CHAPTER 13

Capital Structure and Leverage

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When a firm expands, it needs capital, and that capital can come from debt or equity. Debt has two important advantages. First, interest paid is tax deductible, which lowers debt’s effective cost. Second, debtholders get a fixed return, so stockholders do not have to share their profits if the business is extremely successful.

However, debt also has disadvantages. First, the higher the debt ratio, the riskier the company, hence the higher its cost of both debt and equity. Second, if a company falls on hard times and operating income is not sufficient to cover interest charges, its stockholders will have to make up the shortfall, and if they cannot, bankruptcy will result. Good times may be just around the corner, but too much debt can keep the company from getting there and thus can wipe out the stockholders.

Companies with volatile earnings and operating cash flows therefore limit their use of debt. On the other hand, companies with less business risk and more stable operating cash flows can take on more debt. General Mills, a consumer-goods company with such well-known brands as Cheerios, Wheaties, Betty Crocker, and Hamburger Helper, is a good example of a stable company that uses a lot of debt financing. Indeed, at the end of 1999, General Mills’ capital structure as shown on its balance sheet was 90 percent debt and 10 percent equity.

At first glance, a 90 percent debt ratio seems extraordinarily high. In the past, there have been numerous examples of high debt pushing otherwise well-regarded companies into bankruptcy. For example, a few years ago, two of the nation’s largest retailers, Federated Department Stores and R.H. Macy, were forced to declare bankruptcy as a result of their excessive use of debt.

With these examples in mind, some analysts are concerned that General Mills may have taken on too much debt. These concerns have recently increased. The company has issued more debt and has repurchased common stock, to the point where the company had negative equity on its year-end 2000 balance sheet. Moreover, these numbers do not reflect General Mills’ recent plans to acquire Pillsbury assets from Diageo PLC. General Mills plans to finance the purchase by issuing more than $5 billion in stock. The terms of the deal also require General Mills to assume $5.14 billion of Pillsbury’s debt.

Despite these concerns, General Mills’ high debt ratio might be appropriate, given the stability of its basic business. After all, the consumption of Cheerios and Hamburger Helper has historically remained stable even
In Chapter 10, when we calculated the weighted average cost of capital for use in capital budgeting, we assumed that the firm had a specific target capital structure. However, the optimal capital structure may change over time, changes in capital structure affect the riskiness and cost of each type of capital, and all this can change the weighted average cost of capital. Moreover, a change in the cost of capital can affect capital budgeting decisions and, ultimately, the firm’s stock price.

Many factors influence the capital structure decision, and, as you will see, determining the optimal capital structure is not an exact science. Therefore, even firms in the same industry often have dramatically different capital structures. In this chapter we first consider the effect of capital structure on risk, and then we use these insights to help answer the question of how firms should determine the mix of debt and equity used to finance their operations.

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**Target Capital Structure**

The mix of debt, preferred stock, and common equity with which the firm plans to raise capital.

Firms should first analyze a number of factors, then establish a **target capital structure**. This target may change over time as conditions change, but at any given moment, management should have a specific capital structure in mind. If the actual debt ratio is below the target level, expansion capital should gener-
ally be raised by issuing debt, whereas if the debt ratio is above the target, equity should generally be issued.

Capital structure policy involves a trade-off between risk and return:

- Using more debt raises the risk borne by stockholders.
- However, using more debt generally leads to a higher expected rate of return on equity.

Higher risk tends to lower a stock's price, but a higher expected rate of return raises it. Therefore, the optimal capital structure must strike a balance between risk and return so as to maximize the firm's stock price.

Four primary factors influence capital structure decisions.

1. **Business risk**, or the riskiness inherent in the firm's operations if it used no debt. The greater the firm's business risk, the lower its optimal debt ratio.

2. **The firm's tax position**. A major reason for using debt is that interest is deductible, which lowers the effective cost of debt. However, if most of a firm's income is already sheltered from taxes by depreciation tax shields, by interest on currently outstanding debt, or by tax loss carry-forwards, its tax rate will be low, so additional debt will not be as advantageous as it would be to a firm with a higher effective tax rate.

3. **Financial flexibility**, or the ability to raise capital on reasonable terms under adverse conditions. Corporate treasurers know that a steady supply of capital is necessary for stable operations, which is vital for long-run success. They also know that when money is tight in the economy, or when a firm is experiencing operating difficulties, suppliers of capital prefer to provide funds to companies with strong balance sheets. Therefore, both the potential future need for funds and the consequences of a funds shortage influence the target capital structure — the greater the probable future need for capital, and the worse the consequences of a capital shortage, the stronger the balance sheet should be.

4. **Managerial conservatism or aggressiveness**. Some managers are more aggressive than others, hence some firms are more inclined to use debt in an effort to boost profits. This factor does not affect the true optimal, or value-maximizing, capital structure, but it does influence the manager-determined target capital structure.

These four points largely determine the target capital structure, but operating conditions can cause the actual capital structure to vary from the target. For example, Illinois Power has a target debt ratio of about 45 percent, but large losses associated with a nuclear plant forced it to write down its common equity, and that raised the debt ratio above the target level. The company is now trying to get its equity back up to the target level.

**SELF-TEST QUESTIONS**

What four factors affect the target capital structure?

In what sense does capital structure policy involve a trade-off between risk and return?
BUSINESS AND FINANCIAL RISK

In Chapter 6, when we examined risk from the viewpoint of a stock investor, we distinguished between market risk, which is measured by the firm’s beta coefficient, and stand-alone risk, which includes both market risk and an element of risk that can be eliminated by diversification. Now we introduce two new dimensions of risk: (1) business risk, or the riskiness of the firm’s stock if it uses no debt, and (2) financial risk, which is the additional risk placed on the common stockholders as a result of the firm’s decision to use debt.\footnote{Preferred stock also adds to financial risk. To simplify matters, we concentrate on debt and common equity in this chapter.}

Conceptually, the firm has a certain amount of risk inherent in its operations: this is its business risk. If it uses debt, then, in effect, it partitions its investors into two groups and concentrates most of its business risk on one class of investors — the common stockholders. However, the common stockholders will demand compensation for assuming more risk and thus require a higher rate of return. In this section, we examine business and financial risk within a stand-alone risk framework, which ignores the benefits of stockholder diversification.

BUSINESS RISK

Business risk in a stand-alone sense is a function of the uncertainty inherent in projections of a firm’s return on invested capital (ROIC), defined as follows:

\[
\text{ROIC} = \frac{\text{NOPAT}}{\text{Capital}} = \frac{\text{Net income to common stockholders} + \text{interest payments}}{\text{Capital}}.
\]

Here NOPAT is net operating profit after taxes and capital is the sum of the firm’s debt and common equity. (We ignore preferred stock in this section.) If a firm uses no debt, then its interest payments will be zero, its capital will be all equity, and its ROIC will equal its return on equity, ROE:

\[
\text{ROIC (zero debt)} = \text{ROE} = \frac{\text{Net income to common stockholders}}{\text{Common equity}}.
\]

Therefore, the business risk of a leverage-free firm can be measured by the standard deviation of its ROE, \( \sigma_{\text{ROE}} \).

To illustrate, consider Bigbee Electronics Company, a debt-free (unlevered) firm. Figure 13-1 gives some clues about the company’s business risk. The top graph shows the trend in ROE from 1991 through 2001; this graph gives both security analysts and Bigbee’s management an idea of the degree to which ROE has varied in the past and might vary in the future.

The lower graph shows the beginning-of-year subjectively estimated probability distribution of Bigbee’s ROE for 2001, based on the trend line in the top section of Figure 13-1. As both graphs indicate, Bigbee’s actual ROE in 2001 was only 8 percent, well below the expected value of 12 percent — 2001 was a bad year.
Bigbee’s past fluctuations in ROE were caused by many factors — booms and recessions in the national economy, successful new products introduced both by Bigbee and by its competitors, labor strikes, a fire in Bigbee’s main plant, and so on. Similar events will doubtless occur in the future, and when they do, the realized ROE will be higher or lower than the projected level. Further, there is always the possibility that a long-term disaster will strike, permanently depressing the company’s earning power; for example, a competitor might introduce a new product that would permanently lower Bigbee’s earnings. This uncertainty regarding Bigbee’s future ROE, assuming the firm uses no debt financing, is defined as the company’s business risk. Because Bigbee uses no debt, stockholders bear all of the company’s business risk.

Business risk varies not only from industry to industry but also among firms in a given industry. Further, business risk can change over time. For example, the electric utilities were regarded for years as having little business risk, but a combination of events in recent years altered the utilities’ situation, producing sharp declines in their ROEs and greatly increasing the industry’s business risk.
Now, food processors and grocery retailers frequently are given as examples of industries with low business risk, while cyclical manufacturing industries such as autos and steel, as well as many small startup companies, are regarded as having especially high business risk.\(^2\)

Business risk depends on a number of factors, the more important of which are listed below:

1. **Demand variability.** The more stable the demand for a firm’s products, other things held constant, the lower its business risk.

2. **Sales price variability.** Firms whose products are sold in highly volatile markets are exposed to more business risk than similar firms whose output prices are more stable.

3. **Input cost variability.** Firms whose input costs are highly uncertain are exposed to a high degree of business risk.

4. **Ability to adjust output prices for changes in input costs.** Some firms are better able than others to raise their own output prices when input costs rise. The greater the ability to adjust output prices to reflect cost conditions, the lower the degree of business risk.

5. **Ability to develop new products in a timely, cost-effective manner.** Firms in such high-tech industries as drugs and computers depend on a constant stream of new products. The faster its products become obsolete, the greater a firm’s business risk.

6. **Foreign risk exposure.** Firms that generate a high percentage of their earnings overseas are subject to earnings declines due to exchange rate fluctuations. Also, if a firm operates in a politically unstable area, it may be subject to political risks. See Chapter 16 for a further discussion.

7. **The extent to which costs are fixed: operating leverage.** If a high percentage of costs are fixed, hence do not decline when demand falls, then the firm is exposed to a relatively high degree of business risk. This factor is called *operating leverage,* and it is discussed at length in the next section.

Each of these factors is determined partly by the firm’s industry characteristics, but each of them is also controllable to some extent by management. For example, most firms can, through their marketing policies, take actions to stabilize both unit sales and sales prices. However, this stabilization may require spending a great deal on advertising and/or price concessions to get commitments from customers to purchase fixed quantities at fixed prices in the future. Similarly, firms such as Bigbee Electronics can reduce the volatility of future input costs by negotiating long-term labor and materials supply contracts, but they may have to pay prices above the current spot price to obtain these contracts. Many firms are also using hedging techniques to reduce business risk, but the curious student may refer to Brigham and Houston’s *Fundamentals of Financial Management,* 9th edition, Chapter 18, where hedging is discussed in more detail.

\(^2\) We have avoided any discussion of market versus company-specific risk in this section. We note now (1) that any action that increases business risk in the stand-alone risk sense will generally also increase a firm’s beta coefficient and (2) that a part of business risk as we define it will generally be company-specific, hence subject to elimination by diversification by the firm’s stockholders.
**Operating Leverage**

As noted above, business risk depends in part on the extent to which a firm builds fixed costs into its operations—if fixed costs are high, even a small decline in sales can lead to a large decline in ROE. So, other things held constant, the higher a firm’s fixed costs, the greater its business risk. Higher fixed costs are generally associated with more highly automated, capital intensive firms and industries. However, businesses that employ highly skilled workers who must be retained and paid even during recessions also have relatively high fixed costs, as do firms with high product development costs, because the amortization of development costs is an element of fixed costs.

If a high percentage of total costs are fixed, then the firm is said to have a high degree of operating leverage. In physics, leverage implies the use of a lever to raise a heavy object with a small force. In politics, if people have leverage, their smallest word or action can accomplish a lot. *In business terminology, a high degree of operating leverage, other factors held constant, implies that a relatively small change in sales results in a large change in ROE.*

Figure 13-2 illustrates the concept of operating leverage by comparing the results that Bigbee could expect if it used different degrees of operating leverage. Plan A calls for a relatively small amount of fixed costs, $20,000. Here the firm would not have much automated equipment, so its depreciation, maintenance, property taxes, and so on would be low. However, the total operating costs line has a relatively steep slope, indicating that variable costs per unit are higher than they would be if the firm used more operating leverage. Plan B calls for a higher level of fixed costs, $60,000. Here the firm uses automated equipment (with which one operator can turn out a few or many units at the same labor cost) to a much larger extent. The breakeven point is higher under Plan B — breakeven occurs at 60,000 units under Plan B versus only 40,000 units under Plan A.

We can calculate the breakeven quantity by recognizing that operating breakeven occurs when ROE = 0, hence when EBIT = 0.³

\[
\text{EBIT} = PQ - VQ - F = 0. \quad (13-1)
\]

Here P is average sales price per unit of output, Q is units of output, V is variable cost per unit, and F is fixed operating costs. If we solve for the breakeven quantity, \(Q_{\text{BE}}\), we get this expression:

\[
Q_{\text{BE}} = \frac{F}{P - V}. \quad (13-1a)
\]

Thus for Plan A,

\[
Q_{\text{BE}} = \frac{$20,000}{$2.00 - $1.50} = 40,000 \text{ units},
\]

and for Plan B,

\[
Q_{\text{BE}} = \frac{$60,000}{$2.00 - $1.00} = 60,000 \text{ units}.
\]

³ This definition of breakeven does not include any fixed financial costs because Bigbee is an unlevered firm. If there were fixed financial costs, the firm would suffer an accounting loss at the operating breakeven point. We will introduce financial costs shortly.
**FIGURE 13-2 Illustration of Operating Leverage**

**Plan A**
- **Revenues and Costs** (Thousands of Dollars)
- **Sales**
- **Operating Profit (EBIT)**
- **Total Operating Costs**
- **Breakeven Point (EBIT = 0)**
- **Fixed Costs**

**Plan B**
- **Revenues and Costs** (Thousands of Dollars)
- **Sales**
- **Operating Profit (EBIT)**
- **Total Operating Costs**
- **Breakeven Point (EBIT = 0)**
- **Fixed Costs**

**PLAN A**
- **PLAN B**

<table>
<thead>
<tr>
<th>Price</th>
<th>$2.00</th>
<th>$2.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable costs</td>
<td>$1.50</td>
<td>$1.00</td>
</tr>
<tr>
<td>Fixed costs</td>
<td>$20,000</td>
<td>$60,000</td>
</tr>
<tr>
<td>Assets</td>
<td>$200,000</td>
<td>$200,000</td>
</tr>
<tr>
<td>Tax rate</td>
<td>40%</td>
<td>40%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DEMAND</th>
<th>PROBABILITY</th>
<th>UNITS SOLD</th>
<th>DOLLAR SALES</th>
<th>OPERATING COSTS</th>
<th>OPERATING PROFITS (EBIT)</th>
<th>NET INCOME</th>
<th>ROE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrible</td>
<td>0.05</td>
<td>0</td>
<td>$0</td>
<td>$20,000</td>
<td>($20,000) ($12,000)</td>
<td>−6.00%</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>0.20</td>
<td>40,000</td>
<td>80,000</td>
<td>80,000</td>
<td>0</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>0.30</td>
<td>100,000</td>
<td>200,000</td>
<td>170,000</td>
<td>30,000 18,000</td>
<td>9.00</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>0.20</td>
<td>160,000</td>
<td>320,000</td>
<td>260,000</td>
<td>60,000 36,000</td>
<td>18.00</td>
<td></td>
</tr>
<tr>
<td>Wonderful</td>
<td>0.05</td>
<td>200,000</td>
<td>400,000</td>
<td>320,000</td>
<td>80,000 48,000</td>
<td>24.00</td>
<td></td>
</tr>
</tbody>
</table>

**Expected value:**
- Plan A: $24,698 7.41%
- Plan B: $49,396 14.82%

**Coefficient of variation:**
- Plan A: 0.82
- Plan B: 0.82

**Notes:**
- a. Operating costs = Variable costs + Fixed costs.
- b. The federal-plus-state tax rate is 40 percent, so NI = EBIT(1 − Tax rate) = EBIT(0.6).
- c. ROE = NI/Equity. The firm has no debt, so Assets = Equity = $200,000.
- d. The breakeven sales level for Plan B is not shown in the table, but it is 60,000 units or $120,000.
- e. The expected values, standard deviations, and coefficients of variation were found using the procedures discussed in Chapter 6.
How does operating leverage affect business risk? *Other things held constant, the higher a firm’s operating leverage, the higher its business risk.* This point is demonstrated in Figure 13-3, where we develop probability distributions for ROE under Plans A and B.

The top section of Figure 13-3 graphs the probability distribution of sales that was presented in tabular form in Figure 13-2. The sales probability distribution depends on how demand for the product varies, not on whether the product is manufactured by Plan A or by Plan B. Therefore, the same sales probability distribution applies to both production plans; this distribution has expected sales of $200,000, and it ranges from zero to about $400,000, with a standard deviation of $98,793.
We use the sales probability distribution, together with the operating costs at each sales level, to develop graphs of the ROE probability distributions under Plans A and B. These are shown in the bottom section of Figure 13-3. Plan B has a higher expected ROE, but this plan also entails a much higher probability of losses. Clearly, Plan B, the one with more fixed costs and a higher degree of operating leverage, is riskier. In general, holding other factors constant, the higher the degree of operating leverage, the greater the firm’s business risk. In the discussion that follows, we assume that Bigbee has decided to go ahead with Plan B because they believe that the higher expected return is sufficient to compensate for the higher risk.

To what extent can firms control their operating leverage? To a large extent, operating leverage is determined by technology. Electric utilities, telephone companies, airlines, steel mills, and chemical companies simply must have large investments in fixed assets; this results in high fixed costs and operating leverage. Similarly, drug, auto, computer, and other companies must spend heavily to develop new products, and product-development costs increase operating leverage. Grocery stores, on the other hand, generally have significantly lower fixed costs, hence lower operating leverage. Still, although industry factors do exert a major influence, all firms have some control over their operating leverage. For example, an electric utility can expand its generating capacity by building either a gas-fired or a coal-fired plant. The coal plant would require a larger investment and would have higher fixed costs, but its variable operating costs would be relatively low. The gas-fired plant, on the other hand, would require a smaller investment and would have lower fixed costs, but the variable costs (for gas) would be high. Thus, by its capital budgeting decisions, a utility (or any other company) can influence its operating leverage, hence its business risk.

The concept of operating leverage was originally developed for use in capital budgeting. Mutually exclusive projects that involve alternative methods for producing a given product often have different degrees of operating leverage, hence different breakeven points and different degrees of risk. Bigbee Electronics and many other companies regularly undertake a type of breakeven analysis (the sensitivity analysis discussed in Chapter 12) for each proposed project as a part of their regular capital budgeting process. Still, once a corporation’s operating leverage has been established, this factor exerts a major influence on its capital structure decision.

**Financial Risk**

Financial risk is the additional risk placed on the common stockholders as a result of the decision to finance with debt. Conceptually, stockholders face a certain amount of risk that is inherent in a firm’s operations — this is its business risk, which is defined as the uncertainty inherent in projections of future operating income. If a firm uses debt (financial leverage), this concentrates the business risk on common stockholders. To illustrate, suppose 10 people decide to form a corporation to manufacture disk drives. There is a certain amount of business risk in the operation. If the firm is capitalized only with common equity, and if each person buys 10 percent of the stock, then each investor shares equally in the business risk. However, suppose the firm is capitalized with 50 percent debt and 50 percent equity, with five of the investors putting up their capital as debt and the other five putting up their money as equity. In this case, the five investors who put
Financial Leverage
The extent to which fixed-income securities (debt and preferred stock) are used in a firm’s capital structure.

Table 13-1: Interest Rates for Bigbee with Different Debt/Assets Ratios

<table>
<thead>
<tr>
<th>AMOUNT BORROWED*</th>
<th>DEBT/ASSETS RATIO</th>
<th>INTEREST RATE, ( k_d ), ON ALL DEBT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$20,000</td>
<td>10%</td>
<td>8.0%</td>
</tr>
<tr>
<td>40,000</td>
<td>20</td>
<td>8.3</td>
</tr>
<tr>
<td>60,000</td>
<td>30</td>
<td>9.0</td>
</tr>
<tr>
<td>80,000</td>
<td>40</td>
<td>10.0</td>
</tr>
<tr>
<td>100,000</td>
<td>50</td>
<td>12.0</td>
</tr>
<tr>
<td>120,000</td>
<td>60</td>
<td>15.0</td>
</tr>
</tbody>
</table>

* We assume that the firm must borrow in increments of $20,000. We also assume that Bigbee is unable to borrow more than $120,000, which is 60 percent of its $200,000 of assets, because of restrictions in its corporate charter.

Up the equity will have to bear all of the business risk, so the common stock will be twice as risky as it would have been had the firm been financed only with equity. Thus, the use of debt, or financial leverage, concentrates the firm’s business risk on its stockholders. This concentration of business risk occurs because debtholders, who receive fixed interest payments, bear none of the business risk.

To illustrate the concentration of business risk, we can extend the Bigbee Electronics example. To date, the company has never used debt, but the treasurer is now considering a possible change in the capital structure. Changes in the use of debt will cause changes in earnings per share (EPS) as well as changes in risk—both of which will affect the company’s stock price. To understand the relationship between financial leverage and EPS, first consider Table 13-1, which shows how Bigbee’s cost of debt would vary if it used different percentages of debt. The higher the percentage of debt, the riskier the debt, hence the higher the interest rate lenders will charge.

For now, assume that only two financing choices are being considered—remaining at 100 percent equity, or shifting to 50 percent debt and 50 percent equity. We also assume that with no debt Bigbee has 10,000 shares of common stock outstanding and, if it changes its capital structure, common stock can be repurchased at the $20 current stock price. Now consider Table 13-2, which shows how the financing choice will affect Bigbee’s profitability and risk.

First focus on Section I of Table 13-2, which assumes that Bigbee uses no debt. Since debt is zero, interest is also zero, hence pre-tax income is equal to EBIT. Taxes at 40 percent are deducted to obtain net income, which is then divided by the $200,000 of equity to calculate ROE. Note that Bigbee receives a tax credit if the demand is either terrible or poor (which are the two scenarios where net income is negative). Here we assume that Bigbee’s losses can be carried back to offset income earned in the prior year. The ROE at each sales level is then multiplied by the probability of that sales level to calculate the 12 percent expected ROE. Note that this 12 percent is the same as we found in Figure 13-2 for Plan B.

Section I of Table 13-2 also calculates Bigbee’s earnings per share (EPS) for each scenario under the assumption that the company continues to use no debt. Net income is divided by the 10,000 common shares outstanding to obtain
### TABLE 13-2

#### Effects of Financial Leverage: Bigbee Electronics Financed with Zero Debt or with 50 Percent Debt

**SECTION I. ZERO DEBT**

| Debt ratio | 0% |
| Assets     | $200,000 |
| Debt       | 0 |
| Equity     | $200,000 |
| Shares outstanding | 10,000 |

<table>
<thead>
<tr>
<th>DEMAND FOR PRODUCT</th>
<th>PROBABILITY</th>
<th>EBIT</th>
<th>INTEREST</th>
<th>PRE-TAX INCOME</th>
<th>TAXES (40%)</th>
<th>NET INCOME</th>
<th>ROE</th>
<th>EPS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrible</td>
<td>0.05</td>
<td>($60,000)</td>
<td>0</td>
<td>($60,000)</td>
<td>($24,000)</td>
<td>($36,000)</td>
<td>18.00%</td>
<td>($3.60)</td>
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<tr>
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<td>20,000</td>
<td>0</td>
<td>20,000</td>
<td>8,000</td>
<td>12,000</td>
<td>6.00</td>
<td>1.20</td>
</tr>
<tr>
<td>Normal</td>
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<td>40,000</td>
<td>0</td>
<td>40,000</td>
<td>16,000</td>
<td>24,000</td>
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<td>Good</td>
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<td>40,000</td>
<td>60,000</td>
<td>30.00</td>
<td>6.00</td>
</tr>
<tr>
<td>Wonderful</td>
<td>0.05</td>
<td>140,000</td>
<td>0</td>
<td>140,000</td>
<td>56,000</td>
<td>84,000</td>
<td>42.00</td>
<td>8.40</td>
</tr>
<tr>
<td>Expected value:</td>
<td></td>
<td>$40,000</td>
<td>0</td>
<td>$40,000</td>
<td>$16,000</td>
<td>$24,000</td>
<td>12.00</td>
<td>2.40</td>
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<tr>
<td>Standard deviation:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14.82%</td>
<td>$2.96</td>
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<td>Coefficient of variation:</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.23</td>
<td>1.23</td>
</tr>
</tbody>
</table>

Assumptions:
1. In terms of its operating leverage, Bigbee has chosen Plan B. The probability distribution and EBIT are obtained from Figure 13-2.
2. Sales and operating costs, hence EBIT, are not affected by the financing decision. Therefore, EBIT under both financing plans is identical, and it is taken from the EBIT column for Plan B in Figure 13-2.
3. All losses can be carried back to offset income in the prior year.

* The EPS figures can also be obtained using the following formula, in which the numerator amounts to an income statement at a given sales level laid out horizontally:

$$\text{EPS} = \frac{(\text{Sales} - \text{Fixed costs} - \text{Variable costs} - \text{Interest})(1 - \text{Tax rate})}{\text{Shares outstanding}} = \frac{(\text{EBIT} - \text{I})(1 - \text{T})}{\text{Shares outstanding}}.$$  

EPS. If the demand is terrible, the EPS will be $-3.60, but if demand is wonderful, the EPS will rise to $8.40. The EPS at each sales level is then multiplied by the probability of that sales level to calculate the expected EPS, which is $2.40 if Bigbee uses no debt. We also calculate the standard deviation of EPS and the coefficient of variation as indicators of the firm’s risk at a zero debt ratio: $\sigma_{\text{EPS}} = 2.96$, and $\text{CV}_{\text{EPS}} = 1.23$. *  

Now let’s look at the situation if Bigbee decides to use 50 percent debt financing, shown in Section II of Table 13-2, with the debt costing 12 percent. Demand will not be affected, nor will operating costs, hence the EBIT columns are the same for the zero debt and 50 percent debt cases. However, the company will now have $100,000 of debt with a cost of 12 percent, hence its inter-

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* See Chapter 6 for a review of procedures for calculating the standard deviation and coefficient of variation. Recall that the advantage of the coefficient of variation is that it permits better comparisons when the expected values of EPS vary, as they do here for the two capital structures.
### TABLE 13-2

**SECTION II. 50% DEBT**

<p>| | | | | | | | | | | |</p>
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<tbody>
<tr>
<td>Debt ratio</td>
<td>50.00%</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Assets</td>
<td>$200,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Debt</td>
<td>$100,000</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Interest rate</td>
<td>12.00%</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Equity</td>
<td>$100,000</td>
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<tr>
<td>Shares outstanding</td>
<td>5,000</td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DEMAND FOR PRODUCT</th>
<th>PROBABILITY</th>
<th>EBIT</th>
<th>INTEREST</th>
<th>PRE-TAX INCOME</th>
<th>TAXES (40%)</th>
<th>NET INCOME</th>
<th>ROE</th>
<th>EPSa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrible</td>
<td>0.05</td>
<td>($60,000)</td>
<td>12,000</td>
<td>($72,000)</td>
<td>($28,800)</td>
<td>($43,200)</td>
<td>-43.20%</td>
<td>($8.64)</td>
</tr>
<tr>
<td>Poor</td>
<td>0.20</td>
<td>(20,000)</td>
<td>12,000</td>
<td>(32,000)</td>
<td>(12,800)</td>
<td>(19,200)</td>
<td>-19.20</td>
<td>(3.84)</td>
</tr>
<tr>
<td>Normal</td>
<td>0.50</td>
<td>40,000</td>
<td>12,000</td>
<td>28,000</td>
<td>11,200</td>
<td>16,800</td>
<td>16.80</td>
<td>3.36</td>
</tr>
<tr>
<td>Good</td>
<td>0.20</td>
<td>100,000</td>
<td>12,000</td>
<td>88,000</td>
<td>35,200</td>
<td>52,800</td>
<td>52.80</td>
<td>10.56</td>
</tr>
<tr>
<td>Wonderful</td>
<td>0.05</td>
<td>140,000</td>
<td>12,000</td>
<td>128,000</td>
<td>51,200</td>
<td>76,800</td>
<td>76.80</td>
<td>15.36</td>
</tr>
</tbody>
</table>

**Expected value:**

- EBIT: $40,000
- Interest: $12,000
- Net Income: $16,800
- ROE: 16.80%
- EPSa: $3.36

**Standard deviation:**

- 29.64%
- 5.93

**Coefficient of variation:**

- 1.76
- 1.76

---

For example, with zero debt and sales = $200,000, EPS is $2.40:

\[
\text{EPS}_{A=0} = \frac{($200,000 - $60,000 - $100,000 - 0)(0.6)}{1000} = $2.40.
\]

With 50 percent debt and sales = $200,000, EPS is $3.36:

\[
\text{EPS}_{A=0.50} = \frac{($200,000 - $60,000 - $100,000 - $12,000)(0.6)}{5000} = $3.36.
\]

Refer to the tabular data given in Figure 13-2 to arrive at sales, fixed costs, and variable costs that are used in the equations above.

---

**Business and Financial Risk**

Est interest expense will be $12,000. This interest must be paid regardless of the state of the economy — if it is not paid, the company will be forced into bankruptcy, and stockholders will probably be wiped out. Therefore, we show a $12,000 cost in Column 4 as a fixed number for all demand conditions. Column 5 shows pre-tax income, Column 6 the applicable taxes, and Column 7 the resulting net income. When the net income figures are divided by the equity investment — which will now be only $100,000 because $100,000 of the $200,000 total requirement was obtained as debt — we find the ROEs under each demand state. If demand is terrible and sales are zero, then a very large loss will be incurred, and the ROE will be -43.2 percent. However, if demand is wonderful, then ROE will be 76.8 percent. The probability-weighted average is the expected ROE, which is 16.8 percent if the company uses 50 percent debt.

Typically, financing with debt increases the expected rate of return for an investment, but debt also increases the riskiness of the investment to the owners of the firm, its common stockholders. This situation holds with our example —
Financial leverage raises the expected ROE from 12 percent to 16.8 percent, but it also increases the riskiness of the investment as measured by the coefficient of variation from 1.23 to 1.76.

Figure 13-4 graphs the data in Table 13-2. It shows in another way that using financial leverage increases the expected ROE, but that leverage also flattens out the probability distribution and increases the probability of a large loss, thus increasing the risk borne by stockholders.

We can also calculate Bigbee’s EPS if it is financed with 50 percent debt. Once again EPS is calculated as net income divided by shares outstanding. With debt = 0, there would be 10,000 shares outstanding. However, if half of the equity were replaced by debt (debt = $100,000), there would be only 5,000 shares outstanding, and we must use this fact to determine the EPS figures that would result at each of the possible demand levels. With a debt/assets ratio of 50 percent, the EPS figure would be −$8.64 if sales were terrible; it would rise to $3.36 if sales were normal; and it would soar to $15.36 if sales were wonderful.

The EPS distributions under the two financial structures are graphed in Figure 13-5, where we use continuous distributions rather than the discrete distributions contained in Table 13-2. Although expected EPS would be much higher if financial leverage were employed, the graph makes it clear that the risk of low, or even negative, EPS would also be higher if debt were used.

Another view of the relationships among expected EPS, risk, and financial leverage is presented in Figure 13-6. The tabular data in the lower section were calculated in the manner set forth in Table 13-2, and the graphs plot these data. Here we see that expected EPS rises until the firm is financed with 50 percent debt. Interest charges rise, but this effect is more than off-

---

5 We assume in this example that the firm could change its capital structure by repurchasing common stock at its book value of $100,000/5,000 shares = $20 per share. However, the firm may actually have to pay a higher price to repurchase its stock on the open market. If Bigbee had to pay $22 per share, then it could repurchase only $100,000/$22 = 4,545 shares, and, in this case, expected EPS would be only $16,800/(10,000 − 4,545) = $16,800/5,455 = $3.08 rather than $3.36.
set by the declining number of shares outstanding as debt is substituted for equity. However, EPS peaks at a debt ratio of 50 percent, beyond which interest rates rise so rapidly that EPS falls in spite of the falling number of shares outstanding.

The right panel of Figure 13-6 shows that risk, as measured by the coefficient of variation of EPS, rises continuously, and at an increasing rate, as debt is substituted for equity.

We see, then, that using leverage has both good and bad effects: higher leverage increases expected earnings per share (in this example, until the D/A ratio equals 50 percent), but it also increases risk. Clearly, Bigbee’s debt ratio should not exceed 50 percent, but where, in the range of 0 to 50 percent, should it be set? This issue is discussed in the following sections.

**SELF-TEST QUESTIONS**

What is business risk, and how can it be measured?
What are some determinants of business risk?
Why does business risk vary from industry to industry?
What is operating leverage?
How does operating leverage affect business risk?
What is financial risk, and how does it arise?

Explain this statement: “Using leverage has both good and bad effects.”
As we saw in Figure 13-6, Bigbee’s expected EPS is maximized at a debt/assets ratio of 50 percent. Does that mean that Bigbee’s optimal capital structure calls for 50 percent debt? The answer is a resounding no — the optimal capital struc-
ture is the one that maximizes the price of the firm’s stock, and this generally calls for a debt ratio that is lower than the one that maximizes expected EPS.

Recall from Chapter 9 that stock prices are positively related to expected dividends but negatively related to the required return on equity. Firms with higher earnings are able to pay higher dividends, so to the extent that higher debt levels raise expected earnings per share, leverage works to increase the stock price. However, higher debt levels also increase the firm’s risk, and that raises the cost of equity and works to reduce the stock price. So, even though increasing the debt ratio from 40 to 50 percent raises EPS, the higher EPS is more than offset by the corresponding increase in risk.

**WACC and Capital Structure Changes**

Managers should choose the capital structure that maximizes the firm’s stock price. However, it is difficult to estimate how a given change in the capital structure will affect the stock price. As it turns out, however, the capital structure that maximizes the stock price is also the one that minimizes the WACC. Because it is usually easier to predict how a capital structure change will affect the WACC than the stock price, many managers use the predicted changes in the WACC to guide their capital structure decisions.

Recall from Chapter 10 that when there is no preferred stock in a firm’s capital structure, the WACC is defined as follows:

\[
WACC = \frac{w_d(k_d)(1 - T) + w_e(k_e)}{(D/A)(1 - T) + (E/A)}
\]

In this expression, D/A and E/A represent the debt and equity ratios, and they sum to 1.0.

Note that in Table 13-3 an increase in the debt/assets ratio raises the costs of both debt and equity. [The cost of debt, \(k_d\), is taken from Table 13-1, but multiplied by \((1 - T)\) to put it on an after-tax basis.] Bondholders recognize that if a firm has a higher debt ratio, this increases the risk of financial distress, and more risk leads to higher interest rates.

In practice, financial managers use the forecasting techniques described in Chapter 4 to determine how changes in the debt ratio will affect the current ratio, times-interest-earned ratio, and EBITDA coverage ratio. They then discuss their pro forma financial statements with bankers and bond rating agencies, who ask probing questions and may make their own adjustments to the firm’s forecasts. The bankers and rating agencies then compare the firm’s ratios with those of other firms in its industry, and end up with a rating and corresponding interest rate. Moreover, if the company plans to issue bonds to the public, the SEC requires that it inform investors what the coverages will be after the new bonds have been sold. Recognizing all this, sophisticated financial managers use their forecasted ratios to predict how bankers and other lenders will judge their firms’ risks and thus determine their cost of debt. Thus, they can judge quite accurately the effects of capital structure on the cost of debt.

**The Hamada Equation**

An increase in the debt ratio also increases the risk faced by shareholders, and this has an effect on the cost of equity, \(k_e\). This relationship is harder to quantify, but it can be done. To begin, recall from Chapter 6 that a stock’s beta
is the relevant measure of risk for diversified investors. Moreover, it has been demonstrated, both theoretically and empirically, that beta increases with financial leverage. Indeed, Robert Hamada developed the following equation to specify the effect of financial leverage on beta:\(^6\)

\[
b = b_U [1 + (1 - T) (D/E)]. \tag{13-2}
\]

The Hamada equation shows how increases in the debt/equity ratio increase beta. Here $b_U$ is the firm’s unlevered beta coefficient, that is, the beta it would have if it has no debt. In that case, beta would depend entirely upon business risk and thus be a measure of the firm’s “basic business risk.” $D/E$ is the measure of financial leverage used in the Hamada equation.\(^7\)

Note that beta is the only variable under management’s control in the cost of equity equation, $k_s = k_{RF} + (k_M - k_{RF})b_i$. Both $k_{RF}$ and $k_M$ are determined by market forces that are beyond the firm’s control. However, $b_i$ is determined (1) by the firm’s operating decisions as discussed earlier in the chapter, which affect $b_U$, and (2) by its capital structure decisions as reflected in its $D/A$ (or $D/E$) ratio.

As a starting point, a firm can take its current beta, tax rate, and debt/equity ratio and calculate its **unlevered beta**, $b_U$, by simply transforming Equation 13-2 as follows:

$$b_U = b/[1 + (1 - T)(D/E)]. \quad (13-2a)$$

Then, once $b_U$ is determined, the Hamada equation can be used to estimate how changes in the debt/equity ratio would affect the leveraged beta, $b_i$, and thus the cost of equity, $k_s$.

We can illustrate the procedure with Bigbee Electronics. First, we assume that the risk-free rate of return, $k_{RF}$, is 6 percent, and that the required return on an average stock, $k_M$, is 10 percent. Next, we need the unlevered beta, $b_U$. Because Bigbee has no debt, its $D/E = 0$. Therefore, its current beta of 1.5 is also its unlevered beta; hence $b_U = 1.5$. Now, with $b_U$, $k_{RF}$, and $k_M$ specified, we can use the CAPM to estimate how much Bigbee’s market beta would rise if it began to use financial leverage, hence what its cost of equity would be at different capital structures. These beta estimates are shown in Column 5 of Table 13-3.

Currently, based on Plan B and no debt, Bigbee has a beta of $b = 1.5$. Further, the risk-free rate is $k_{RF} = 6\%$ and the market risk premium is $k_M - k_{RF} = 10\% - 6\% = 4\%$. Therefore, Bigbee’s current cost of equity is 12 percent as shown in Column 6:

$$k_s = k_{RF} + \text{Risk premium}$$

$$= 6\% + (4\%)(1.5)$$

$$= 6\% + 6\% = 12\%.$$  

The first 6 percent is the risk-free rate, the second the risk premium. Because Bigbee currently uses no debt, it has no financial risk. Therefore, the 6 percent risk premium reflects only its business risk.

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\(^7\) Recall from Chapter 3 that the debt/equity ratio, $D/E$, is directly related to the $D/A$ ratio:

$$\frac{D}{E} = \frac{D/A}{1 - D/A}$$

For example, if the firm has $40 of debt and $60 of equity, then $D/A = 0.4$, $E/A = 0.6$, and

$$\frac{D}{E} = \frac{0.4}{1 - 0.4} = 0.4/0.6 = 0.6667.$$  

Thus, any $D/A$ ratio can be directly translated into a $D/E$ ratio. Note also that Hamada’s equation assumes that assets are reported at market values rather than accounting book values. This point is discussed at length in Brigham and Daves, *Intermediate Financial Management*, 7th edition, where the feedbacks among capital structure, stock prices, and capital costs are developed.
If Bigbee changes its capital structure by adding debt, this would increase the risk stockholders bear. That, in turn, would result in an additional risk premium. Conceptually, this situation would exist:

$$k_s = k_{RF} + \text{Premium for business risk} + \text{Premium for financial risk}.$$ 

Figure 13-7 (using data calculated in Column 6 of Table 13-3) graphs Bigbee’s required return on equity at different debt ratios. As the figure shows, $k_s$ consists of the 6 percent risk-free rate, a constant 6 percent premium for business risk, and a premium for financial risk that starts at zero but rises at an increasing rate as the debt ratio increases.
Column 9 of Table 13-3 shows Bigbee’s weighted average cost of capital, WACC, at different capital structures. Currently, it has no debt, so its capital structure is 100 percent equity, and at this point \( WACC = k_e = 12\% \). As Bigbee begins to use lower-cost debt, the WACC declines. However, as the debt ratio increases, the costs of both debt and equity rise, at first slowly but then at a faster and faster rate. Eventually, the increasing costs of the two components offset the fact that more low-cost debt is being used. At 40 percent debt, the WACC hits a minimum of 11.04 percent, and after that it rises with further increases in the debt ratio.

Note too that even though the component cost of equity is generally higher than that of debt, using only lower-cost debt would not maximize value because of the feedback effects of debt on the costs of debt and equity. If Bigbee were to issue more than 40 percent debt, it would then be relying more on the cheaper source of capital, but this lower cost would be more than offset by the fact that using more debt would raise the costs of both debt and equity. These thoughts were echoed in a recent Annual Report of the Georgia-Pacific Corporation:

> On a market-value basis, our debt-to-capital ratio was 47 percent. By employing this capital structure, we believe that our weighted average cost of capital is nearly optimized—at approximately 10 percent. Although reducing debt significantly would somewhat reduce the marginal cost of debt, significant debt reduction would likely increase our weighted average cost of capital by raising the proportion of higher-cost equity.

Finally, recall that the capital structure that minimizes the WACC is also the capital structure that maximizes the firm’s stock price. In principle, we could use the stock valuation techniques described in Chapter 9 to predict how changes in capital structure would affect the stock price. This exercise is difficult, especially for firms that do not pay a dividend or whose cash flows are not constant over time. However, Bigbee pays out all of its earnings as dividends, so it plows none of its earnings back into the business and its growth in earnings and dividends per share are zero. Thus, in Bigbee’s case we can use the zero growth stock price model developed in Chapter 9 to estimate the stock price at each different capital structure. These estimates are shown in Column 7 of Table 13-3. Here we see that the expected stock price first rises with financial leverage, hits a peak of $22.22 at a debt ratio of 40 percent, and then begins to decline. Thus, Bigbee’s optimal capital structure occurs at a debt ratio of 40 percent, and that debt ratio both maximizes its stock price and minimizes its WACC.

The EPS, cost of capital, and stock price data shown in Table 13-3 are plotted in Figure 13-8. As the graph shows, the debt/assets ratio that maximizes Bigbee’s expected EPS is 50 percent. However, the expected stock price is maximized, and the cost of capital is minimized, at a 40 percent debt ratio. Thus, Bigbee’s optimal capital structure calls for 40 percent debt and 60 percent equity. Management should set its target capital structure at these ratios, and if the existing ratios are off target, it should move toward the target when new security offerings are made.
FIGURE 13-8 Effects of Capital Structure on EPS, Cost of Capital, and Stock Price

- **Expected EPS ($)**
  - Maximum EPS = $3.36

- **Cost of Capital (%)**
  - Cost of Equity, $k_e$
  - Weighted Average Cost of Capital, WACC
  - Min. = 11.04%

- **Stock Price ($)**
  - Maximum = $22.22
In the previous section, we showed how a firm might estimate its optimal capital structure. For a number of reasons, we would expect capital structures to vary considerably across industries. For example, pharmaceutical companies generally have very different capital structures than airline companies. Moreover, capital structures vary among firms within a given industry. What factors can explain these differences? In an attempt to answer this question, academics and practitioners developed a number of theories, and the theories have been subjected to empirical tests.

Modern capital structure theory began in 1958, when Professors Franco Modigliani and Merton Miller (hereafter MM) published what has been called the most influential finance article ever written. MM proved, under a very

YOGI BERRA ON THE M&M PROPOSITION

When a waitress asked Yogi Berra (Baseball Hall of Fame catcher for the New York Yankees) whether he wanted his pizza cut into four pieces or eight, Yogi replied: “Better make it four. I don’t think I can eat eight.”

Yogi’s quip helps convey the basic insight of Modigliani and Miller. The firm’s choice of leverage “slices” the distribution of future cash flows in a way that is like slicing a pizza. MM recognize that if you fix a company’s investment activities, it’s like fixing the size of the pizza; no information costs means that everyone sees the same pizza; no taxes means the IRS gets none of the pie; and no “contracting” costs means nothing sticks to the knife.

So, just as the substance of Yogi’s meal is unaffected by whether the pizza is sliced into four pieces or eight, the economic substance of the firm is unaffected by whether the liability side of the balance sheet is sliced to include more or less debt under the M&M assumptions.

Lee Green, Sportswit (New York: Fawcett Crest, 1984), 228.


What happens to the costs of debt and equity when the debt/assets ratio increases? Explain.

Using the Hamada equation, show the effect of financial leverage on beta.

Give the equation for calculating a firm’s unlevered beta.

Using a graph and illustrative data, identify the premiums for financial risk and business risk at different debt levels. Do these premiums vary depending on the debt level? Explain.

Is expected EPS maximized at the optimal capital structure?

CAPITAL STRUCTURE THEORY

In the previous section, we showed how a firm might estimate its optimal capital structure. For a number of reasons, we would expect capital structures to vary considerably across industries. For example, pharmaceutical companies generally have very different capital structures than airline companies. Moreover, capital structures vary among firms within a given industry. What factors can explain these differences? In an attempt to answer this question, academics and practitioners developed a number of theories, and the theories have been subjected to empirical tests.

Modern capital structure theory began in 1958, when Professors Franco Modigliani and Merton Miller (hereafter MM) published what has been called the most influential finance article ever written. MM proved, under a very

restrictive set of assumptions, that a firm’s value is unaffected by its capital structure. Put another way, MM's results suggest that it does not matter how a firm finances its operations, hence capital structure is irrelevant. However, MM’s study was based on some unrealistic assumptions, including the following:

1. There are no brokerage costs.
2. There are no taxes.
3. There are no bankruptcy costs.
4. Investors can borrow at the same rate as corporations.
5. All investors have the same information as management about the firm’s future investment opportunities.
6. EBIT is not affected by the use of debt.

Despite the fact that some of these assumptions are obviously unrealistic, MM’s irrelevance result is extremely important. By indicating the conditions under which capital structure is irrelevant, MM also provided us with clues about what is required for capital structure to be relevant and hence to affect a firm’s value. MM’s work marked the beginning of modern capital structure research, and subsequent research has focused on relaxing the MM assumptions in order to develop a more realistic theory of capital structure. Research in this area is quite extensive, but the highlights are summarized in the following sections.

**The Effect of Taxes**

MM published a follow-up paper in 1963 in which they relaxed the assumption that there are no corporate taxes. The Tax Code allows corporations to deduct interest payments as an expense, but dividend payments to stockholders are not deductible. This differential treatment encourages corporations to use debt in their capital structures. Indeed, MM demonstrated that if all their other assumptions hold, this differential treatment leads to a situation that calls for 100 percent debt financing.

However, this conclusion was modified several years later by Merton Miller (this time without Modigliani) when he brought in the effects of personal taxes. He noted that all of the income from bonds is generally interest, which is taxed as personal income at rates going up to 39.6 percent, while income from stocks generally comes partly from dividends and partly from capital gains. Further, long-term capital gains are taxed at a rate of 20 percent, and this tax is deferred until the stock is sold and the gain realized. If stock is held until the owner dies, no capital gains tax whatever must be paid. So, on balance, returns on common stocks are taxed at lower effective rates than returns on debt.

Because of the tax situation, Miller argued that investors are willing to accept relatively low before-tax returns on stock relative to the before-tax returns on bonds. (The situation here is similar to that with tax-exempt municipal

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bonds as discussed in Chapter 8 and preferred stocks held by corporate investors as discussed in Chapter 9.) For example, an investor might require a return of 10 percent on Bigbee's bonds, and if stock income were taxed at the same rate as bond income, the required rate of return on Bigbee's stock might be 16 percent because of the stock's greater risk. However, in view of the favorable treatment of income on the stock, investors might be willing to accept a before-tax return of only 14 percent on the stock.

Thus, as Miller pointed out, (1) the deductibility of interest favors the use of debt financing, but (2) the more favorable tax treatment of income from stocks lowers the required rate of return on stock and thus favors the use of equity financing. It is difficult to say what the net effect of these two factors is. Most observers believe that interest deductibility has the stronger effect, hence that our tax system still favors the corporate use of debt. However, that effect is certainly reduced by the lower long-term capital gains tax rate.

One can observe changes in corporate financing patterns following major changes in tax rates. For example, in 1993 the top personal tax rate on interest and dividends was raised sharply, but the capital gains tax rate was not increased. This could be expected to result in a greater reliance on equity financing, especially through retained earnings, and that has indeed been the case. The lowering of the long-term capital gains tax rate in 1997 has continued this trend.

**The Effect of Bankruptcy Costs**

MM's irrelevance results also depend on the assumption that there are no bankruptcy costs. However, in practice bankruptcy can be quite costly. Firms in bankruptcy have very high legal and accounting expenses, and they also have a hard time retaining customers, suppliers, and employees. Moreover, bankruptcy often forces a firm to liquidate or sell assets for less than they would be worth if the firm were to continue operating. For example, if a steel manufacturer goes out of business, it might be hard to find buyers for the company's blast furnaces, even though they were quite expensive. Assets such as plant and equipment are often illiquid because they are configured to a company's individual needs and also because they are difficult to disassemble and move.

Note, too, that the threat of bankruptcy, not just bankruptcy per se, brings about these problems. Key employees jump ship, suppliers refuse to grant credit, customers seek more stable suppliers, and lenders demand higher interest rates and impose more restrictive loan covenants if potential bankruptcy looms.

Bankruptcy-related problems are more likely to arise when a firm includes more debt in its capital structure. Therefore, bankruptcy costs discourage firms from pushing their use of debt to excessive levels.

Bankruptcy-related costs have two components: (1) the probability of their occurrence and (2) the costs they would produce given that financial distress has arisen. Firms whose earnings are more volatile, all else equal, face a greater chance of bankruptcy and, therefore, should use less debt than more stable firms. This is consistent with our earlier point that firms with high operating leverage, and thus greater business risk, should limit their use of financial leverage. Likewise, firms that would face high costs in the event of financial distress should rely less heavily on debt. For example, firms whose assets are illiquid and thus would have to be sold at “fire sale” prices should limit their use of debt financing.
TRADE-OFF THEORY

The preceding arguments led to the development of what is called “the trade-off theory of leverage,” in which firms trade off the benefits of debt financing (favorable corporate tax treatment) against the higher interest rates and bankruptcy costs. A summary of the trade-off theory is expressed graphically in Figure 13-9. Here are some observations about the figure:

1. The fact that interest is a deductible expense makes debt less expensive than common or preferred stock. In effect, the government pays part of the cost of debt capital, or, to put it another way, debt provides tax shelter benefits. As a result, using debt causes more of the firm’s operating income (EBIT) to flow through to investors. Therefore, the more debt a company uses, the higher its value and stock price. Under the assumptions of the Modigliani-Miller with-taxes paper, a firm’s stock price will be maximized if it uses virtually 100 percent debt, and the line labeled “MM Result Incorporating the Effects of Corporate Taxation” in Figure 13-9 expresses the relationship between stock prices and debt under their assumptions.

2. In the real world, firms rarely use 100 percent debt. The primary reason is that firms limit their use of debt to hold down bankruptcy-related costs.

3. There is some threshold level of debt, labeled D₁ in Figure 13-9, below which the probability of bankruptcy is so low as to be immaterial. Beyond
D₁, however, bankruptcy-related costs become increasingly important, and they reduce the tax benefits of debt at an increasing rate. In the range from D₁ to D₂, bankruptcy-related costs reduce but do not completely offset the tax benefits of debt, so the firm’s stock price rises (but at a decreasing rate) as its debt ratio increases. However, beyond D₂, bankruptcy-related costs exceed the tax benefits, so from this point on increasing the debt ratio lowers the value of the stock. Therefore, D₂ is the optimal capital structure. Of course, D₁ and D₂ vary from firm to firm, depending on their business risk and bankruptcy costs.

4. While theoretical and empirical work supports the general shape of the curves in Figures 13-8 and 13-9, these graphs must be taken as approximations, not as precisely defined functions. The numbers in Figure 13-8 are shown out to two decimal places, but that is merely for illustrative purposes—the numbers are not nearly that accurate in view of the fact that the data on which the graph is based are judgmental estimates.

5. Another disturbing aspect of capital structure theory as expressed in Figure 13-9 is the fact that many large, successful firms, such as Intel and Microsoft, use far less debt than the theory suggests. This point led to the development of signaling theory, which is discussed below.

**Signaling Theory**

MM assumed that investors have the same information about a firm’s prospects as its managers — this is called symmetric information. However, in fact managers often have better information than outside investors. This is called asymmetric information, and it has an important effect on the optimal capital structure. To see why, consider two situations, one in which the company’s managers know that its prospects are extremely favorable (Firm F) and one in which the managers know that the future looks unfavorable (Firm U).

Suppose, for example, that Firm F’s R&D labs have just discovered a non-patentable cure for the common cold. They want to keep the new product a secret as long as possible to delay competitors’ entry into the market. New plants must be built to make the new product, so capital must be raised. How should Firm F’s management raise the needed capital? If the firm sells stock, then, when profits from the new product start flowing in, the price of the stock would rise sharply, and the purchasers of the new stock would make a bonanza. The current stockholders (including the managers) would also do well, but not as well as they would have done if the company had not sold stock before the price increased, because then they would not have had to share the benefits of the new product with the new stockholders. Therefore, one would expect a firm with very favorable prospects to try to avoid selling stock and, rather, to raise any required new capital by other means, including using debt beyond the normal target capital structure.¹¹

Now let’s consider Firm U. Suppose its managers have information that new orders are off sharply because a competitor has installed new technology that has improved its products’ quality. Firm U must upgrade its own facilities, at a

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¹¹ It would be illegal for Firm F’s managers to personally purchase more shares on the basis of their inside knowledge of the new product. They could be sent to jail if they did.
high cost, just to maintain its current sales. As a result, its return on investment will fall (but not by as much as if it took no action, which would lead to a 100 percent loss through bankruptcy). How should Firm U raise the needed capital? Here the situation is just the reverse of that facing Firm F, which did not want to sell stock so as to avoid having to share the benefits of future developments. A firm with unfavorable prospects would want to sell stock, which would mean bringing in new investors to share the losses!12

The conclusion from all this is that firms with extremely bright prospects prefer not to finance through new stock offerings, whereas firms with poor prospects do like to finance with outside equity. How should you, as an investor, react to this conclusion? You ought to say, “If I see that a company plans to issue new stock, this should worry me because I know that management would not want to issue stock if future prospects looked good. However, management would want to issue stock if things looked bad. Therefore, I should lower my estimate of the firm’s value, other things held constant, if it plans to issue new stock.”

If you gave the above answer, your views are consistent with those of sophisticated portfolio managers of institutions such as Morgan Guaranty Trust, Prudential Insurance, and so forth. In a nutshell, the announcement of a stock offering is generally taken as a signal that the firm’s prospects as seen by its management are not bright. This, in turn, suggests that when a firm announces a new stock offering, more often than not, the price of its stock will decline. Empirical studies have shown that this situation does indeed exist.13

What are the implications of all this for capital structure decisions? Since issuing stock emits a negative signal and thus tends to depress the stock price, even if the company’s prospects are bright, a firm should, in normal times, maintain a reserve borrowing capacity that can be used in the event that some especially good investment opportunity comes along. This means that firms should, in normal times, use more equity and less debt than is suggested by the tax benefit/bankruptcy cost trade-off model expressed in Figure 13-9.

USING DEBT FINANCING TO CONSTRAIN MANAGERS

In Chapter 1 we stated that agency problems may arise if managers and shareholders have different objectives. Such conflicts are particularly likely when the firm’s managers have too much cash at their disposal. Managers often use such cash to finance their pet projects or for perquisites such as nicer offices, corporate jets, and sky boxes at sports arenas, all of which may do little to maximize stock prices.14 By contrast, managers with limited “free cash flow” are less able to make wasteful expenditures.

Firms can reduce excess cash flow in a variety of ways. One way is to funnel some of it back to shareholders through higher dividends or stock repurchases. Another alternative is to shift the capital structure toward more debt in the hope that higher debt service requirements will force managers to become

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12 Of course, Firm U would have to make certain disclosures when it offered new shares to the public, but it might be able to meet the legal requirements without fully disclosing management’s worst fears.


14 If you don’t believe corporate managers can waste money, read Bryan Burrough, Barbarians at the Gate (New York: Harper & Row, 1990), the story of the takeover of RJR-Nabisco.
more disciplined. If debt is not serviced as required, the firm will be forced into bankruptcy, in which case its managers would likely lose their jobs. Therefore, a manager is less likely to buy an expensive new corporate jet if the firm has large debt service requirements that could cost the manager his or her job.

A leveraged buyout (LBO) is one way to reduce excess cash flow. In an LBO debt is used to finance the purchase of a company’s shares, after which the firm “goes private.” Many leveraged buyouts, which were especially common during the late 1980s, were designed specifically to reduce corporate waste. As noted, high debt payments force managers to conserve cash by eliminating unnecessary expenditures.

Of course, increasing debt and reducing free cash flow has its downside: It increases the risk of bankruptcy. One professor has argued that adding debt to a firm’s capital structure is like putting a dagger into the steering wheel of a car.\textsuperscript{15} The dagger—which points toward your stomach—motivates you to drive more carefully, but you may get stabbed if someone runs into you, even if you are being careful. The analogy applies to corporations in the following sense: Higher debt forces managers to be more careful with shareholders’ money, but even well-run firms could face bankruptcy (get stabbed) if some event beyond their control such as a war, an earthquake, a strike, or a recession occurs. To complete the analogy, the capital structure decision comes down to deciding how big a dagger stockholders should use to keep managers in line.

If you find our discussion of capital structure theory imprecise and somewhat confusing, you are not alone. In truth, no one knows how to identify precisely a firm’s optimal capital structure, or how to measure the effects of capital structure on stock prices and the cost of capital. In practice, capital structure decisions must be made using a combination of judgment and numerical analysis. Still, an understanding of the theoretical issues presented here can help you make better judgments on capital structure issues.\textsuperscript{16}

\textbf{SELF-TEST QUESTIONS}

Why does M&M’s theory with taxes lead to 100 percent debt?

How would an increase in corporate taxes affect firms’ capital structure decisions? What about personal taxes?

Explain how “asymmetric information” and “signals” affect capital structure decisions.

What is meant by \textit{reserve borrowing capacity}, and why is it important to firms?

How can the use of debt serve to discipline managers?


\textsuperscript{16} One of the authors can report firsthand the usefulness of financial theory in the actual establishment of corporate capital structures. In recent years, he has served as a consultant to several of the regional telephone companies established as a result of the breakup of AT&T, as well as to several large electric utilities. On the basis of finance theory and computer models that simulated results under a range of conditions, the companies were able to specify “optimal capital structure ranges” with at least a reasonable degree of confidence. Without finance theory, setting a target capital structure would have amounted to little more than throwing darts.
In addition to the types of analysis discussed above, firms generally consider the following factors when making capital structure decisions:

1. **Sales stability.** A firm whose sales are relatively stable can safely take on more debt and incur higher fixed charges than a company with unstable sales. Utility companies, because of their stable demand, have historically been able to use more financial leverage than industrial firms.

2. **Asset structure.** Firms whose assets are suitable as security for loans tend to use debt rather heavily. General-purpose assets that can be used by many businesses make good collateral, whereas special-purpose assets do not. Thus, real estate companies are usually highly leveraged, whereas companies involved in technological research are not.

3. **Operating leverage.** Other things the same, a firm with less operating leverage is better able to employ financial leverage because it will have less business risk.

4. **Growth rate.** Other things the same, faster-growing firms must rely more heavily on external capital (see Chapter 4). Further, the flotation costs involved in selling common stock exceed those incurred when selling debt, which encourages rapidly growing firms to rely more heavily on debt. At the same time, however, these firms often face greater uncertainty, which tends to reduce their willingness to use debt.

5. **Profitability.** One often observes that firms with very high rates of return on investment use relatively little debt. Although there is no theoretical justification for this fact, one practical explanation is that very profitable firms such as Intel, Microsoft, and Coca-Cola simply do not need to do much debt financing. Their high rates of return enable them to do most of their financing with internally generated funds.

6. **Taxes.** Interest is a deductible expense, and deductions are most valuable to firms with high tax rates. Therefore, the higher a firm’s tax rate, the greater the advantage of debt.

7. **Control.** The effect of debt versus stock on a management’s control position can influence capital structure. If management currently has voting control (over 50 percent of the stock) but is not in a position to buy any more stock, it may choose debt for new financings. On the other hand, management may decide to use equity if the firm’s financial situation is so weak that the use of debt might subject it to serious risk of default, because if the firm goes into default, the managers will almost surely lose their jobs. However, if too little debt is used, management runs the risk of a takeover. Thus, control considerations could lead to the use of either debt or equity, because the type of capital that best protects management will vary from situation to situation. In any event, if management is at all insecure, it will consider the control situation.

8. **Management attitudes.** Since no one can prove that one capital structure will lead to higher stock prices than another, management can exercise its own judgment about the proper capital structure. Some manage-
ments tend to be more conservative than others, and thus use less debt than the average firm in their industry, whereas aggressive managements use more debt in the quest for higher profits.

9. **Lender and rating agency attitudes.** Regardless of managers’ own analyses of the proper leverage factors for their firms, lenders’ and rating agencies’ attitudes frequently influence financial structure decisions. In the majority of cases, the corporation discusses its capital structure with lenders and rating agencies and gives much weight to their advice. For example, one large utility was recently told by Moody’s and Standard & Poor’s that its bonds would be downgraded if it issued more bonds. This influenced its decision to finance its expansion with common equity.

10. **Market conditions.** Conditions in the stock and bond markets undergo both long- and short-run changes that can have an important bearing on a firm’s optimal capital structure. For example, during a recent credit crunch, the junk bond market dried up, and there was simply no market at a “reasonable” interest rate for any new long-term bonds rated below triple B. Therefore, low-rated companies in need of capital were forced to go to the stock market or to the short-term debt market, regardless of their target capital structures. When conditions eased, however, these companies sold bonds to get their capital structures back on target.

11. **The firm’s internal condition.** A firm’s own internal condition can also have a bearing on its target capital structure. For example, suppose a firm has just successfully completed an R&D program, and it forecasts higher earnings in the immediate future. However, the new earnings are not yet anticipated by investors, hence are not reflected in the stock price. This company would not want to issue stock—it would prefer to finance with debt until the higher earnings materialize and are reflected in the stock price. Then it could sell an issue of common stock, retire the debt, and return to its target capital structure. This point was discussed earlier in connection with asymmetric information and signaling.

12. **Financial flexibility.** An astute corporate treasurer made this statement to the authors:

> Our company can earn a lot more money from good capital budgeting and operating decisions than from good financing decisions. Indeed, we are not sure exactly how financing decisions affect our stock price, but we know for sure that having to turn down a promising venture because funds are not available will reduce our long-run profitability. For this reason, my primary goal as treasurer is to always be in a position to raise the capital needed to support operations.

> We also know that when times are good, we can raise capital with either stocks or bonds, but when times are bad, suppliers of capital are much more willing to make funds available if we give them a secured position, and this means debt. Further, when we sell a new issue of stock, this sends a negative “signal” to investors, so stock sales by a mature company such as ours are not desirable.

Putting all these thoughts together gives rise to the goal of maintaining financial flexibility, which, from an operational viewpoint, means maintaining adequate reserve borrowing capacity. Determining an “adequate” reserve borrowing capacity is judgmental, but it clearly depends on the factors discussed in the

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**CHECKLIST FOR CAPITAL STRUCTURE DECISIONS**

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VARIATIONS IN CAPITAL STRUCTURES

As might be expected, wide variations in the use of financial leverage occur both across industries and among the individual firms in each industry. Table 13-4 illustrates differences for selected industries; the ranking is in descending order of the ratio of common equity to total capital, as shown in Column 1.17

Pharmaceutical and computer companies do not use much debt (their ratios of common equity to total capital are high) because the uncertainties inherent in industries that are cyclical, oriented toward research, or subject to huge product liability suits render the heavy use of debt unwise. The airline and utility companies, on the other hand, use debt relatively heavily. The utilities have traditionally used large amounts of debt, particularly long-term debt, because their fixed assets make good security for mortgage bonds, and also because their relatively stable sales make it safe for them to carry more debt than would be true for firms with more business risk.

Particular attention should be given to the times-interest-earned (TIE) ratio because it gives an indication of how safe the debt is and how vulnerable the company is to financial distress. TIE ratios depend on three factors: (1) the percentage of debt, (2) the interest rate on the debt, and (3) the company’s profitability. Generally, the least leveraged industries, such as the pharmaceutical industry, have the highest coverage ratios, whereas the utility industry, which finances heavily with debt, has a low average coverage ratio.

Wide variations also exist among firms within given industries. For example, although the average ratio of common equity to total capital in 2000 for the pharmaceutical industry was 80 percent, Eli Lilly & Co. had a ratio of only 68.5 percent. Thus, factors unique to individual firms, including managerial attitudes, play an important role in setting target capital structures.

17 Information on capital structures and financial strength is available from a multitude of sources. We used the Dow Jones News Retrieval system to develop Table 13-4, but published sources include The Value Line Investment Survey, Robert Morris Association Annual Studies, and Dun & Bradstreet Key Business Ratios.
TAKING A LOOK AT GLOBAL CAPITAL STRUCTURES

To what extent does capital structure vary across different countries? The following table, which is taken from a recent study by Raghuram Rajan and Luigi Zingales, both of the University of Chicago, shows the median debt ratios of firms in the largest industrial countries.

Rajan and Zingales also show that there is considerable variation in capital structure among firms within each of the seven countries. However, they also show that capital structures for the firms in each country are generally determined by a similar set of factors: firm size, profitability, market-to-book ratio, and the ratio of fixed assets to total assets. All in all, the Rajan-Zingales study suggests that the points developed in this chapter apply to firms all around the world.


### Median Percentage of Debt to Total Assets in Different Countries

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>BOOK VALUE DEBT RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>32%</td>
</tr>
<tr>
<td>France</td>
<td>18</td>
</tr>
<tr>
<td>Germany</td>
<td>11</td>
</tr>
<tr>
<td>Italy</td>
<td>21</td>
</tr>
<tr>
<td>Japan</td>
<td>21</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>10</td>
</tr>
<tr>
<td>United States</td>
<td>25</td>
</tr>
</tbody>
</table>

### Capital Structure Percentages, 2000: Six Industries Ranked by Common Equity Ratios

<table>
<thead>
<tr>
<th>INDUSTRY</th>
<th>COMMON EQUITY RATIO</th>
<th>LONG-TERM DEBT RATIO</th>
<th>TIMES-INTEREST- EARNED RATIO</th>
<th>RETURN ON EQUITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmaceuticals</td>
<td>80.00%</td>
<td>20.00%</td>
<td>13.4×</td>
<td>34.8%</td>
</tr>
<tr>
<td>Computers</td>
<td>71.43</td>
<td>28.57</td>
<td>11.7</td>
<td>18.2</td>
</tr>
<tr>
<td>Steel</td>
<td>65.79</td>
<td>34.21</td>
<td>2.4</td>
<td>6.8</td>
</tr>
<tr>
<td>Aerospace</td>
<td>57.47</td>
<td>42.53</td>
<td>4.2</td>
<td>11.6</td>
</tr>
<tr>
<td>Utilities</td>
<td>41.91</td>
<td>58.09</td>
<td>2.8</td>
<td>10.5</td>
</tr>
<tr>
<td>Airlines</td>
<td>40.82</td>
<td>59.18</td>
<td>3.7</td>
<td>10.5</td>
</tr>
</tbody>
</table>

NOTES:

*Capital structure ratios are calculated as a percentage of total capital, where total capital is defined as long-term debt plus equity, with both measured at book value.

*These ratios are based on accounting (or book) values. Stated on a market-value basis, the equity percentages would rise because most stocks sell at prices that are much higher than their book values.

In Chapter 10, we took the firm’s financing choice as given and then calculated the cost of capital based on that capital structure. Then, in Chapters 11 and 12, we described capital budgeting techniques, which use the firm’s cost of capital as input. Capital budgeting decisions determine the types of projects that the firm accepts, which affect the nature of the firm’s assets and its business risk. In this chapter we reverse the process, taking the firm’s assets and business risk as given and then seeking to determine the best way to finance those assets. More specifically, in this chapter we examined the effects of financial leverage on stock prices, earnings per share, and the cost of capital. The key concepts covered are listed below.

- A firm’s **optimal capital structure** is that mix of debt and equity that maximizes the stock price. At any point in time, management has a specific **target capital structure** in mind, presumably the optimal one, although this target may change over time.

- Several factors influence a firm’s capital structure. These include the firm’s (1) **business risk**, (2) **tax position**, (3) need for **financial flexibility**, and (4) **managerial conservatism or aggressiveness**.

- **Business risk** is the riskiness inherent in the firm’s operations if it uses no debt. A firm will have little business risk if the demand for its products is stable, if the prices of its inputs and products remain relatively constant, if it can adjust its prices freely if costs increase, and if a high percentage of its costs are variable and hence will decrease if sales decrease. Other things the same, the lower a firm’s business risk, the higher its optimal debt ratio.

- **Financial leverage** is the extent to which fixed-income securities (debt and preferred stock) are used in a firm’s capital structure. **Financial risk** is the added risk borne by stockholders as a result of financial leverage.

- **Operating leverage** is the extent to which fixed costs are used in a firm’s operations. In business terminology, a high degree of operating leverage, other factors held constant, implies that a relatively small change in sales results in a large change in ROE.

- Robert Hamada used the underlying assumptions of the CAPM, along with the Modigliani and Miller model, to develop the **Hamada equation**, which shows the effect of financial leverage on beta as follows:

\[
b = b_U [1 + (1 - T)(D/E)].
\]
Firms can take their current beta, tax rate, and debt/equity ratio to arrive at their **unlevered beta**, $b_U$, as follows:

$$b_U = b/[1 + (1 - T)(D/E)].$$

- **Modigliani and Miller** and their followers developed a trade-off theory of capital structure. They showed that debt is useful because interest is **tax deductible**, but also that debt brings with it costs associated with actual or potential bankruptcy. Under MM's theory, the optimal capital structure strikes a balance between the tax benefits of debt and the costs associated with bankruptcy.

- An alternative (or, really, complementary) theory of capital structure relates to the **signals** given to investors by a firm's decision to use debt versus stock to raise new capital. A stock issue sets off a negative signal, while using debt is a positive, or at least a neutral, signal. As a result, companies try to avoid having to issue stock by maintaining a **reserve borrowing capacity**, and this means using less debt in “normal” times than the MM trade-off theory would suggest.

- A firm's owners may have it use a relatively large amount of debt to constrain the managers. **A high debt ratio raises the threat of bankruptcy**, which carries a cost but which also forces managers to be more careful and less wasteful with shareholders’ money. Many of the corporate takeovers and leveraged buyouts in recent years were designed to improve efficiency by reducing the free cash flow available to managers.

Although it is theoretically possible to determine a firm's optimal capital structure, as a practical matter we cannot estimate it with precision. Accordingly, financial executives generally treat the optimal capital structure as a range — for example, 40 to 50 percent debt — rather than as a precise point, such as 45 percent. The concepts discussed in this chapter help managers understand the factors they should consider when they set the target capital structure ranges for their firms.

**QUESTIONS**

13-1 Explain why the following statement is true: “Other things the same, firms with relatively stable sales are able to carry relatively high debt ratios.”

13-2 Why do public utilities pursue a different financial policy than retail firms?

13-3 Why is EBIT generally considered to be independent of financial leverage? Why might EBIT actually be influenced by financial leverage at high debt levels?

13-4 If a firm went from zero debt to successively higher levels of debt, why would you expect its stock price to first rise, then hit a peak, and then begin to decline?

13-5 Why is the debt level that maximizes a firm's expected EPS generally higher than the one that maximizes its stock price?

13-6 When the Bell System was originally broken up, the old AT&T was split into a new AT&T plus seven regional telephone companies. The specific reason for forcing the breakup was to increase the degree of competition in the telephone industry. AT&T had a monopoly on local service, long distance, and the manufacture of all the equipment used by telephone companies, and the breakup was expected to open most of these markets to competition. In the court order that set the terms of the breakup, the capital structures of the surviving companies were specified, and much attention was given to the increased competition telephone companies could expect in the future. Do you think...
the optimal capital structure after the breakup should be the same as the pre-breakup optimal capital structure? Explain your position.

13-7 Assume that you are advising the management of a firm that is about to double its assets to serve its rapidly growing market. It must choose between a highly automated production process and a less automated one, and it must also choose a capital structure for financing the expansion. Should the asset investment and financing decisions be jointly determined, or should each decision be made separately? How would these decisions affect one another? How could the leverage concept be used to help management analyze the situation?

13-8 Your firm’s R&D department has been working on a new process that, if it works, can produce oil from coal at a cost of about $5 per barrel versus a current market price of $30 per barrel. The company needs $10 million of external funds at this time to complete the research. The results of the research will be known in about a year, and there is about a 50-50 chance of success. If the research is successful, your company will need to raise a substantial amount of new money to put the idea into production. Your economists forecast that although the economy will be depressed next year, interest rates will be high because of international monetary problems. You must recommend how the currently needed $10 million should be raised — as debt or as equity. How would the potential impact of your project influence your decision?

13-9 Explain how profits or losses will be magnified for a firm with high operating leverage as opposed to a firm with lower operating leverage.

13-10 What data are necessary to construct a breakeven analysis?

13-11 What would be the effect of each of the following on a firm’s breakeven point?
   a. An increase in the sales price with no change in unit costs.
   b. A change from straight-line depreciation to the MACRS method with no change in the beginning amount of fixed assets.
   c. A reduction in variable labor costs; other things are held constant.

13-12 If Congress considers a change in the Tax Code that will increase personal tax rates but reduce corporate tax rates, what effect would this Tax Code change have on the average company’s capital structure decision?

13-13 Which of the following are likely to encourage a firm to increase the amount of debt in its capital structure?
   a. The corporate tax rate increases.
   b. The personal tax rate increases.
   c. The firm’s assets become less liquid.
   d. Changes in the bankruptcy code make bankruptcy less costly.
   e. The firm’s earnings become more volatile.

SELF-TEST PROBLEMS (SOLUTIONS APPEAR IN APPENDIX B)

ST-1 Define each of the following terms:
   a. Target capital structure
   b. Business risk; financial risk
   c. Financial leverage; operating leverage; operating breakeven
   d. Hamada equation; unlevered beta; signal
   e. Symmetric information; asymmetric information
   f. Trade-off theory; signaling theory
   g. Reserve borrowing capacity

ST-2 Gentry Motors Inc., a producer of turbine generators, is in this situation: EBIT = $4 million; tax rate = T = 35%; debt outstanding = D = $2 million; k_d = 10%; k_s = 15%; shares of stock outstanding = N_s = 600,000; and book value per share = $10. Since Gentry’s product market is stable and the company expects no growth, all earnings are paid out as dividends. The debt consists of perpetual bonds.
   a. What are Gentry’s earnings per share (EPS) and its price per share (P_0)?
   b. What is Gentry’s weighted average cost of capital (WACC)?
   c. Gentry can increase its debt by $8 million, to a total of $10 million, using the new debt to buy back and retire some of its shares at the current price. Its interest rate on debt will be 12 percent (it will have to call and refund the old debt), and its cost of equity will rise from 15 percent to 17 percent. EBIT will remain constant. Should Gentry change its capital structure?
d. If Gentry did not have to refund the $2 million of old debt, how would this affect things? Assume that the new and the still outstanding debt are equally risky, with \( k_d = 12\% \), but that the coupon rate on the old debt is 10 percent.
e. What is Gentry’s TIE coverage ratio under the original situation and under the conditions in Part c of this question?

Olinde Electronics Inc. produces stereo components that sell for \( P = $100 \). Olinde’s fixed costs are $200,000; 5,000 components are produced and sold each year; EBIT is currently $50,000; and Olinde’s assets (all equity financed) are $500,000. Olinde estimates that it can change its production process, adding $400,000 to investment and $50,000 to fixed operating costs. This change will (1) reduce variable costs per unit by $10 and (2) increase output by 2,000 units, but (3) the sales price on all units will have to be lowered to $95 to permit sales of the additional output. Olinde has tax loss carry-forwards that cause its tax rate to be zero. Olinde uses no debt, and its average cost of capital is 10 percent.
a. Should Olinde make the change?
b. Would Olinde’s breakeven point increase or decrease if it made the change?
c. Suppose Olinde were unable to raise additional equity financing and had to borrow the $400,000 to make the investment at an interest rate of 10 percent. Use the Du Pont equation to find the expected ROA of the investment. Should Olinde make the change if debt financing must be used?

**STARTER PROBLEMS**

**13-1**

A company estimates that its fixed operating costs are $500,000, and its variable costs are $3.00 per unit sold. Each unit produced sells for $4.00. What is the company's breakeven point? In other words, how many units must it sell before its operating income becomes positive?

**13-2**

Jackson Trucking Company is trying to determine its optimal capital structure. The company’s CFO believes the optimal debt ratio is somewhere between 20 percent and 50 percent. Her staff has compiled the following projections for the company’s EPS and stock price for various debt levels:

<table>
<thead>
<tr>
<th>DEBT RATIO</th>
<th>PROJECTED EPS</th>
<th>PROJECTED STOCK PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>$3.20</td>
<td>$35.00</td>
</tr>
<tr>
<td>30%</td>
<td>3.45</td>
<td>36.50</td>
</tr>
<tr>
<td>40%</td>
<td>3.75</td>
<td>36.25</td>
</tr>
<tr>
<td>50%</td>
<td>3.50</td>
<td>35.50</td>
</tr>
</tbody>
</table>

Assuming that the firm uses only debt and common equity, what is Jackson’s optimal capital structure? At what debt ratio is the company’s WACC minimized?

**13-3**

Harley Motors has $10 million in assets, which is financed with $2 million of debt and $8 million in equity. If Harley’s beta is currently 1.2 and its tax rate is 40 percent, what is its unlevered beta, \( b_U \)?

**EXAM-TYPE PROBLEMS**

The problems included in this section are set up in such a way that they could be used as multiple-choice exam problems.

**13-4**

The Shipley Corporation produces tea kettles, which it sells for $15 each. Fixed costs are $700,000 for up to 400,000 units of output. Variable costs are $10 per kettle.

a. What is the firm’s gain or loss at sales of 125,000 units? Of 175,000 units?
b. What is the breakeven point? Illustrate by means of a chart.

**13-5**

The Weaver Watch Company manufactures ladies’ watches that are sold through discount houses. Each watch is sold for $25; the fixed costs are $140,000 for 30,000 watches or less; variable costs are $15 per watch.

a. What is the firm’s gain or loss at sales of 8,000 watches? Of 18,000 watches?
b. What is the breakeven point? Illustrate by means of a chart.
c. What happens to the breakeven point if the selling price rises to $31? What is the significance of the change to the financial manager?
d. What happens to the breakeven point if the selling price rises to $31 but variable costs rise to $23 a unit?

Breakeven analysis

The following relationships exist for Shome Industries, a manufacturer of electronic components. Each unit of output is sold for $45; the fixed costs are $175,000; variable costs are $20 per unit.

a. What is the firm’s gain or loss at sales of 5,000 units? Of 12,000 units?
b. What is the breakeven point?

Financial leverage effects

A company currently has assets of $5 million. The firm is 100 percent equity financed. The company currently has net income of $1 million, and it pays out 40 percent of its net income as dividends. Both net income and dividends are expected to grow at a constant rate of 5 percent per year. There are 200,000 shares of stock outstanding, and it is estimated that the current cost of capital is 13.40 percent.

The company is considering a recapitalization where it will issue $1 million in debt and use the proceeds to repurchase stock. Investment bankers have estimated that if the company goes through with the recapitalization, its before-tax cost of debt will be 11 percent, and the cost of equity will rise to 14.5 percent. The company has a 40 percent federal-plus-state tax rate.

a. What is the current share price of the stock (before the recapitalization)?
b. Assuming that the company maintains the same payout ratio, what will be its stock price following the recapitalization?

Financial leverage effects

The firms HL and LL are identical except for their leverage ratios and interest rates on debt. Each has $20 million in assets, earned $4 million before interest and taxes in 2001, and has a 40 percent federal-plus-state tax rate. Firm HL, however, has a leverage ratio (D/TA) of 50 percent and pays 12 percent interest on its debt, whereas LL has a 30 percent leverage ratio and pays only 10 percent interest on debt.

a. Calculate the rate of return on equity (net income/equity) for each firm.
b. Observing that HL has a higher return on equity, LL’s treasurer decides to raise the leverage ratio from 30 to 60 percent, which will increase LL’s interest rate on all debt to 15 percent. Calculate the new rate of return on equity for LL.

Financial leverage effects

The Neal Company wishes to calculate next year’s return on equity under different leverage ratios. Neal’s total assets are $14 million, and its federal-plus-state tax rate is 40 percent. The company is able to estimate next year’s earnings before interest and taxes for three possible states of the world: $4.2 million with a 0.2 probability, $2.8 million with a 0.5 probability, and $700,000 with a 0.3 probability. Calculate Neal’s expected return on equity, standard deviation, and coefficient of variation for each of the following leverage ratios, and evaluate the results:

<table>
<thead>
<tr>
<th>LEVERAGE (DEBT/TOTAL ASSETS)</th>
<th>INTEREST RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>—</td>
</tr>
<tr>
<td>10</td>
<td>9%</td>
</tr>
<tr>
<td>50</td>
<td>11</td>
</tr>
<tr>
<td>60</td>
<td>14</td>
</tr>
</tbody>
</table>

Cyclone Software Co. is trying to estimate its optimal capital structure. Cyclone’s current capital structure consists of 25 percent debt and 75 percent equity; however, management believes the firm should use more debt. The risk-free rate, \( k_{RF} \), is 5 percent, the market risk premium, \( k_M - k_{RF} \), is 6 percent, and the firm’s tax rate is 40 percent. Currently, Cyclone’s cost of equity is 14 percent, which is determined on the basis of the CAPM. What would be Cyclone’s estimated cost of equity if it were to change its capital structure from its present capital structure to 50 percent debt and 50 percent equity?

Hamada equation

PROBLEMS

a. Given the following information, calculate the expected value for Firm C’s EPS. \( E(EPS_A) = 5.10 \), and \( \sigma_A = 3.61 \); \( E(EPS_B) = 4.20 \), and \( \sigma_B = 2.96 \); and \( \sigma_C = 4.11 \).
b. Discuss the relative riskiness of the three firms’ (A, B, and C) earnings.

Wingler Communications Corporation (WCC) supplies headphones to airlines for use with movie and stereo programs. The headphones, which use the latest in electronic components, sell for $28.80 per set, and this year's sales are expected to be 450,000 units. Variable production costs for the expected sales under present production methods are estimated at $10,200,000, and fixed production (operating) costs at present are $1,560,000. WCC has $4,800,000 of debt outstanding at an interest rate of 8 percent. There are 240,000 shares of common stock outstanding, and there is no preferred stock. The dividend payout ratio is 70 percent, and WCC is in the 40 percent federal-plus-state tax bracket.

The company is considering investing $7,200,000 in new equipment. Sales would not increase, but variable costs per unit would decline by 20 percent. Also, fixed operating costs would increase from $1,560,000 to $1,800,000. WCC could raise the required capital by borrowing $7,200,000 at 10 percent or by selling 240,000 additional shares at $30 per share.

a. What would be WCC's EPS (1) under the old production process, (2) under the new process if it uses debt, and (3) under the new process if it uses common stock?

b. At what unit sales level would WCC have the same EPS, assuming it undertakes the investment and finances it with debt or with stock? (Hint: \( V = \text{variable cost per unit} = 8,160,000/450,000 \), and 
\[
\text{EPS} = \frac{(PQ - VQ - F)(1 - T)}{N}. \]
Set \( \text{EPS}_{\text{Stock}} = \text{EPS}_{\text{Debt}} \) and solve for \( Q \).

c. At what unit sales level would \( \text{EPS} = 0 \) under the three production/financing setups — that is, under the old plan, the new plan with debt financing, and the new plan with stock financing? (Hint: Note that \( V_{\text{Old}} = 10,200,000/450,000 \), and use the hints for part b, setting the EPS equation equal to zero.)

d. On the basis of the analysis in parts a through c, and given that operating leverage is lower under the new setup, which plan is the riskiest, which has the highest expected EPS, and which would you recommend? Assume here that there is a fairly high probability of sales falling as low as 250,000 units, and determine \( \text{EPS}_{\text{Debt}} \) and \( \text{EPS}_{\text{Stock}} \) at that sales level to help assess the riskiness of the two financing plans.

The Severn Company plans to raise a net amount of $270 million to finance new equipment and working capital in early 2002. Two alternatives are being considered: Common stock may be sold to net $60 per share, or bonds yielding 12 percent may be issued.

The balance sheet and income statement of the Severn Company prior to financing are as follows:

### The Severn Company: Balance Sheet as of December 31, 2001
(Millions of Dollars)

<table>
<thead>
<tr>
<th>Current assets</th>
<th>$ 900.00</th>
<th>Accounts payable</th>
<th>$ 172.50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net fixed assets</td>
<td>450.00</td>
<td>Notes payable to bank</td>
<td>255.00</td>
</tr>
<tr>
<td>Other current liabilities</td>
<td></td>
<td>225.00</td>
<td></td>
</tr>
<tr>
<td>Total current liabilities</td>
<td>$ 652.50</td>
<td>Long-term debt (10%)</td>
<td>300.00</td>
</tr>
<tr>
<td>Common stock, $3 par</td>
<td>60.00</td>
<td>Retained earnings</td>
<td>337.50</td>
</tr>
<tr>
<td>Total assets</td>
<td>$1,350.00</td>
<td>Total liabilities and equity</td>
<td>$1,350.00</td>
</tr>
</tbody>
</table>
The Severn Company: Income Statement for Year Ended December 31, 2001
(Millions of Dollars)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$2,475.00</td>
</tr>
<tr>
<td>Operating costs</td>
<td>2,227.50</td>
</tr>
<tr>
<td>Earnings before interest and taxes (10%)</td>
<td>$247.50</td>
</tr>
<tr>
<td>Interest on short-term debt</td>
<td>15.00</td>
</tr>
<tr>
<td>Interest on long-term debt</td>
<td>30.00</td>
</tr>
<tr>
<td>Earnings before taxes</td>
<td>$202.50</td>
</tr>
<tr>
<td>Federal-plus-state taxes (40%)</td>
<td>81.00</td>
</tr>
<tr>
<td>Net income</td>
<td>$121.50</td>
</tr>
</tbody>
</table>

The probability distribution for annual sales is as follows:

<table>
<thead>
<tr>
<th>PROBABILITY</th>
<th>ANNUAL SALES (MILLIONS OF DOLLARS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.30</td>
<td>$2,250</td>
</tr>
<tr>
<td>0.40</td>
<td>2,700</td>
</tr>
<tr>
<td>0.30</td>
<td>3,150</td>
</tr>
</tbody>
</table>

Assuming that EBIT is equal to 10 percent of sales, calculate earnings per share under both the debt financing and the stock financing alternatives at each possible level of sales. Then calculate expected earnings per share and \( \sigma_{\text{EPS}} \) under both debt and stock financing alternatives. Also, calculate the debt ratio and the times-interest-earned (TIE) ratio at the expected sales level under each alternative. The old debt will remain outstanding. Which financing method do you recommend?

13-14

a. Given the graphs shown at the top of the next page, calculate the total fixed costs, variable costs per unit, and sales price for Firm A. Firm B’s fixed costs are $120,000, its variable costs per unit are $4, and its sales price is $8 per unit.

b. Which firm has the higher operating leverage at any given level of sales? Explain.

c. At what sales level, in units, do both firms earn the same operating profit?

13-15

Elliott Athletics is trying to determine its optimal capital structure, which now consists of only debt and common equity. The firm does not currently use preferred stock in its capital structure, and it does not plan to do so in the future. To estimate how much its debt would cost at different debt levels, the company’s treasury staff has consulted with investment bankers and, on the basis of those discussions, has created the following table:

<table>
<thead>
<tr>
<th>DEBT-TO-ASSETS RATIO ((w_d))</th>
<th>EQUITY-TO-ASSETS RATIO ((w_e))</th>
<th>DEBT-TO-EQUITY RATIO ((D/E))</th>
<th>BOND RATING</th>
<th>BEFORE-TAX COST OF DEBT ((k_d))</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>1.0</td>
<td>0.00</td>
<td>A</td>
<td>7.0%</td>
</tr>
<tr>
<td>0.2</td>
<td>0.8</td>
<td>0.25</td>
<td>BBB</td>
<td>8.0</td>
</tr>
<tr>
<td>0.4</td>
<td>0.6</td>
<td>0.67</td>
<td>BB</td>
<td>10.0</td>
</tr>
<tr>
<td>0.6</td>
<td>0.4</td>
<td>1.50</td>
<td>C</td>
<td>12.0</td>
</tr>
<tr>
<td>0.8</td>
<td>0.2</td>
<td>4.00</td>
<td>D</td>
<td>15.0</td>
</tr>
</tbody>
</table>

Elliott uses the CAPM to estimate its cost of common equity, \(k_e\). The company estimates that the risk-free rate is 5 percent, the market risk premium is 6 percent, and its tax rate is 40 percent. Elliott estimates that if it had no debt, its “unlevered” beta, \(b_U\), would be 1.2. On the basis of this information, what is the firm’s optimal capital structure, and what would the weighted average cost of capital be at the optimal capital structure?
Rework Problem 13-15 using a spreadsheet model. After completing the problem as it appears, answer the following related questions.

a. Plot a graph of the after-tax cost of debt, the cost of equity, and the WACC versus (1) the debt/assets ratio and (2) the debt/equity ratio.

b. Would the optimal capital structure change if the unlevered beta changed? To answer this question, do a sensitivity analysis of WACC on $b_U$ for different levels of $b_U$.

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The information related to this cyberproblem is likely to change over time, due to the release of new information and the ever-changing nature of the World Wide Web. Accordingly, we will periodically update the problem on the textbook’s web site. To avoid problems, please check for updates before proceeding with the cyberproblems.

In Chapter 6, we introduced the concept of the Capital Asset Pricing Model (CAPM). The CAPM, as developed by Harry Markowitz and William Sharpe, contends that all stocks have an element of market risk. This market risk is materialized in the form of beta. We arrive at an asset’s beta by running a linear regression of an asset’s returns against market returns. However, we have never really addressed the matter of what drives beta.
In 1969, Robert Hamada published his paper, “Portfolio Analysis, Market Equilibrium, and Corporation Finance,” wherein he combined the traditional CAPM and the Modigliani and Miller capital structure theory to create what is now called the “Hamada equation.” The Hamada equation seeks to illustrate how increasing financial leverage increases a firm’s risk and, by extension, the firm's beta.

In this cyberproblem, we use the Hamada equation to determine how useful it is when used in practice. Recall from the chapter that the Hamada equation is:

\[ b = b_U [1 + (1 - T)(D/E)]. \]

For this cyberproblem, you will need to access Quicken’s web site at http://www.quicken.com.

a. Access Quicken’s web site, and request a stock quote for Pfizer, Inc., whose stock symbol is PFE. When the quote appears, scroll down the page and look for “Fundamentals” on the left side of your screen. Click on that. Now, a large screen of data appears. First, record the 60-month beta for Pfizer. You should find the beta in the first section of the “Fundamentals” page, called “Price and Valuation.” Next, scroll further down the “Fundamentals” page until you find the “Financial Strength” section. In this section, we see two kinds of debt-to-equity ratios: total debt to equity and long-term debt to equity. Because we are concerned with the long-term capital structure effects on beta, we will use the long-term debt-to-equity ratio. So, be sure to write that down, too.

b. From the “Fundamentals” page, request reports on the following companies: Merck & Co. (MRK), Heinz, HJ Co. (HNZ), Nabisco Holdings Company (NA), Southwest Airlines (LUV), American Airlines (AMR), Dow Chemical Co. (DOW), and DuPont (DD). Be sure to record the same information (the 60-month beta and the long-term debt-to-equity ratio) for these companies as we did for Pfizer, Inc. Note, at this point we have two companies each from the chemical, drug, food, and airline industries.

c. These data illustrate that those firms in different industries and even firms within the same industry have relatively different capital structures. Using the Hamada equation and data gathered in parts a and b, unlever the betas of these eight companies. For simplicity, assume the corporate tax rate is 40 percent for all of these companies.
**CAMPUS DELI INC.**

13-18  **Optimal capital structure**  Assume that you have just been hired as business manager of Campus Deli (CD), which is located adjacent to the campus. Sales were $1,100,000 last year; variable costs were 60 percent of sales; and fixed costs were $40,000. Therefore, EBIT totaled $400,000. Because the university’s enrollment is capped, EBIT is expected to be constant over time. Since no expansion capital is required, CD pays out all earnings as dividends. Assets are $2 million, and 80,000 shares are outstanding. The management group owns about 50 percent of the stock, which is traded in the over-the-counter market.

CD currently has no debt—it is an all-equity firm—and its 80,000 shares outstanding sell at a price of $25 per share, which is also the book value. The firm’s federal-plus-state tax rate is 40 percent. On the basis of statements made in your finance text, you believe that CD’s shareholders would be better off if some debt financing were used. When you suggested this to your new boss, she encouraged you to pursue the idea, but to provide support for the suggestion.

In today’s market, the risk-free rate, $k_{RF}$, is 6 percent and the market risk premium, $k_m - k_{RF}$, is 6 percent. CD’s unlevered beta, $b_u$, is 1.0. Since CD currently has no debt, its cost of equity (and WACC) is 12 percent.

If the firm were recapitalized, debt would be issued, and the borrowed funds would be used to repurchase stock. Stockholders, in turn, would use funds provided by the repurchase to buy equities in other fast-food companies similar to CD. You plan to complete your report by asking and then answering the following questions.

a. (1) What is business risk? What factors influence a firm’s business risk?

   (2) What is operating leverage, and how does it affect a firm’s business risk?

b. (1) What is meant by the terms “financial leverage” and “financial risk”?

   (2) How does financial risk differ from business risk?

c. Now, to develop an example that can be presented to CD’s management as an illustration, consider two hypothetical firms, Firm U, with zero debt financing, and Firm L, with $10,000 of 12 percent debt. Both firms have $20,000 in total assets and a 40 percent federal-plus-state tax rate, and they have the following EBIT probability distribution for next year:

<table>
<thead>
<tr>
<th>PROBABILITY</th>
<th>EBIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25</td>
<td>$2,000</td>
</tr>
<tr>
<td>0.50</td>
<td>3,000</td>
</tr>
<tr>
<td>0.25</td>
<td>4,000</td>
</tr>
</tbody>
</table>

(1) Complete the partial income statements and the firms’ ratios in Table IC13-1.

(2) Be prepared to discuss each entry in the table and to explain how this example illustrates the impact of financial leverage on expected rate of return and risk.

d. After speaking with a local investment banker, you obtain the following estimates of the cost of debt at different debt levels (in thousands of dollars):

| AMOUNT BORROWED | DEBT/ASSETS RATIO | DEBT/EQUITY RATIO | BOND RATING | $k_d$
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$0</td>
<td>0</td>
<td>0</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>250</td>
<td>0.125</td>
<td>0.1429</td>
<td>AA</td>
<td>8.0%</td>
</tr>
<tr>
<td>500</td>
<td>0.250</td>
<td>0.3333</td>
<td>A</td>
<td>9.0</td>
</tr>
<tr>
<td>750</td>
<td>0.375</td>
<td>0.6000</td>
<td>BBB</td>
<td>11.5</td>
</tr>
<tr>
<td>1,000</td>
<td>0.500</td>
<td>1.0000</td>
<td>BB</td>
<td>14.0</td>
</tr>
</tbody>
</table>

Now consider the optimal capital structure for CD.

(1) To begin, define the terms “optimal capital structure” and “target capital structure.”

e. Now repeat this process for a new set of companies. Unlever the betas for Union Carbide (UK, chemical industry), Johnson & Johnson (JNJ, drug), General Mills (GIS, food), and Delta Airlines (DAL, airline).

f. Compare these firms’ unlevered betas to their industry counterparts’ unlevered betas calculated in part c. Do they seem consistent with your previous results? What conclusions can you make about using the Hamada equation in practice?
(2) Why does CD’s bond rating and cost of debt depend on the amount of money borrowed?

(3) Assume that shares could be repurchased at the current market price of $25 per share. Calculate CD’s expected EPS and TIE at debt levels of $0, $250,000, $500,000, $750,000, and $1,000,000. How many shares would remain after recapitalization under each scenario?

(4) Using the Hamada equation, what is the cost of equity if CD recapitalizes with $250,000 of debt? $500,000? $750,000? $1,000,000?

(5) Considering only the levels of debt discussed, what is the capital structure that minimizes CD’s WACC?

(6) What would be the new stock price if CD recapitalizes with $250,000 of debt? $500,000? $750,000? $1,000,000? Recall that the payout ratio is 100 percent, so g = 0.

(7) Is EPS maximized at the debt level that maximizes share price? Why or why not?

(8) Considering only the levels of debt discussed, what is CD’s optimal capital structure?

(9) What is the WACC at the optimal capital structure?

e. Suppose you discovered that CD had more business risk than you originally estimated. Describe how this would affect the analysis. What if the firm had less business risk than originally estimated?

f. What are some factors a manager should consider when establishing his or her firm’s target capital structure?

g. Put labels on Figure IC13-1, and then discuss the graph as you might use it to explain to your boss why CD might want to use some debt.

h. How does the existence of asymmetric information and signaling affect capital structure?

**TABLE IC13-1**

<table>
<thead>
<tr>
<th>Income Statements and Ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FIRM U</strong></td>
</tr>
<tr>
<td>Assets</td>
</tr>
<tr>
<td>Equity</td>
</tr>
<tr>
<td>Probability</td>
</tr>
<tr>
<td>Sales</td>
</tr>
<tr>
<td>Operating costs</td>
</tr>
<tr>
<td>Earnings before interest and taxes</td>
</tr>
<tr>
<td>Interest (12%)</td>
</tr>
<tr>
<td>Earnings before taxes</td>
</tr>
<tr>
<td>Taxes (40%)</td>
</tr>
<tr>
<td>Net income</td>
</tr>
<tr>
<td>Basic earning power (BEP = EBIT/Assets)</td>
</tr>
<tr>
<td>ROE</td>
</tr>
<tr>
<td>TIE</td>
</tr>
<tr>
<td>Expected basic earning power</td>
</tr>
<tr>
<td>Expected ROE</td>
</tr>
<tr>
<td>Expected TIE</td>
</tr>
<tr>
<td>σBEP</td>
</tr>
<tr>
<td>σROE</td>
</tr>
<tr>
<td>σTIE</td>
</tr>
</tbody>
</table>
**Figure IC13-1** Relationship between Capital Structure and Stock Price

- **Value of Firm's Stock**
- **Leverage, D/A**
- **D1**
- **D2**