

## Valuing Equity in Distressed Firms

Chapter 22 examined how discounted cash flow models could be adapted to value firms with negative earnings. Most of the solutions estimated the expected cash flows into the future, and assumed that an improvement in margins or earnings would result in positive cash flows and firm value. In the special case where the firm has substantial amounts of debt, we argued that there is a very real possibility of defaulting on the debt and going bankrupt. In these cases, discounted cash flow valuation may be an inadequate tool for estimating value. This chapter looks at firms with negative earnings, significant assets in place, and substantial debt. We argue that the equity investors in this firm, given limited liability, have the option to liquidate the firm and pay off the debt. This call option on the underlying firm can add value to equity, especially when there is significant uncertainty about the value of the assets.

### EQUITY IN HIGHLY LEVERED DISTRESSED FIRMS

In most publicly traded firms, equity has two features. The first is that the equity investors run the firm and can choose to liquidate its assets and pay off other claim holders at any time. The second is that the liability of equity investors in some private firms and almost all publicly traded firms is restricted to their equity investments in these firms. This combination of the option to liquidate and limited liability allows equity to have the features of a call option. In firms with substantial liabilities and negative earnings, the option value of equity may be in excess of the discounted cash flow value.

#### Payoff on Equity as an Option

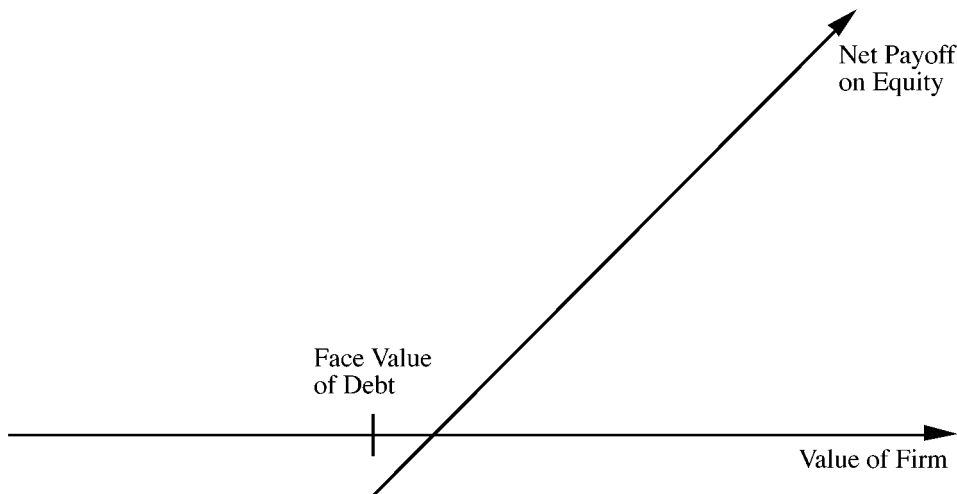
The equity in a firm is a residual claim, that is, equity holders lay claim to all cash flows left after other financial claimholders (debt, preferred stock, etc.) have been satisfied. If a firm is liquidated, the same principle applies; equity investors receive the cash that is left in the firm after all outstanding debt and other financial claims have been paid off. With limited liability, if the value of the firm is less than the value of the outstanding debt, equity investors cannot lose more than their investment in the firm. The payoff to equity investors on liquidation can therefore be written as:

$$\begin{aligned} \text{Payoff to equity on liquidation} &= V - D && \text{if } V > D \\ &= 0 && \text{if } V \leq D \end{aligned}$$

where  $V$  = Liquidation value of the firm

$D$  = Face value of the outstanding debt and other nonequity claims

Equity can thus be viewed as a call option on the firm, where exercising the option requires that the firm be liquidated and the face value of the debt (which corresponds to the exercise price) be paid off. The firm is the underlying asset and the option expires when the debt comes due. The payoffs are shown in Figure 30.1.



**FIGURE 30.1** Payoff on Equity as Option on a Firm

#### IMPORTANCE OF LIMITED LIABILITY

The argument that equity is a call option holds only if equity has limited liability—that is, the most that an equity investor can lose is what he or she has invested in a firm. This is clearly the case in publicly traded companies. In private companies, however, the owners often have unlimited liability. If these firms get into financial trouble and are unable to make their debt payments, the owner's personal assets can be put at risk. You should not value equity as a call option in these cases.

**ILLUSTRATION 30.1: Valuing Equity as an Option**

Assume that you are valuing the equity in a firm whose assets are currently valued at \$100 million; the standard deviation in this asset value is 40%. The face value of debt is \$80 million (it is zero coupon debt with 10 years left to maturity). The 10-year Treasury bond rate is 10%. We can value equity as a call option on the firm, using the following inputs for the option pricing model:

Value of the underlying asset =  $S$  = Value of the firm = \$100 million  
 Exercise price =  $K$  = Face value of outstanding debt = \$80 million  
 Life of the option =  $t$  = Life of zero coupon debt = 10 years  
 Variance in the value of the underlying asset =  $\sigma^2$  = Variance in firm value = 0.16  
 Riskless rate =  $r$  = Treasury bond rate corresponding to option life = 10%

Based on these inputs, the Black-Scholes model provides the following value for the call:

$$d1 = 1.5994 \quad N(d1) = 0.9451$$

$$d2 = 0.3345 \quad N(d2) = 0.6310$$

$$\text{Value of the call} = 100(0.9451) - 80 \exp^{(-0.10)(10)}(0.6310) = \$75.94 \text{ million}$$

Since the call value represents the value of equity, and the firm value is \$100 million, the estimated value of the outstanding debt is:

$$\text{Value of the outstanding debt} = \$100 - \$75.94 = \$24.06 \text{ million}$$

The debt is a 10-year zero coupon bond, and the market interest rate on the bond is:

$$\text{Interest rate on debt} = (\$80/\$24.06)^{1/10} - 1 = 12.77\%$$

Thus the default spread on this bond should be 2.77%.

**IMPLICATIONS OF VIEWING EQUITY AS AN OPTION**

When the equity in a firm takes on the characteristics of a call option, you have to change the way you think about its value and what determines its value. In this section, we will consider a number of potential implications for equity investors and bondholders in the firm.

**When Will Equity Be Worthless?**

In discounted cash flow valuation, we argue that equity is worthless if what you own (the value of the firm) is less than what you owe. The first implication of viewing equity as a call option is that equity will have value, even if the value of the firm falls well below the face value of the outstanding debt. While the firm will be viewed as troubled by investors, accountants, and analysts, its equity is not worthless. In fact, just as deep out-of-the-money traded options command value because of the possibility that the value of the underlying asset may increase above the strike price in the remaining lifetime of the option, equity commands value because of the time premium on the option (the time until the bonds mature and come due) and the possibility that the value of the assets may increase above the face value of the bonds before they come due.

**ILLUSTRATION 30.2: Firm Value and Equity Value**

Revisiting the preceding example, assume that the value of the firm drops to \$50 million, below the face value of the outstanding debt (\$80 million). Assume that all the other inputs remain unchanged. The parameters of equity as a call option are as follows:

- Value of the underlying asset =  $S$  = Value of the firm = \$50 million
- Exercise price =  $K$  = Face value of outstanding debt = \$80 million
- Life of the option =  $t$  = Life of zero coupon debt = 10 years
- Variance in the value of the underlying asset =  $\sigma^2$  = Variance in firm value = 0.16
- Riskless rate =  $r$  = Treasury bond rate corresponding to option life = 10%

Based on these inputs, the Black-Scholes model provides the following value for the call:

$$d1 = 1.0515 \quad N(d1) = 0.8534$$

$$d2 = -0.2135 \quad N(d2) = 0.4155$$

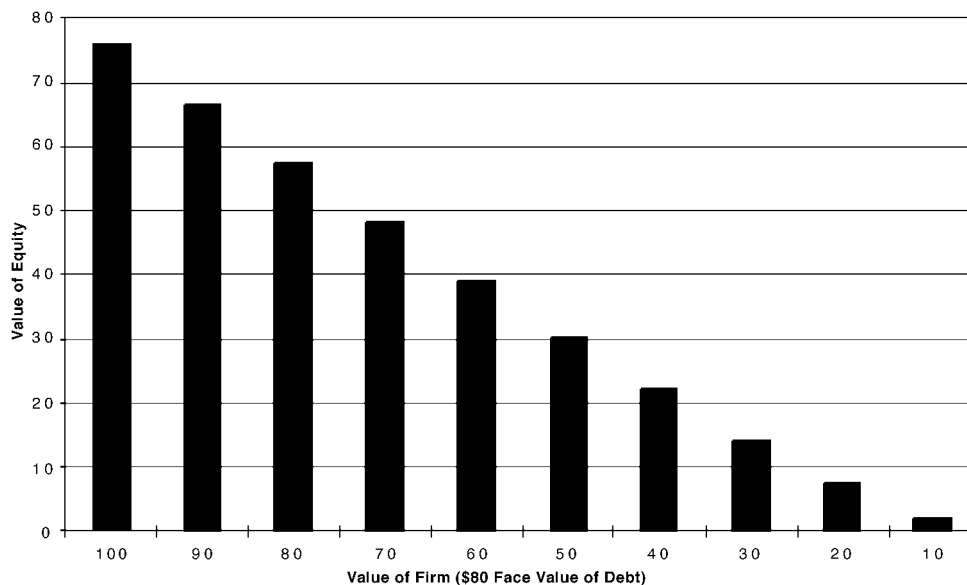
$$\text{Value of the call (equity)} = 50(0.8534) - 80 \exp^{(-0.10)(10)}(0.4155) = \$30.44 \text{ million}$$

$$\text{Value of the bond} = \$50 - \$30.44 = \$19.56 \text{ million}$$

As you can see, the equity in this firm retains value, because of the option characteristics of equity. In fact, equity continues to have value in this example even if the firm value drops to \$10 million or below, as shown in Figure 30.2.

**Increasing Risk Can Increase Equity Value**

In traditional discounted cash flow valuation, higher risk almost always translates into lower value for equity investors. When equity takes on the characteristics of a call option, you should not expect this relationship to continue to hold. Risk can become your ally, when you are an equity investor in a troubled firm. In essence, you have little to lose and much to gain from swings in firm value.



**FIGURE 30.2** Value of Equity as Firm Value Changes

**ILLUSTRATION 30.3: Equity Value and Volatility**

Let us revisit the valuation in Illustration 30.1. The value of the equity is a function of the standard deviation in firm value, which we assumed to be 40%. If we change this estimate, holding all else constant, the value of the equity will increase as evidenced in Figure 30.3.

Note that the value of equity increases, if we hold firm value constant, as the standard deviation increases. The interest rate on debt also increases as the standard deviation increases.

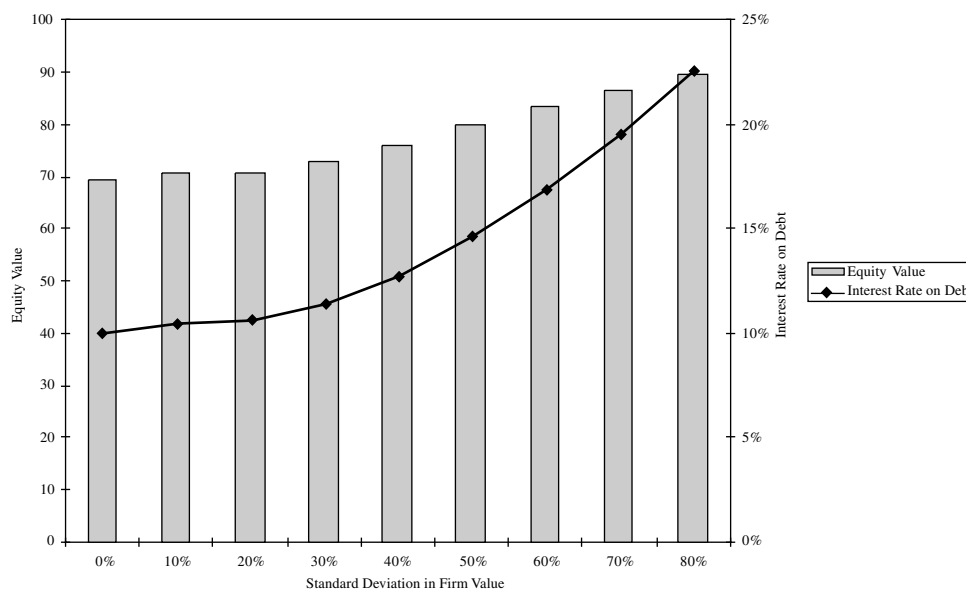
**Probability of Default and Default Spreads**

One of the more interesting pieces of output from the option pricing model is the risk-neutral probability of default that you can obtain for the firm. In the Black-Scholes model, you can estimate this value from  $N(d_2)$ , which is the risk-neutral probability that  $S > K$ , which in this model is the probability that the value of the firm's asset will exceed the face value of the debt.

$$\text{Risk-neutral probability of default} = 1 - N(d_2)$$

In addition, the interest rate from the debt allows us to estimate the appropriate default spread to charge on bonds.

You can see the potential in applying this model to bank loan portfolios to extract both the probability of default and to measure whether you are charging an interest rate that is high enough on the debt. In fact, there are commercial services that use fairly sophisticated option pricing models to estimate both values for firms.



**FIGURE 30.3** Equity Value and Standard Deviation in Firm Value

**ILLUSTRATION 30.4: Probabilities of Default and Default Spreads**

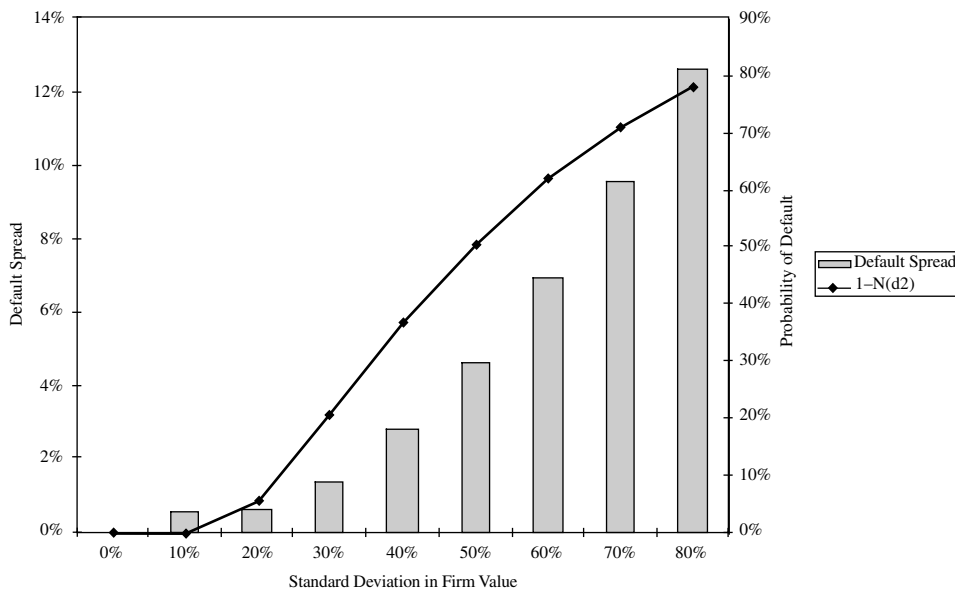
We return to Illustration 30.1 and estimate the probability of default as  $1 - N(d_2)$  and the default spread as the difference between the interest rate on a firm's debt and the risk-free rate. These values are graphed in Figure 30.4. Note that the probability of default climbs very quickly as the standard deviation in firm value increases and the default spread keeps up with it.

**ESTIMATING THE VALUE OF EQUITY AS AN OPTION**

The examples we have used thus far to illustrate the application of option pricing to value equity have included some simplifying assumptions. Among them are the following:

- There are only two claimholders in the firm—debt and equity.
- There is only one issue of debt outstanding, and it can be retired at face value.
- The debt has a zero coupon and no special features (convertibility, put clauses, etc.).
- The value of the firm and the variance in that value can be estimated.

Each of these assumptions is made for a reason. First, restricting the claimholders to just debt and equity makes the problem more tractable; introducing other claimholders such as preferred stock makes it more difficult to arrive at a result, albeit not impossible. Second, by assuming only one zero coupon debt issue that can be retired at face value any time prior to maturity, we align the features of the debt



**FIGURE 30.4** Risk-Neutral Probability of Default and Default Spread

more closely to the features of the strike price on a standard option. Third, if the debt is coupon debt, or more than one debt issue is outstanding, the equity investors can be forced to exercise (liquidate the firm) at these earlier coupon dates if they do not have the cash flows to meet their coupon obligations.

Finally, knowing the value of the firm and the variance in that value makes the option pricing possible, but it also raises an interesting question about the usefulness of option pricing in equity valuation. If the bonds of the firm are publicly traded, the market value of the debt can be subtracted from the value of the firm to obtain the value of equity much more directly. The option pricing approach does have its advantages, however. Specifically, when the debt of a firm is not publicly traded, option pricing theory can provide an estimate of value for the equity in the firm. Even when the debt is publicly traded, the bonds may not be correctly valued, and the option pricing framework can be useful in evaluating the values of debt and equity. Finally, relating the values of debt and equity to the variance in firm value provides some insight into the redistributive effects of actions taken by the firm.

### Inputs for Valuing Equity as an Option

Since most firms do not fall into the neat framework just developed (such as having only one zero coupon bond outstanding), some compromises are needed in order to use this model in valuation.

**Value of the Firm** The value of the firm can be obtained in one of four ways. In the first, we cumulate the market values of outstanding debt and equity, assuming that all debt and equity are traded, to obtain firm value. The option pricing model then reallocates the firm value between debt and equity. This approach, while simple, is internally inconsistent. We start with one set of market values for debt and equity and, using the option pricing model, end up with entirely different values for each.

In the second, we estimate the market values of the assets of the firm by discounting expected cash flows at the cost of capital. The one consideration that we need to keep in mind is that the value of the firm in an option pricing model should be the value obtained on liquidation. This may be less than the total firm value, which includes expected future investments, and it may also be reduced to reflect the cost of liquidation. If we estimate the firm value using a discounted cash flow model this would suggest that only existing investments should be considered while estimating firm value.<sup>1</sup> The biggest problem with this approach is that financial distress can affect operating income and thus the value that you obtain by using current operating income may be too low.

In the third approach, we estimate a multiple of revenues by looking at healthy firms in the same business and apply this multiple to the revenues of the firm you are valuing. Implicitly, we are assuming that a potential buyer, in the event of liquidation, will pay this value.

---

<sup>1</sup>Technically, this can be done by putting the firm into stable growth and valuing it as a stable growth firm, where reinvestments are used to either preserve or augment existing assets.

**Variance in Firm Value** We can obtain the variance in firm value directly if both stocks and bonds in the firm are traded. Defining  $\sigma_e^2$  as the variance in the stock price and  $\sigma_d^2$  as the variance in the bond price,  $w_e$  as the market-value weight of equity, and  $w_d$  as the market-value weight of debt, we can write the variance in firm value as:<sup>2</sup>

$$\sigma_{\text{firm}}^2 = w_e^2 \sigma_e^2 + w_d^2 \sigma_d^2 + 2 w_e w_d \rho_{ed} \sigma_e \sigma_d$$

where  $\rho_{ed}$  is the correlation between the stock and the bond prices. When the bonds of the firm are not traded, we can use the variance of similarly rated bonds as the estimate of  $\sigma_d^2$  and the correlation between similarly rated bonds and the firm's stock as the estimate of  $\rho_{ed}$ .

When companies get into financial trouble, this approach can yield misleading results as both its stock prices and its bond prices become more volatile. An alternative that often yields more reliable estimates is to use the average variance in firm value for other firms in the sector. Thus the value of equity in a deeply troubled steel company can be estimated using the average variance in firm value of all traded steel companies.



**optvar.xls:** This dataset on the Web summarizes standard deviations in equity and firm value, by industry, for firms in the United States.

**Maturity of the Debt** Most firms have more than one debt issue on their books, and much of the debt comes with coupons. Since the option pricing model allows for only one input for the time to expiration, we have to convert these multiple bonds issues and coupon payments into one equivalent zero coupon bond.

- One solution, which takes into account both the coupon payments and the maturity of the bonds, is to estimate the duration of each debt issue and calculate a face-value-weighted average of the durations of the different issues. This value-weighted duration is then used as a measure of the time to expiration of the option.
- An approximation is to use the face-value-weighted maturity of the debt coming for the maturity of the zero coupon bond in the option pricing model.

**Face Value of Debt** When a distressed firm has multiple debt issues outstanding, you have three choices when it comes to what you use as the face value of debt:

1. You could add up the principal due on all of the debt of the firm and consider it to be the face value of the hypothetical zero coupon bond that you assume that your firm has issued. The limitation of this approach is that it will understate what the firm will truly have to pay out over the life of the debt, since there will be coupon payments and interest payments during the period.

<sup>2</sup>This is an extension of the variance formula for a two-asset portfolio.



2. At the other extreme, you could add the expected interest and coupon payments that will come due on the debt to the principal payments to come up with a cumulated face value of debt. Since the interest payments occur in the near years and the principal payments are due only when the debt comes due, you are mixing cash flows up at different points in time when you do this. This is, however, the simplest approach of dealing with intermediate interest payments coming due.
3. You can consider only the principal due on the debt as the face value of the debt and the interest payments each year, specified as a percent of firm value, can take the place of the dividend yield in the option pricing model. In effect, each year that the firm remains in existence, you would expect to see the value of the firm decline by the expected payments on the debt.

#### ILLUSTRATION 30.5: Valuing Equity as an Option: Eurotunnel in 1997

Eurotunnel was the firm that was created to build and ultimately profit from the tunnel under the English Channel linking England and France. The tunnel was readied for operations in the early 1990s but was not a commercial success, reporting significant losses each year after opening. In early 1998 Eurotunnel had a book value of equity of –£117 million, and in 1997 the firm had reported earnings before interest and taxes of –£3.45 million and net income of –£611 million on revenues of £456 million. By any measure, it was a firm in financial trouble.

Much of the financing for the tunnel had come from debt, and at the end of 1997 Eurotunnel had debt obligations in excess of £5,000 million, raised from a variety of bond issues and bank debt. Adding the expected interest payments and coupon payments onto the debt brings the total obligations of the firm up to £8,865 million. The following table summarizes the outstanding debt at the firm, with our estimates of the expected duration for each class of debt:

<i>Debt Type</i>	<i>Face Value (Including Cumulated Coupons)</i>	<i>Duration (Years)</i>
Short-term	£935	0.50
100-year	£2,435	6.7
20-year	£3,555	12.6
Longer	£1,940	18.2
Total	£8,865 mil	10.93

The firm's only significant asset is its ownership of the tunnel, and we estimated the value of this asset from its expected cash flows and the appropriate cost of capital. The assumptions were as follows:

- Revenues will grow 10% a year for five years and 3% thereafter.
- The cost of goods sold, which was 72% of revenues in 1997, will drop to 60% of revenues by 2002 in linear increments and stay at that level. (This does not include depreciation.)
- In the most recent year capital expenditures were \$45 million and depreciation amounted to \$137 million. Capital spending and depreciation will grow 3% a year for the next five years. Beyond year 5, capital expenditures will offset depreciation.
- There are no working capital requirements.
- The debt ratio, which was 95.35% at the end of 1997, will drop to 70% by 2002. The cost of debt is 10% for the next 5 years and 8% after that.
- The beta for the stock will be 2.00 for the next five years, and drop to 0.8 thereafter (as the leverage decreases).

The long-term bond rate at the time of the valuation was 6% and the risk premium was 5.5%. Based on these assumptions, we estimated the cash flows in the following table:

	1	2	3	4	5	Terminal Year
Revenues	\$ 501.60	\$551.76	\$606.94	\$667.63	\$ 734.39	\$756.42
– COGS	\$ 361.15	\$380.71	\$400.58	\$420.61	\$ 440.64	\$453.85
– Depreciation	\$ 141.11	\$145.34	\$149.70	\$154.19	\$ 158.82	\$163.59
EBIT	(\$ 0.66)	\$ 25.70	\$ 56.65	\$ 92.83	\$ 134.94	\$138.98
– EBIT $\times$ t	\$ 0.00	\$ 9.00	\$ 19.83	\$ 32.49	\$ 47.23	\$ 48.64
EBIT(1 – t)	(\$ 0.66)	\$ 16.71	\$ 36.83	\$ 60.34	\$ 87.71	\$ 90.34
+ Depreciation	\$ 141.11	\$145.34	\$149.70	\$154.19	\$ 158.82	\$163.59
– Capital spending	\$ 46.35	\$ 47.74	\$ 49.17	\$ 50.65	\$ 52.17	\$163.59
– Change in working capital	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00
Free CF to firm	\$ 94.10	\$114.31	\$137.36	\$163.89	\$ 194.36	\$ 90.34
Terminal value					\$2,402.66	
Present value	\$ 87.95	\$ 99.86	\$112.16	\$125.08	\$1,852.67	
Value of firm	\$2,277.73					

The value of the assets of the firm is £2,278 million.

The final input we estimated was the standard deviation in firm value. Since there are no directly comparable firms, we estimated the standard deviations in Eurotunnel stock and debt using the data over the previous years:

Standard deviation in Eurotunnel stock price (ln) = 41%

Standard deviation in Eurotunnel bond price (ln) = 17%

We also estimated a correlation of 0.50 between Eurotunnel stock and bond prices, and the average market debt-to-capital ratio during the two-year period was 85%. Combining these inputs, we estimated the standard deviation in firm value to be:

$$\sigma_{\text{firm}}^2 = (0.15)^2(0.41)^2 + (0.85)^2(0.17)^2 + 2(0.15)(0.85)(0.5)(0.41)(0.17) = 0.0335$$

In summary, the inputs to the option pricing model were as follows:

Value of the underlying asset = S = Value of the firm = £2,312 million

Exercise price = K = Face value of outstanding debt = £8,865 million

Life of the option = t = Weighted average duration of debt = 10.93 years

Variance in the value of the underlying asset =  $\sigma^2$  = Variance in firm value = 0.0335

Riskless rate = r = Treasury bond rate corresponding to option life = 6%

Based on these inputs, we estimate the following value for the call:

$$d1 = -0.8582 \quad N(d1) = 0.1955$$

$$d2 = -1.4637 \quad N(d2) = 0.0717$$

$$\text{Value of the call} = 2,278(0.1955) - 8,865 \exp^{(-0.06)(10.93)}(0.0717) = £116 \text{ million}$$

Eurotunnel's equity was trading at £150 million in 1997.

The option pricing framework, in addition to yielding a value for Eurotunnel equity, also yields some valuable insight into the drivers of value for this equity. While it is certainly important that the firm try to bring costs under control and increase operating margins, the two most critical variables determining equity value are the duration of the debt and the variance in firm value. Any action that increases or decreases the debt duration will have a positive or negative effect on equity value. For instance, when the French government put pressure on the bankers who had lent money to Eurotunnel to ease restrictions and allow the firm more time to repay its debt, equity investors benefited as their options became more long-term. Similarly, an action that increases the volatility of expected firm value will increase the value of the option.



**equity.xls:** This spreadsheet allows you to estimate the value the equity in a troubled firm as an option.

### VULTURE INVESTING AND OPTION PRICING

Vulture investing refers to an investment strategy of buying the securities of firms that are in severe financial distress. In a sense, you are investing in deep out-of-the-money options and hoping that some of these options pay off handsomely. Using the option pricing framework allows us to draw some conclusions about when and how this strategy can pay off:

- As with any portfolio of deep out-of-the-money options, you should expect a considerable proportion of the portfolio to end up worthless. The relatively few investments that do pay off, however, will earn huge returns, and you could still end up with a portfolio with impressive returns.
- You should direct your equity investments to equity in deeply troubled firms in volatile sectors. Risk is your ally when you invest in options, and the equity in these firms should be worth more than equity in deeply troubled stable firms.
- If you are buying equity in deeply troubled firms, you should direct your investments toward troubled firms with longer-term debt rather than shorter-term debt. As the life of the option increases, you will see the value of the option also increase.
- If you are investing in the debt issued by financially troubled firms, you cannot be a passive bondholder. You have to take an active role in the management and obtain an equity stake in the companies you invest in, perhaps by making the debt convertible.

## CONSEQUENCES FOR DECISION MAKING

Option pricing theory can be applied to illustrate the conflict between stockholders and bondholders when it comes to investment analysis and conglomerate mergers. This section argues that decisions that make stockholders better off are not necessarily value maximizing for the firm and can hurt bondholders.

### The Conflict between Bondholders and Stockholders

Stockholders and bondholders have different objective functions, and this can lead to agency problems, whereby stockholders expropriate wealth from bondholders. The conflict can manifest itself in a number of ways. For instance, stockholders have an incentive to invest in riskier projects than bondholders, and to pay more out in dividends than bondholders would like them to. The conflict between bondholders and stockholders can be illustrated dramatically using the option pricing methodology developed in the previous section.

**Investing in Risky Projects** Since equity is a call option on the value of the firm, other things remaining equal, an increase in the variance in the firm value will lead to an increase in the value of equity. It is therefore conceivable that stockholders can invest in risky projects with negative net present values, which, while making them better off, may make the bonds and the firm less valuable. To illustrate, consider the firm in Illustration 30.1 with a value of assets of \$100 million, a face value of zero coupon 10-year debt of \$80 million, and a standard deviation in the value of the firm of 40 percent, valued in the earlier illustration. The equity and debt in this firm were valued as follows:

Value of equity = \$75.94 million

Value of debt = \$24.06 million

Value of firm = \$100 million

Now assume that the stockholders have the opportunity to invest in a project with a net present value of -\$2 million; the project is a very risky one that will push up the standard deviation in firm value to 50 percent. The equity as a call option can then be valued using the following inputs:

Value of the underlying asset =  $S$  = Value of the firm = \$100 million - \$2 million = \$98 million (the value of the firm is lowered because of the negative net present value project)

Exercise price =  $K$  = Face value of outstanding debt = \$80 million

Life of the option =  $t$  = Life of zero coupon debt = 10 years

Variance in the value of the underlying asset =  $\sigma^2$  = Variance in firm value = 0.25

Riskless rate =  $r$  = Treasury bond rate corresponding to option life = 10%

Based on these inputs, the Black-Scholes model provides the following value for the equity and debt in this firm:

Value of equity = \$77.71

Value of debt = \$20.29

Value of firm = \$98.00

The value of equity rises from \$75.94 million to \$77.71 million, even though the firm value declines by \$2 million. The increase in equity value comes at the expense of bondholders, who find their wealth decline from \$24.06 million to \$20.19 million.

**Conglomerate Mergers** Bondholders and stockholders may also be affected differently by conglomerate mergers, where the variance in earnings and cash flows of the combined firm can be expected to decline because the merging firms have earning streams that are not perfectly correlated. In these mergers, the value of the combined equity in the firm will decrease after the merger because of the decline in variance; consequently, bondholders will gain. Stockholders can reclaim some or all of this lost wealth by utilizing their higher debt capacity and issuing new debt. To illustrate, suppose you are provided with the following information on two firms, Lube & Auto (auto service) and Gianni Cosmetics (a cosmetics manufacturer) that hope to merge.

	<i>Lube &amp; Auto</i>	<i>Gianni Cosmetics</i>
Value of the firm	\$100 million	\$150 million
Face value of debt	\$80 million	\$50 million (zero coupon debt)
Maturity of debt	10 years	10 years
Standard deviation in firm value	40%	50%

Correlation between firm cash flows is 0.4. The 10-year bond rate is 10%.

We calculate the variance in the value of the firm after the acquisition as follows:

$$\begin{aligned}
 \text{Variance in combined firm value} &= w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \rho_{12} \sigma_1 \sigma_2 \\
 &= (0.4)^2 (0.16) + (0.6)^2 (0.25) \\
 &\quad + 2(0.4)(0.6)(0.4)(0.4)(0.5) \\
 &= 0.154
 \end{aligned}$$

We estimate the values of equity and debt in the individual firms and the combined firm using the option pricing model:

	<i>Lube &amp; Auto</i>	<i>Gianni Cosmetics</i>	<i>Combined Firm</i>
Value of equity in the firm	\$ 75.94	\$134.48	\$207.58
Value of debt in the firm	\$ 24.06	\$ 15.52	\$ 42.42
Value of the firm	\$100.00	\$150.00	\$250.00

The combined value of the equity prior to the merger is \$210.42 million; it declines to \$207.58 million after that. The wealth of the bondholders increases by an equal amount. There is a transfer of wealth from stockholders to bondholders as a consequence of the merger. Thus conglomerate mergers that are not followed by increases in leverage are likely to result in a wealth transfer from stockholders to bondholders.

### IS EQUITY NOT A CALL OPTION IN EVERY FIRM?

Looking at the framework employed in this chapter, you are probably wondering why equity in every firm cannot be viewed as a call option and why therefore we should not add a premium to discounted cash flow values for all firms. It is true that equity is a call option in every firm, but in most firms the value of the firm as a going concern will be greater than the value you obtain from a liquidation option. Consider, for instance, a high-growth firm with very little in assets in place and a high proportion of value from growth potential. If this firm liquidates, it will get the value of its assets in place; this will become the value of the underlying asset in the option pricing model and determine the value of equity as a call option on the firm. This value will be much lower than the value you would obtain if you valued the firm as a going concern and considered the cash flows from expected growth. For some mature firms that derive most of their value from assets in place and substantial debt, the equity value as a call option on liquidation can be the higher value. For other firms, though, the equity value as a going concern will be greater.

## CONCLUSION

---

The value of equity in deeply troubled firms—firms with negative earnings and high leverage—can be viewed as a call option. The option rests in the hands of equity investors, who can choose to liquidate the firm and claim the difference between firm value and debt outstanding. With limited liability, they do not have to make up the difference if firm value falls below the value of the outstanding debt. The equity will retain value even when the value of the assets of the firm is lower than the debt outstanding, because of the time premium on the option.

## QUESTIONS AND SHORT PROBLEMS

---

1. Designate the following statements as true or false:
  - a. Equity can be viewed as an option because equity investors have limited liability (limited to their equity investment in the firm).  
True \_\_\_\_ False \_\_\_\_
  - b. Equity investors will sometimes take bad projects (with negative net present value) because they can add to the value of the firm.  
True \_\_\_\_ False \_\_\_\_
  - c. Investing in a good project (with positive NPV)—which is less risky than the average risk of the firm—can negatively impact equity investors.  
True \_\_\_\_ False \_\_\_\_
  - d. The value of equity in a firm is an increasing function of the duration of the debt in the firm (i.e., equity will be more valuable in a firm with longer-term debt than in an otherwise similar firm with short-term debt).  
True \_\_\_\_ False \_\_\_\_
2. XYZ Corporation has \$500 million in zero coupon debt outstanding, due in five years. The firm had earnings before interest and taxes of \$40 million in the most recent year (the tax rate is 40%). These earnings are expected to grow 5% a year in perpetuity, and the firm paid no dividends. The firm had a return on capital of 12% and a cost of capital of 10%. The annualized standard deviation in firm values of comparable firms is 12.5%. The five-year bond rate is 5%.
  - a. Estimate the value of the firm.
  - b. Estimate the value of equity, using an option pricing model.
  - c. Estimate the market value of debt and the appropriate interest rate on the debt.
3. McCaw Cellular Communications reported earnings before interest and taxes of \$850 million in 1993, with a depreciation allowance of \$400 million and capital expenditures of \$550 million in that year; the working capital requirements were negligible. The earnings before interest and taxes and net cap ex are expected to grow 20% a year for the next five years. The cost of capital is 10% and the return on capital is expected to be 15% in perpetuity after year 5; the growth rate in perpetuity is 5%. The firm has \$10 billion in debt outstanding with the following characteristics:

<i>Duration</i>	<i>Debt</i>
1 year	\$2 billion
2 years	\$4 billion
5 years	\$4 billion

The annualized standard deviation in the firm's stock price is 35%, while the annualized standard deviation in the traded bonds is 15%. The correlation between stock and bond prices has been 0.5, and the average debt ratio over the past few years has been 60%. The three-year bond rate is 5%, and the tax rate is 40%.

- a. Estimate the value of the firm.
  - b. Estimate the value of the equity.
  - c. The stock was trading at \$30, and there were 210 million shares outstanding in January 1994. Estimate the implied standard deviation in firm value.
  - d. Estimate the market value of the debt.
4. You have been asked to analyze the value of equity in a company that has the following features:
- The earnings before interest and taxes is \$25 million, and the corporate tax rate is 40%.
  - The earnings are expected to grow 4% a year in perpetuity, and the return on capital is 10%. The cost of capital of comparable firms is 9%.
  - The firm has two types of debt outstanding—two-year zero coupon bonds with a face value of \$250 million and bank debt with 10 years to maturity with a face value of \$250 million. (The duration of this debt is four years.)
  - The firm is in two businesses—food processing and auto repair. The average standard deviation in firm value for firms in food processing is 25%, whereas the standard deviation for firms in auto repair is 40%. The correlation between the businesses is 0.5.
  - The riskless rate is 7%.

Use the option pricing model to value equity as an option.

5. You are valuing the equity in a firm with \$800 million (face value) in debt with an average duration of six years and assets with an estimated value of \$400 million. The standard deviation in asset value is 30%. With these inputs (and a riskless rate of 6%) we obtain the following values (approximately) for  $d_1$  and  $d_2$ :

$$d_1 = -0.15 \quad d_2 = -0.90$$

Estimate the default spread (over and above the risk-free rate) that you would charge for the debt in this firm.

## Value Enhancement: A Discounted Cash Flow Valuation Framework

In much of this book, we have taken on the role of a passive investor valuing going concerns. In this chapter, we switch roles and look at valuation from the perspective of those who can make a difference in the way a company is run and hence its value. Our focus is therefore on how actions taken by managers and owners can change the value of a firm.

We will use the discounted cash flow framework developed in earlier parts of the book to explore the requirements for an action to be value creating, and then go on to examine the different ways in which a firm can create value. In the process, we will also examine the role that marketing decisions, production decisions, and strategic decisions have in value creation.

### VALUE CREATING AND VALUE-NEUTRAL ACTIONS

---

The value of a firm is the present value of the expected cash flows from both assets in place and future growth, discounted at the cost of capital. For an action to create value, it has to do one or more of the following:

- Increase the cash flows generated by existing investments.
- Increase the expected growth rate in earnings.
- Increase the length of the high-growth period.
- Reduce the cost of capital that is applied to discount the cash flows.

Conversely, an action that does not affect cash flows, the expected growth rate, the length of the high growth period, or the cost of capital cannot affect value.

While this might seem obvious, a number of value-neutral actions taken by firms receive disproportionate attention from both managers and analysts. Consider four examples:

1. Stock dividends and stock splits change the number of units of equity in a firm but do not affect cash flows, growth, or value. These actions can have price effects, though, because they alter investors' perceptions of the future of the company.
2. Accounting changes in inventory valuation and depreciation methods that are restricted to the reporting statements and do not affect tax calculations have no



effect on cash flows, growth, or value. In recent years, firms have spent an increasing amount of time on the management and smoothing of earnings and seem to believe that there is a value payoff to doing this.

3. When making acquisitions, firms often try to structure the deals in such a way that they can pool their assets and not show the market premium paid in the acquisition. When they fail and they are forced to show the difference between market value and book value as goodwill, their earnings are reduced by the amortization of the goodwill over subsequent periods. This amortization is generally not tax deductible, however, and thus does not affect the cash flows of the firm. So, whether a firm adopts purchase or pooling accounting, and the length of time it takes to write off the goodwill, should not really make any difference to value.
4. In the late 1990s, a number of firms that have issued tracking stock on their high-growth divisions. Since these divisions remain under the complete control of the parent company, we would argue that the issue of tracking stock, by itself, should not create value.

Some would take issue with this proposition. When a stock splits or a firm issues tracking stock, they would argue, the stock price often goes up significantly.<sup>1</sup> While this is true, we would emphasize that it is value, not price, that we claim is unaffected by these actions.

While paying stock dividends, splitting stock and issuing tracking stock are value-neutral actions, they can still be useful tools for a firm that perceives itself to be undervalued by the market. These actions can change market perceptions about growth or cash flows and thus act as signals to financial markets. Alternatively, they might provide more information about undervalued assets owned by the firm, and the price may react, as a consequence. In some cases, these actions may even lead to changes in operations; tying the compensation of managers to the price of stock tracking the division in which they work may improve efficiency and thus increase cash flows, growth, and value.

## **WAYS OF INCREASING VALUE**

---

The value of a firm can be increased by increasing cash flows from assets in place, by increasing expected growth and the length of the growth period, and by reducing the cost of capital. In reality, however, none of these is easily accomplished, and they are likely to reflect all the qualitative factors that financial analysts are often accused of ignoring in valuation. This section will consider how actions taken by a firm on a variety of fronts—marketing, strategic, and financial—can have an effect on value.

### **Increase Cash Flows from Existing Investments**

The first place to look for value is in the firm's existing assets. These assets represent investments the firm has already made and they generate the current operating

---

<sup>1</sup>This is backed up empirically. Stock prices do tend to increase, on average, when stocks are split.

income for the firm. To the extent that these investments earn less than their cost of capital or are earning less than they could if optimally managed, there is potential for value creation.

**Poor Investments: Keep, Divest, or Liquidate** Every firm has some investments that earn less than the cost of capital used to fund them and sometimes even lose money. At first sight, it would seem to be a simple argument to make that investments that do not earn their cost of capital should be either liquidated or divested. If, in fact, the firm could get back the original capital on liquidation, this statement would be true. But that assumption is not generally true, and there are three different measures of value for an existing investment that we need to consider.

The first is the continuing value, and it reflects the present value of the expected cash flows from continuing the investment through the end of its life. The second is the liquidation or salvage value, which is the net cash flow that the firm will receive if it terminated the project today. Finally, there is the divestiture value, which is the price that will be paid by the highest bidder for this investment.

Whether a firm should continue with an existing project, liquidate the project, or sell it to someone else will depend on which of the three is highest. If the continuing value is the highest, the firm should continue with the project to the end of the project life, even though it might be earning less than the cost of capital. If the liquidation or divestiture value is higher than the continuing value, there is potential for an increase in value from liquidation or divestiture. The value increment can then be summarized:

If liquidation is optimal:

$$\text{Expected value increase} = \text{Liquidation value} - \text{Continuing value}$$

If divestiture is optimal:

$$\text{Expected value increase} = \text{Divestiture value} - \text{Continuing value}$$

How does a divestiture affect a firm's value? To answer this question, we compare the price received on the divestiture to the present value of the expected cash flows that the firm would have received from the divested assets. There are three possible scenarios:

1. If the divestiture value is equal to the present value of the expected cash flows, the divestitures will have no effect on the divesting firm's value.
2. If the divestiture value is greater than the present value of the expected cash flows, the value of the firm will increase on the divestiture.
3. If the divestiture value is less than the present value of the expected cash flows, the value of the firm will decrease on the divestiture.

The divesting firm receives cash in return for the assets and can choose to retain the cash and invest it in marketable securities, invest the cash in other assets or new investments, or return the cash to stockholders in the form of dividends or stock buybacks. This action, in turn, can have a secondary effect on value.

**ILLUSTRATION 31.1: Potential for Value Creation from Divestiture: Boeing**

While it is difficult to make judgments about individual investments that firms might have and their capacity to generate continuing value, you can make some observations about the potential for value creation from divestitures and liquidation by looking at the cost of capital of and return on capital earned by different divisions of a firm. For instance, Boeing earned a return on capital of 5.82% in 1998, while its cost of capital was 9.18%. Breaking down Boeing's return by division, we obtain the numbers in the following table:

	<i>Commercial Aircraft</i>	<i>Information, Space, and Defense</i>	<i>Firm</i>
Operating income	\$ 75	\$1,576	\$ 1,651
Capital invested	\$18,673	\$9,721	\$28,394
After-tax return on capital	0.40%	16.21%	5.82%

At Boeing's annual meeting in 1999, Phil Condit, Boeing's CEO, was candid in admitting that 35% of Boeing's capital was in investments that earned less than the cost of capital. He revealed little, however, about whether it would be feasible to liquidate or divest these investments<sup>2</sup> and get more than continuing value from such actions.

Assume that Boeing is interested in selling its information, space, and defense systems division, and that it has found a potential buyer who is willing to pay \$11 billion for the division. The division reported cash flows before debt payments but after reinvestment needs and taxes of \$393 million in the most recent year, and the cash flows are expected to grow 5% a year in the long term. The cost of capital for the division is 9%, a little lower than the cost of capital for the entire firm. The division, as a continuing part of Boeing, can be valued as follows:

$$\text{Value of division} = \$393(1.05)/(.09 - .05) = \$10,316 \text{ million}$$

With the divestiture value of \$11 billion, the net effect of the divestiture will be an increase in Boeing's value of \$684 million.

$$\begin{aligned} \text{Net effect on value} &= \text{Divestiture value} - \text{Continuing value} = \$11,000 \text{ million} - \$10,316 \text{ million} \\ &= \$684 \text{ million} \end{aligned}$$

**Improve Operating Efficiency** A firm's operating efficiency determines its operating margin and thus its operating income; more efficient firms have higher operating margins, other things remaining equal, than less efficient firms in the same business. If a firm can increase its operating margin on existing assets, it will generate additional value. There are a number of indicators of the potential to increase margins, but the most important is a measure of how much a firm's operating margin deviates from its industry. Firms whose current operating margins are well below their industry average must locate the source of the difference and try to fix it.

In most firms, the first step in value enhancement takes the form of cost cutting and layoffs. These actions are value enhancing only if the resources that are pruned do not contribute sufficiently either to current operating income or to future

<sup>2</sup>In 1999, Lockheed, Boeing's leading competitor in the sector, announced plans to divest itself of approximately 15% of its assets as a remedy for its poor stock price performance.

### REASONS FOR DIVESTITURES

Why would a firm sell assets or a division? There are at least three reasons. The first is that the divested assets may have a higher value to the buyer of these assets. For assets to have a higher value, they have to either generate higher cash flows for the buyer or result in lower risk (leading to a lower discount rate). The higher cash flows can occur because the buyer is more efficient at utilizing the assets or because the buyer finds synergies with its existing businesses. The lower discount rate may reflect the fact that the owners of the buying firm are more diversified than the owners of the firm selling the assets. In either case, both sides can gain from the divestiture and share in the increased value.

The second reason for divestitures is less value-driven and more a result of the immediate cash flow needs of the divesting firm. Firms that find themselves unable to meet their current operating or financial expenses may have to sell assets to raise cash. For instance, many leveraged acquisitions in the 1980s were followed by divestitures of assets. The cash generated from these divestitures was used to retire and service debt.

The third reason for divestitures relates to the assets not sold by the firm, rather than the divested assets. In some cases, a firm may find the cash flows and values of its core businesses affected by the fact that it has diversified into unrelated businesses. This lack of focus can be remedied by selling assets or businesses that are peripheral to the main business of a firm.

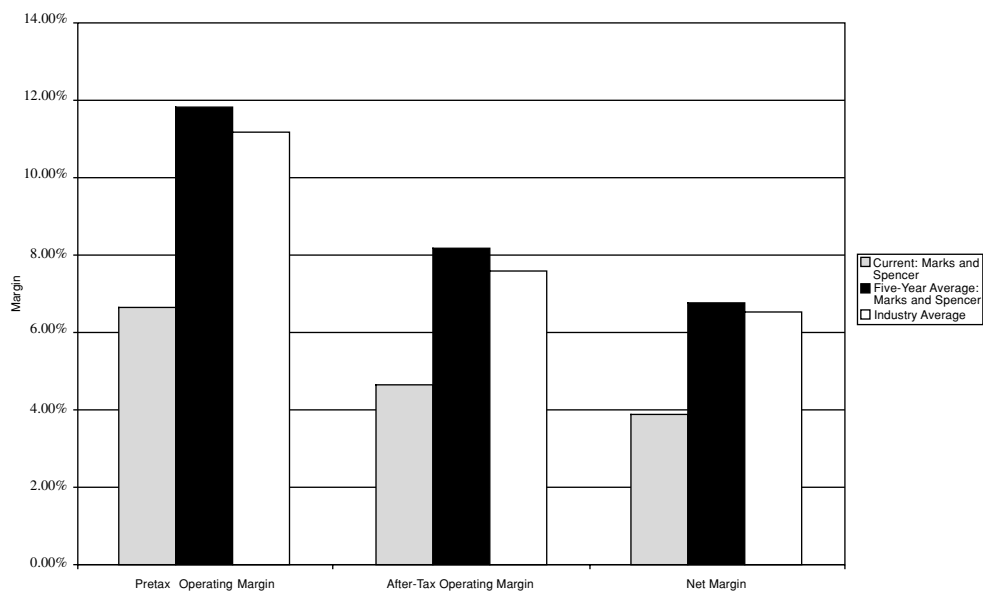
growth. Companies can easily show increases in current operating income by cutting back on expenditures such as research and training, but they may sacrifice future growth in doing so.

### ILLUSTRATION 31.2: Operating Margin Comparisons

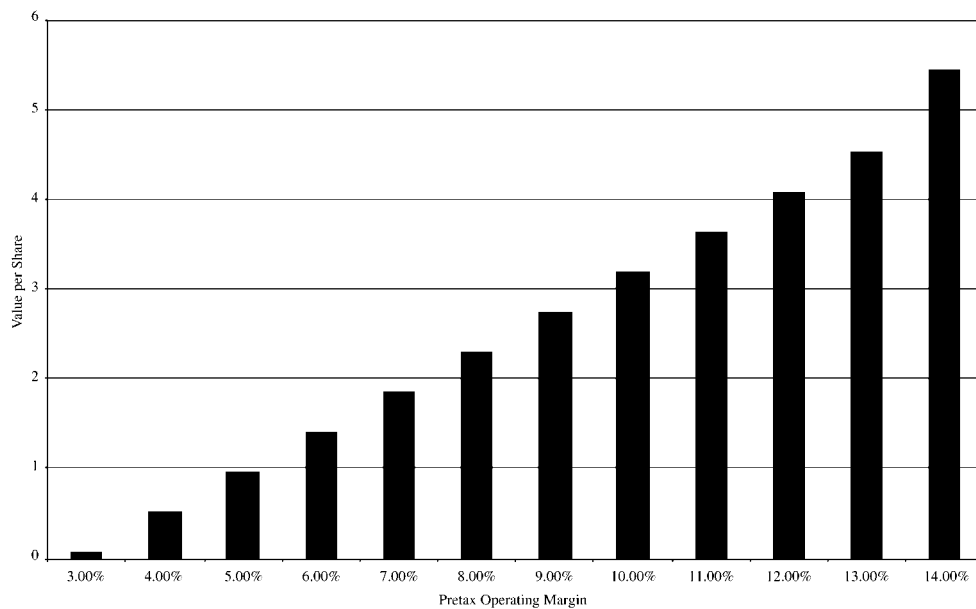
In Chapter 22, we valued Marks and Spencer in 2000 and noted that its value was depressed because its operating margins had dropped over the previous two years. Figure 31.1 compares the after-tax operating margins at Marks and Spencer in 2000 with the average after-tax margin earned by the firm over the previous five years and the average after-tax margin in 2000 for other firms in the sector.

Marks and Spencer's current margins lag both its own historical levels and the average for the sector. We estimated the effect on value per share at Marks and Spencer of improvements in the operating margin from the current level. Figure 31.2 summarizes the effect of these changes.

While it is not surprising that the value per share is sensitive to changes in the operating margin, you can see that the decline in operating margins from historical levels to the current one have had a significant impact on value. Any value enhancement plan for the firm, therefore, has to be centered on improving operating margins.



**FIGURE 31.1** Marks and Spencer: Margin Comparisons



**FIGURE 31.2** Operating Margin and Value per Share: Marks and Spencer

### SOME THOUGHTS ON COST CUTTING

Firms embark on cost cutting with a great deal of fanfare but seem to have trouble carrying through. Cost cutting is often promised by firms, especially after acquisitions or new management comes into the firm, but seldom delivered. Here are some general conclusions about cost cutting:

- The greater the absolute magnitude of the cost cuts promised, the more likely it is that they will not be delivered.
- Cost cutting is never painless; not only is the human cost associated with layoffs large, but there is an associated loss of morale that can be just as expensive.
- The initial phases of cost cuts go much more smoothly than the later phases. Part of the reason for this is that the easy cost cuts come first and the tough ones come later.
- It is far more difficult to separate those costs that do not generate benefits for the firm from those that do than it seems at the outset, especially if we think of benefits in the long term.
- Cost cutting that is promised in the abstract is less likely to happen than cost cutting that is described in detail. An example would be a bank merger where the branches that will be closed after the merger are specified as opposed to one where the bank just specified that economies of scale will lower costs.

From a valuation perspective, you should first evaluate the credibility of the management that is making the cost cutting claims, and even if you believe the managers you should allow for phasing in the cost cuts over time; the larger the firm and the bigger the cost cuts, the longer the period.

**Reduce the Tax Burden** The value of a firm is the present value of its after-tax cash flows. Thus, any action that can reduce the tax burden on a firm for a given level of operating income will increase value. Although there are some aspects of the tax code that offer no flexibility to the firm, the tax rate can be reduced over time by doing any or all of the following:

- Multinational firms that generate earnings in different markets may be able to move income from high-tax locations to low-tax or no-tax locations. For instance, the prices that divisions of these firms charge each other for intracompany sales (transfer prices) can allow profits to be shifted from one part of the firm to another.<sup>3</sup>
- A firm may be able to acquire net operating losses that can be used to shield future income. In fact, this might be why a profitable firm acquires an unprofitable one.

---

<sup>3</sup>Taxes are only one aspect of transfer pricing. Brickley, Smith, and Zimmerman (1995) look at the broader issue of how to best set transfer prices.

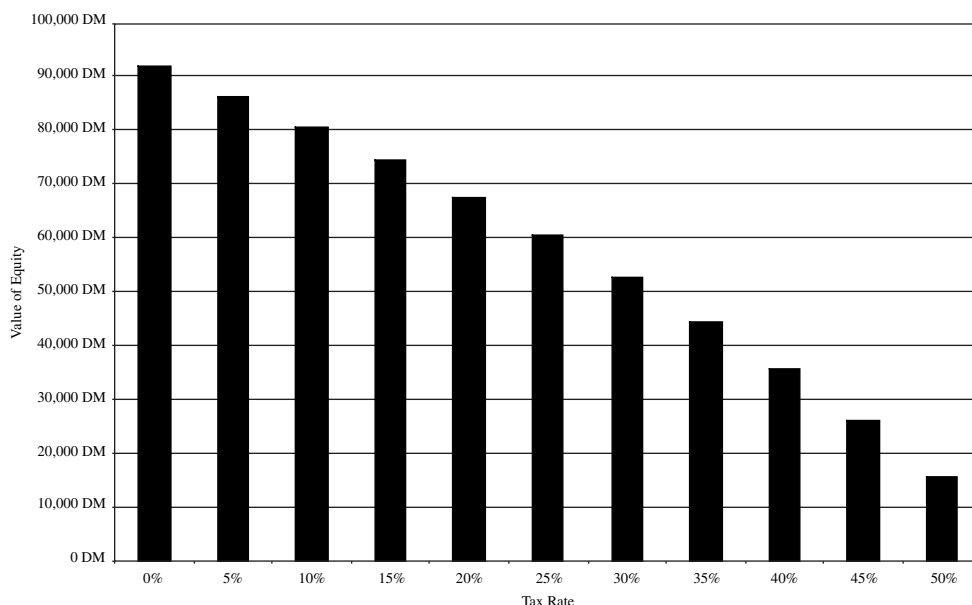
- A firm can use risk management to reduce the average tax rate paid on income over time because the marginal tax rate on income tends to rise, in most tax systems, as income increases. By using risk management to smooth income over time, firms can make their incomes more stable and reduce their exposure to the highest marginal tax rates.<sup>4</sup> This is especially the case when a firm faces a windfall or supernormal profit taxes.

### ILLUSTRATION 31.3: Tax Burden and Valuation

In Chapter 22 we valued DaimlerChrysler using a tax rate of 44%, which is much higher than the tax rates used for other companies that we have valued. As a German company, Daimler is clearly much more exposed to high tax rates, but there are two forces that may change this tax rate:

1. With the acquisition of Chrysler and the increasing globalization of its business, DaimlerChrysler has far more options when it comes to moving income to lower-tax locales.
2. As a result of expected changes in German law, the tax rate in Germany will decline over the next five years.

The impact on the value of equity at DaimlerChrysler of changes in the tax rate from 0% to 50% are shown in Figure 31.3. The value of equity changes dramatically as the tax rate changes and would triple from the base case value if the tax rate were zero. This is notwithstanding the fact that the tax benefits from depreciation and interest expenses also decline as the tax rate drops.



**FIGURE 31.3** DaimlerChrysler: Tax Rate versus Value of Equity

<sup>4</sup>Stulz (1996) makes this argument for risk management. He also presents other ways in which risk management can be value enhancing.

**Reduce Net Capital Expenditures on Existing Investments** The net capital expenditures is the difference between capital expenditures and depreciation, and, as a cash outflow, it reduces the free cash flow to the firm. Part of the net capital expenditure is designed to generate future growth, but part is to maintain existing assets. If a firm can reduce its net capital expenditures on existing assets, it will increase value. During short periods, the capital expenditures can even be lower than depreciation for those assets, creating a cash inflow from net capital expenditures.

There is generally a trade-off between capital maintenance expenditures and the life of existing assets. A firm that does not make any capital expenditures on its assets will generate much higher after-tax cash flows from these assets, but the assets will have a far shorter life. At the other extreme, a firm that reinvests all the cash flows it gets from depreciation into capital maintenance may be able to extend the life of its assets in place significantly. Firms often ignore this trade-off when they embark on cost cutting and reduce or eliminate capital maintenance expenditures. Although these actions increase current cash flows from existing assets, the firm might actually lose value as it depletes these assets at a faster rate.

**Reduce Noncash Working Capital** The noncash working capital in a firm is the difference between noncash current assets, generally inventory and accounts receivable, and the nondebt portion of current liabilities, generally accounts payable. Money invested in noncash working capital is tied up and cannot be used elsewhere; thus, increases in noncash working capital are cash outflows, whereas decreases are cash inflows. For retailers and service firms, noncash working capital may be a much larger drain on cash flows than traditional capital expenditures.

The path to value creation seems simple. Reducing noncash working capital as a percent of revenues should increase cash flows and, therefore, value. This assumes, however, that there are no negative consequences for growth and operating income. Firms generally maintain inventory and provide credit because it allows them to sell more. If cutting back on one or both causes lost sales, the net effect on value may be negative.

The availability of updated and reliable data on customers has made it easier for firms to plan and reduced the need for inventory and working capital. In fact, the average noncash working capital as a percent of revenues at major U.S. corporations has dropped from 17.6 percent in 1988 to 14.5 percent in 1998.

---

**ILLUSTRATION 31.4: Noncash Working Capital: The Home Depot**

---

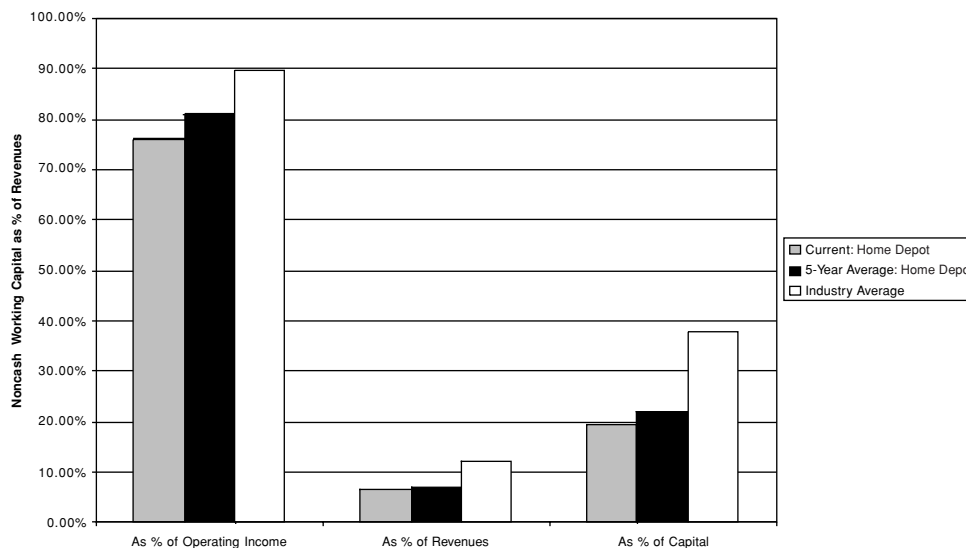
Consider a large retail firm like the Home Depot. It has significant investments in working capital, and changes in this input can make a significant difference to the value of equity in the firm. Figure 31.4 compares noncash working capital as a percent of revenues, operating income, and book value of capital invested for the Home Depot for 1998 with the previous five years and the average for the sector.

Due to its economies of scale, the Home Depot carries far less working capital than its competitors and this has a positive effect on both cash flows and value. In 1998, we valued the Home Depot using the following inputs for the valuation:



	High-Growth Phase	Stable-Growth Phase
Length	10 years	Forever after year 10
<i>Growth inputs</i>		
Reinvestment rate	88.62%	35.46%
Return on capital	16.37%	14.10%
Expected growth rate	14.51%	5.00%
<i>Cost of capital inputs</i>		
Beta	0.87	0.87
Cost of debt	5.80%	5.50%
Debt ratio	4.55%	30.00%
Cost of capital	9.52%	7.92%
<i>General information</i>		
Tax rate	35%	35%

The value per share obtained, which is summarized in Figure 31.5, was \$42.55. We looked at the impact on the Home Depot's value of changing the noncash working capital as a percent of revenues. As noncash working capital increases, the value of equity decreases, and the results are graphed in Figure 31.6. As the noncash working capital increases from 0% to 20% of revenues, the value per share decreases by approximately 20%.



**FIGURE 31.4** The Home Depot's Working Capital Investment



**cfbasics.xls:** This dataset on the Web summarizes operating margins, tax rates, and noncash working capital as a percent of revenues by industry group for the United States.

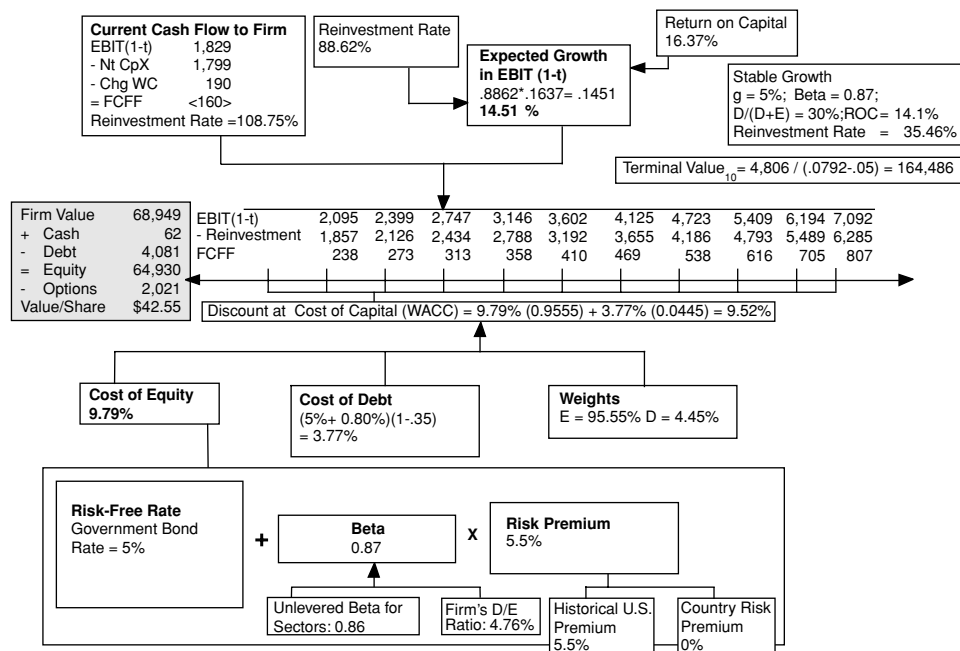


FIGURE 31.5 The Home Depot: A Valuation

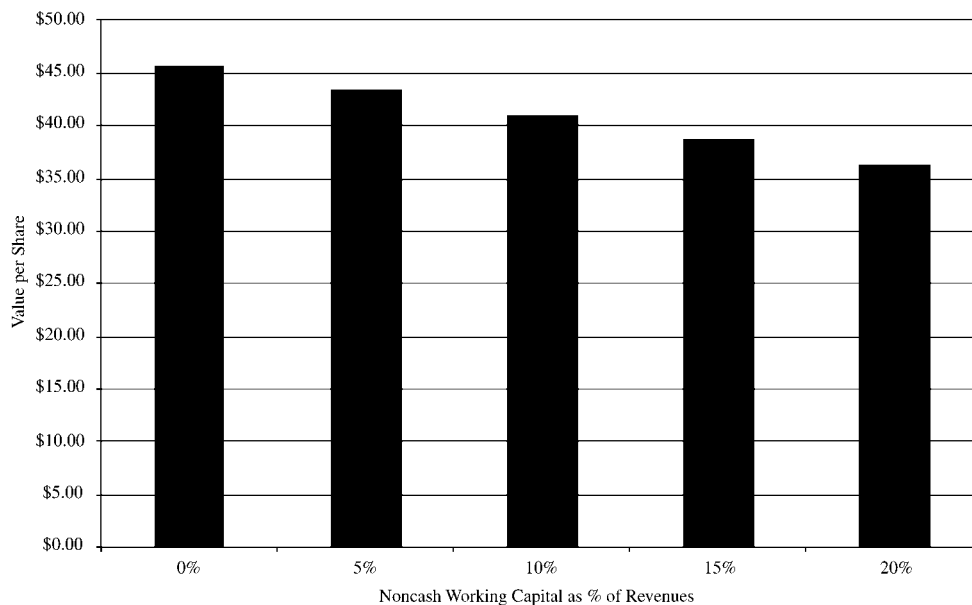


FIGURE 31.6 The Home Depot: Working Capital and Value per Share

## Increase Expected Growth

A firm with low current cash flows can still have high value if it is able to grow quickly. For profitable firms, the growth will be defined in terms of earnings but for money-losing firms, you have to consider the nexus of revenue growth and higher margins.

**Profitable Firms** Higher growth arises from either increases in reinvestment or a higher return on capital. It does not always translate into higher value, though, since higher growth can be offset by changes elsewhere in the valuation. Thus, higher reinvestment rates usually result in higher expected growth but at the expense of lower cash flows, since reinvestment reduces the free cash flows. Higher returns on capital also cause expected growth to increase, but value can still go down if the new investments are in riskier businesses and there is a more than proportionate increase in the cost of capital.

The trade-off from increasing the reinvestment rate is listed in Table 31.1. The positive effect of reinvesting more, higher growth, has to be compared to the negative effect of reinvesting more, the drop in free cash flows.

We could work through the entire valuation and determine whether the present value of the additional cash flows created by higher growth is greater than the present value of the actual reinvestments made, in cash flow terms. There is, however, a far simpler test to determine the effect on value. Note that the net present value of a project measures the value added by the project to overall firm value, and that the net present value is positive only if the internal rate of return on the project exceeds the cost of capital. If we make the assumption that the accounting return on capital on a project is a reasonable estimate for the internal rate of return, then increasing the reinvestment rate will increase value if and only if the return on capital is greater than the cost of capital. If the return on capital is less than the cost of capital, the positive effects of growth will be less than the negative effects of making the reinvestment.

Note that the return on capital that we are talking about is the marginal return on capital (i.e., the return on capital earned on the actual reinvestment), rather than the average return on capital. Given that firms tend to accept their most attractive investment first and their less attractive investments later, the average returns on capital will tend to be greater than the marginal returns on capital. Thus, a firm with a return on capital of 18 percent and a cost of capital of 12 percent may really be earning only 11 percent on its marginal projects. In addition, the marginal return on capital will be much lower if the increase in the reinvestment rate is substantial. Thus, we have to be cautious about assuming large increases in the reinvestment rate while keeping the current return on capital constant.

**TABLE 31.1** Trade-Off on Reinvestment Rate

Negative Effects	Positive Effects
Reduces free cash flow to firm: FCFF = EBIT (1 – Tax rate) (1 – Reinvestment rate)	Increases expected growth: Expected growth = Reinvestment rate × Return on capital

A firm that is able to increase its return on capital while keeping the cost of capital fixed will increase its value. The increase in growth will increase value, and there are generally no offsetting effects. If, however, the increase in return on capital comes from the firm entering new businesses that are far riskier than its existing business, there might be an increase in the cost of capital that offsets the increase in growth. The general rule for value creation remains simple, however. As long as the projects, no matter how risky they are, have a marginal return on capital that exceeds their cost of capital, they will create value.

Using the comparison between return on capital and cost of capital, a firm that earns a return on capital that is less than its cost of capital can get an increase in value by accepting higher return investments, but it would get an even greater increase in value by not investing at all and returning the cash to the owners of the business. Liquidation or partial liquidation might be the most value-enhancing strategy for firms trapped in businesses where it is impossible to earn the cost of capital.

#### ILLUSTRATION 31.5: Reinvestment Rates, Return on Capital, and Value

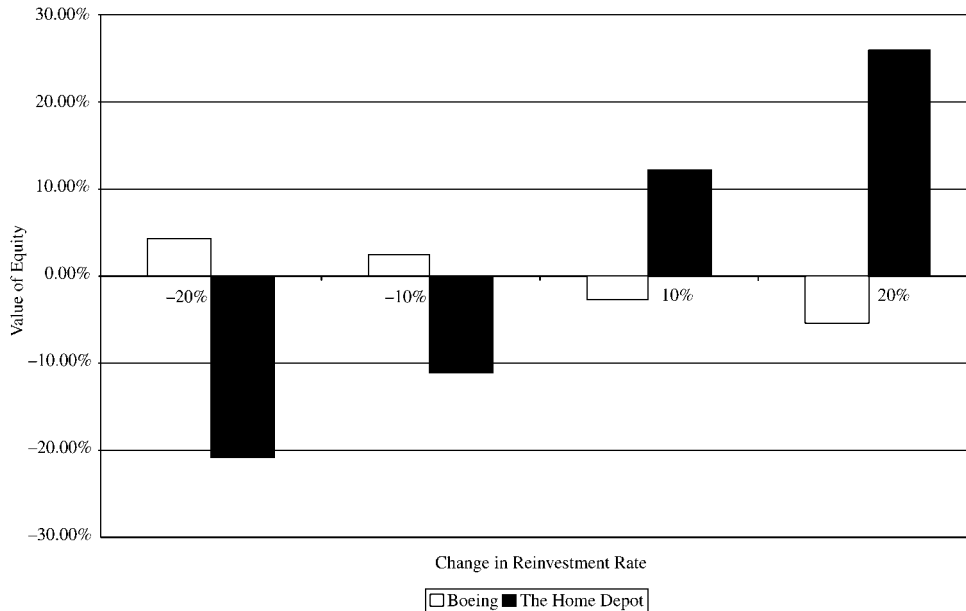
In 1998, Boeing earned a return on capital of 6.59% and had a reinvestment rate of 65.98%. If you assume a cost of capital of 9.17% for the firm, you would value the equity in the firm at \$13.14 a share. In the same year, the Home Depot had a return on capital of 16.38%, a reinvestment rate of 88.62%, and a cost of capital of 9.51%, resulting in a value per share of \$42.55.

	<i>Boeing</i>	<i>Home Depot</i>
Cost of capital	9.17%	9.51%
Return on capital	6.59%	16.38%
Reinvestment rate	65.98%	88.62%
Expected growth rate	4.35%	14.51%
Value per share	\$13.14	\$42.55

If the Home Depot could increase its reinvestment rates without affecting its returns on capital, the effect on value will be positive, because it is earning excess returns. For Boeing, the effect of increasing the reinvestment rate at the current return on capital will be negative, since the firm's return on capital is less than its cost of capital. Figure 31.7 summarizes the impact on the value of equity of changing the reinvestment rate at both firms, keeping the cost of capital.

To illustrate, we reduced the reinvestment rate at Boeing from 65.98% to 45.98% and examined the percentage effect on value of equity; the change was +4.49%. The effects of a similar change at the Home Depot was negative. The effect of changes in the reinvestment rate were dramatic at the Home Depot, because the high-growth period lasts 10 years.



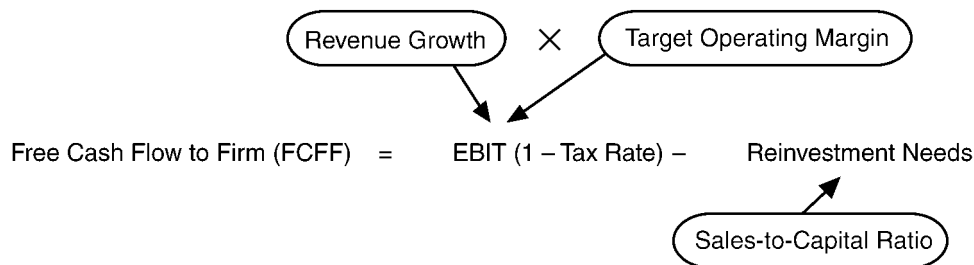


**FIGURE 31.7** Effect of Changes in the Reinvestment Rate on the Value of Equity

**Negative Earnings Firms** For young firms with negative earnings, expected future cash flows are derived from assumptions made about three variables—the expected growth rate in revenues, the target operating margin, and the sales-to-capital ratio. The first two variables determine the operating earnings in future years, and the last variable determines reinvestment needs. Figure 31.8 summarizes the impact of each of these variables on the cash flows.

Other things remaining equal, the expected cash flows in future years will be higher if any of the three variables—revenue growth, target margins, and sales-to-capital ratios—increase. Increasing revenue growth and target margins will increase operating earnings, while increasing the sales-to-capital ratio will reduce reinvestment needs.

In reality, though, firms have to make a trade-off between higher revenue growth and higher margins. When firms increase prices for their products, they improve operating margins but reduce revenue growth. Michael Porter, one of the leading



**FIGURE 31.8** Determinants of Growth

thinkers in corporate strategy, suggests that when it comes to pricing strategy, there are two basic routes a firm can take.<sup>5</sup> It can choose to be a volume leader, reducing prices and hoping to increase revenues sufficiently to compensate for the lower margins. For this strategy to work, the firm needs a cost advantage over its competitors to prevent pricing wars that may make all firms in the industry worse off. Alternatively, it can attempt to be a price leader, increasing prices and hoping that the effect on volume will be smaller than the increased margins. The extent to which revenue growth will drop depends on how elastic the demand for the product is and how competitive the overall product market is. The net effect will determine value.

While a higher sales-to-capital ratio reduces reinvestment needs and increases cash flow, there are both internal and external constraints on the process. As the sales-to-capital ratio increases, the return on capital on the firm in future years will also increase. If the return on capital substantially exceeds the cost of capital, new competitors will enter the market, making it more difficult to sustain the expected operating margins and revenue growth.

#### ILLUSTRATION 31.6: Revenue Growth, Operating Margins, and Sales-to-Capital Ratios

In Chapter 23, we valued Commerce One, a firm with an operating loss of \$529 million and only \$537 million in revenues. Using a compounded revenue growth rate of 40.24%, a target operating margin of 14.72% in 10 years, and a sales-to-capital ratio of 2.20, we estimated a value for the firm of \$4.8 billion and value per share of \$19.26. Changes in these inputs can have a dramatic effect on the value of the firm, as noted in Chapter 23.

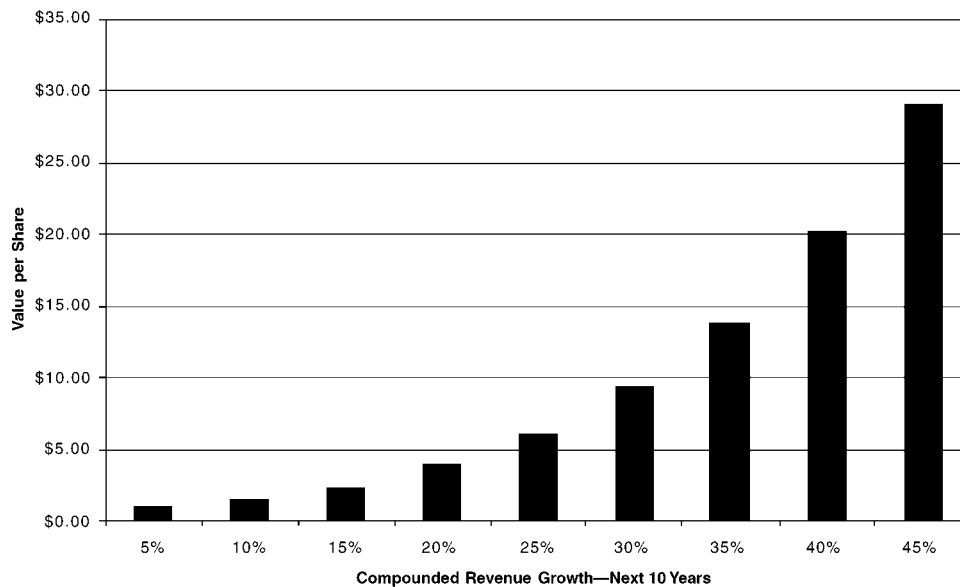
As you would expect, higher revenue growth translates into higher values per share. Figure 31.9 graphs the change in value per share for Commerce One as a function of the change in expected growth rate in revenues over the next decade. Thus, Commerce One's value per share increases by 50% if the compounded revenue growth over the next 10 years is 45% instead of 40%. By the same token, the value per share drops by a third if the growth rate is 35%.

While higher revenue growth clearly increases value, we assumed that the target margin would remain unchanged as the growth rate changes. The target margin is just as important, if not more so, than revenue growth in determining value. Figure 31.10 estimates the value per share, holding revenue growth at 40.24% and changing the target margin. Every 1% change in the target operating margin changes the value by approximately \$3 per share.

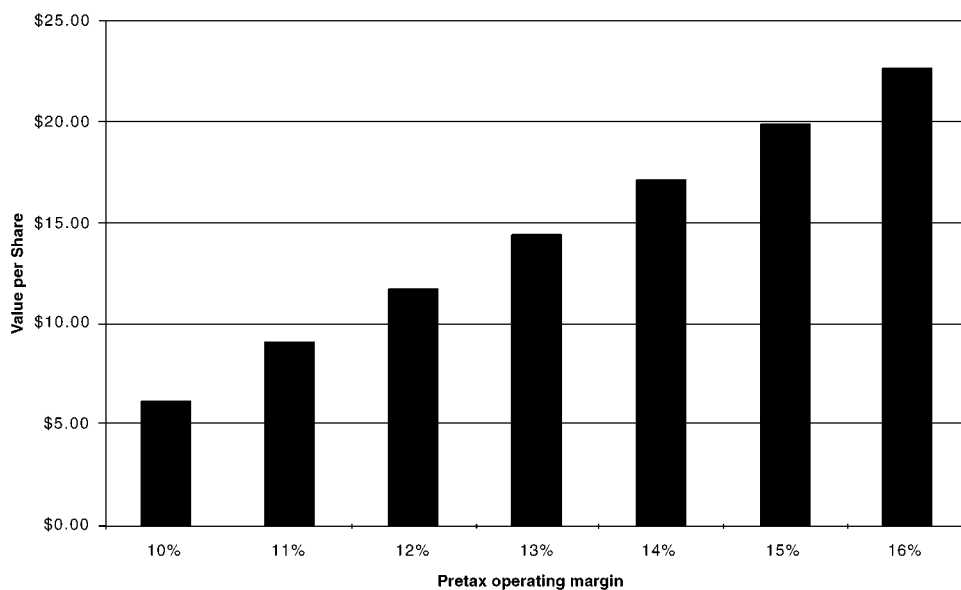
The trade-off between revenue growth and margins is made more explicit in the following table, which shows value per share as a function of both variables.

<i>Compounded Revenue Growth over Next 10 Years</i>	<i>Target Pretax Operating Margin in 10 years</i>				
	<i>8%</i>	<i>10%</i>	<i>12%</i>	<i>14%</i>	<i>16%</i>
10%	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.47	\$ 1.08
20%	\$ 0.00	\$ 0.18	\$ 1.46	\$ 2.91	\$ 4.29
30%	\$ 0.02	\$ 2.98	\$ 5.74	\$ 8.47	\$11.18
40%	\$ 3.51	\$ 8.94	\$14.36	\$19.77	\$25.17
50%	\$10.31	\$20.74	\$31.16	\$41.56	\$51.97

<sup>5</sup>*Competitive Strategy*, by Michael Porter (1980).



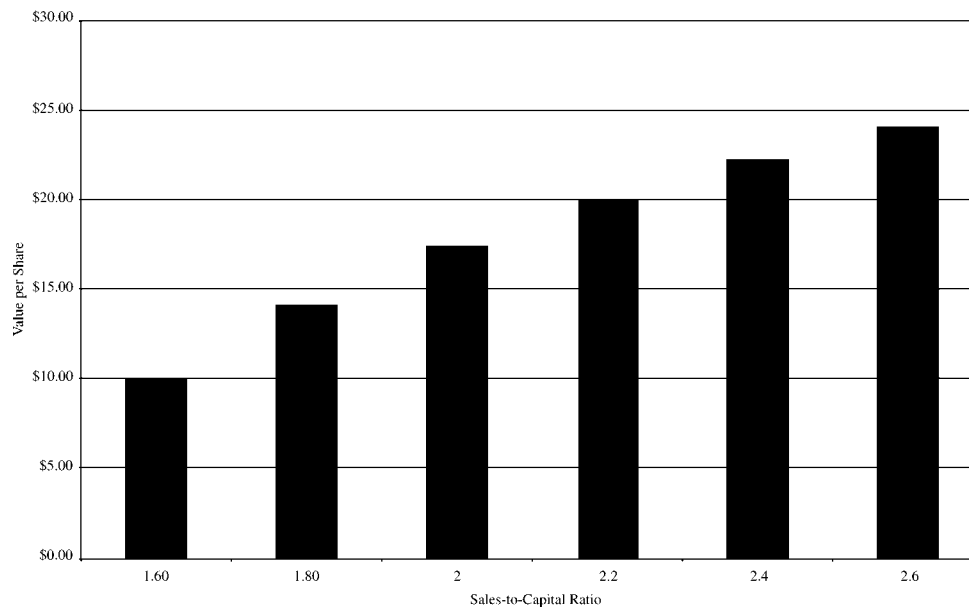
**FIGURE 31.9** Revenue Growth and Value per Share



**FIGURE 31.10** Value per Share and Sustainable Margins

Commerce One's value varies widely depending on the combination of revenue growth and margins that you assume. In practical terms, this also provides the firm with a sense of the trade-off between higher revenue growth and lower target margins.

Finally, a higher sales-to-capital ratio (which translates into a higher return on capital in 10 years) leads to a higher value per share, because it determines how much Commerce One has to reinvest to generate its expected growth rate. Figure 31.11 presents the effects on value per share of



**FIGURE 31.11** Value per Share versus Sales-to-Capital Ratio

changing the sales-to-capital ratio over the high-growth period for Commerce One. As the sales-to-capital ratio changes, the return on capital in stable growth follows suit, increasing as the sales-to-capital ratio increases. As the sales-to-capital ratio (and the terminal return on capital) increases, the value per share of Commerce One also increases.

### Lengthen the Period of High Growth

Every firm, at some point in the future, will become a stable-growth firm, growing at a rate equal to or less than that of the economy in which it operates. In addition, growth creates value only if the firm earns excess returns on its investments. With excess returns, the longer the high-growth period lasts, other things remaining equal, the greater the value of the firm. No firm should be able to earn excess returns for any length of time in a competitive product market, since competitors will be attracted to the business by the excess returns. Thus, implicit in the assumption that there will be high growth with excess returns is the assumption that there also exist some barriers to entry that prevent competing firms from entering the market and eliminating the excess returns that prevail.

One way firms can increase value is by increasing existing barriers to entry and erecting new ones. Another way to express this idea is that companies earning excess returns have significant competitive advantages. Nurturing these advantages can increase value.

**Brand Name Advantage** As we noted earlier in the book, the inputs to the traditional discounted cash flow valuation incorporate the effects of brand name. In par-



ticular, firms with more valuable brand names are either able to charge higher prices than the competition for the same products (leading to higher margins) or sell more than the competitors at the same price (leading to higher turnover ratios). They usually have higher returns on capital and greater value than their competitors in the industry.

Creating a brand name is a difficult and expensive process that may take years to achieve, but firms can often build on existing brand names and make them valuable. Brand management and advertising can thus contribute in value creation. Consider the extraordinary success that Coca-Cola has had in increasing its market value over the past two decades. Some attribute its success to its high return on equity or capital, yet these returns are not the cause of its success but the consequence of it. The high returns can be traced to the company's relentless focus on making its brand name more valuable globally.<sup>6</sup> Conversely, the managers of a firm who take over a valuable brand name and then dissipate its value will reduce the values of the firm substantially. The near-death experience of Apple Computer in 1996 and 1997, and the travails of Quaker Oats after the Snapple acquisition suggest that managers can quickly squander the advantage that comes from valuable brand names.

**Patents, Licenses, and Other Legal Protection** The second competitive advantage that companies can possess is a legal one. Firms may enjoy exclusive rights to produce and market a product because they own the patent rights on the product, as is often the case in the pharmaceutical industry. Alternatively, firms may have exclusive licensing rights to service a market, as is the case with utilities in the United States.

The key to value enhancement is not just to preserve but to increase any competitive advantages that the firm possesses. If the competitive advantage comes from its existing patents, the firm has to work at developing new patents that allow it to maintain this advantage over time. While spending more money on research and development (R&D) is clearly one way, the efficiency of reinvestment also applies here. The companies that have the greatest increases in value are not necessarily those that spend the most on R&D, but those that have the most productive R&D departments not only in generating patents but also in converting patents into commercial products.

The competitive advantage from exclusive licensing or a legal monopoly is a mixed blessing and may not lead to value enhancement. When a firm is granted these rights by another entity, say the government, that entity usually preserves the right to control the prices charged and margins earned through regulation. In the United States, for instance, much of the regulation of power and phone utilities was driven by the objective of ensuring that these firms did not earn excess returns. In these circumstances, firms may actually gain in value by giving up their legal monopolies, if they get pricing freedom in return. We could argue that this has already occurred, in great part, in the airline and long-distance telecommunications businesses, and will occur in the future in other regulated businesses. In the aftermath of deregulation, the firms that retain competitive advantages will gain value at the expense of others in the business.

---

<sup>6</sup>Companies like Coca-Cola have taken advantage of the global perception that they represent American culture, and have used it to grow strongly in other markets.

**Switching Costs** There are some businesses where neither brand name nor a patent provides adequate protection against competition. Products have short life cycles, competition is fierce, and customers develop little loyalty to companies or products. This describes the computer software business in the 1980s, and it still applies to a significant portion of that business today. How, then, did Microsoft succeed so well in establishing its presence in the market? Although many would attribute its success entirely to its ownership of the operating system needed to run the software, there is another reason. Microsoft recognized earlier than most firms that the most significant barrier to entry in the software business is the cost to the end user of switching from its products to those of a competitor. In fact, Microsoft Excel, early in its life, had to overcome the obstacle that most users were working with Lotus spreadsheets and did not want to bear the switching cost. Microsoft made it easy for end users to switch to its products (by allowing Excel to open Lotus spreadsheets, for instance), and it made it more and more expensive for them to switch to a competitor by creating the Microsoft Office Suite. Thus, a user who has Microsoft Office installed on his or her system and who wants to try to switch from Microsoft Word to WordPerfect has to overcome multiple barriers: Will the conversion work well on the hundreds of Word files that exist already? Will the user still be able to cut and paste from Microsoft Excel and PowerPoint into Word Perfect documents? The end result, of course, is that it becomes very difficult for competitors that do not have Microsoft's resources to compete with it in this arena.

There are a number of other businesses where the switching cost concept can be used to augment an argument for value enhancement or debunk it. For instance, there are many who argue that the valuations of Internet companies such as Amazon.com reflect their first-mover advantage—that is, the fact that they are pioneers in the online business. However, the switching costs in online retailing seem to be minimal, and these companies have to come up with a way of increasing switching costs if they want to earn high returns in the future.

**Cost Advantages** There are several ways in which firms can establish a cost advantage over their competitors and use it as a barrier to entry:

- In businesses where scale can be used to reduce costs, economies of scale can give bigger firms advantages over smaller firms. This is the advantage, for instance, that the Home Depot has used to gain market share at the expense of its smaller and often local competitors.
- Owning or having exclusive rights to a distribution system can provide firms with a cost advantage over its competitors. For instance, American Airlines' ownership of the Sabre airline reservation system gave it an advantage over its competitors in attracting customers.
- Having access to lower-cost labor or resources can also provide cost advantages. Thus Southwest Airlines, with its nonunionized labor force, has an advantage over its unionized competitors, as do natural resource companies with access to reserves that are less expensive to exploit.

These cost advantages will influence value in one of two ways: The firm with the cost advantage may charge the same price as its competitors but have a much higher operating margin. Or the firm may charge lower prices than its competitors and have a much higher capital turnover ratio. In fact, the net effect of increasing

margins or turnover ratios (or both) will increase the return on capital, and through it expected growth.

The cost advantage of economies of scale can create high capital requirements that prevent new firms from entering the business. In businesses such as aerospace and automobiles, the competition is almost entirely among existing competitors. The absence of new competitors may allow these firms to maintain above-normal returns, though the competition between existing firms will constrain the magnitude of these returns.

### ILLUSTRATION 31.7: Potential for Increasing the Length of the High-Growth Period

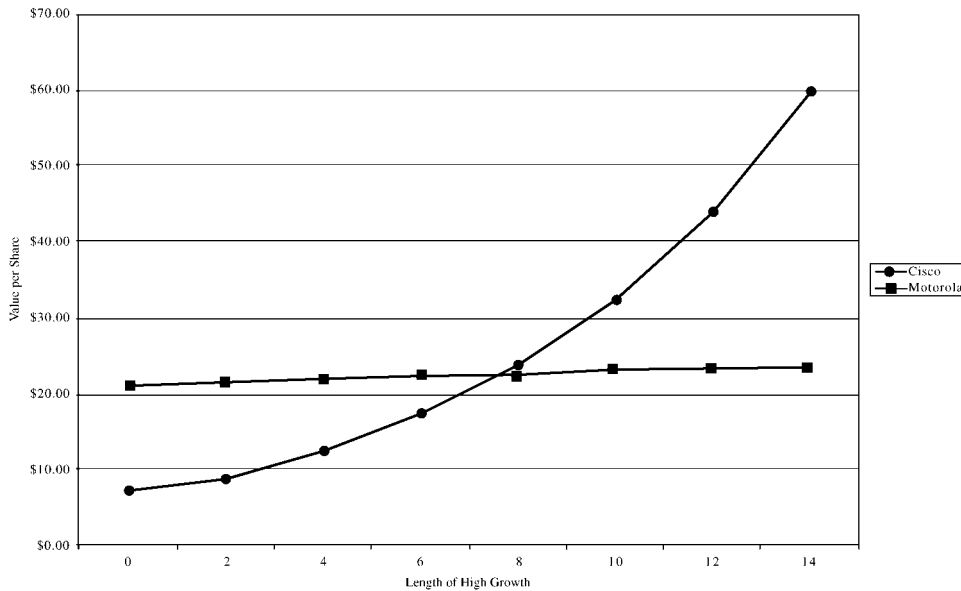
This example examines the potential for increasing barriers to entry, and by extension the excess returns and the length of the high-growth period at Cisco Systems and Motorola. The competitive advantages are different for the two firms, and the potential for building on these advantages is different as well.

- Cisco's most significant differential advantage seems to be its capacity to generate much larger excess returns on its new investments than its competitors. Since most of these investments take the form of acquisitions of other firms, Cisco's excess returns rest on whether it can continue to maintain its success in this area. The primary challenge, however, is that as Cisco continues to grow, it will need to do even more acquisitions each year to maintain the growth rate it had the previous year. It is possible that there might be both external and internal constraints on this process. The number of firms that are potential takeover targets is limited, and the firm may not have the resources to replicate its current success if the number of acquisitions doubles or triples.
- Motorola's research capabilities and the patents that emerge from the research represent its most significant competitive advantage. However, it is not viewed as the technological leader in either of the two businesses that it operates in. Firms like Nokia are viewed as more innovative when it comes to mobile communications (cellular phones) and Intel is considered the leading innovator among large semiconductor manufacturers.

We begin by valuing each of these firms using their current returns on capital and estimated reinvestment rates as inputs for the high growth period. The following table summarizes the inputs used in the base case valuations and the value per share estimated with these assumptions:

	<i>Cisco</i>		<i>Motorola</i>	
	<i>High Growth</i>	<i>Stable Growth</i>	<i>High Growth</i>	<i>Stable Growth</i>
Beta	1.43	1.00	1.21	1.00
Cost of equity	11.72%	10.00%	10.85%	10.00%
After-tax cost of debt	4.03%	4.03%	4.23%	4.23%
Debt ratio	0.18%	10.00%	6.86%	6.86%
Cost of capital	11.71%	9.40%	10.39%	9.58%
Return on capital	34.07%	16.52%	12.18%	12.18%
Reinvestment rate	106.8%	30.27%	52.99%	41.07%
Expected growth rate	36.39%	5.00%	6.45%	5.00%
<i>Value per share</i>	\$44.13		\$20.97	

In the base case, we assume 12 years of high growth for Cisco—six years of high growth and six years of transition—and five years of high growth for Motorola. We then consider how much the value per share changes as we change the growth period in Figure 31.12.



**FIGURE 31.12** Value per Share and Length of High-Growth Period

The effect of changing the length of the growth period is very different for the two firms. For Cisco, the value per share changes significantly as the length of the growth period change, increasing as it gets longer. For Motorola, the effect is muted and the value per share is relatively insensitive to changes in the length of the growth period. The reason lies in the excess returns that we are assuming for the two firms over the length of the growth period. For Cisco, the excess returns are very large and thus the impact on value is also large. For Motorola, we assume that the excess returns are relatively small and the effect on value is also much lower.

#### LEAD TIMES FROM COMPETITIVE ADVANTAGES

A key question that we often face when looking at the effects of a competitive advantage on value is how long a competitive advantage lasts. This is a difficult question to answer because there are a number of firm-specific factors, but there are few interesting studies in corporate strategy that try to address the issue. Levin, Klevorick, Nelson, and Winter (1987) estimate, for instance, that it takes between three and five years to duplicate a patented product or process and between one and three years to duplicate an unpatented product or process. The same study found that patenting is often much less effective at preventing imitation than moving quickly down the learning curve and creating sales and service networks. For example, Intel was able to maintain its competitive advantage even as its computer chips were being cloned by Advanced Micro Devices (AMD) by using the lead time it had to move quickly to the next-generation chips.

## Reduce the Cost of Financing

The cost of capital for a firm is a composite cost of debt and equity financing. The cash flows generated over time are discounted to the present at the cost of capital. Holding the cash flows constant, reducing the cost of capital will increase the value of the firm. This section will explore the ways in which a firm may reduce its cost of capital, or more generally, increase its firm value by changing both financing mix and type.

**Change Operating Risk** The operating risk of a firm is a direct function of the kinds of products or services it provides and the degree to which these products or services are discretionary to the customer. The more discretionary they are, the greater the operating risk faced by the firm. Both the cost of equity and cost of debt of a firm are affected by the operating risk of the business or businesses in which it operates. In the case of equity, only that portion of the operating risk that is not diversifiable will affect value.

Firms can reduce their operating risk by making their products and services less discretionary to their customers. Advertising clearly plays a role, but finding new uses for a product or service is another way. Reducing operating risk will result in a lowered unlevered beta and a lower cost of debt.

**Reduce Operating Leverage** The operating leverage of a firm measures the proportion of its costs that are fixed. Other things remaining equal, the greater the proportion of the costs of a firm that are fixed, the more volatile its earnings will be, and the higher its cost of capital. Reducing the proportion of the costs that are fixed will make firms much less risky and reduce their cost of capital. Firms can reduce their fixed costs by using outside contractors for some services; if business does not measure up, the firm is not stuck with the costs of providing this service. They can also tie expenses to revenues; for instance, tying wages paid to revenues made will reduce the proportion of costs that are fixed.

This basic idea of tying expenses to revenues is often described as making the cost structure more flexible. A more flexible cost structure influences three inputs in a valuation. It leads to a lower unlevered beta (due to the lower operating leverage), reduces the cost of debt (because of the reduction in default risk) and increases the optimal debt ratio. All three reduce the cost of capital and increase firm value.

**Change the Financing Mix** A third way to reduce the cost of capital is to change the mix of debt and equity used to finance the firm. As we argued in Chapter 15, debt is always cheaper than equity, partly because lenders bear less risk and partly because of the tax advantage associated with debt. This benefit has to be weighed off against the additional risk of bankruptcy created by the borrowing; this higher risk increases both the beta for equity and the cost of borrowing. The net effect will determine whether the cost of capital will increase or decrease as the firm takes on more debt.

Note, however, that firm value will increase as the cost of capital decreases, if and only if the operating cash flows are unaffected by the higher debt ratio. If, as the debt ratio increases, the riskiness of the firm increases, and this, in turn, affects the firm's operations and cash flows, the firm value may decrease even as cost of capital declines. If this is the case, the objective function when designing the financing mix for a firm has to be restated in terms of firm value maximization rather than cost of capital minimization.



*wacc.xls*: This dataset on the Web summarizes debt ratios and costs of capital by industry group for the United States.

### ILLUSTRATION 31.8: The Effect of Financing Mix on Value

To analyze the effect of changing the financing mix on value, you would need to estimate the costs of equity and debt at each debt ratio. In the following table, the costs of equity and debt are estimated for Motorola for debt ratios from 0% to 90%:

<i>Debt Ratio</i>	<i>Beta</i>	<i>Cost of Equity</i>	<i>Bond Rating</i>	<i>Interest Rate on Debt</i>	<i>Tax Rate</i>	<i>Cost of Debt (After-Tax)</i>	<i>WACC</i>
0%	1.16	10.63%	AAA	6.20%	35.00%	4.03%	10.63%
10%	1.24	10.96%	A–	7.25%	35.00%	4.71%	10.33%
20%	1.34	11.38%	B–	10.25%	35.00%	6.66%	10.43%
30%	1.48	11.91%	CC	12.00%	35.00%	7.80%	10.68%
40%	1.72	12.90%	C	13.50%	26.34%	9.94%	11.72%
50%	2.07	14.28%	C	13.50%	21.07%	10.66%	12.47%
60%	2.63	16.54%	D	16.00%	14.82%	13.63%	14.79%
70%	3.51	20.05%	D	16.00%	12.70%	13.97%	15.79%
80%	5.27	27.07%	D	16.00%	11.11%	14.22%	16.79%
90%	10.54	48.14%	D	16.00%	9.88%	14.42%	17.79%

Note that the cost of equity is estimated based on the levered beta. As the debt ratio increases, the beta increases as well.<sup>7</sup> The cost of debt is estimated based on a synthetic rating that is determined by the interest coverage ratio at each debt ratio. As the debt ratio increases, the interest expense increases leading to a drop in the ratings and higher costs of debt. As Motorola moves from a 0% debt ratio to a 10% debt ratio, the cost of capital decreases (and firm value increases). At a 10% debt ratio, Motorola's cost of capital is 10.33%, which is lower than the current cost of capital of 10.39%. Beyond 10%, though, the trade-off operates against debt, as the cost of capital increases as the debt ratio increases. (The tax rate drops beyond 30% since the interest expenses > EBIT.)

**Change Financing Type** A fundamental principle in corporate finance is that the financing of a firm should be designed to ensure, as far as possible, that the cash flows on debt match as closely as possible the cash flows on the asset. By matching cash flows on debt to cash flows on the asset, a firm reduces its risk of default and increases its capacity to carry debt, which, in turn, reduces its cost of capital, and increases value.

Firms that mismatch cash flows on debt and cash flows on assets (by using short-term debt to finance long-term assets, debt in one currency to finance assets in a different currency, or floating-rate debt to finance assets whose cash flows tend to be adversely impacted by higher inflation) will have higher default risk, higher costs of capital, and lower firm value. Firms can use derivatives and swaps to reduce these mismatches and, in the process, increase firm value. Alternatively, they can re-

<sup>7</sup>Levered beta = Unlevered beta[1 + (1 – Tax rate)(Debt/Equity)].

**WHAT ABOUT MILLER-MODIGLIANI?**

One of corporate finance's best-known and most enduring propositions—the Miller-Modigliani theorem—argues that the value of a firm is independent of its capital structure. In other words, changing your financing mix should have no effect on your firm value. How would we reconcile our arguments in this section with the Miller-Modigliani theorem? Note that the original version of the theorem was derived for a world with no taxes and default. With these assumptions, debt creates no tax advantages and no bankruptcy costs and does not affect value. In a world with taxes and default risk, you are much more likely to have to make trade-offs, and debt can increase value, decrease value, or leave it unaffected, depending on how the trade-offs operate.

place their existing debt with debt that is more closely matched to their assets. Finally, they can use innovative securities that allow them to pattern cash flows on debt to cash flows on investments. The use of catastrophe bonds by insurance companies and commodity bonds by natural resource firms are good examples.

**VALUE ENHANCEMENT CHAIN**

We can categorize the range of actions firms can take to increase value in several ways. One is in terms of whether they affect cash flows from assets in place, growth, the cost of capital, or the length of the growth period. There are two other levels at which we can distinguish between actions that create value:

1. *Does an action create a value trade-off or is it a pure value creator?* Very few actions increase value without any qualifications. Among these are the divestitures of assets when the divestiture value exceeds the continuing value, and the elimination of deadweight costs that contribute nothing to the firm's earnings or future growth. Most actions have both positive and negative effects on value, and it is the net effect that determines whether these actions are value enhancing. In some cases, the trade-off is largely internal, and the odds are much better for value creation. An example is a firm changing its mix of debt and equity to reduce the cost of capital. In other cases, however, the net effect on value will be a function of how competitors react to a firm's actions. As an example, changing pricing strategy to increase margins may not work as a value enhancement measure, if competitors react and change prices as well.
2. *How quickly do actions pay off?* Some actions generate an immediate increase in value. Among these are divestitures and cost cutting. Many actions, however, are designed to create value in the long term. Thus, building up a respected brand name clearly creates value in the long term but is unlikely to affect value today.

Table 31.2 summarizes a value enhancement chain, where actions that create value are categorized both on how quickly they create value and on how much control the firm has over the value creation. The first column, "Quick Fixes," lists

**TABLE 31.2** The Value Enhancement Chain

More Control Quick Payoff		Less Control Payoff in Long Term	
	Quick Fixes	Odds On	Long Term
Existing investments	<ul style="list-style-type: none"> <li>• Divest assets/projects with divestiture value &gt; continuing value.</li> <li>• Terminate projects with liquidation value &gt; continuing value.</li> <li>• Eliminate operating expenses that generate no revenues and no growth.</li> <li>• Take advantage of tax law to increase cash flow.</li> </ul>	<ul style="list-style-type: none"> <li>• Reduce net working capital requirements by reducing inventory and accounts receivable or by increasing accounts payable.</li> <li>• Reduce capital maintenance expenditures on assets in place.</li> <li>• Reduce marginal tax rate.</li> </ul>	<ul style="list-style-type: none"> <li>• Change pricing strategy to maximize return on capital and value.</li> <li>• Move to more efficient technology for operations to reduce expenses and improve margins.</li> </ul>
Expected growth	<ul style="list-style-type: none"> <li>• Eliminate new capital expenditures that are expected to earn less than the cost of capital.</li> </ul>	<ul style="list-style-type: none"> <li>• Increase reinvestment rate or marginal return on capital or both in firm's existing businesses.</li> </ul>	<ul style="list-style-type: none"> <li>• Increase reinvestment rate or marginal return on capital or both in new businesses.</li> </ul>
Length of high-growth period	<ul style="list-style-type: none"> <li>• If any of the firm's products or services can be patented and protected, do so.</li> </ul>	<ul style="list-style-type: none"> <li>• Use economies of scale or cost advantages to create higher return on capital.</li> </ul>	<ul style="list-style-type: none"> <li>• Build up brand name.</li> <li>• Increase the cost of switching from product and reduce the cost of switching to it.</li> </ul>
Cost of financing	<ul style="list-style-type: none"> <li>• Use swaps and derivatives to match debt more closely to firm's assets.</li> <li>• Recapitalize to move the firm toward its optimal debt ratio.</li> </ul>	<ul style="list-style-type: none"> <li>• Change financing type and use innovative securities to reflect the types of assets being financed.</li> <li>• Use the optimal financing mix to finance new investments.</li> <li>• Make cost structure more flexible to reduce operating leverage.</li> </ul>	<ul style="list-style-type: none"> <li>• Reduce the operating risk of the firm by making products less discretionary to customers.</li> </ul>

actions in which the firm has considerable control over the outcome and the benefit in terms of value creation is immediate. The second column, "Odds On," includes actions that are likely to create value in the near or medium term and where the firm still continues to exercise significant control over the outcome. The third column includes actions designed to create value in the long term. This is where the major strategic initiatives of the firm show up.



**ILLUSTRATION 31.9: A Value Enhancement Plan**

Illustration 31.7 valued Motorola at \$22.97 using its current return on capital of 12.18% and debt ratio of 6.86% in the valuation. Figure 31.13 summarizes this valuation. Note, though, that the current return on capital is well below what the firm has earned historically and lags the industry average (of 22.36%) by almost 10%. If Motorola could increase its return on capital to 17.22% on its new investments (leaving its existing investments earning 12.18%) and increase its debt ratio to its optimal of 10%, its value per share would increase to \$23.86. The restructured valuation is summarized in Figure 31.14.

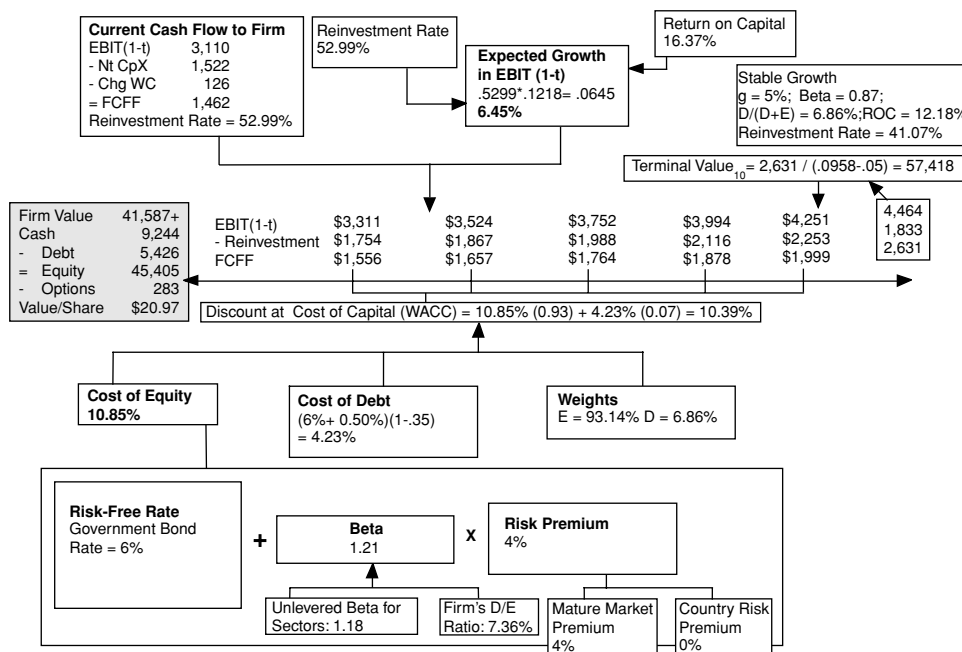


**valenh.xls:** This spreadsheet allows you to estimate the approximate effect of changing the way a firm is run on its value.

**CLOSING THOUGHTS ON VALUE ENHANCEMENT**

Almost all firms claim to be interested in value enhancement, but very few are able to increase value consistently. If value enhancement is as simple as it is made out to be in this chapter, you might wonder why this is so. There are four basic propositions you need to consider in the context of value enhancement:

1. *Value enhancement is hard work, takes time, and may make life uncomfortable for existing managers.* There are no magic bullets that increase value painlessly.



**FIGURE 31.13** Motorola: A Status Quo Valuation

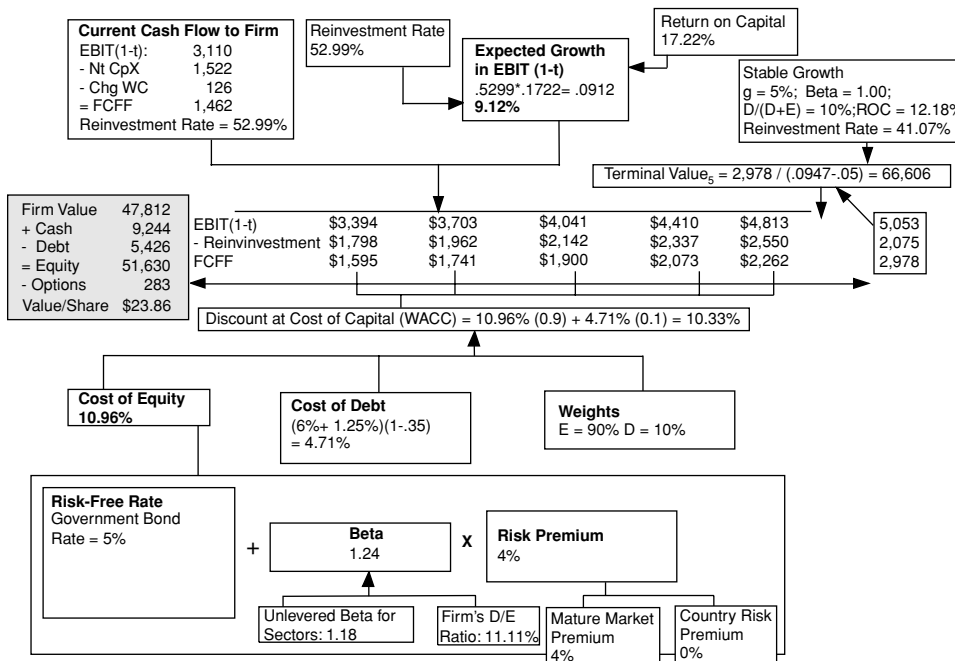


FIGURE 31.14 Motorola: A Restructured Valuation

Increasing cash flows requires hard decisions on layoffs and cost cutting, and in some cases, admitting past mistakes. Increasing the reinvestment rate will require that you analyze new investments with more care and that you invest in the infrastructure you need to manage these investments. Increasing your debt ratio may also create new pressures to make interest payments and to deal with ratings agencies and banks.

2. *For a firm to enhance value, all of its component parts need to buy into the value enhancement plan.* You cannot increase value by edict and you cannot do it from the executive offices (or the finance department). As you probably noticed in the discussion, every part of the firm has a role to play in increasing value. Table 31.3 summarizes the role of each part of the firm in the value enhancement actions that have been described in this chapter. Departments have to cooperate for value enhancement to become a reality.
3. *Value enhancement has to be firm-specific.* No two firms in trouble share the same problems, and using a cookbook approach seldom works in value enhancement. You have to begin by diagnosing the specific problems faced by the firm you are analyzing and tailor a response to these problems. Thus, the value enhancement plan you would devise for a mature firm with cost overruns will be very different from the plan you would devise for a young firm that has a product that no longer meets market needs.
4. *Price enhancement may not always follow value enhancement.* This is perhaps the most disappointing aspect of value enhancement. A firm that takes all the right actions may not necessarily be rewarded immediately by financial mar-

**TABLE 31.3** Value Enhancement Actions: Who Is Responsible?

Value-Enhancing Action	Primary Responsibility
Increasing operating efficiency	Operating managers and personnel, from shop-floor stewards to factory managers
Reducing working capital needs	Inventory personnel; credit personnel
Increasing revenue growth	Sales and marketing personnel
Increasing return on capital/reinvestment rate	Strategic teams, with help from financial analysts
Build brand name	Advertising personnel
Other competitive advantages	Strategic analysts
Reduce cost of financing	Finance department

kets. In some cases, markets may even punish such firms because of the effects of these actions on reported earnings. In the long term, markets most likely will recognize value-enhancing actions and reward them, but the manager who took these actions may not be around to share in the rewards.

## CONCLUSION

Value enhancement is clearly on the minds of many managers today. Building on the discounted cash flow principles developed in the preceding chapter, the value of a firm can be increased by changing one of the four primary inputs into value: the cash flows from assets in place, the expected growth rate during the high-growth period, the length of the high-growth period and the cost of capital. Conversely, actions that do not change any of these variables cannot create value. Cash flows from assets in place can be increased by cost cutting and more efficient operations, as well as by lowering taxes paid on income and reducing investment needs (capital maintenance and noncash working capital investments). Expected growth can be increased by increasing the reinvestment rate or the return on capital, but increases in the reinvestment rate will generate value only if the return on capital exceeds the cost of capital. High growth, at least the value-creating kind, can be made to last longer by generating new competitive advantages or augmenting existing ones. Finally, the cost of capital can be lowered by moving toward an optimal debt ratio, using debt that is more suited for the assets being financed and by reducing market risk.

## QUESTIONS AND SHORT PROBLEMS

1. Marion Manufacturing, a steel company, announces that it will be taking a major restructuring charge that will lower earnings this year by \$500 million. Assume that the charge is not tax deductible and has no effects on operations.
  - a. What will the effect of this charge be on the value of the firm?
  - b. When the firm announces the charge, what effect would you expect it to have on the stock price? Is your answer consistent with your response to question a?

2. Universal Health Care (UHC) is a company whose stock price has declined by 40% in the past year. In the current year, UHC earned \$300 million in pretax operating income on revenues of \$10 billion. The new CEO of the firm has proposed cost-cutting measures she anticipates will save the firm \$100 million in expenses, without any effect on revenues. Assume the firm is growing at a stable rate of 5% a year and that its cost of capital is 10%; neither number is expected to change as a consequence of the cost cutting. The firm's tax rate is 40%. (You can assume that the firm reinvests \$100 million each year and that this reinvestment will not change as the firm cuts costs.)
  - a. What effect will the cost cutting have on value?
  - b. What effect will the cost cutting have on value if the expected growth rate will drop to 4.5% as a consequence? (Some of the costs cut were designed to generate future growth.)
3. Atlantic Cruise Lines operates cruise ships and is headquartered in Florida. The firm had \$100 million in pretax operating income in the current year, of which it reinvested \$25 million. The firm expects its operating income to grow 4% in perpetuity, and expects to maintain its existing reinvestment rate. Atlantic has a capital structure composed 60% of equity and 40% of debt. Its cost of equity is 12% and it has a pretax cost of borrowing of 8%. The firm currently faces a tax rate of 40%.
  - a. Estimate the value of the firm.
  - b. Assume now that Atlantic Cruise Lines will move its headquarters to the Cayman Islands. If its tax rate drops to 0% as a consequence, estimate the effect on value of the shift.
4. Furniture Depot is a retail chain selling furniture and appliances. The firm has after-tax operating income of \$250 million in the current year on revenues of \$5 billion. The firm also has noncash working capital of \$1 billion. The net capital expenditures this year of \$100 million, and expects revenues, operating income and net capital expenditures to grow 5% a year forever. The firm's cost of capital is 9%.
  - a. Assume that noncash working capital remains at the existing percent of revenues, estimate the value of the firm.
  - b. Assume now that the firm is able to reduce its noncash working capital requirement by 50%. Estimate the effect on value of this change.
  - c. If as a consequence of this noncash working capital change, earnings growth declines to 4.75%, what would the effect on value be of the drop in noncash working capital?
5. General Systems is a firm that manufactures personal computers. As a top manager in the firm, you are considering changes in the way the firm is run. Currently, the firm has after-tax operating income of \$50 million on capital invested of \$250 million (at the beginning of the year). The firm also reinvests \$25 million in net capital expenditures and working capital.
  - a. Estimate the expected growth rate in earnings, given the firm's current return on capital and reinvestment rate.
  - b. Holding the return on capital constant, what would happen to the expected growth rate if the firm increased its reinvestment rate to 80%?
  - c. What would the effect on growth be if, as the reinvestment rate increases to 80%, the return on capital on investments drops by 5%? (For instance, if the return on capital is currently 18%, it will drop to 13%.)

6. Compaq Computers has seen its stock price decline from \$45 to \$24. The firm is expected to reinvest 50% of its expected after-tax operating income of \$2 billion in new investments, and expects to earn a return on capital of 10.69%. The firm is all equity financed and has a cost of equity of 11.5%.
  - a. What is the firm's expected growth rate, assuming that it maintains its existing reinvestment rate and return on capital?
  - b. Assuming that this growth is perpetual, what is the value of the firm?
  - c. How much value is being created or destroyed by the firm's new investments?
7. Referring to problem 6, now assume that Compaq's optimal debt ratio is 20%. Its cost of equity will increase to 12.5%, and its after-tax cost of debt will be 4.5% at the optimal debt ratio.
  - a. What is the firm's expected growth rate, assuming it maintains its existing reinvestment rate and return on capital?
  - b. Assuming this growth is perpetual, what is the value of the firm?
  - c. How much value is being created or destroyed by the firm's new investments?
8. Coca-Cola is considered to have one of the most valuable brand names in the world. The firm has an after-tax operating margin of 20% on revenues of \$25 billion. The capital invested in the firm is \$10 billion. In addition, Coca-Cola reinvests 50% of its after-tax operating earnings.
  - a. Estimate the expected growth in operating earnings, assuming Coca-Cola can sustain these values for the foreseeable future.
  - b. Assume generic soft drink manufacturers have after-tax operating margins of only 7.5%. If Coca-Cola maintains its existing reinvestment rate but loses its brand name value, estimate the expected growth rate in operating earnings. (You can assume that with the loss in brand name value Coca-Cola's operating margins would drop to 7.5% as well.)
9. BioMask Genetics is a biotechnology firm with only one patent to its name. The after-tax operating earnings in the current year are \$10 million, and the firm has no reinvestment needs. The patent will expire in three years, and the firm will have a 15% growth rate in earnings during that period. After year 3, operating earnings are expected to remain constant forever. The firm's management is considering an advertising plan designed to build up the brand name of its patented product. The advertising campaign will cost \$50 million (pretax) a year over the next three years; the firm's tax rate is 40%. The firm believes this campaign will allow it to maintain a 15% growth rate for 10 years, as the brand name compensates for the loss of the patent protection. After year 10, the operating earnings are expected to remain constant forever. The firm has a cost of capital of 10%.
  - a. Estimate the value of the firm assuming it does not embark on the advertising campaign.
  - b. Estimate the value of the firm with the advertising campaign.
  - c. Assume there is no guarantee the growth rate will last 10 years as a result of the campaign. What would the probability of success need to be for the campaign to be financially viable?
10. Sunmask is a cosmetics firm that has seen its stock price fall and its earnings decline in the past year. You have been hired as the new CEO of the company, and a careful analysis of Sunmask's current financials reveals the following:

- The firm currently has after-tax operating earnings of \$300 million on revenues of \$10 billion, and a capital turnover ratio (sales–book value of capital) of 2.5.
  - The firm is expected to reinvest 60% of its after-tax operating income.
  - The firm is all equity financed and has a cost of capital of 10%.
- a. Estimate the value of the firm, assuming existing policies continue forever. (Returns on capital and reinvestment rates remain constant forever as well.)
  - b. Assume that you can increase operating margins from 3% to 5% without affecting the capital turnover ratio, that you can lower the reinvestment rate to 40%, and that the cost of capital will become 9% if you shift to your optimal debt ratio. How much would your firm value increase if you were able to make these changes?