These kinds of tables are the basis for sensitivity analysis.
2. ***Scenario analysis.*** *Scenario analysis* recognizes that assumptions tend to vary together to create scenarios. A classic example would be macroeconomic scenarios in which profit margins and unit volumes increase in buoyant times, and fall in recessions. Setting a number of assumptions at levels consistent with that possible future state of the world creates a scenario estimate of value.
3. ***Breakeven analysis.*** This is an agnostic approach to sensitivity analysis: *Breakeven analysis* seeks the levels of certain assumptions at which the estimated intrinsic value falls below a certain target (such as the current stock price). In Microsoft Excel, the "Goal Seek" feature automates the determination of breakeven assumptions.
4. ***Monte Carlo simulation.*** This is the most advanced (and analytically complex) of the sensitivity analysis alternatives. It explicitly models the uncertainty around assumptions and can be used to estimate the probability distribution of value. The software found on the CD-ROM, "Crystal Ball," can be used to automate a simulation analysis.

RULE #6: THINK CRITICALLY; TRIANGULATE CAREFULLY

Done right, valuation analysis could generate a blizzard of value estimates. These need to be boiled down to a point estimate, or, better yet, a *range of value* that could form the basis for negotiation strategy. These summary figures are achieved through a process of *triangulation*. This is a term borrowed from trigonometry and

surveying: A surveyor measures the height of a mountain not by direct measurement, but from indirect data and perhaps several observation points. Deriving summary valuation figures employs a similar approach. Triangulation in valuing a firm would entail the following kinds of steps:

Scrutinize Estimators

Develop a view about the appropriateness of the different valuation approaches in the particular valuation problem you face. Exhibit 9.8 gives a summary of the chief virtues and defects of each of the main approaches. The point of this survey of valuation methods is not to belabor the reader with analytical approaches that are better presented elsewhere, but rather to make several points:

- There are many valuation approaches.
- No approach is flawless. At best, each *estimates* intrinsic value.
- The professional analyst understands these approaches sufficiently to be able to apply them when reasonable, and tailor them as necessary.
- Not all approaches warrant equal weight in the thinking of decision makers. To decide how much weight any approach should have is to have a view. Discounted cash flow approximates best what it means to think like an investor, and therefore may deserve more weight than other approaches. Book value poorly applies the investor's point of view, and therefore deserves little weight.
- Be flexible, not doctrinaire. Adapt your view to the circumstances of the firm you are valuing. While DCF generally does the best job, it can be quite awkward if not impossible to apply to some types of businesses like trading operations, to firms in financial distress, to assets that are to be liquidated, and in instances of high inflation.[23]

Scrutinize Data

Remember that virtually all of the approaches summarized here rely on information about the target firm and/or its peers. A good due diligence research process should help one assess the reasonableness of financial data supplied by the firm; but recall that generally accepted accounting principles permit relatively wide latitude in the recognition of economic events. These latitudes can be considerably wider outside the United States. Regarding information about peers, remember that *the choice of firms to include in the peer sample is of crucial importance.* Therefore, one should review the peer sample in the triangulation process as a step in developing a level of confidence in the valuation estimates.

Scrutinize the Spreadsheet Model

In practice, spreadsheet models are often passed among professionals and tailored to meet the needs of particular situations. Errors creep in undetected and cause em-

EXHIBIT 9.8 Overview of Classic Measures of Value

Approach	Advantages	Disadvantages
Book value	• Simple • "Authoritative"	• Ignores some assets and liabilities. • Historical costs: backward-looking. • Subject to accounting manipulation.
Liquidation value	• Conservative	• Ignores "going concern" value. • (Dis)orderly sale?
Replacement value	• "Current"	• Replace *what*? • Subjective estimates.
Multiples, earnings capitalization • Price/earnings • Value/EBIT • Price/book	• Simple • Widely used	• "Earnings" subject to accounting manipulation. • "Snapshot" estimate: may ignore cyclical, secular changes. • Depends on comparable firms: ultimately just a measure of relative, not absolute value.
Discounted cash flow • FCF @ WACC • RCF @ K_e • APV	• Theoretically based • Rigorous • Affords many analytical insights • Cash focus • Multiperiod • Reflects time value of money	• Time-consuming. • Risks "analysis paralysis." • Easy to abuse, misuse. • Tough to explain to novices.
Venture capital/private equity approach	• Simpler than standard DCF approaches. • Focuses on timing and exit values. •Avoids heavy theoretical assumptions.	• Discount rates may appear to be arbitrary and too high. • Interim cash flows may be material.
Option-adjusted valuation	• Augments DCF for hidden option value. • Permits explicit modeling of important rights.	• Difficult to estimate parameters, especially volatility. • Some hidden options do not map easily onto the simple models. • Complex modeling may be required.

barrassment (or worse) later. Here's a general approach for checking out a spreadsheet model:

- ***Look for obvious errors.*** Does the balance sheet balance? Are earnings from the income statement posted correctly to retained earnings? Are subtotals correct? Is interest expense linked to the balance of debt outstanding? Are there any discontinuities in the assumed growth rate, tax rate, and interest rate over time?

- *Take it for a test drive.* It is very hard to detect some errors without exercising the model. First, insert some extreme assumptions in growth or profit margins to see what happens to the results. Then, vary a number of assumptions simultaneously, perhaps using a data table to capture the results. Do the results change according to your intuition?
- *Screen it with common sense.* Ravindran, Phillips, and Solberg (1987) offer 10 questions against which an analyst should benchmark a computer model. These are especially relevant for M&A work:

1. How much complexity and precision are necessary? Don't build a complicated model when a simple one will suffice.
2. What is the problem? Beware of molding the problem to fit the technique.
3. Have you fully specified the major drivers of the model? The deduction phase of modeling must be conducted rigorously.
4. Have you checked the model for programming errors and reasonableness? Models should be validated before implementation.
5. Where is your sense of irony? A model should never be taken too literally.
6. What is the intended purpose of the model? A model should neither be pressed to do nor be criticized for failing to do that for which it was never intended.
7. What promises are made about the model? Beware of overselling it.
8. What have you learned from the modeling process? Some of the primary benefits from modeling are associated with the *process* of development.
9. What is the foundation for your modeling assumptions? Garbage in, garbage out. A model cannot be any better than its parameters.
10. Who will use the model? Models cannot replace decision makers. Is this model accessible to them?

The spreadsheet model "Value Merge.xls," available on the CD-ROM, is one example of a built-out spreadsheet valuation model for general M&A application. This model is described in Appendix 9.1 later in this chapter.

Scrutinize Sensitivity Assumptions

The sensitivity analysis outlined in the preceding section depends crucially on choosing sensible ranges over which to vary valuation assumptions. Uncertainty accumulates rapidly in this kind of analysis. Choosing an arbitrarily wide range on a few forecast assumptions can easily generate a resulting range of value in which you would have relatively little confidence. Wherever possible, one should seek to tighten sensitivity ranges, based on an *informed view* about the target's business (that is, not based on arbitrary guesswork).

Eliminate Estimates in Which You Have Little Confidence

This is a process of eliminating "noise" in order to find the "signal" about intrinsic value. An obvious example regards the use of the liquidation value approach—this is rarely useful for healthy firms considered to be going concerns. Your analyst may have calculated a liquidation value for the sake of completeness, but its use for negotiation purposes may be nil.

Compare the Finalist Estimates of Value

This comparison can be offered in several ways, though one that has helped executives is a graphic comparison, using a bar chart such as the one shown in Exhibit 9.9. A chart such as this summarizes visually the various valuation ranges, and permits the decision maker to absorb data more readily. This chart is also available in a template program, "Triangulation Graph.xls," found on the CD-ROM.

Choose

Realistically, this is the hardest step of all. One cannot automate judgment of this sort; there is no formula or heuristic to lead to a final decision. But judgment is accelerated to the extent that you follow the preceding steps. Referring again to Exhibit 9.9, suppose that the decision maker is a buyer, and that he or she must choose a negotiation range of values, varying between an opening bid and a walk-away bid.

- ***The opening bid*** will be bounded on the low side by the recent market price range of $82 to $88 per share. It is extremely rare for a target to be acquired at a price less than its recent share value in the market. How much higher to open above this floor is determined by synergies (see Chapter 11), negotiation tactics (see Chapter 30), and competition with other potential bidders (see Chapters 31 through 33).
- ***The walk-away bid*** will be bounded on the high side by the intrinsic value of the target. As the example in Exhibit 9.9 reveals, the DCF approach estimates

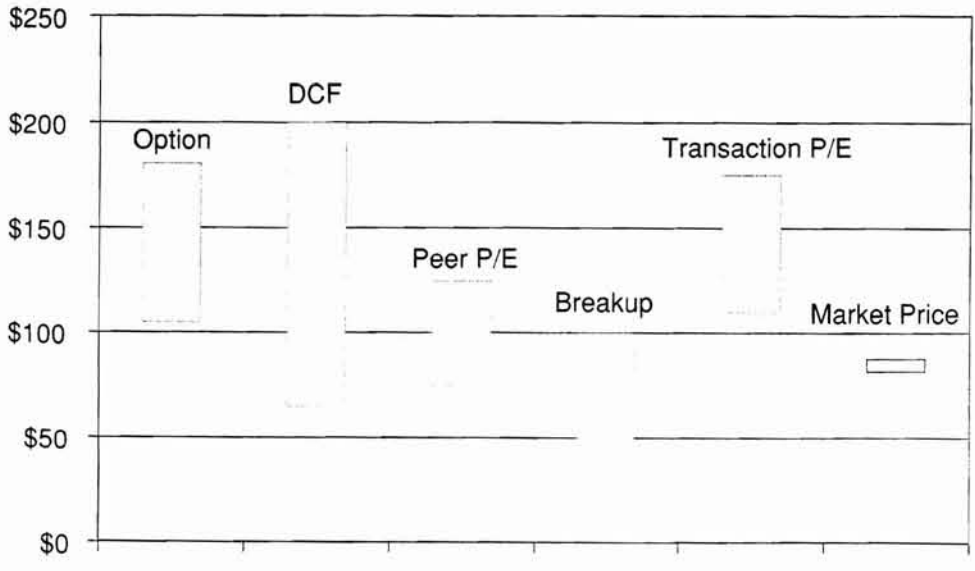

EXHIBIT 9.9 Graph of Value Ranges Suggested by a Variety of Valuation Approaches, as Might Be Used in a Triangulation Process

the maximum intrinsic value to be $200 per share (this includes the impact of synergies and optimistic forecast assumptions). But none of the other approaches support as high a maximum. While you may like the DCF approach better than all others, you may decide to reduce your walk-away bid slightly to reflect the information contained in the other estimates. A value of $175 per share would be at the high end of the ranges estimated by the option approach and the transaction multiples approach.

As a buyer, you might choose an opening bid of $100 and a walk-away bid of $175. The triangulation process is finished. (As will be explained in later chapters, whether you actually quote these values to the seller will depend on your other choices about form of payment, other deal terms, and your bargaining strategy.)

RULE #7: FOCUS ON PROCESS, NOT PRODUCT

Some of the key conclusions of this chapter are that the valuation of firms is riddled with judgments, and that excellence here depends rather more on wisdom than on computing power. Simply asking a staff member to run the numbers and tell you what a target firm is worth may be starting down the easy road to M&A hell. Instead, there is no substitute for the following virtues of M&A valuation:

- ***Scrutiny of assumptions and critical thinking.*** "Garbage in, garbage out" goes the saying. Financial forecasts are only as good as their assumptions. The aggregate effect of many small, inadvertent forecasting biases can be huge. *The only solution is to "have a view."* This means that instead of passively accepting historical trends or industry consensus outlooks, the analysts and decision makers must develop their own opinions through a process of research, scrutiny, and reflection. Critical thinking ties to the due diligence effort. There is no substitute for the quality of information obtained through primary research, which in the M&A field is the due diligence process. The more removed and abstract is the valuation process, the greater the likelihood of error. Due diligence is discussed in a later chapter.
- ***Dogged persistence to test and sensitize.*** Scrutiny, critical thinking, and due diligence call for valuation models that will be *exercised*, not simply used once. As discussed earlier, the point of sensitivity analysis is to help define the range within which the true (but unobservable) intrinsic value of the firm lies.
- ***Feedback, followed by refinement.*** Scrutiny, critical thinking, due diligence, and sensitivity analysis inevitably challenge the structure and definition of the valuation process. Excellent valuation processes are stimulated to greater refinement by this kind of feedback.
- ***Thoughtful triangulation from many estimators.*** The many estimates must be distilled into a range of value on which a decision maker can take action. The worst example of triangulation is averaging the estimates. Thoughtful analysts and decision makers will weight these estimates according to the reasonableness of the methodologies, and the assumptions underlying them. Again, one must have a view about the estimators and their estimates.

- ***Acceptance of estimates, not certainty.*** M&A professionals view the resulting estimates with neither belief, nor disbelief but rather with a sense of *irony* that acknowledges there are no "right" answers in valuing firms (though there may be many wrong ones).

Many of these virtues are reflected in Exhibit 9.10, which offers a summary of the analytic flow described in this chapter.

Excellence in valuation arises from careful attention to process, in the belief that if the valuation process is well executed, good results will follow. Excellent process management draws on skills that go beyond the scope of this book, though in my experience it includes these features:

- ***Positive team dynamics.*** A team is formed consisting of a sponsor, a project leader, one or two analysts, due diligence researchers, and possibly specialists who know the target company and/or its industry. The mission of the team is clear. The commitment of team members to that mission is strong and positive. Team members respect each other's contributions. Energy level and spirit of collaboration are high. Members take initiative, rather than wait to be told what to do. Responsibilities are backstopped, so that a temporary absence by any member does not stall the process.
- ***Learning mind-set.*** The team members are in a search for the truth, and enjoy the process. They challenge the assumptions and thinking of one another.

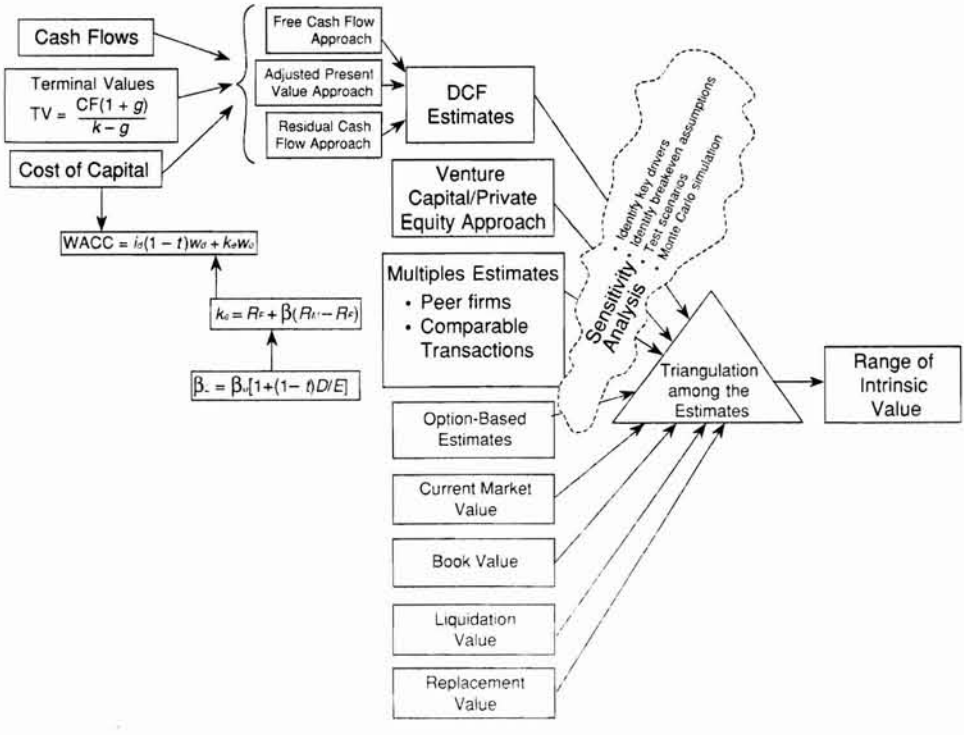

EXHIBIT 9.10 Summary Flowchart of the Valuation Process

Fact-based judgments are valued; but dogmatic assertions are discounted. Tough-mindedness dominates, but is tempered with an openness to new ideas and creative thinking.

- ***Resource commitment.*** The team has enough money, information, and time to do the job. Target expectations, particularly about time, are tight enough to be motivating. The team sponsor helps obtain the resources as needs arise.
- ***Culture of excellence.*** Great project processes seem to have at their core a desire to excel, defined in terms of the quality of the work itself. Excellent teams avoid the trap of believing that a deal has to get done to justify their work. Viewing their work as an end in itself empowers them to walk away from bad deals.

Ultimately, these qualities emerge from good organization, culture, and leadership.

RULE #8: WHEN IN DOUBT, SEE RULE #1

The aim of this chapter has been to survey techniques for valuing the firm and to draw some implications for managing the valuation process. The chapter shows that there are numerous valuation techniques and that these can be fashioned into an analytic process. Good work in this area depends heavily on wise judgment, not only careful analytics. Therefore, the valuation process should be managed in ways that broaden and deepen the quality of judgment in the process. I have argued at several points that one must "have a view" with which to work through the many questions that will arise in the valuation process. One of the most important views that excellent analysts and deal doers display is that they think like an investor. The perspective of the investor is extremely helpful in sorting through knotty methodological questions, as well as generating the kind of scrutiny, critical thinking, research, and irony that one sees in excellent valuation processes. Ultimately, an investor is a judge, a mind-set well suited for valuation.

VALUATION CASE: CHRYSLER CORPORATION, MARCH 1998

The following discussion[24] presents a step-by-step valuation of Chrysler Corporation, as if valued on a stand-alone basis by its shareholders as of early March 1998, two months before the announcement of the merger with Daimler-Benz A.G., presumably a time when the deal was taking shape. In January 1998, Jürgen Schrempp, CEO of Daimler-Benz, approached Chrysler chairman and CEO Robert Eaton about a possible merger between their two firms. In Schrempp's view,

> *The two companies are a perfect fit of two leaders in their respective markets. Both companies have dedicated and skilled work forces and successful products, but in different markets and different parts of the world. By combining and utilizing each other's strengths, we will have a pre-eminent strategic position in the global marketplace for the benefit of our customers. We will be able to exploit new markets, and we will improve return and value for our shareholders.*[25]

Independently Eaton had concluded that some type of combination of Chrysler with another major automobile firm was needed: The firm was currently financially healthy, but industry overcapacity and huge prospective investment outlays called for an even larger type of global competitor. Before seeing Schrempp, Eaton had polled investment bankers for their ideas about a major automotive merger, and had spoken with executives from BMW on this topic.

Eaton replied positively to Schrempp's idea of an industrial combination. Now lay ahead the task of forging the details of the agreement to combine. Eaton appointed a small task force of business executives and lawyers to represent Chrysler in the detailed negotiations. He challenged this team on several counts: exploit the benefits of combination; preserve and strengthen the Chrysler brands; minimize the adverse effects of combination on employees and executives; and maximize shareholder value. Eaton reflected on the varieties of terms the Chrysler team might seek, and immediately convened a meeting to begin planning the team's negotiation strategy. Eaton said,

> *My number one criterion is that [any deal] has got to be a long-term upside with no negative short-term impact. It's got to be good for the shareholders. That's my—and my board's—fiduciary responsibility.*[26]

One can apply the valuation process to Chrysler using the steps outlined previously in this chapter:

Think Like an Investor

Robert Eaton seemed to be in this mode when he acknowledged that "it's got to be good for the shareholders." This emphasizes that one should think in terms of rational economic value.

Estimate Values

Recall that the emphasis is on the word "estimate," and that one should seek as many vantage points as possible about true intrinsic value. An important practical tip is that all estimates should be put on the same basis, such as total value versus value per share of stock, or enterprise value versus equity value. In the illustration that follows, all values will be expressed in equity value per share of Chrysler stock outstanding.

ACCOUNTING BOOK VALUE This is obtained by dividing the total shareholders' equity reported by Chrysler on its most recent balance sheet by the number of shares outstanding, plus any shares under option that might be exercised as a result of the transaction.[27] It is a common error to use authorized shares, or average shares over the past year. Instead one wants to use the number of shares actually outstanding at the end of the most recent reporting period. Chrysler's shareholders' equity was $11.362 billion; the number of shares outstanding was 648.4 million. The accounting book value per share was $17.52—this is a value far below all other values estimated, a real outlier. For the reasons outlined earlier, this value will be dropped from further discussion in our valuation analysis.

LIQUIDATION VALUE One could estimate the liquidation value of each asset item on the latest balance sheet, subtract the liabilities outstanding, and divide by the number of shares outstanding. But as described earlier, liquidation value ignores the franchise value of Chrysler as a going concern. This is not an instance of bankruptcy or liquidation. Chrysler is healthy. It would be inappropriate to give this any weight in the valuation process. Therefore, liquidation value will be ignored here.

REPLACEMENT VALUE Because of annual styling changes and tooling, a significant part of Chrysler's physical plant was probably close to replacement value; therefore one might simply settle for book value as a proxy for replacement value. Generally, replacement value estimates are important where, because of old age and inflation, the book and replacement values are likely to differ. But during much of the 1990s the United States experienced a very low rate of inflation. The replacement value estimate will be ignored in this analysis.

CURRENT VALUE IN THE MARKET This is an extremely important estimator, because it represents an economic floor below which it would be irrational for the target to sell. Exhibit 9.11 gives the recent stock price history of both firms, as well as estimates of their betas, based on trading on the New York Stock Exchange. In February 1998, Chrysler's stock price per share closed at $38.75. In 1996, Chrysler's share price varied between a high of $36.375 and a low of $25.75. In 1997, the high and low were $38.75 and $25.125.

VALUE BASED ON TRADING MULTIPLES OF PEERS The data in Exhibit 9.12 show that Chrysler's trailing price/earnings multiple of 9.8 was the highest of the "big three" American automobile manufacturers. The other very interesting insight from that exhibit is that the American car firms had the lowest P/E multiples of all the global car manufacturers. The existence of differing industry multiples is inconsistent with the existence of a global capital market. But this difference could be explained by differing growth outlooks among car firms just as easily as by capital market imperfections. A crucial question then is, "Who are Chrysler's peers?" The answer lies in a comparison of product and market positions of Chrysler and the other car firms. In essence, one could argue that Chrysler was the most American of the "big three," and that therefore its proper peer group included only the four North American manufactureres. Choosing the average of the four North American firms (10.67) one might lower the weight given to Navistar, yielding an adjusted average of 10.1. This suggests a multiple for Chrysler in the range of 9.8 to 10.1, implying a stock price of $40.75 to $41.92.

VALUE BASED ON ACQUISITION PREMIUMS The valuation based on peer multiples ignores the fact that buyers must pay some premium to acquire a target. There were relatively few comparable acquisitions in the automobile industry, so one could turn to a sample of acquisition premiums in very large deals[28] to gain some insight. It would be better if this sample could be restricted to only the car firms. But since that would not yield a feasible sample, Exhibit 9.13 offers a sample that crosses several industries. Exhibit 9.14 shows average premiums across major acquisitions—these display a great deal of variation. From the data of these two exhibits, one must make a judgment about the reasonable range of acquisition premiums. No calculation, such as an average, can easily substitute for judgment. For pur-

EXHIBIT 9.11 Recent Stock Price Information Chrysler Corporation and Daimler-Benze A.G.

Chrysler Corporation		Daimler-Benz (ADR in US$)		Ratio of
Month	Month-End Stock Price	Month	Month-End Stock Price	Chrysler to Daimler
May 1996	$33.31	May 1996	$53.50	0.6227
June 1996	$31.25	June 1996	$53.00	0.5896
July 1996	$28.38	July 1996	$53.13	0.5341
August 1996	$29.25	August 1996	$54.25	0.5392
September 1996	$28.63	September 1996	$58.25	0.4914
October 1996	$33.63	October 1996	$64.50	0.5213
November 1996	$35.50	November 1996	$67.31	0.5274
December 1996	$33.00	December 1996	$71.00	0.4648
January 1997	$34.88	January 1997	$71.13	0.4903
February 1997	$34.00	February 1997	$76.00	0.4474
March 1997	$30.00	March 1997	$73.13	0.4103
April 1997	$30.00	April 1997	$78.00	0.3846
May 1997	$31.88	May 1997	$80.13	0.3978
June 1997	$32.88	June 1997	$82.13	0.4003
July 1997	$37.19	July 1997	$73.50	0.5060
August 1997	$35.13	August 1997	$80.75	0.4350
September 1997	$36.81	September 1997	$67.31	0.5469
October 1997	$35.25	October 1997	$69.44	0.5077
November 1997	$34.31	November 1997	$71.00	0.4833
December 1997	$35.19	December 1997	$68.75	0.5118
January 1998	$34.81	January 1998	$79.75	0.4365
February 1998	$38.75	February 1998	$99.63	0.3890
High	$38.75	High	$99.63	0.6227
Low	$28.38	Low	$53.00	0.3846
Average	$33.36	Average	$70.25	0.4835
Adjusted beta*:	0.85	Adjusted beta*:	0.97	
Volatility†:	25.83%	Volatility†:	29.39%	

*Beta was calculated with respect to the S&P 500 index from weekly data over the period May 3, 1996, to March 1, 1998, and adjusted for beta's tendency to converge to 1.0 according to the formula: Adjusted beta = .67 · Raw beta + .33 · 1.00.
†Volatility was calculated from daily data for the 260 most recent trading days.
Source of data: Bloomberg Financial Service.

poses of this illustration, one could assume that the going premium to acquire a very large firm was in the neighborhood of 31 to 39 percent, which would suggest a value in the range of $50.76 and $53.86.

DISCOUNTED CASH FLOW VALUATION

- ***Cost of equity.*** Using the capital asset pricing model, Chrysler's cost of equity can be estimated directly. Chrysler's beta was 0.85. The risk-free rate (the yield on 30-year U.S. government debt) was 5.97 percent. The equity market risk premium had averaged (geometrically) about 5.6 percent over the previous 70

EXHIBIT 9.12 Comparable Automobile Manufacturers (in US$ Millions, Except Where Otherwise Noted)

	Price Feb. 1998	1997 Revenues	1997 Profits	1997 EPS	1998E EPS*	1997 CF/ Share	Trailing P/E	Forward P/E	Price/ Cash Flow	Shares Outstanding	Long-Term Debt	Debt/ Total Cap	Market/ Book Value	Beta†
U.S.														
Ford Motor	37 9/16	$153,627	$6,920	$ 5.75	$ 5.38	$ 11.97	6.5	7.0	3.1	1,194	$80,245	64%	1.51	0.86
General Motors	68 15/16	166,445	6,276	8.70	7.97	22.82	7.9	8.6	3.0	721	41,972	46%	2.67	0.96
Chrysler	40 3/4	61,147	2,804	4.15	5.01	8.43	9.8	8.1	4.8	648	9,006	25%	2.33	0.85
Navistar	30 3/8	6,321	150	1.65	2.60	3.33	18.4	11.7	9.1	72	1,316	37%	2.83	1.03
Average, U.S.						*11.64*	*10.67*	*8.86*	*5.03*			*43%*	*2.33*	*0.93*
Japan														
Honda Motor	70 3/8	45,111	1,960	4.02	4.40	6.39	17.5	16.0	11.0	487	5,096	13%	4.55	0.80
Nissan Motor	8 7/8	49,358	382	0.30	0.55	3.34	29.6	16.1	2.7	1,257	12,554	53%	0.92	0.66
Toyota Motor	54 7/8	87,807	3,416	1.79	2.35	3.81	30.7	23.4	14.4	1,902	16,006	13%	2.70	0.63
Average, Japan						*4.51*	*25.92*	*18.49*	*9.36*			*26%*	*2.72*	*0.70*
Europe														
Daimler-Benz	99 5/8	68,951	1,764	3.38	3.75	11.50	29.5	26.6	8.7	517	9,564	16%	2.69	0.86
Volvo	27 1/8	23,118	400	0.88	2.20	2.99	30.8	12.3	9.1	442	2,913	20%	1.59	0.71
BMW DM	1,475	60,137	1,246	50.63	59.50	412.99	29.1	24.8	3.6	25	10,516	22%	3.59	0.88
Peugeot-C FFr	867	186,785	(2,768)	(55.24)	48.20	336.97	NM	18.0	2.6	50	17,004	28%	0.82	0.88
Fiat Lira	6,292	89,658	2,417	459.90	379.60	2,141.76	13.7	16.6	2.9	5	10,938	25%	1.35	0.73
Audi DM	1,450	22,410	367	85.35	125.00	536.28	17.0	11.6	2.7	4	—	0%	2.93	0.68
Renault FFr	212	207,912	5,427	22.79	16.00	48.88	9.3	13.3	4.3	238	30,760	38%	1.16	0.78
Average, Europe						*NM*	*21.57*	*17.59*	*4.84*			*21%*	*2.02*	*0.79*
Average, all firms							*19.22*	*15.29*	*5.86*			*29%*	*2.26*	*0.81*

NM = Not meaningful.

Note: Data is taken from Value Line Investment Survey and Bloomberg.

*Domestic EPS estimates are taken from Nelson's. International EPS estimates are taken from Value Line and IBES.

†Beta is calculated against the S&P in all cases and is based on weekly observations between Mar-96 and Feb-98.

EXHIBIT 8.13 Twelve-Month Moving Average Stock Premiums

One Month before Announcement		One Week before Announcement	
2Q97	35.31%	2Q97	29.53%
3Q97	47.97%	3Q97	39.61%
4Q97	36.51%	4Q97	28.34%
1Q98	37.11%	1Q98	31.61%

Source: Mergers and Acquisitions, July/August 1998.

years. Inserting these values into the capital asset pricing model yields an estimated cost of equity of 10.7 percent.

- ***Weighted average cost of capital.*** Chrysler's pretax cost of debt derived from market yields on outstanding debt was about 6.3 percent, the average yield on debt rated "A." The market value of debt could be assumed to be similar to the book value, since the coupon rates and market yields on Chrysler's debt were similar. If this were not true, it would be desirable to actually estimate the market value of Chrysler's debt. The amount of debt used in the calculation was $15.485 billion. The market value of Chrysler's equity was estimated by multiplying the most recent price per share for Chrysler ($38.75) times the number of shares outstanding plus shares under option (648.4 million). This gave a market value of equity of $25.126 billion. Thus, the percentage weights of debt and equity in Chrysler's capital structure were 38 and 62 percent. Including a marginal assumed tax rate of 38 percent on Chrysler's income and the cost of equity estimated in the previous section gives an estimated weighted average cost of capital of 8.1 percent, computed as follows:

$$\text{WACC} = [.063(1 - .38)0.38] + (0.107 \cdot 0.62) = 0.081 \qquad (26)$$

  For greater accuracy, the WACC is recalculated each year in the spreadsheets prepared for this analysis.
- ***Forecast of cash flows.*** A forecast of free cash flows and equity cash flows is given in Exhibits 9.15 and 9.16. These use the forecast template given in the spreadsheet, "Value Merge.xls," on the CD-ROM. The assumptions for growth, margins, and asset investments are drawn from the expectations of securities analysts or, where specific outlooks are lacking, from historical experience.
- ***Terminal values.*** A forecast of continuing value at the end of the forecast period is drawn from the constant growth valuation model. For enterprise terminal values, the numerator was the free cash flow in the final year times 1 plus a perpetual growth rate of 3 percent, all divided by the WACC less the perpetual growth rate. For equity valuation, the numerator was the residual cash flow in the final year times 1 plus the perpetual growth rate for RCF (also assumed to be 3 percent), divided by the cost of equity minus the equity growth rate. The long-term growth rate was estimated from the Fisher formula, which accounts for long-term real growth (assumed to be similar to the U.S. GNP growth rate for the past decade of about 1 percent) and the long-term inflation rate (derived from the U.S. Treasury yield curve, and suggesting a rate of 2.0 percent).

- ***Deriving the DCF estimates.*** Exhibits 9.15 and 9.16 give the resulting worksheets for Chrysler and suggest base-case values of $64.53 using the WACC method, and $60.71 per share using the equity residual method.
- ***Sensitivity analysis.*** One could exercise the valuation model to demonstrate the sensitivity of Chrysler's share value to variations in revenue growth and profit margins. Interpretation of these tables requires one to have a view about what levels of assumptions are reasonable. The outlook of securities analysts is

EXHIBIT 9.15 Valuation of Chrysler Corporation Shares Discounting Free Cash Flows at WACC

	Projected				
Discounted Cash Flow Analysis: WACC Method	**1998**	**1999**	**2000**	**2001**	**2002**
Net income	3,037.0	3,291.1	3,582.1	3,883.8	4,201.1
Interest expense	1,002.7	929.1	815.9	706.8	595.2
Tax effect of interest expense	(385.0)	(356.8)	(313.3)	(271.4)	(228.6)
After-tax interest expense	617.6	572.3	502.6	435.4	366.7
NOPAT	3,654.6	3,863.4	4,084.7	4,319.2	4,567.7
Depreciation	3,194.7	3,406.7	3,631.4	3,869.7	4,122.2
Amortization	39.3	38.3	37.4	36.4	35.5
Deferred taxes	1,537.2	1029.0	702.2	492.9	359.4
Minority interest	0.0	0.0	0.0	0.0	0.0
Income from affiliates	0.0	0.0	0.0	0.0	0.0
Other noncash items	0.0	0.0	0.0	0.0	0.0
Changes in net working capital	2,676.0	(182.3)	(193.2)	(204.8)	(217.1)
Cash flow from operations	11,101.8	8,155.1	8,262.5	8,513.4	8,867.8
Capital expenditures	(4,000.3)	(4,240.3)	(4,494.7)	(4,764.4)	(5,050.3)
Other	0.0	0.0	0.0	0.0	0.0
Free cash flow	7,101.6	3,914.8	3,767.8	3,749.0	3,817.5
Terminal value (perpetuity)	0.0	0.0	0.0	0.0	59,696.5
Total free cash flows to capital providers	7,101.6	3,914.8	3,767.8	3,749.0	63,514.0
Valuation					
Firm value	56,227.4	54,297.2	55,178.6	56,432.3	57,957.7
Plus: excess cash	2,848.0	3,318.9	3,818.0	4,347.1	4,907.9
Less: debt outstanding	15,485.0	15,107.1	13,270.6	11,561.5	9,856.3
Less: minority interest	0.0	0.0	0.0	0.0	0.0
Less: preferred stock	0.0	0.0	0.0	0.0	0.0
Equity value	43,590.4	42,508.9	45,726.0	49,217.9	53,009.4
Value per share, beginning of year	**$64.53**	**$70.28**	**$75.60**	**$81.37**	**$87.64**
Memo: WACC Calculation					
Debt market equity	35.5%	35.5%	29.0%	23.5%	18.6%
Relevered beta	0.91	0.91	0.88	0.86	0.84
K_e	11.1%	11.1%	10.9%	10.8%	10.6%
WACC	9.2%	9.2%	9.3%	9.5%	9.6%

EXHIBIT 9.14 Recent Jumbo M&A Activity (Greater than US$ 10 Billion) (in Millions, Except Where Otherwise Noted)

Acquirer	Target	Date	Value	P/E	Premium to Stock Price One Week Prior	Outcome
Nonfinancial Companies						
Tracinda Corp.	Chrysler	April 1995	$21,618	5.40	37.50%	Withdrawn
Walt Disney	Capital Cities/ABC	July 1995	$18,837	25.40	25.20%	Completed
SBC Communications	Pacific-Telesis	April 1996	$16,490	15.50	36.20%	Completed
WorldCom	MFS Communications	January 1997	$13,596	NM	60.00%	Completed
CSX Corp.	Conrail	June 1997	$10,436	58.40	60.30%	Withdrawn
Bell Atlantic	NYNEX Corp.	August 1997	$21,346	19.50	–0.40%	Completed
Boeing Corp.	McDonnell Douglas	August 1997	$13,359	NM	22.70%	Completed
CUC International	HFS Incorporated	December 1997	$11,343	40.30	3.00%	Completed
Lockheed Martin	Northrup Grumman	February 1998	$11,831	28.00	41.20%	Withdrawn
Starwood Lodging	ITT Corp.	February 1998	$13,748	24.70	98.30%	Completed
Financial Companies						
Chemical Banking Corp.	Chase Manhattan Corp.	March 1996	$10,446	10.70	7.50%	Completed
Wells Fargo	First Interstate Corp.	April 1996	$10,930	13.10	36.30%	Completed
Dean Witter Discover	Morgan Stanley	February 1997	$10,573	10.70	12.80%	Completed
Nationsbank	Barnett	January 1998	$14,822	25.00	43.90%	Completed

NM = Not meaningful.

Sources: Thomson Financial Securities Data Company; Bloomberg Financial Services.

EXHIBIT 9.16 Valuation of Chrysler Corporation Shares Discounting Residual Cash Flows at the Cost of Equity

	Projected				
Discounted Cash Flow Analysis: Equity Residual Method	**1998**	**1999**	**2000**	**2001**	**2002**
Net income	3,037.0	3,291.1	3,582.1	3,883.8	4,201.1
Depreciation	3,194.7	3,406.7	3,631.4	3,869.7	4,122.2
Amortization	39.3	38.3	37.4	36.4	35.5
Deferred taxes	1,537.2	1,029.0	702.2	492.9	359.4
Minority interest	0.0	0.0	0.0	0.0	0.0
Income from affiliates	0.0	0.0	0.0	0.0	0.0
Other noncash items	0.0	0.0	0.0	0.0	0.0
Changes in net working capital	2,676.0	(182.3)	(193.2)	(204.8)	(217.1)
Equity cash flow from operations	10,484.2	7,582.8	7,759.9	8,078.1	8,501.1
Capital expenditures	(4,000.3)	(4,240.3)	(4,494.7)	(4,764.4)	(5,050.3)
Change in debt	(377.9)	(1,836.5)	(1,709.1)	(1,705.2)	(1,787.8)
Change in preferred	0.0	0.0	0.0	0.0	0.0
Preferred dividends (includes convertible)	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0
Residual cash flow	6,106.0	1,506.0	1,556.1	1,608.4	1,663.0
Terminal value (perpetuity)	0.0	0.0	0.0	0.0	45,790.8
Cash flows to common equity holders	6,106.0	1,506.0	1,556.1	1,608.4	47,453.8
Valuation					
Equity value	36,722.0	34,708.5	37,321.1	40,024.4	42,843.0
Value per share at beginning of year	**$60.71**	**$57.38**	**$61.70**	**$66.17**	$70.83
Plus: debt outstanding	15,485.0	15,107.1	13,270.6	11,561.5	9,856.3
Plus: minority interest	0.0	0.0	0.0	0.0	0.0
Plus: preferred stock	0.0	0.0	0.0	0.0	0.0
Less: excess cash	2,848.0	3,318.9	3,818.0	4,347.1	4,907.9
Firm value	49,359.0	46,496.8	46,773.7	47,238.9	47,791.4
Memo: Cost of Equity Calculation					
Debt/market equity	42.2%	43.5%	35.6%	28.9%	23.0%
Relevered beta	0.94	0.95	0.91	0.88	0.86
K_e	11.3%	11.3%	11.1%	10.9%	10.8%

helpful in benchmarking one's own views about the future. For the purposes of this case, the DCF values were sensitized around medium- and long-term growth rates of revenues. The sensitivity analysis yielded a range in share value between $48 and $75 per share.

ADJUSTED PRESENT VALUE Under this valuation approach, one discounts the free cash flow forecast at the unlevered cost of capital for Chrysler and then adds the

present value of debt tax shields. To derive the unlevered cost of capital, one simply uses the *asset or unlevered beta* for Chrysler in the capital asset pricing model. The observed beta for Chrysler was 0.85. The tax rate was assumed to be 38 percent. The market value debt-to-equity ratio was 58.6 percent. Inserting these into the formula for the unlevered beta yields 0.75. Using this unlevered beta in the capital asset pricing model along with the other assumptions cited previously yields an estimated unlevered cost of capital of 10.2 percent. The terminal value for the APV approach simply uses the free cash flow for the final year times 1 plus the long-term growth rate, all divided by the unlevered cost of capital less the long-term growth rate. To this DCF value we must add the present value of Chrysler's debt tax shields, assumed to be equal to the marginal tax rate times the market value of Chrysler debt outstanding (assumed to be equal to the book value). As shown in Exhibit 9.17, the sum of the unlevered value of the firm and the present value of debt tax shields, less net debt yields a value of equity of $70.34 per share.

VENTURE CAPITAL VALUATION Chrysler is a firm with sustainable moderately growing cash flows. The venture capital approach is inappropriate here, because we have better and more information than merely a value at entry and a potential value at exit. For this reason, the venture capital approach was not applied in this case.

OPTION VALUATION APPROACH Chrysler arguably consists of a bundle of assets in place, and growth options. But given the dynamics of overcapacity in the auto industry, it seemed that the valuation based on the assets in place would represent the bulk of Chrysler's value. While the option approach might yield more insight, this did not seem to be a suitable instance for applying it.

Triangulate toward a Negotiation Range

The valuation analyses yielded a variety of estimates of value for Chrysler. These are summarized in a triangulation graph in Exhibit 9.18. This is where one must exercise significant judgment. The logic begins by recognizing a *floor* for the range:

- The market value of the firm just before negotiations began ($38.75 per share).
- Market value plus a typical acquisition premium of 30 percent, to raise the floor to $42.55 per share.
- Restructuring value. There may be actions that Chrysler management could take on its own to lift the value of the firm. One can estimate the benefits of any restructuring actions (i.e., through DCF valuation), and add them to the existing market value of the firm. Also, one could estimate the value of a firm under a leveraged buyout or other kind of capital restructuring (see Chapters 20 and 34 for more discussion on this). Since the data necessary to support either of these kinds of estimates was not publicly available, they will not be pursued further in this discussion.

The logic for recognizing a *ceiling* for the range will be specific to the buyer and seller. The buyer will not want to pay more for the target than the stand-alone value of the target, plus the value of any synergies (see Chapter 11 for more on the valuation of

EXHIBIT 8.17 Valuation of Chrysler Corp. Shares Adjusted Present Value Approach

	Projected				
Discounted Cash Flow Analysis: Adjusted Present Value	**1998**	**1999**	**2000**	**2001**	**2002**
Net income	3,037.0	3,291.1	3,582.1	3,883.8	4,201.1
Interest expense	1,002.7	929.1	815.9	706.8	595.2
Tax effect of interest expense	(385.0)	(356.8)	(313.3)	(271.4)	(228.6)
After-tax interest expense	617.6	572.3	502.6	435.4	366.7
NOPAT	3,654.6	3,863.4	4,084.7	4,319.2	4,567.7
Depreciation	3,194.7	3,406.7	3,631.4	3,869.7	4,122.2
Amortization	39.3	38.3	37.4	36.4	35.5
Deferred taxes	1,537.2	1,029.0	702.2	492.9	359.4
Minority interest	0.0	0.0	0.0	0.0	0.0
Income from affiliates	0.0	0.0	0.0	0.0	0.0
Other noncash items	0.0	0.0	0.0	0.0	0.0
Changes in net working capital	2,676.0	(182.3)	(193.2)	(204.8)	(217.1)
Cash flow from operations	11,101.8	8,155.1	8,262.5	8,513.4	8,867.8
Capital expenditures	(4,000.3)	(4,240.3)	(4,494.7)	(4,764.4)	(5,050.3)
Other	0.0	0.0	0.0	0.0	0.0
Unlevered free cash flow	7,101.6	3,914.8	3,767.8	3,749.0	3,817.5
Terminal value (perpetuity)	0.0	0.0	0.0	0.0	54,857.3
Cash flows to capital providers	7,101.6	3,914.8	3,767.8	3,749.0	58,674.8
Valuation					
Unlevered free cash flows	51,190.6	49,294.0	50,391.2	51,747.1	53,259.5
Debt tax shield	3,992.8	3,859.4	3,745.7	3,688.4	3,628.1
Firm value	55,183.5	53,153.4	54,137.0	55,415.5	56,887.6
Plus: excess cash	2,848.0	3,318.9	3,818.0	4,347.1	4,907.9
Less: debt outstanding	15,485.0	15,107.1	13,270.6	11,561.5	9,856.3
Less: minority interest	0.0	0.0	0.0	0.0	0.0
Less: preferred stock	0.0	0.0	0.0	0.0	0.0
Equity value	42,546.5	41,365.1	44,684.3	48,201.0	51,939.2
Value per share at beginning of year	**$70.34**	**$68.39**	**$73.87**	**$79.69**	**$85.87**

synergies). The target will not want to drive the buyer away with an unreasonably high asking price. On the other hand, the target will feel a legitimate claim to at least some of the synergies to be created in the deal. Compounding the challenge is the fact that the buyer and seller will view the target from different vantage points, perhaps reflecting differing degrees of optimism. The buyer would be ill served by a ceiling that offered more than the value of the firm on a stand-alone basis, plus the value of synergies. Since a discussion of synergies is deferred to Chapter 11, the story will end here with a judgment that on a stand-alone basis (that is, without synergies) the intrinsic value of Chrysler might be in a range of $50 to $65 per share.

The level of analysis represented in this example is perhaps a reasonable "first cut" at valuing a firm. One could easily extend it by deepening levels of scrutiny of as-

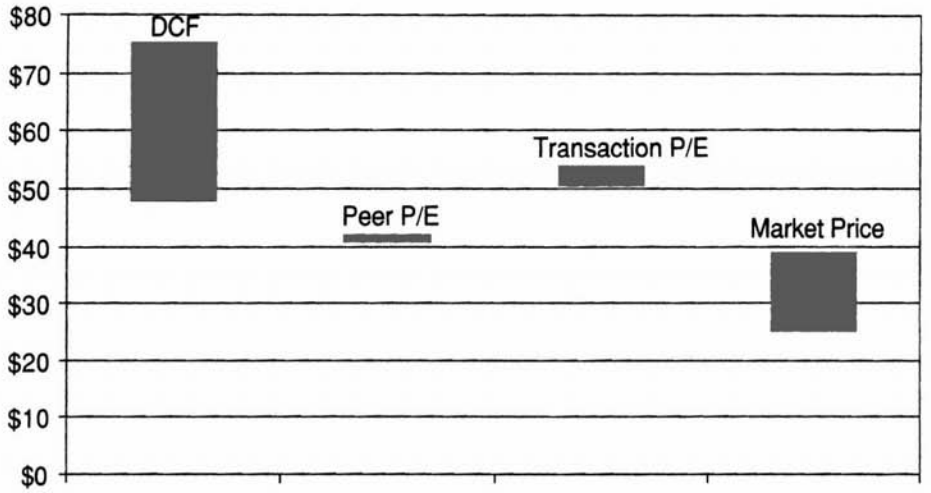

EXHIBIT 9.18 Triangulation Graph, Chrysler Corporation Shares

sumptions, richer sensitivity analysis, the use of scenarios and breakeven analyses, and greater detail in modeling. Where one stops is inevitably dictated by practical limits on energy, time, and money. Negotiators and managers will often request refinements as the deal matures. Therefore, it always makes sense to offer interim reports on the analysis, rather than drill deeply from the start and discover that one is drilling in the wrong area.

APPENDIX 9.1
Value Merge.xls: When and How to Use the Model

WHEN TO USE THE MODEL

"Value Merge.xls" is a multipurpose model[29] on the CD-ROM that enables users to forecast a company's financial data, value the company, and assess the earnings impact of merger scenarios. The most common application for the model will be in M&A analyses performed from the acquirer's point of view. On a macro level, key issues weighing on any acquirer's mind will be:

- What is the target company worth?
- What critical assumptions are built into the valuation?
- How much should we pay?
- What mix of acquisition currencies (cash, stock, 50–50) will we offer?
- What will be the earnings impact under various deal structures?

The model is designed as a tool for managers to address these questions. It is not designed to give a single point estimate answer. Therefore, multiple analysts of the same deal may well arrive at different estimates.

GOOD PRACTICE: EXERCISING THE MODEL

A single point estimate of value is useful mainly for presentation purposes. The best decision makers look deeply beneath that estimate to understand the range of uncertainty that surrounds that estimate, and identify the drivers of that uncertainty. This is the whole point of investing time and effort into a computer model: By exercising the model one gains insights into uncertainty and drivers. Experienced analysts exercise computer models in several ways:

- ***Univariate analysis:*** Changing assumptions one at a time to see how the results change is the simplest and most time-consuming approach. Novices often begin here, because it requires no particular view of the economics of a deal or a company. But it easily descends into "analysis paralysis" as the analyst loses sight of the ultimate insights as he or she sinks beneath the tide of trivial numbers.
- ***Data tables and two-way analysis.*** The data table function in Excel (click on Data and Tables) creates one-way and two-way tables of results for the analyst. These are highly useful in giving the decision maker some feel for how the key result (e.g., value of a firm) varies as key assumptions vary. As with the univariate analysis, it is useful to start with some idea of what are likely to be the key drivers and work with those rather than simply generating numerous tables.
- ***Scenario analysis.*** Experienced practitioners often work with scenarios of the future, typically an upside and downside scenario that might roughly correspond to macroeconomic views of the future such as "expansion" and "recession." With each new scenario, the analyst possibly varies *many* assumptions at the same time—this reflects the reality that assumptions tend to move together (that is, they "covary" rather than remain independent). Successful scenario forecasting requires careful reflection to assess possible states of the future.
- ***Breakeven analysis.*** When experienced practitioners have no particular view of the future, models such as this one can be used to "backsolve" for those assumptions (such as growth rate or margins) that produce a key result (such as a minimum acceptable rate of return). With knowledge of these breakevens, the decision maker can ask whether the firm's performance is likely to exceed the breakeven.
- ***Monte Carlo simulation.*** Simulation can be used to look at many possible future scenarios in order to build a probability distribution of outcomes such as value. Usually, add-on software is required to supplement the capabilities of Excel in order to produce a simulation analysis. "Value Merge.xls," on the CD-ROM, could be adapted for use with simulation software.

LAYOUT AND CONTENTS

Worksheets or tabs are used to break up the analysis. Upon opening the model, you will notice these in the lower left-hand corner of the computer screen. These tabs and their contents are:

- Tab 1: "Financials" (7 pages). Allows the user to perform income statement, balance sheet, and cash flow forecasting over a five-year time horizon. Histori-

cal data is also required. Schedules for debt issuance/amortization and capital expenditure requirements are included. The final page contains calculations of profitability, leverage, and interest coverage ratios.

- Tab 2: "Valuation" (4 pages). The first page requires users to input cost of capital and terminal value (both perpetuity and terminal multiple) assumptions. Free cash flow forecasting for the valuation analyses is based on the statement of cash flows built in Tab 1. The WACC, equity residual, and adjusted present value methodologies are presented.
- Tab 3: "Merger Scenario" (2 pages). Enables users to combine the target and acquirer's financial data. Target data is based on the inputs from Tab 1, while summary income statement and balance sheet data is required for the acquirer. Potential scenarios include cash and stock combinations and the impact of deal synergies. Under these scenarios, the model calculates the earnings accretion or dilution to the acquirer.

MODELING RULES

- Blue cells are your only inputs to the model. All inputs should be in millions, except share data (weighted average shares outstanding, options, stock appreciation rights, convertible share equivalents).
- Red cells are toggle cells, which allow you to run different scenarios based on the number entered. An example is the option to Build Cash (1) or Repay Debt (2) in cell G37 of the Financials tab.
- Black cells are calculations and should not be altered by the user under any circumstances.

NOTES

1. E. Richard Brownlee, Kenneth R. Ferris, and Mark E. Haskins, *Corporate Financial Reporting: Text and Cases*, 3d ed., Burr Ridge: Irwin/McGraw-Hill, 1996, page 6.
2. R. Kay and G. Searfoss, *Handbook of Accounting and Auditing*, 2d ed., New York: Warren, Gorham & Lamont, 1989.
3. Berkshire Hathaway Annual Report, 1994, page 2. "Charlie" is Charles Munger, vice chairman of Berkshire Hathaway.
4. Berkshire Hathaway Annual Report, 1992, page 14.
5. Some of these exceptions are manias and panics, the January effect, and the usually temporary inefficiencies that hedge funds exploit.
6. Quoted in Michael Lewis, *Liar's Poker*, New York: Norton, 1989, page 35.
7. Originally published in Berkshire Hathaway Annual Report, 1987. This quotation was paraphrased from James Grant, *Minding Mr. Market*, New York: Times Books, 1993, page xxi.
8. See "UV Industries Inc." Case Study 9-280-072, Harvard Business School, Copyright © 1979, and associated teaching note by Robert F. Bruner, under the direction of R. R. Glauber and D. W. Mullins Jr.

9. Quoted in Steven Lipin, "Lack of Premium May Irk GTE Holders, but It's a Feature of Some 1998 Megadeals," *Wall Street Journal*, July 29, 1998, page A3.
10. Stewart Myers originally suggested the important role of growth options in the valuation of the firm. See his paper, "Determinants of Corporate Borrowing," *Journal of Financial Economics*, 5:146–175 (1977). The decomposition of P/E presented here is discussed more fully by Myers in his book with Richard Brealey, *Principles of Corporate Finance*, 6th ed. (Burr Ridge: McGraw-Hill/Irwin, 2000), page 73.
11. A quotation of Robert Olstein in "Ebitda: Never Trust Anything That You Can't Pronounce," by Herb Greenberg, *Fortune*, June 22, 1998, page 192.
12. The economist Irving Fisher derived this model of economic growth. Its common name is the Fisher Equation.
13. This is a sensible assumption under the axiom of the limited liability for investors in corporations: Investors cannot be held liable for claims against the firm beyond the amount of their investment in it.
14. The arithmetic average is calculated by adding the annual returns over the period, and dividing by the number of observations. The geometric average is calculated as the *compound* average of the returns. Which should one use? There are arguments for both. If one foresees a normal probability distribution of *expected* annual returns, then the arithmetic average is the correct summary of the expected value of that distribution. But if, like most people, one extrapolates from past history into the future, then one should use the geometric average of past returns, since that correctly describes historical experience. As proof of this, consider the average return over two years, having earned +100 percent in the first year and –50 percent in the second. The arithmetic average is +25 percent, which is a flawed view of historical performance since you are no wealthier at the end of the second year than when you started. Only the geometric average captures this with a mean return of zero percent. Bruner, Eades, Harris, and Higgins (1998) surveyed the financial offices of 27 firms that were judged to be "best practitioners" in corporate finance by a finance magazine. They found great variation in the figure used for the equity risk premium; the largest cluster (37 percent) of practice in the sample was in the range of 5 to 6 percent. Another 11 percent used even lower assumptions. This book generally assumes a risk premium in the neighborhood of 6 percent.
15. The case for this assumption was originally advanced by Miller (1977).
16. In technical terms, the ability of CAPM to explain investor returns is measured by R-squared, a statistic that measures the percent of variation explained by the CAPM equation. This statistic can vary from 100 percent (indicating that the model explains *all* variation) to 0 percent (the model explains *nothing*). Typically, the R-squared for CAPM is low, between 10 and 20 percent.
17. See, for instance, Fama and French (1992 and 1993).
18. See Bruner, Eades, Harris, and Higgins (1998) and Graham and Harvey (2001).
19. Chapter 13 illustrates the construction of a model with these complications, in valuing a firm in a highly levered transaction.
20. In the second equation, the "at" symbol, @, is used to show clearly that each cash flow is discounted at (@) a specific discount rate. For instance, "FCF @

WACC" indicates that the value of the enterprise is obtained by discounting free cash flow (FCF) at the weighted average cost of capital (WACC).

21. For further discussion see Lerner (1999).
22. This estimate is derived using the Black-Scholes option pricing model, "Option Valuation.xls," available on the CD-ROM.
23. DCF is perhaps the *only* feasible valuation approach under conditions of high inflation. Nevertheless, effective application of DCF takes extremely careful work largely because inflation is very subtle in the way it distorts cash flows, discount rates, tax rates, and so on.
24. This section draws from the case studies of the merger of Daimler and Chrysler by Bruner, Christmann, and Spekman (1998); this book defers until Chapter 11 ("Valuing Synergies") a discussion of the synergies anticipated in the merger of Daimler-Benz and Chrysler.
25. Press release, Daimler-Benz A.G., May 6, 1998.
26. John Pepper, "Why Eaton Cut the Deal," *Detroit News*, May 7, 1998, www.detnews.com.
27. Shares under option may be found in the firm's annual report. The exercise price on such options is typically not reported in detail. But common (and conservative) assumptions are that the exercise price is probably below the consummation price in the merger agreement and that all the options will be exercised. Therefore, a simple approach would be to count all outstanding shares under option. However, due diligence research at the target company should permit a more refined assumption about the exercise of shares under option.
28. Many practitioners prefer to base peer analysis on size as well as industry. Some research (e.g., on takeover defenses) finds that size helps to explain variations in returns. Intuitively, size matters in choosing a sample of peers if large firms are harder to take over than smaller firms.
29. This appendix and the associated model were prepared by Mark Miles and modified by Baocheng Yang, both under the direction of Professor Robert F. Bruner.