CHAPTER 12

LEVERAGE AND CAPITAL STRUCTURE

LEARNING GOALS

- **LG1** Discuss the role of breakeven analysis, the operating breakeven point, and the effect of changing costs on it.
- **LG2** Understand operating, financial, and total leverage and the relationships among them.
- **LG3** Describe the types of capital, external assessment of capital structure, the capital structure of non-U.S. firms, and capital structure theory.
- **LG4** Explain the optimal capital structure using a graphical view of the firm's cost-of-capital functions and a zero-growth valuation model.
- **LG5** Discuss the EBIT–EPS approach to capital structure.
- **LG6** Review the return and risk of alternative capital structures, their linkage to market value, and other important considerations related to capital structure.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

Accounting: You need to understand how to calculate and analyze operating and financial leverage and to be familiar with the tax effects of various capital structures.

Information systems: You need to understand the types of capital and what capital structure is, because you will provide much of the information needed in management's determination of the best capital structure for the firm.

Management: You need to understand leverage so that you can magnify returns for the firm's owners and to understand capital structure theory so that you can make decisions about the firm's optimal capital structure.

Marketing: You need to understand breakeven analysis, which you will use in pricing and product feasibility decisions.

Operations: You need to understand the impact of fixed and variable operating costs on the firm's breakeven point and its operating leverage, because these costs will have a major impact on the firm's risk and return.

KRISPY KREME

INVESTORS EAT UP KRISPY KREME STOCK

In April 2000, **Krispy Kreme Doughnuts** went public at $21 a share. Investors gobbled up the shares as fast as consumers did its hot-from-the-oven glazed doughnuts. In 2001 the stock split, and the company did a secondary offering that doubled the number of shares in the market. By the end of its fiscal year in January 2002, the company's market capitalization was over $2 billion.

Krispy Kreme used the proceeds from its equity issues to fund an aggressive expansion campaign to build stores in new U.S. and international markets. Its timing was particularly good: Investors were looking for an alternative to dot-com high fliers, and the company's popular brand and product appealed to many different types of consumers. Krispy Kreme's financial condition was also strong. Sales growth—24 percent for the period 1998–2001 and a projected 5-year rate of over 26 percent—was well above its peers in the retail restaurant industry. Net income and EPS were beginning to climb as the company brought new stores online. Its capital structure (the mix of debt and equity used to fund the company) at October 31, 2001, consisted of $9.7 million in long-term debt and $175.8 million in stockholders' equity. With a debt-to-equity ratio of just 5.2 percent (extremely low compared to the industry average of 92 percent) and a times interest earned ratio of 122, Krispy Kreme has plenty of flexibility in its capital structure.

Is a capital structure consisting mostly of equity better than one with a higher percentage of debt? Not necessarily. Capital structure varies among companies in the same industry and across industry groups. Within the restaurant sector, for example, you'll find **California Pizza Kitchen** and **Cheesecake Factory** with no debt; debt-to-equity ratios of 20–30 percent at **Wendy's** and **Applebee's; Papa John's** and **Dave & Buster's** at around 60 percent; **Chart House** and **McDonald's** with close to equal amounts of debt and equity; and **Atomic Burrito** with more than twice as much debt as equity.

A company's choice of debt versus equity depends on many factors. Conditions in the equity markets may be unfavorable when a company needs to raise funds. When interest rates are low, the debt markets become attractive. Before issuing debt, however, a company must be sure that it can generate cash flows adequate to repaying its debt obligations.

Each type of long-term capital has its advantages. As we learned in Chapter 11, debt costs less than equity. Adding debt, with its fixed rate, to the capital structure creates *financial leverage*, the use of fixed financial costs to magnify returns. Leverage also increases risk. This chapter will show that financial leverage and capital structure are closely related concepts that can minimize the cost of capital and maximize owners' wealth.

LG1 LG2 12.1 Leverage

leverage
Results from the use of fixed-cost assets or funds to magnify returns to the firm's owners.

capital structure
The mix of long-term debt and equity maintained by the firm.

Leverage results from the use of fixed-cost assets or funds to magnify returns to the firm's owners. Generally, increases in leverage result in increased return and risk, whereas decreases in leverage result in decreased return and risk. The amount of leverage in the firm's **capital structure**—the mix of long-term debt and equity maintained by the firm—can significantly affect its value by affecting return and risk. Unlike some causes of risk, management has almost complete control over the risk introduced through the use of leverage. Because of its effect on value, the financial manager must understand how to measure and evaluate leverage, particularly when making capital structure decisions.

The three basic types of leverage can best be defined with reference to the firm's income statement, as shown in the general income statement format in Table 12.1.

- *Operating leverage* is concerned with the relationship between the firm's sales revenue and its earnings before interest and taxes, or EBIT. (EBIT is a descriptive label for *operating profits*.)
- *Financial leverage* is concerned with the relationship between the firm's EBIT and its common stock earnings per share (EPS).
- *Total leverage* is concerned with the relationship between the firm's sales revenue and EPS.

We will examine the three types of leverage concepts in detail in sections that follow. First, though, we will look at breakeven analysis, which lays the foundation for leverage concepts by demonstrating the effects of fixed costs on the firm's operations.

TABLE 12.1 General Income Statement Format and Types of Leverage

Operating leverage	Sales revenue	Total leverage
	Less: Cost of goods sold	
	Gross profits	
	Less: Operating expenses	
	Earnings before interest and taxes (EBIT)	
Financial leverage	Less: Interest	
	Net profits before taxes	
	Less: Taxes	
	Net profits after taxes	
	Less: Preferred stock dividends	
	Earnings available for common stockholders	
	Earnings per share (EPS)	

Breakeven Analysis

breakeven analysis
Indicates the level of operations necessary to cover all operating costs and the profitability associated with various levels of sales.

operating breakeven point
The level of sales necessary to cover all *operating costs;* the point at which EBIT = $0.

Breakeven analysis, sometimes called *cost-volume-profit analysis,* is used by the firm (1) to determine the level of operations necessary to cover all operating costs and (2) to evaluate the profitability associated with various levels of sales. The firm's **operating breakeven point** is the level of sales necessary to cover all *operating costs*. At that point, earnings before interest and taxes equals $0.[1]

The first step in finding the operating breakeven point is to divide the cost of goods sold and operating expenses into fixed and variable operating costs. *Fixed costs* are a function of time, not sales volume, and are typically contractual; rent, for example, is a fixed cost. *Variable costs* vary directly with sales and are a function of volume, not time; shipping costs, for example, are a variable cost.[2]

The Algebraic Approach

Using the following variables, we can recast the operating portion of the firm's income statement given in Table 12.1 into the algebraic representation shown in Table 12.2.

P = sale price per unit
Q = sales quantity in units
FC = fixed operating cost per period
VC = variable operating cost per unit

Rewriting the algebraic calculations in Table 12.2 as a formula for earnings before interest and taxes yields Equation 12.1:

$$\text{EBIT} = (P \times Q) - FC - (VC \times Q) \tag{12.1}$$

Simplifying Equation 12.1 yields

$$\text{EBIT} = Q \times (P - VC) - FC \tag{12.2}$$

TABLE 12.2 Operating Leverage, Costs, and Breakeven Analysis

	Item	Algebraic representation
Operating leverage	Sales revenue	$(P \times Q)$
	Less: Fixed operating costs	$-\ FC$
	Less: Variable operating costs	$-(VC \times Q)$
	Earnings before interest and taxes	EBIT

1. Quite often, the breakeven point is calculated so that it represents the point at which *all operating and financial costs* are covered. Our concern in this chapter is not with this overall breakeven point.

2. Some costs, commonly called *semifixed* or *semivariable,* are partly fixed and partly variable. An example is sales commissions that are fixed for a certain volume of sales and then increase to higher levels for higher volumes. For convenience and clarity, we assume that all costs can be classified as either fixed or variable.

As noted above, the operating breakeven point is the level of sales at which all fixed and variable *operating costs* are covered—the level at which EBIT equals \$0. Setting EBIT equal to \$0 and solving Equation 12.2 for Q yield

$$Q = \frac{FC}{P - VC} \tag{12.3}$$

Q is the firm's operating breakeven point.[3]

EXAMPLE Assume that Cheryl's Posters, a small poster retailer, has fixed operating costs of \$2,500, its sale price per unit (poster) is \$10, and its variable operating cost per unit is \$5. Applying Equation 12.3 to these data yields

$$Q = \frac{\$2{,}500}{\$10 - \$5} = \frac{\$2{,}500}{\$5} = 500 \text{ units}$$

At sales of 500 units, the firm's EBIT should just equal \$0. The firm will have positive EBIT for sales greater than 500 units and negative EBIT, or a loss, for sales less than 500 units. We can confirm this by substituting values above and below 500 units, along with the other values given, into Equation 12.1.

The Graphical Approach

Figure 12.1 presents in graphical form the breakeven analysis of the data in the preceding example. The firm's operating breakeven point is the point at which its *total operating cost*—the sum of its fixed and variable operating costs—equals sales revenue. At this point, EBIT equals \$0. The figure shows that for sales *below* 500 units, total operating cost exceeds sales revenue, and EBIT is less than \$0 (a loss). For sales *above* the breakeven point of 500 units, sales revenue exceeds total operating cost, and EBIT is greater than \$0.

Changing Costs and the Operating Breakeven Point

A firm's operating breakeven point is sensitive to a number of variables: fixed operating cost (FC), the sale price per unit (P), and the variable operating cost per unit (VC). The effects of increases or decreases in these variables can be readily seen by referring to Equation 12.3. The sensitivity of the breakeven sales volume (Q) to an *increase* in each of these variables is summarized in Table 12.3. As might be expected, an increase in cost (FC or VC) tends to increase the operating breakeven point, whereas an increase in the sale price per unit (P) decreases the operating breakeven point.

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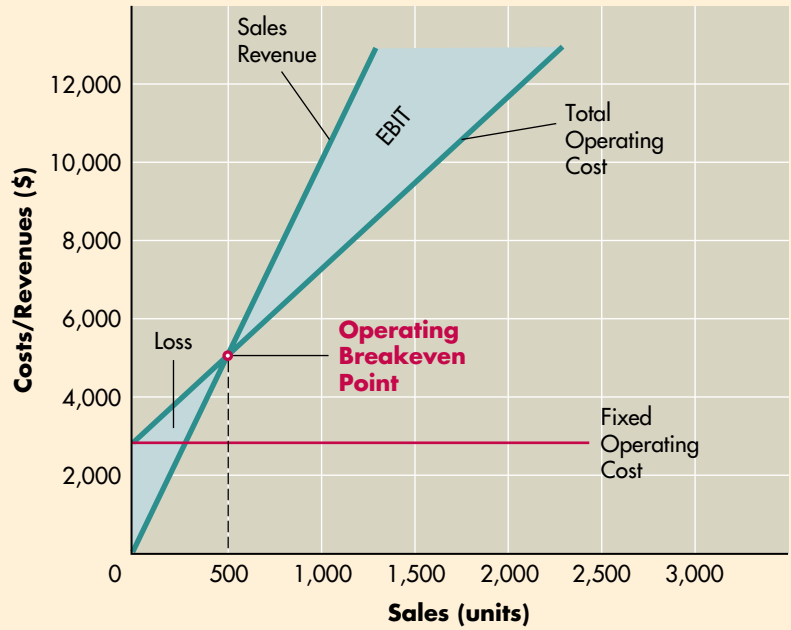
3. Because the firm is assumed to be a single-product firm, its operating breakeven point is found in terms of unit sales, Q. For multiproduct firms, the operating breakeven point is generally found in terms of dollar sales, S. This is done by substituting the contribution margin, which is 100% minus total variable operating costs as a percentage of total sales, denoted $VC\%$, into the denominator of Equation 12.3. The result is Equation 12.3a:

$$S = \frac{FC}{1 - VC\%} \tag{12.3a}$$

This multiproduct-firm breakeven point assumes that the firm's product mix remains the same at all levels of sales.

FIGURE 12.1

Breakeven Analysis
Graphical operating breakeven analysis



EXAMPLE

Assume that Cheryl's Posters wishes to evaluate the impact of several options: (1) increasing fixed operating costs to $3,000, (2) increasing the sale price per unit to $12.50, (3) increasing the variable operating cost per unit to $7.50, and (4) simultaneously implementing all three of these changes. Substituting the appropriate data into Equation 12.3 yields the following results:

$$\text{(1) Operating breakeven point} = \frac{\$3{,}000}{\$10 - \$5} = 600 \text{ units}$$

$$\text{(2) Operating breakeven point} = \frac{\$2{,}500}{\$12.50 - \$5} = 333\tfrac{1}{3} \text{ units}$$

TABLE 12.3 **Sensitivity of Operating Breakeven Point to Increases in Key Breakeven Variables**

Increase in variable	Effect on operating breakeven point
Fixed operating cost *(FC)*	Increase
Sale price per unit *(P)*	Decrease
Variable operating cost per unit *(VC)*	Increase

Note: Decreases in each of the variables shown would have the opposite effect from their effect on operating breakeven point.

$$(3)\ \text{Operating breakeven point} = \frac{\$2{,}500}{\$10 - \$7.50} = 1{,}000 \text{ units}$$

$$(4)\ \text{Operating breakeven point} = \frac{\$3{,}000}{\$12.50 - \$7.50} = 600 \text{ units}$$

Comparing the resulting operating breakeven points to the initial value of 500 units, we can see that the cost increases (actions 1 and 3) raise the breakeven point, whereas the revenue increase (action 2) lowers the breakeven point. The combined effect of increasing all three variables (action 4) also results in an increased operating breakeven point.

We now turn our attention to the three types of leverage. It is important to recognize that the demonstrations of leverage that follow are conceptual in nature and that the measures presented are *not* routinely used by financial managers for decision-making purposes.

operating leverage
The potential use of *fixed operating costs* to magnify the effects of changes in sales on the firm's earnings before interest and taxes.

Operating Leverage

Operating leverage results from the existence of *fixed operating costs* in the firm's income stream. Using the structure presented in Table 12.2, we can define **operating leverage** as the potential use of *fixed operating costs* to magnify the effects of changes in sales on the firm's earnings before interest and taxes.

FIGURE 12.2
Operating Leverage
Breakeven analysis and operating leverage

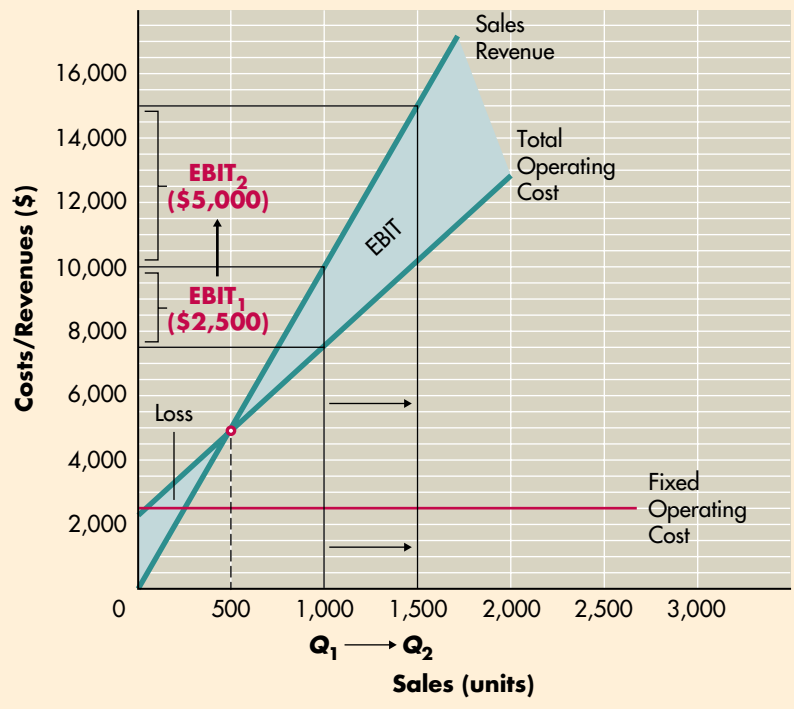


TABLE 12.4 The EBIT for Various Sales Levels

	Case 2		Case 1
	−50%		+50%
Sales (in units)	500	1,000	1,500
Sales revenue[a]	$5,000	$10,000	$15,000
Less: Variable operating costs[b]	2,500	5,000	7,500
Less: Fixed operating costs	2,500	2,500	2,500
Earnings before interest and taxes (EBIT)	$ 0	$ 2,500	$ 5,000
	−100%		+100%

[a]Sales revenue = $10/unit × sales in units.
[b]Variable operating costs = $5/unit × sales in units.

EXAMPLE

Using the data for Cheryl's Posters (sale price, $P = \$10$ per unit; variable operating cost, $VC = \$5$ per unit; fixed operating cost, $FC = \$2{,}500$), Figure 12.2 presents the operating breakeven graph originally shown in Figure 12.1. The additional notations on the graph indicate that as the firm's sales increase from 1,000 to 1,500 units (Q_1 to Q_2), its EBIT increases from $2,500 to $5,000 ($EBIT_1$ to $EBIT_2$). In other words, a 50% increase in sales (1,000 to 1,500 units) results in a 100% increase in EBIT ($2,500 to $5,000). Table 12.4 includes the data for Figure 12.2 as well as relevant data for a 500-unit sales level. We can illustrate two cases using the 1,000-unit sales level as a reference point.

Case 1 A 50% *increase* in sales (from 1,000 to 1,500 units) results in a 100% *increase* in earnings before interest and taxes (from $2,500 to $5,000).

Case 2 A 50% *decrease* in sales (from 1,000 to 500 units) results in a 100% *decrease* in earnings before interest and taxes (from $2,500 to $0).

From the preceding example, we see that operating leverage works in *both directions*. When a firm has fixed operating costs, operating leverage is present. An increase in sales results in a more-than-proportional increase in EBIT; a decrease in sales results in a more-than-proportional decrease in EBIT.

degree of operating leverage (DOL)
The numerical measure of the firm's operating leverage.

Measuring the Degree of Operating Leverage (DOL)

The **degree of operating leverage** (DOL) is the numerical measure of the firm's operating leverage. It can be derived using the following equation:[4]

$$\text{DOL} = \frac{\text{Percentage change in EBIT}}{\text{Percentage change in sales}} \tag{12.4}$$

4. The degree of operating leverage also depends on the base level of sales used as a point of reference. The closer the base sales level used is to the operating breakeven point, the greater the operating leverage. *Comparison of the degree of operating leverage of two firms is valid only when the same base level of sales is used for both firms.*

Whenever the percentage change in EBIT resulting from a given percentage change in sales is greater than the percentage change in sales, operating leverage exists. This means that as long as DOL is greater than 1, there is operating leverage.

EXAMPLE Applying Equation 12.4 to cases 1 and 2 in Table 12.4 yields the following results:[5]

$$\textbf{Case 1:} \quad \frac{+100\%}{+50\%} = 2.0$$

$$\textbf{Case 2:} \quad \frac{-100\%}{-50\%} = 2.0$$

Because the result is greater than 1, operating leverage exists. For a given base level of sales, the higher the value resulting from applying Equation 12.4, the greater the degree of operating leverage.

A more direct formula for calculating the degree of operating leverage at a base sales level, Q, is shown in Equation 12.5.[6]

$$\text{DOL at base sales level } Q = \frac{Q \times (P - VC)}{Q \times (P - VC) - FC} \tag{12.5}$$

EXAMPLE Substituting $Q = 1{,}000$, $P = \$10$, $VC = \$5$, and $FC = \$2{,}500$ into Equation 12.5 yields the following result:

$$\text{DOL at 1,000 units} = \frac{1{,}000 \times (\$10 - \$5)}{1{,}000 \times (\$10 - \$5) - \$2{,}500} = \frac{\$5{,}000}{\$2{,}500} = 2.0$$

The use of the formula results in the same value for DOL (2.0) as that found by using Table 12.4 and Equation 12.4.[7]

Fixed Costs and Operating Leverage

Changes in fixed operating costs affect operating leverage significantly. Firms sometimes can incur fixed operating costs rather than variable operating costs and at other times may be able to substitute one type of cost for the other. For example, a firm could make fixed-dollar lease payments rather than payments equal to a specified percentage of sales. Or it could compensate sales representatives with a fixed salary and bonus rather than on a pure percent-of-sales com-

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5. Because the concept of leverage is *linear*, positive and negative changes of equal magnitude will always result in equal degrees of leverage when the same base sales level is used as a point of reference. This relationship holds for all types of leverage discussed in this chapter.

6. Technically, the formula for DOL given in Equation 12.5 should include absolute value signs because it is possible to get a negative DOL when the EBIT for the base sales level is negative. Because we assume that the EBIT for the base level of sales is positive, we do not use the absolute value signs.

7. When total sales in dollars—instead of unit sales—are available, the following equation, in which TR = dollar level of base sales and TVC = total variable operating costs in dollars, can be used.

$$\text{DOL at base dollar sales } TR = \frac{TR - TVC}{TR - TVC - FC}$$

This formula is especially useful for finding the DOL for multiproduct firms. It should be clear that because in the case of a single-product firm, $TR = P \times Q$ and $TVC = VC \times Q$, substitution of these values into Equation 12.5 results in the equation given here.

In Practice

FOCUS ON PRACTICE Adobe's Design for Profitability

Adobe Systems, the second largest PC software company in the United States, dominates the graphic design, imaging, dynamic media, and authoring-tool software markets. Web site designers prefer its Photoshop and Illustrator software applications, and Adobe's Acrobat software has become a standard for sharing documents online.

Despite a sales slowdown in 2001, the company continued to meet its earnings targets. Its ability to manage discretionary expenses helped to keep its bottom line strong. As a software company, it has an additional advantage: *operating leverage,* the use of fixed operating costs to magnify the effect of changes in sales on earnings before interest and taxes (EBIT).

Adobe and its peers in the software industry incur the bulk of their costs early in a product's life cycle, in the research and development and initial marketing stages. The up-front development costs are fixed, regardless of how many copies of a program the company sells, and subsequent production costs are practically zero. The economies of scale are huge; once a company sells enough copies to cover its fixed costs, incremental revenue dollars go primarily to profit.

The following table demonstrates the impact of operating leverage on Adobe Systems in fiscal years (FYs) 2000 and 2001.

Operating leverage magnified the increase in EBIT in 2000. Sales growth of 24.7 percent resulted in EBIT growth of 56.9 percent. In 2001 a slight dip in sales—just under 3 percent—became a 7.4 percent drop in EBIT. Because the company has no long-term debt in its capital structure, its total leverage is derived only from fixed operating costs. When sales and EBIT again rise, the company's high operating leverage will boost EBIT growth. (It's important to remember that this example represents only 2 years and that Adobe's degree of operating leverage may change in the future.)

Sources: Adapted from Zeke Ashton, "The Software Advantage," *Motley Fool* (March 31, 2000), downloaded from *www.fool.com;* James K. Glassman, "Tech Still Has a Place in Portfolios," *Washington Post,* December 16, 2001, p. H1; Matt Richey, "EMC's Operating Leverage," *Motley Fool* (August 14, 2000); Mike Trigg, "Assessing Adobe's Valuation," *Motley Fool* (September 10, 2001); and "Operating Leverage Helps Adobe," *Motley Fool* (March 16, 2001), all downloaded from *www.fool.com.*

	FY 1999	FY 2000	FY 2001
Sales revenue (millions)	$1,015	$1,266	$1,230
EBIT (millions)	$260	$408	$378
(1) % change in sales		24.7	−2.9
(2) % change in EBIT		56.9	−7.4
DOL [(2) ÷ (1)]		2.3	2.6

mission basis. The effects of changes in fixed operating costs on operating leverage can best be illustrated by continuing our example.

EXAMPLE Assume that Cheryl's Posters exchanges a portion of its variable operating costs for fixed operating costs by eliminating sales commissions and increasing sales salaries. This exchange results in a reduction in the variable operating cost per unit from $5 to $4.50 and an increase in the fixed operating costs from $2,500 to $3,000. Table 12.5 presents an analysis like that in Table 12.4, but using the new costs. Although the EBIT of $2,500 at the 1,000-unit sales level is the same as before the shift in operating cost structure, Table 12.5 shows that the firm has increased its operating leverage by shifting to greater fixed operating costs.

With the substitution of the appropriate values into Equation 12.5, the degree of operating leverage at the 1,000-unit base level of sales becomes

$$\text{DOL at 1,000 units} = \frac{1{,}000 \times (\$10 - \$4.50)}{1{,}000 \times (\$10 - \$4.50) - \$3{,}000} = \frac{\$5{,}500}{\$2{,}500} = 2.2$$

TABLE 12.5 Operating Leverage and Increased Fixed Costs

	Case 2		Case 1
		−50%	+50%
Sales (in units)	500	1,000	1,500
Sales revenue[a]	$5,000	$10,000	$15,000
Less: Variable operating costs[b]	2,250	4,500	6,750
Less: Fixed operating costs	3,000	3,000	3,000
Earnings before interest and taxes (EBIT)	−$ 250	$ 2,500	$ 5,250
		−110%	+110%

[a]Sales revenue was calculated as indicated in Table 12.4.
[b]Variable operating costs = $4.50/unit × sales in units.

Comparing this value to the DOL of 2.0 before the shift to more fixed costs makes it is clear that the higher the firm's fixed operating costs relative to variable operating costs, the greater the degree of operating leverage.

Financial Leverage

financial leverage
The potential use of *fixed financial costs* to magnify the effects of changes in earnings before interest and taxes on the firm's earnings per share.

Financial leverage results from the presence of *fixed financial costs* in the firm's income stream. Using the framework in Table 12.1, we can define **financial leverage** as the potential use of *fixed financial costs* to magnify the effects of changes in earnings before interest and taxes on the firm's earnings per share. The two fixed financial costs that may be found on the firm's income statement are (1) interest on debt and (2) preferred stock dividends. These charges must be paid regardless of the amount of EBIT available to pay them.[8]

EXAMPLE

Chen Foods, a small Oriental food company, expects EBIT of $10,000 in the current year. It has a $20,000 bond with a 10% (annual) coupon rate of interest and an issue of 600 shares of $4 (annual dividend per share) preferred stock outstanding. It also has 1,000 shares of common stock outstanding. The annual interest on the bond issue is $2,000 (0.10 × $20,000). The annual dividends on the preferred stock are $2,400 ($4.00/share × 600 shares). Table 12.6 presents the EPS corresponding to levels of EBIT of $6,000, $10,000, and $14,000, assuming that the firm is in the 40% tax bracket. Two situations are shown:

8. As noted in Chapter 7, although preferred stock dividends can be "passed" (not paid) at the option of the firm's directors, it is generally believed that payment of such dividends is necessary. *This text treats the preferred stock dividend as a contractual obligation, not only to be paid as a fixed amount, but also to be paid as scheduled.* Although failure to pay preferred dividends cannot force the firm into bankruptcy, it increases the common stockholders' risk because they cannot be paid dividends until the claims of preferred stockholders are satisfied.

TABLE 12.6 The EPS for Various EBIT Levels[a]

	Case 2		Case 1
	−40%		+40%
EBIT	$6,000	$10,000	$14,000
Less: Interest (I)	2,000	2,000	2,000
Net profits before taxes	$4,000	$ 8,000	$12,000
Less: Taxes ($T = 0.40$)	1,600	3,200	4,800
Net profits after taxes	$2,400	$ 4,800	$ 7,200
Less: Preferred stock dividends (PD)	2,400	2,400	2,400
Earnings available for common (EAC)	$ 0	$ 2,400	$ 4,800
Earnings per share (EPS)	$\frac{\$0}{1{,}000} = \$0$	$\frac{\$2{,}400}{1{,}000} = \$2.40$	$\frac{\$4{,}800}{1{,}000} = \$4.80$
	−100%		+100%

[a]As noted in Chapter 1, for accounting and tax purposes, interest is a *tax-deductible expense,* whereas dividends must be paid from after-tax cash flows.

Case 1 A 40% *increase* in EBIT (from $10,000 to $14,000) results in a 100% *increase* in earnings per share (from $2.40 to $4.80).

Case 2 A 40% *decrease* in EBIT (from $10,000 to $6,000) results in a 100% *decrease* in earnings per share (from $2.40 to $0).

The effect of financial leverage is such that an increase in the firm's EBIT results in a more-than-proportional increase in the firm's earnings per share, whereas a decrease in the firm's EBIT results in a more-than-proportional decrease in EPS.

Measuring the Degree of Financial Leverage (DFL)

degree of financial leverage (DFL)
The numerical measure of the firm's financial leverage.

The **degree of financial leverage** (DFL) is the numerical measure of the firm's financial leverage. Computing it is much like computing the degree of operating leverage. The following equation presents one approach for obtaining the DFL.[9]

$$\text{DFL} = \frac{\text{Percentage change in EPS}}{\text{Percentage change in EBIT}} \tag{12.6}$$

Whenever the percentage change in EPS resulting from a given percentage change in EBIT is greater than the percentage change in EBIT, financial leverage exists. This means that whenever DFL is greater than 1, there is financial leverage.

9. This approach is valid only when the same base level of EBIT is used to calculate and compare these values. In other words, *the base level of EBIT must be held constant to compare the financial leverage associated with different levels of fixed financial costs.*

EXAMPLE Applying Equation 12.6 to cases 1 and 2 in Table 12.6 yields

$$\text{Case 1:} \quad \frac{+100\%}{+40\%} = 2.5$$

$$\text{Case 2:} \quad \frac{-100\%}{-40\%} = 2.5$$

In both cases, the quotient is greater than 1, so financial leverage exists. The higher this value, the greater the degree of financial leverage.

A more direct formula for calculating the degree of financial leverage at a base level of EBIT is given by Equation 12.7, where the notation from Table 12.6 is used.[10] Note that in the denominator, the term $1/(1-T)$ converts the after-tax preferred stock dividend to a before-tax amount for consistency with the other terms in the equation.

$$\text{DFL at base level EBIT} = \frac{\text{EBIT}}{\text{EBIT} - I - \left(PD \times \dfrac{1}{1-T}\right)} \tag{12.7}$$

EXAMPLE Substituting EBIT = \$10,000, I = \$2,000, PD = \$2,400, and the tax rate (T = 0.40) into Equation 12.7 yields the following result:

$$\text{DFL at \$10,000 EBIT} = \frac{\$10{,}000}{\$10{,}000 - \$2{,}000 - \left(\$2{,}400 \times \dfrac{1}{1-0.40}\right)}$$

$$= \frac{\$10{,}000}{\$4{,}000} = 2.5$$

Note that the formula given in Equation 12.7 provides a more direct method for calculating the degree of financial leverage than the approach illustrated using Table 12.6 and Equation 12.6.

Total Leverage

total leverage
The potential use of *fixed costs, both operating and financial,* to magnify the effect of changes in sales on the firm's earnings per share.

We also can assess the combined effect of operating and financial leverage on the firm's risk by using a framework similar to that used to develop the individual concepts of leverage. This combined effect, or **total leverage,** can be defined as the potential use of *fixed costs, both operating and financial,* to magnify the effect of changes in sales on the firm's earnings per share. Total leverage can therefore be viewed as the *total impact of the fixed costs* in the firm's operating and financial structure.

EXAMPLE Cables Inc., a computer cable manufacturer, expects sales of 20,000 units at \$5 per unit in the coming year and must meet the following obligations: variable operating costs of \$2 per unit, fixed operating costs of \$10,000, interest of \$20,000, and preferred stock dividends of \$12,000. The firm is in the 40% tax bracket and has 5,000 shares of common stock outstanding. Table 12.7 presents

10. By using the formula for DFL in Equation 12.7, it is possible to get a negative value for the DFL if the EPS for the base level of EBIT is negative. Rather than show absolute value signs in the equation, we instead assume that the base-level EPS is positive.

TABLE 12.7 The Total Leverage Effect

		+50% →	
Sales (in units)	20,000	30,000	DOL = +60%/+50% = 1.2
Sales revenue[a]	$100,000	$150,000	
Less: Variable operating costs[b]	40,000	60,000	
Less: Fixed operating costs	10,000	10,000	
Earnings before interest and taxes (EBIT)	$ 50,000	$ 80,000	
		+60% →	DTL = +300%/+50% = 6.0
Less: Interest	20,000	20,000	
Net profits before taxes	$ 30,000	$ 60,000	DFL = +300%/+60% = 5.0
Less: Taxes ($T = 0.40$)	12,000	24,000	
Net profits after taxes	$ 18,000	$ 36,000	
Less: Preferred stock dividends	12,000	12,000	
Earnings available for common	$ 6,000	$ 24,000	
Earnings per share (EPS)	$6,000/5,000 = $1.20	$24,000/5,000 = $4.80	
		+300% →	

[a]Sales revenue = $5/unit × sales in units.
[b]Variable operating costs = $2/unit × sales in units.

the levels of earnings per share associated with the expected sales of 20,000 units and with sales of 30,000 units.

The table illustrates that as a result of a 50% increase in sales (from 20,000 to 30,000 units), the firm would experience a 300% increase in earnings per share (from $1.20 to $4.80). Although it is not shown in the table, a 50% decrease in sales would, conversely, result in a 300% decrease in earnings per share. The linear nature of the leverage relationship accounts for the fact that sales changes of equal magnitude in opposite directions result in EPS changes of equal magnitude in the corresponding direction. At this point, it should be clear that whenever a firm has fixed costs—operating or financial—in its structure, total leverage will exist.

Measuring the Degree of Total Leverage (DTL)

degree of total leverage (DTL)
The numerical measure of the firm's total leverage.

The **degree of total leverage** (DTL) is the numerical measure of the firm's total leverage. It can be computed much as operating and financial leverage are computed. The following equation presents one approach for measuring DTL:[11]

$$\text{DTL} = \frac{\text{Percentage change in EPS}}{\text{Percentage change in sales}} \tag{12.8}$$

11. This approach is valid only when the same base level of sales is used to calculate and compare these values. In other words, *the base level of sales must be held constant if we are to compare the total leverage associated with different levels of fixed costs.*

Whenever the percentage change in EPS resulting from a given percentage change in sales is greater than the percentage change in sales, total leverage exists. This means that as long as the DTL is greater than 1, there is total leverage.

EXAMPLE Applying Equation 12.8 to the data in Table 12.7 yields

$$\text{DTL} = \frac{+300\%}{+50\%} = 6.0$$

Because this result is greater than 1, total leverage exists. The higher the value, the greater the degree of total leverage.

A more direct formula for calculating the degree of total leverage at a given base level of sales, Q, is given by Equation 12.9,[12] which uses the same notation that was presented earlier:

$$\text{DTL at base sales level } Q = \frac{Q \times (P - VC)}{Q \times (P - VC) - FC - I - \left(PD \times \frac{1}{1 - T}\right)} \quad (12.9)$$

EXAMPLE Substituting $Q = 20{,}000$, $P = \$5$, $VC = \$2$, $FC = \$10{,}000$, $I = \$20{,}000$, $PD = \$12{,}000$, and the tax rate ($T = 0.40$) into Equation 12.9 yields

$$\text{DTL at 20,000 units} = \frac{20{,}000 \times (\$5 - \$2)}{20{,}000 \times (\$5 - \$2) - \$10{,}000 - \$20{,}000 - \left(\$12{,}000 \times \frac{1}{1 - 0.40}\right)}$$

$$= \frac{\$60{,}000}{\$10{,}000} = 6.0$$

Clearly, the formula used in Equation 12.9 provides a more direct method for calculating the degree of total leverage than the approach illustrated using Table 12.7 and Equation 12.8.

The Relationship of Operating, Financial, and Total Leverage

Total leverage reflects the *combined impact* of operating and financial leverage on the firm. High operating leverage and high financial leverage will cause total leverage to be high. The opposite will also be true. The relationship between operating leverage and financial leverage is *multiplicative* rather than *additive*. The relationship between the degree of total leverage (DTL) and the degrees of operating leverage (DOL) and financial leverage (DFL) is given by Equation 12.10.

$$\text{DTL} = \text{DOL} \times \text{DFL} \quad (12.10)$$

12. By using the formula for DTL in Equation 12.9, it is possible to get a negative value for the DTL if the EPS for the base level of sales is negative. For our purposes, rather than show absolute value signs in the equation, we instead assume that the base-level EPS is positive.

EXAMPLE Substituting the values calculated for DOL and DFL, shown on the right-hand side of Table 12.7, into Equation 12.10 yields

$$DTL = 1.2 \times 5.0 = 6.0$$

The resulting degree of total leverage is the same value that we calculated directly in the preceding examples.

Review Questions

12–1 What is meant by the term *leverage?* How are operating leverage, financial leverage, and total leverage related to the income statement?

12–2 What is the *operating breakeven point?* How do changes in fixed operating costs, the sale price per unit, and the variable operating cost per unit affect it?

12–3 What is *operating leverage?* What causes it? How is the *degree of operating leverage (DOL)* measured?

12–4 What is *financial leverage?* What causes it? How is the *degree of financial leverage (DFL)* measured?

12–5 What is the general relationship among operating leverage, financial leverage, and the total leverage of the firm? Do these types of leverage complement each other? Why or why not?

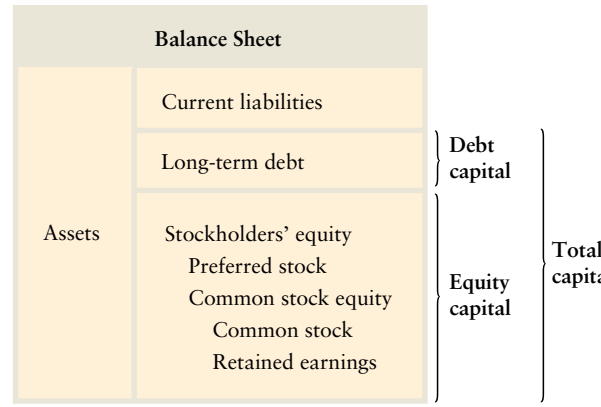
LG3 LG4 12.2 The Firm's Capital Structure

Capital structure is one of the most complex areas of financial decision making because of its interrelationship with other financial decision variables.[13] Poor capital structure decisions can result in a high cost of capital, thereby lowering the NPVs of projects and making more of them unacceptable. Effective capital structure decisions can lower the cost of capital, resulting in higher NPVs and more acceptable projects—and thereby increasing the value of the firm. This section links together many of the concepts presented in Chapters 4, 5, 6, 7, and 11 and the discussion of leverage in this chapter.

Types of Capital

All of the items on the right-hand side of the firm's balance sheet, excluding current liabilities, are sources of capital. The following simplified balance sheet illustrates the basic breakdown of total capital into its two components, *debt capital* and *equity capital.*

13. Of course, although capital structure is financially important, it, like many business decisions, is generally not so important as the firm's products or services. In a practical sense, a firm can probably more readily increase its value by improving quality and reducing costs than by fine-tuning its capital structure.



The various types and characteristics of *corporate bonds,* a major source of *debt capital,* were discussed in detail in Chapter 6. The cost of debt is lower than the cost of other forms of financing. Lenders demand relatively lower returns because they take the least risk of any long-term contributors of capital: (1) They have a higher priority of claim against any earnings or assets available for payment. (2) They can exert far greater legal pressure against the company to make payment than can holders of preferred or common stock. (3) The tax deductibility of interest payments lowers the debt cost to the firm substantially.

Unlike debt capital, which must be repaid at some future date, *equity capital* is expected to remain in the firm for an indefinite period of time. The two basic sources of equity capital are (1) preferred stock and (2) common stock equity, which includes common stock and retained earnings. Common stock is typically the most expensive form of equity, followed by retained earnings and then preferred stock. Our concern here is the relationship between debt and equity capital. Key differences between these two types of capital, relative to voice in management, claims on income and assets, maturity, and tax treatment, were summarized in Chapter 7, Table 7.1. Because of its secondary position relative to debt, suppliers of equity capital take greater risk than suppliers of debt capital and therefore must be compensated with higher expected returns.

External Assessment of Capital Structure

We saw earlier that *financial leverage* results from the use of fixed-cost financing, such as debt and preferred stock, to magnify return and risk. The amount of leverage in the firm's capital structure can affect its value by affecting return and risk. Those outside the firm can make a rough assessment of capital structure by using measures found in the firm's financial statements. Some of these important debt ratios were presented in Chapter 2. For example, a direct measure of the degree of indebtedness is the *debt ratio*. The higher this ratio, the greater the relative amount of debt (or financial leverage) in the firm's capital structure. Measures of the firm's ability to meet contractual payments associated with debt include the *times interest earned ratio* and the *fixed-payment coverage ratio*. These ratios provide indirect information on financial leverage. Generally, the smaller these ratios, the greater the firm's financial leverage and the less able it is to meet payments as they come due.

TABLE 12.8 Debt Ratios for Selected Industries and Lines of Business (Fiscal Years Ended 4/1/00 Through 3/31/01)

Industry or line of business	Debt ratio	Times interest earned ratio
Manufacturing industries		
Books	65.2%	3.3
Dairy products	74.6	3.0
Electronic computers	55.4	3.4
Iron and steel forgings	62.7	2.3
Machine tools, metal cutting types	60.4	2.4
Wines & distilled alcoholic beverages	69.7	4.4
Women's, misses' & juniors' dresses	53.5	2.4
Wholesaling industries		
Furniture	69.4	3.0
General groceries	66.8	2.8
Men's and boys' clothing	60.8	2.6
Retailing industries		
Autos, new and used	76.1	1.4
Department stores	52.8	2.3
Restaurants	92.5	2.3
Service industries		
Accounting, auditing, bookkeeping	68.4	5.6
Advertising agencies	81.3	4.2
Auto repair—general	75.9	2.5
Insurance agents and brokers	94.1	4.1

Source: RMA Annual Statement Studies, 2001–2002 (fiscal years ended 4/1/00 through 3/31/01) (Philadelphia: Robert Morris Associates, 2001). Copyright © 2001 by Robert Morris Associates.

Note: Robert Morris Associates recommends that these ratios be regarded only as general guidelines and not as absolute industry norms. No claim is made as to the representativeness of these figures.

The level of debt (financial leverage) that is acceptable for one industry or line of business can be highly risky in another, because different industries and lines of business have different operating characteristics. Table 12.8 presents the debt and times interest earned ratios for selected industries and lines of business. Significant industry differences can be seen in these data. Differences in debt positions are also likely to exist *within* an industry or line of business.

Capital Structure of Non-U.S. Firms

In general, non-U.S. companies have much higher degrees of indebtedness than their U.S. counterparts. Most of the reasons for this are related to the fact that U.S. capital markets are much more developed than those elsewhere and have played a

In Practice

FOCUS ON PRACTICE Enron Plays Hide and Seek with Debt

Enron Corp.'s December 31, 2000, balance sheet showed long-term debt of $10. 2 billion and $300 million in other financial obligations. These figures gave the company a 41 percent ratio of total obligations to total capitalization. That didn't seem out of line for a company in the capital-intensive energy industry.

Yet as the company's financial condition fell apart in the fall of 2001, investors and lenders discovered that Enron's true debt load was far beyond what its balance sheet indicated. By selling assets to perfectly legal special-purpose entities (SPEs), Enron had moved billions of dollars of debt off its balance sheet into subsidiaries, trusts, partnerships, and other creative financing arrangements. Former CFO Andrew Fastow claimed that these complex arrangements were disclosed in footnotes and that Enron was not liable for repayment of the debts of these SPEs.

Enron's required filing of Form 10-Q with the SEC, on November 19, 2001, told a different story: If its debt were to fall below investment grade, Enron would have to repay those off-balance-sheet partnership obligations. Ironically, its disclosure of about $4 billion in off-balance-sheet liabilities triggered the downgrade of its debt to "junk" status and accelerated debt repayment. Enron's secrecy about its off-balance-sheet ventures led to its loss of credibility in the investment community. Its stock and bond prices slid downward; its market value plunged $35 billion in about a month; and on December 2, 2001, Enron became the largest U.S. company ever to have filed for bankruptcy.

Enron is not alone in its use of off-balance-sheet debt. Most airlines have large aircraft leases structured through off-balance-sheet vehicles, although analysts and investors are aware that the true leverage is higher. **Pacific Gas & Electric**, **Southern California Edison**, and **Xerox** have also run into problems from off-balance-sheet debt obligations. Don't expect the Enron debacle to eliminate special-purpose entities, although the SEC has been calling for tighter consolidation rules. Companies like the flexibility that off-balance-sheet financing sources provide, not to mention that such financing makes debt ratios and returns look better.

Sources: Peter Behr, "Cause of Death: Mistrust," *Washington Post* (December 13, 2001), p. E1; Ronald Fink, "What Andrew Fastow Knew," *CFO* (January 1, 2002); and David Henry, "Who Else Is Hiding Debt?" *Business Week* (January 28, 2002).

greater role in corporate financing than has been the case in other countries. In most European countries and especially in Japan and other Pacific Rim nations, large commercial banks are more actively involved in the financing of corporate activity than has been true in the United States. Furthermore, in many of these countries, banks are allowed to make large equity investments in nonfinancial corporations—a practice that is prohibited for U.S. banks. Finally, share ownership tends to be more tightly controlled among founding-family, institutional, and even public investors in Europe and Asia than it is for most large U.S. corporations. Tight ownership enables owners to understand the firm's financial condition better, resulting in their willingness to tolerate a higher degree of indebtedness.

On the other hand, similarities do exist between U.S. corporations and corporations in other countries. First, the same industry patterns of capital structure tend to be found all around the world. For example, in nearly all countries, pharmaceutical and other high-growth industrial firms tend to have lower debt ratios than do steel companies, airlines, and electric utility companies. Second, the capital structures of the largest U.S.-based multinational companies, which have access to many different capital markets around the world, typically resemble the capital structures of multinational companies from other countries more than they resemble those of smaller U.S. companies. Finally, the worldwide trend is

away from reliance on banks for corporate financing and toward greater reliance on security issuance. Over time, the differences in the capital structures of U.S. and non-U.S. firms will probably lessen.

Capital Structure Theory

Scholarly research suggests that there is an optimal capital structure range. *It is not yet possible to provide financial managers with a specified methodology for use in determining a firm's optimal capital structure.* Nevertheless, financial theory does offer help in understanding how a firm's chosen financing mix affects the firm's value.

In 1958, Franco Modigliani and Merton H. Miller[14] (commonly known as "M and M") demonstrated algebraically that, assuming perfect markets,[15] the capital structure that a firm chooses does not affect its value. Many researchers, including M and M, have examined the effects of less restrictive assumptions on the relationship between capital structure and the firm's value. The result is a theoretical *optimal* capital structure based on balancing the benefits and costs of debt financing. The major benefit of debt financing is the tax shield, which allows interest payments to be deducted in calculating taxable income. The cost of debt financing results from (1) the increased probability of bankruptcy caused by debt obligations, (2) the *agency costs* of the lender's monitoring the firm's actions, and (3) the costs associated with managers having more information about the firm's prospects than do investors.

Tax Benefits

Allowing firms to deduct interest payments on debt when calculating taxable income reduces the amount of the firm's earnings paid in taxes, thereby making more earnings available for bondholders and stockholders. The deductibility of interest means the cost of debt, k_i, to the firm is subsidized by the government. Letting k_d equal the before-tax cost of debt and letting T equal the tax rate, from Chapter 11 (Equation 11.2), we have $k_i = k_d \times (1 - T)$.

Probability of Bankruptcy

The chance that a firm will become bankrupt because of an inability to meet its obligations as they come due depends largely on its level of both business risk and financial risk.

Business Risk In Chapter 11, we defined *business risk* as the risk to the firm of being unable to cover its operating costs. In general, the greater the firm's *operating leverage*—the use of fixed operating costs—the higher its business risk. Although operating leverage is an important factor affecting business risk, two

14. Franco Modigliani and Merton H. Miller, "The Cost of Capital, Corporation Finance, and the Theory of Investment," *American Economic Review* (June 1958), pp. 261–297.

15. Perfect-market assumptions include (1) no taxes, (2) no brokerage or flotation costs for securities, (3) symmetrical information—investors and managers have the same information about the firm's investment prospects, and (4) investor ability to borrow at the same rate as corporations.

other factors—revenue stability and cost stability—also affect it. *Revenue stability* reflects the relative variability of the firm's sales revenues. Firms with reasonably stable levels of demand and with products that have stable prices have stable revenues. The result is low levels of business risk. Firms with highly volatile product demand and prices have unstable revenues that result in high levels of business risk. *Cost stability* reflects the relative predictability of input prices such as those for labor and materials. The more predictable and stable these input prices are, the lower the business risk; the less predictable and stable they are, the higher the business risk.

Business risk varies among firms, regardless of their lines of business, and is not affected by capital structure decisions. The level of business risk must be taken as a "given." The higher a firm's business risk, the more cautious the firm must be in establishing its capital structure. Firms with high business risk therefore tend toward less highly leveraged capital structures, and firms with low business risk tend toward more highly leveraged capital structures. We will hold business risk constant throughout the discussions that follow.

EXAMPLE

Cooke Company, a soft drink manufacturer, is preparing to make a capital structure decision. It has obtained estimates of sales and the associated levels of earnings before interest and taxes (EBIT) from its forecasting group: There is a 25% chance that sales will total $400,000, a 50% chance that sales will total $600,000, and a 25% chance that sales will total $800,000. Fixed operating costs total $200,000, and variable operating costs equal 50% of sales. These data are summarized, and the resulting EBIT calculated, in Table 12.9.

Hint The cash flows to investors from bonds are less risky than the dividends from preferred stock, which are less risky than dividends from common stock. Only with bonds is the issuer contractually obligated to pay the scheduled interest, and the amounts due to bondholders and preferred stockholders are usually fixed. Therefore, the required return for bonds is generally lower than that for preferred stock, which is lower than that for common stock.

The table shows that there is a 25% chance that the EBIT will be $0, a 50% chance that it will be $100,000, and a 25% chance that it will be $200,000. When developing the firm's capital structure, the financial manager must accept as given these levels of EBIT and their associated probabilities. These EBIT data effectively reflect a certain level of business risk that captures the firm's operating leverage, sales revenue variability, and cost predictability.

Financial Risk The firm's capital structure directly affects its *financial risk*, which is the risk to the firm of being unable to cover required financial obligations. The penalty for not meeting financial obligations is bankruptcy. The more fixed-cost financing—debt (including financial leases) and preferred stock—a firm has in its capital structure, the greater its financial leverage and risk. Finan-

TABLE 12.9 Sales and Associated EBIT Calculations for Cooke Company ($000)

Probability of sales	.25	.50	.25
Sales revenue	$400	$600	$800
Less: Fixed operating costs	200	200	200
Less: Variable operating costs (50% of sales)	200	300	400
Earnings before interest and taxes (EBIT)	$ 0	$100	$200

cial risk depends on the capital structure decision made by the management, and that decision is affected by the business risk the firm faces.

The *total risk* of a firm—business and financial risk combined—determines its probability of bankruptcy. Financial risk, its relationship to business risk, and their combined impact can be demonstrated by continuing the Cooke Company example.

EXAMPLE Cooke Company's current capital structure is as follows:

Current capital structure	
Long-term debt	$ 0
Common stock equity (25,000 shares at $20)	500,000
Total capital (assets)	$500,000

Hint As you learned in Chapter 2, the debt ratio is equal to the amount of total debt divided by the total assets. The higher this ratio, the more financial leverage a firm is using.

Let us assume that the firm is considering seven alternative capital structures. If we measure these structures using the debt ratio, they are associated with ratios of 0, 10, 20, 30, 40, 50, and 60%. Assuming that (1) the firm has no current liabilities, (2) its capital structure currently contains all equity as shown, and (3) the total amount of capital remains constant[16] at $500,000, the mix of debt and equity associated with the seven debt ratios would be as shown in Table 12.10. Also

TABLE 12.10 Capital Structures Associated with Alternative Debt Ratios for Cooke Company

	Capital structure ($000)			Shares of common stock outstanding (000)
Debt ratio (1)	Total assets[a] (2)	Debt [(1) × (2)] (3)	Equity [(2) − (3)] (4)	[(4) ÷ $20][b] (5)
0%	$500	$ 0	$500	25.00
10	500	50	450	22.50
20	500	100	400	20.00
30	500	150	350	17.50
40	500	200	300	15.00
50	500	250	250	12.50
60	500	300	200	10.00

[a]Because the firm, for convenience, is assumed to have no current liabilities, its total assets equal its total capital of $500,000.

[b]The $20 value represents the book value per share of common stock equity noted earlier.

16. This assumption is needed so that we can assess alternative capital structures without having to consider the returns associated with the investment of additional funds raised. Attention here is given only to the *mix* of capital, not to its investment.

TABLE 12.11 Level of Debt, Interest Rate, and Dollar Amount of Annual Interest Associated with Cooke Company's Alternative Capital Structures

Capital structure debt ratio	Debt ($000) (1)	Interest rate on *all* debt (2)	Interest ($000) [(1) × (2)] (3)
0%	$ 0	0.0%	$ 0.00
10	50	9.0	4.50
20	100	9.5	9.50
30	150	10.0	15.00
40	200	11.0	22.00
50	250	13.5	33.75
60	300	16.5	49.50

shown in the table is the number of shares of common stock outstanding under each alternative.

Associated with each of the debt levels in column 3 of Table 12.10 would be an interest rate that would be expected to increase with increases in financial leverage. The level of debt, the associated interest rate (assumed to apply to *all* debt), and the dollar amount of annual interest associated with each of the alternative capital structures are summarized in Table 12.11. Because both the level of debt and the interest rate increase with increasing financial leverage (debt ratios), the annual interest increases as well.

Table 12.12 uses the levels of EBIT and associated probabilities developed in Table 12.9, the number of shares of common stock found in column 5 of Table 12.10, and the annual interest values calculated in column 3 of Table 12.11 to calculate the earnings per share (EPS) for debt ratios of 0, 30, and 60%. A 40% tax rate is assumed. Also shown are the resulting expected EPS, the standard deviation of EPS, and the coefficient of variation of EPS associated with each debt ratio.[17]

Table 12.13 summarizes the pertinent data for the seven alternative capital structures. The values shown for 0, 30, and 60% debt ratios were developed in Table 12.12, whereas calculations of similar values for the other debt ratios (10, 20, 40, and 50%) are not shown. Because the coefficient of variation measures the risk relative to the expected EPS, it is the preferred risk measure for use in comparing capital structures. As the firm's financial leverage increases, so does its coefficient of variation of EPS. As expected, an increasing level of risk is associated with increased levels of financial leverage.

The relative risks of the two extremes of the capital structures evaluated in Table 12.12 (debt ratios = 0% and 60%) can be illustrated by showing the prob-

17. For explanatory convenience, the coefficient of variation of EPS, which measures total (nondiversifiable and diversifiable) risk, is used throughout this chapter as a proxy for beta, which measures the relevant nondiversifiable risk.

TABLE 12.12 Calculation of EPS for Selected Debt Ratios ($000) for Cooke Company

Probability of EBIT	.25	.50	.25
Debt Ratio = 0%			
EBIT (Table 12.9)	$ 0.00	$100.00	$200.00
Less: Interest (Table 12.11)	0.00	0.00	0.00
Net profits before taxes	$ 0.00	$100.00	$200.00
Less: Taxes ($T = 0.40$)	0.00	40.00	80.00
Net profits after taxes	$ 0.00	$ 60.00	$120.00
EPS (25.0 shares, Table 12.10)	$ 0.00	$ 2.40	$ 4.80
Expected EPS[a]		$ 2.40	
Standard deviation of EPS[a]		$ 1.70	
Coefficient of variation of EPS[a]		0.71	
Debt Ratio = 30%			
EBIT (Table 12.9)	$ 0.00	$100.00	$200.00
Less: Interest (Table 12.11)	15.00	15.00	15.00
Net profits before taxes	($15.00)	$ 85.00	$185.00
Less: Taxes ($T = 0.40$)	(6.00)[b]	34.00	74.00
Net profits after taxes	($ 9.00)	$ 51.00	$111.00
EPS (17.50 shares, Table 12.10)	($ 0.51)	$ 2.91	$ 6.34
Expected EPS[a]		$ 2.91	
Standard deviation of EPS[a]		$ 2.42	
Coefficient of variation of EPS[a]		0.83	
Debt Ratio = 60%			
EBIT (Table 12.9)	$ 0.00	$100.00	$200.00
Less: Interest (Table 12.11)	49.50	49.50	49.50
Net profits before taxes	($49.50)	$ 50.50	$150.50
Less: Taxes ($T = 0.40$)	(19.80)[b]	20.20	60.20
Net profits after taxes	($29.70)	$ 30.30	$ 90.30
EPS (10.00 shares, Table 12.10)	($ 2.97)	$ 3.03	$ 9.03
Expected EPS[a]		$ 3.03	
Standard deviation of EPS[a]		$ 4.24	
Coefficient of variation of EPS[a]		1.40	

[a]The procedures used to calculate the expected value, standard deviation, and coefficient of variation were presented in Equations 5.2, 5.3, and 5.4, respectively, in Chapter 5.

[b]It is assumed that the firm receives the tax benefit from its loss in the current period as a result of applying the tax loss carryback procedures specified in the tax law (see Chapter 1).

TABLE 12.13 Expected EPS, Standard Deviation, and Coefficient of Variation for Alternative Capital Structures for Cooke Company

Capital structure debt ratio	Expected EPS (1)	Standard deviation of EPS (2)	Coefficient of variation of EPS [(2) ÷ (1)] (3)
0%	$2.40	$1.70	0.71
10	2.55	1.88	0.74
20	2.72	2.13	0.78
30	2.91	2.42	0.83
40	3.12	2.83	0.91
50	3.18	3.39	1.07
60	3.03	4.24	1.40

ability distribution of EPS associated with each of them. Figure 12.3 shows these two distributions. The expected level of EPS increases with increasing financial leverage, and so does risk, as reflected in the relative dispersion of each of the distributions. Clearly, the uncertainty of the expected EPS, as well as the chance of experiencing negative EPS, is greater when higher degrees of financial leverage are employed.

Further, the nature of the risk–return tradeoff associated with the seven capital structures under consideration can be clearly observed by plotting the

FIGURE 12.3

Probability Distributions
Probability distributions of EPS for debt ratios of 0% and 60% for Cooke Company

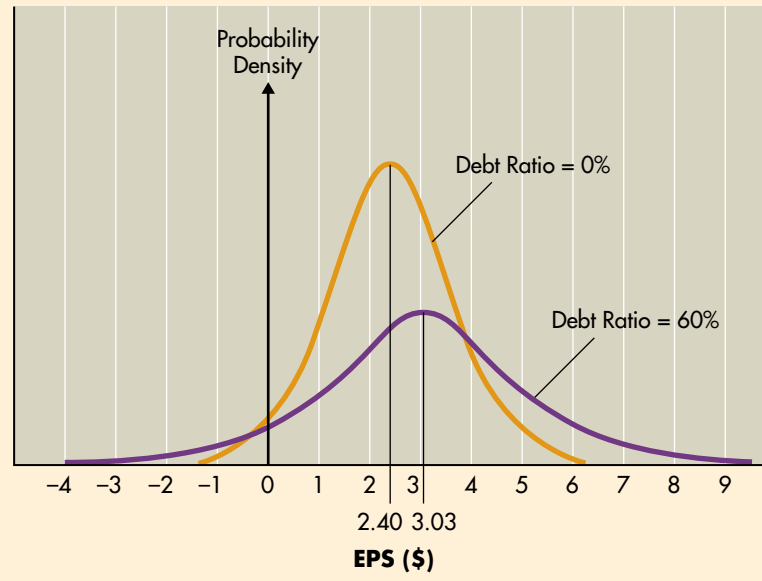
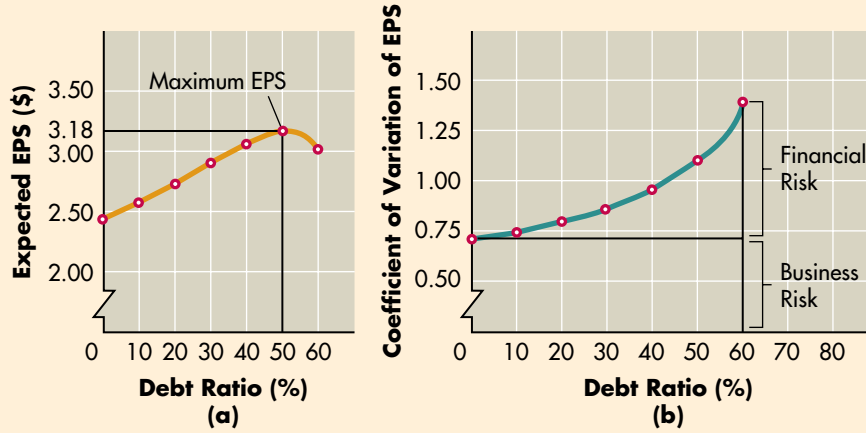


FIGURE 12.4

Expected EPS and Coefficient of Variation of EPS

Expected EPS and coefficient of variation of EPS for alternative capital structures for Cooke Company



expected EPS and coefficient of variation relative to the debt ratio. Plotting the data from Table 12.13 results in Figure 12.4. The figure shows that as debt is substituted for equity (as the debt ratio increases), the level of EPS rises and then begins to fall (graph **a**). The graph demonstrates that the peak earnings per share occurs at a debt ratio of 50%. The decline in earnings per share beyond that ratio results from the fact that the significant increases in interest are not fully offset by the reduction in the number of shares of common stock outstanding.

If we look at the risk behavior as measured by the coefficient of variation (graph **b**), we can see that risk increases with increasing leverage. A portion of the risk can be attributed to business risk, but the portion that changes in response to increasing financial leverage would be attributed to financial risk.

Clearly, a risk–return tradeoff exists relative to the use of financial leverage. How to combine these risk–return factors into a valuation framework will be addressed later in the chapter. The key point to recognize here is that as a firm introduces more leverage into its capital structure, it will experience increases in both the expected level of return and the associated risk.

Agency Costs Imposed by Lenders

As noted in Chapter 1, the managers of firms typically act as *agents* of the owners (stockholders). The owners give the managers the authority to manage the firm for the owners' benefit. The *agency problem* created by this relationship extends not only to the relationship between owners and managers but also to the relationship between owners and lenders.

When a lender provides funds to a firm, the interest rate charged is based on the lender's assessment of the firm's risk. The lender–borrower relationship, therefore, depends on the lender's expectations for the firm's subsequent behavior. The borrowing rates are, in effect, locked in when the loans are negotiated. After obtaining a loan at a certain rate, the firm could increase its risk by investing in risky projects or by incurring additional debt. Such action could weaken the lender's position in terms of its claim on the cash flow of the firm. From

another point of view, if these risky investment strategies paid off, the stockholders would benefit. Because payment obligations to the lender remain unchanged, the excess cash flows generated by a positive outcome from the riskier action would enhance the value of the firm to its owners. In other words, if the risky investments pay off, the owners receive all the benefits; but if the risky investments do not pay off, the lenders share in the costs.

Clearly, an incentive exists for the managers acting on behalf of the stockholders to "take advantage" of lenders. To avoid this situation, lenders impose certain monitoring techniques on borrowers, who as a result incur *agency costs*. The most obvious strategy is to deny subsequent loan requests or to increase the cost of future loans to the firm. Because this strategy is an after-the-fact approach, other controls must be included in the loan agreement. Lenders typically protect themselves by including provisions that limit the firm's ability to alter significantly its business and financial risk. These loan provisions tend to center on issues such as the minimum level of liquidity, asset acquisitions, executive salaries, and dividend payments.

Hint Typical loan provisions included in corporate bonds are discussed in Chapter 6.

By including appropriate provisions in the loan agreement, the lender can control the firm's risk and thus protect itself against the adverse consequences of this agency problem. Of course, in exchange for incurring agency costs by agreeing to the operating and financial constraints placed on it by the loan provisions, the firm should benefit by obtaining funds at a lower cost.

Asymmetric Information

Two surveys examined capital structure decisions.[18] Financial executives were asked which of two major criteria determined their financing decisions: (1) maintaining a *target capital structure* or (2) following a hierarchy of financing. This hierarchy, called a **pecking order,** begins with retained earnings, which is followed by debt financing and finally external equity financing. Respondents from 31 percent of Fortune 500 firms and from 11 percent of the (smaller) 500 largest over-the-counter firms answered target capital structure. Respondents from 69 percent of the Fortune 500 firms and 89 percent of the 500 largest OTC firms chose the pecking order.

pecking order
A hierarchy of financing that begins with retained earnings, which is followed by debt financing and finally external equity financing.

At first glance, on the basis of financial theory, this choice appears to be inconsistent with wealth maximization goals, but Stewart Myers has explained how "asymmetric information" could account for the pecking order financing preferences of financial managers.[19] **Asymmetric information** results when managers of a firm have more information about operations and future prospects than do investors. Assuming that managers make decisions with the goal of maximizing the wealth of existing stockholders, then asymmetric information can affect the capital structure decisions that managers make.

asymmetric information
The situation in which managers of a firm have more information about operations and future prospects than do investors.

18. The results of the survey of Fortune 500 firms are reported in J. Michael Pinegar and Lisa Wilbricht, "What Managers Think of Capital Structure Theory: A Survey," *Financial Management* (Winter 1989), pp. 82–91, and the results of a similar survey of the 500 largest OTC firms are reported in Linda C. Hittle, Kamal Haddad, and Lawrence J. Gitman, "Over-the-Counter Firms, Asymmetric Information, and Financing Preferences," *Review of Financial Economics* (Fall 1992), pp. 81–92.

19. Stewart C. Myers, "The Capital Structure Puzzle," *Journal of Finance* (July 1984), pp. 575–592.

signal
A financing action by management that is believed to reflect its view of the firm's stock value; generally, debt financing is viewed as a *positive signal* that management believes the stock is "undervalued," and a stock issue is viewed as a *negative signal* that management believes the stock is "overvalued."

Suppose, for example, that management has found a valuable investment that will require additional financing. Management believes that the prospects for the firm's future are very good and that the market, as indicated by the firm's current stock price, does not fully appreciate the firm's value. In this case, it would be advantageous to current stockholders if management raised the required funds using debt rather than issuing new stock. Using debt to raise funds is frequently viewed as a **signal** that reflects management's view of the firm's stock value. Debt financing is a *positive signal* suggesting that management believes that the stock is "undervalued" and therefore a bargain. When the firm's positive future outlook becomes known to the market, the increased value will be fully captured by existing owners, rather than having to be shared with new stockholders.

If, however, the outlook for the firm is poor, management may believe that the firm's stock is "overvalued." In that case, it would be in the best interest of existing stockholders for the firm to issue new stock. Therefore, investors often interpret the announcement of a stock issue as a *negative signal*—bad news concerning the firm's prospects—and the stock price declines. This decrease in stock value, along with high underwriting costs for stock issues (compared to debt issues), make new stock financing very expensive. When the negative future outlook becomes known to the market, the decreased value is shared with new stockholders, rather than being fully captured by existing owners.

Because conditions of asymmetric information exist from time to time, firms should maintain some reserve borrowing capacity by keeping debt levels low. This reserve allows the firm to take advantage of good investment opportunities without having to sell stock at a low value and thus send signals that unduly influence the stock price.

The Optimal Capital Structure

What, then, *is* an optimal capital structure, even if it exists (so far) only in theory? To provide some insight into an answer, we will examine some basic financial relationships. It is generally believed that *the value of the firm is maximized when the cost of capital is minimized*. By using a modification of the simple zero-growth valuation model (see Equation 7.3 in Chapter 7), we can define the value of the firm, V, by Equation 12.11.

$$V = \frac{\text{EBIT} \times (1 - T)}{k_a} \tag{12.11}$$

where

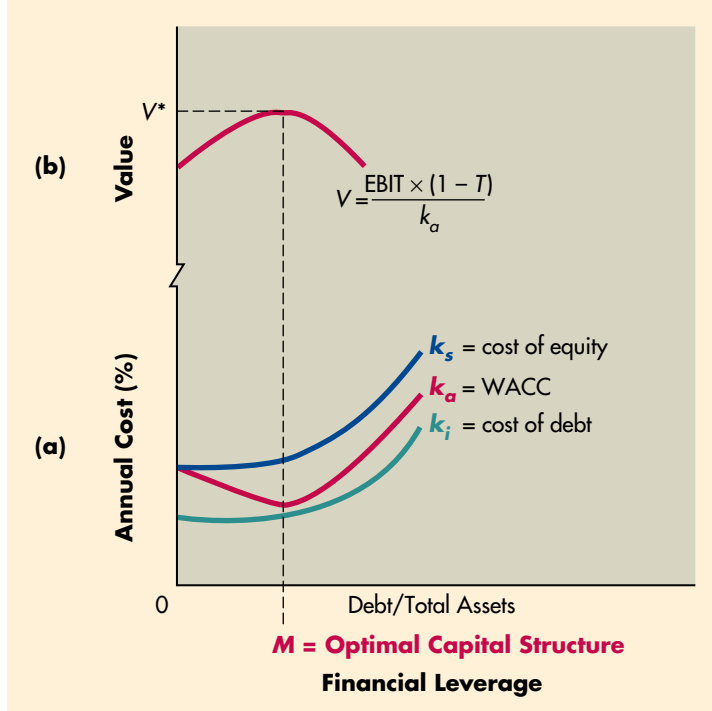
$$\begin{aligned} \text{EBIT} &= \text{earnings before interest and taxes} \\ T &= \text{tax rate} \\ \text{EBIT} \times (1 - T) &= \text{the after-tax operating earnings available to the debt and equity holders} \\ k_a &= \text{weighted average cost of capital} \end{aligned}$$

Clearly, if we assume that EBIT is constant, the value of the firm, V, is maximized by minimizing the weighted average cost of capital, k_a.

FIGURE 12.5

Cost Functions and Value

Capital costs and the optimal capital structure



Cost Functions

Figure 12.5(*a*) plots three cost functions—the cost of debt, the cost of equity, and the weighted average cost of capital (WACC)—as a function of financial leverage measured by the debt ratio (debt to total assets). The *cost of debt,* k_i, remains low because of the tax shield, but it slowly increases as leverage increases, to compensate lenders for increasing risk. The *cost of equity,* k_s, is above the cost of debt. It increases as financial leverage increases, but it generally increases more rapidly than the cost of debt. The cost of equity rises because the stockholders require a higher return as leverage increases, to compensate for the higher degree of financial risk.

The *weighted average cost of capital* (*WACC*) results from a weighted average of the firm's debt and equity capital costs. At a debt ratio of zero, the firm is 100 percent equity-financed. As debt is substituted for equity and as the debt ratio increases, the WACC declines because the debt cost is less than the equity cost ($k_i < k_s$). As the debt ratio continues to increase, the increased debt and equity costs eventually cause the WACC to rise (after point *M* in Figure 12.5(*a*)). This behavior results in a U-shaped, or saucer-shaped, weighted average cost-of-capital function, k_a.

optimal capital structure
The capital structure at which the weighted average cost of capital is minimized, thereby maximizing the firm's value.

A Graphical View of the Optimal Structure

Because the maximization of value, *V*, is achieved when the overall cost of capital, k_a, is at a minimum (see Equation 12.11), the **optimal capital structure** is that at which the weighted average cost of capital, k_a, is minimized. In Figure 12.5(*a*),

point *M* represents the *minimum weighted average cost of capital*—the point of optimal financial leverage and hence of optimal capital structure for the firm. Figure 12.5(*b*) plots the value of the firm that results from substitution of k_a in Figure 12.5(*a*) for various levels of financial leverage into the zero-growth valuation model in Equation 12.11. As shown in Figure 12.5(*b*), at the optimal capital structure, point *M*, the value of the firm is maximized at V^*.

Generally, the lower the firm's weighted average cost of capital, the greater the difference between the return on a project and the WACC, and therefore the greater the owners' return. Simply stated, minimizing the weighted average cost of capital allows management to undertake a larger number of profitable projects, thereby further increasing the value of the firm.

As a practical matter, there is no way to calculate the optimal capital structure implied by Figure 12.5. Because it is impossible either to know or to remain at the precise optimal capital structure, firms generally try to operate in a *range* that places them near what they believe to be the optimal capital structure.

Review Questions

12–6 What is a firm's *capital structure?* What ratios assess the degree of financial leverage in a firm's capital structure?

12–7 In what ways are the capital structures of U.S. and non-U.S. firms different? How are they similar?

12–8 What is the major benefit of debt financing? How does it affect the firm's cost of debt?

12–9 What are *business risk* and *financial risk?* How does each of them influence the firm's capital structure decisions?

12–10 Briefly describe the *agency problem* that exists between owners and lenders. How do lenders cause firms to incur *agency costs* to resolve this problem?

12–11 How does *asymmetric information* affect the firm's capital structure decisions? How do the firm's financing actions give investors *signals* that reflect management's view of stock value?

12–12 How do the cost of debt, the cost of equity, and the weighted average cost of capital (WACC) behave as the firm's financial leverage increases from zero? Where is the *optimal capital structure?* What is its relationship to the firm's value at that point?

LG5 12.3 The EBIT–EPS Approach to Capital Structure

EBIT–EPS approach
An approach for selecting the capital structure that maximizes earnings per share (EPS) over the expected range of earnings before interest and taxes (EBIT).

One of the key variables affecting the market value of the firm's shares is its return to owners, as reflected by the firm's earnings. Therefore, earnings per share (EPS) can be conveniently used to analyze alternative capital structures. The **EBIT–EPS approach** to capital structure involves selecting the capital structure that maximizes EPS over the expected range of earnings before interest and taxes (EBIT).

Presenting a Financing Plan Graphically

To analyze the effects of a firm's capital structure on the owners' returns, we consider the relationship between earnings before interest and taxes (EBIT) and earnings per share (EPS). A constant level of EBIT—constant *business risk*—is assumed, to isolate the effect on returns of the financing costs associated with alternative capital structures. EPS is used to measure the owners' returns, which are expected to be closely related to share price.[20]

The Data Required

To graph a financing plan, we need to know at least two EBIT–EPS coordinates. The approach for obtaining coordinates can be illustrated by an example.

EXAMPLE

EBIT–EPS coordinates can be found by assuming specific EBIT values and calculating the EPS associated with them.[21] Such calculations for three capital structures—debt ratios of 0, 30, and 60%—for Cooke Company were presented in Table 12.12. For EBIT values of $100,000 and $200,000, the associated EPS values calculated there are summarized in the table within Figure 12.6.

Plotting the Data

financial breakeven point
The level of EBIT necessary to just cover all *fixed financial costs;* the level of EBIT for which EPS = $0.

The Cooke Company data can be plotted on a set of EBIT–EPS axes, as shown in Figure 12.6. The figure shows the level of EPS expected for each level of EBIT. For levels of EBIT below the *x*-axis intercept, a loss (negative EPS) results. Each of the *x*-axis intercepts is a **financial breakeven point,** the level of EBIT necessary to just cover all *fixed financial costs* (EPS = $0).

Comparing Alternative Capital Structures

We can compare alternative capital structures by graphing financing plans as shown in Figure 12.6.

EXAMPLE

Cooke Company's capital structure alternatives were plotted on the EBIT–EPS axes in Figure 12.6. This figure shows that each capital structure is superior to the others in terms of maximizing EPS over certain ranges of EBIT. The zero-leverage capital structure (debt ratio = 0%) is superior to either of the other capi-

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20. The relationship that is expected to exist between EPS and owner wealth is not one of cause and effect. As indicated in Chapter 1, the maximization of profits does not necessarily ensure that owners' wealth is also being maximized. Nevertheless, it is expected that the movement of earnings per share will have some effect on owners' wealth, because EPS data constitute one of the few pieces of information investors receive, and they often bid the firm's share price up or down in response to the level of these earnings.

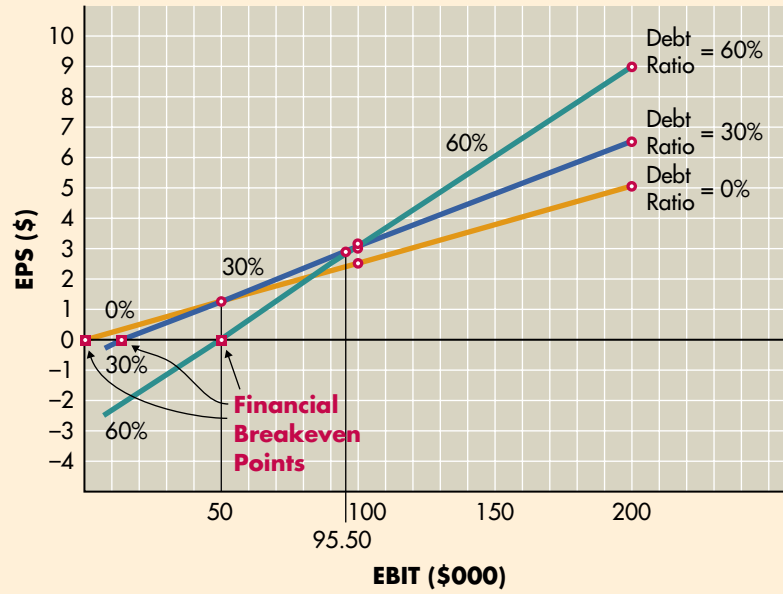
21. A convenient method for finding one EBIT–EPS coordinate is to calculate the *financial breakeven point,* the level of EBIT for which the firm's EPS just equals $0. It is the level of EBIT needed just to cover all fixed financial costs—annual interest (I) and preferred stock dividends (PD). The equation for the financial breakeven point is

$$\text{Financial breakeven point} = I + \frac{PD}{1 - T}$$

where T is the tax rate. It can be seen that when PD = $0, the financial breakeven point is equal to I, the annual interest payment.

FIGURE 12.6

EBIT–EPS Approach
A comparison of selected capital structures for Cooke Company (data from Table 12.12)



Capital structure debt ratio	EBIT $100,000	EBIT $200,000
	Earnings per share (EPS)	
0%	$2.40	$4.80
30	2.91	6.34
60	3.03	9.03

tal structures for levels of EBIT between $0 and $50,000. Between $50,000 and $95,500 of EBIT, the capital structure associated with a debt ratio of 30% is preferred. And at a level of EBIT above $95,500, the 60% debt ratio capital structure provides the highest earnings per share.[22]

22. An algebraic technique can be used to find the *indifference points* between the capital structure alternatives. This technique involves expressing each capital structure as an equation stated in terms of earnings per share, setting the equations for two capital structures equal to each other, and solving for the level of EBIT that causes the equations to be equal. When we use the notation from footnote 21 and let n equal the number of shares of common stock outstanding, the general equation for the earnings per share from a financing plan is

$$\text{EPS} = \frac{(1 - T) \times (\text{EBIT} - I) - PD}{n}$$

Comparing Cooke Company's 0% and 30% capital structures, we get

$$\frac{(1 - 0.40) \times (\text{EBIT} - \$0) - \$0}{25.00} = \frac{(1 - 0.40) \times (\text{EBIT} - \$15.00) - \$0}{17.50}$$

$$\frac{0.60 \times \text{EBIT}}{25.00} = \frac{0.60 \times \text{EBIT} - \$9.00}{17.50}$$

$$10.50 \times \text{EBIT} = 15.00 \times \text{EBIT} - \$225.00$$

$$\$225.00 = 4.50 \times \text{EBIT}$$

$$\text{EBIT} = \$50$$

The calculated value of the indifference point between the 0% and 30% capital structures is therefore $50,000, as can be seen in Figure 12.6.

Considering Risk in EBIT–EPS Analysis

When interpreting EBIT–EPS analysis, it is important to consider the risk of each capital structure alternative. Graphically, the risk of each capital structure can be viewed in light of two measures: (1) the *financial breakeven point* (EBIT-axis intercept) and (2) the *degree of financial leverage* reflected in the slope of the capital structure line: *The higher the financial breakeven point and the steeper the slope of the capital structure line, the greater the financial risk.*[23]

Further assessment of risk can be performed by using ratios. As financial leverage (measured by the debt ratio) increases, we expect a corresponding decline in the firm's ability to make scheduled interest payments (measured by the times interest earned ratio).

EXAMPLE Reviewing the three capital structures plotted for Cooke Company in Figure 12.6, we can see that as the debt ratio increases, so does the financial risk of each alternative. Both the financial breakeven point and the slope of the capital structure lines increase with increasing debt ratios. If we use the $100,000 EBIT value, for example, the times interest earned ratio (EBIT ÷ interest) for the zero-leverage capital structure is infinity ($100,000 ÷ $0); for the 30% debt case, it is 6.67 ($100,000 ÷ $15,000); and for the 60% debt case, it is 2.02 ($100,000 ÷ $49,500). Because lower times interest earned ratios reflect higher risk, these ratios support the conclusion that the risk of the capital structures increases with increasing financial leverage. The capital structure for a debt ratio of 60% is riskier than that for a debt ratio of 30%, which in turn is riskier than the capital structure for a debt ratio of 0%.

The Basic Shortcoming of EBIT–EPS Analysis

The most important point to recognize when using EBIT–EPS analysis is that this technique tends to concentrate on *maximizing earnings* rather than maximizing owner wealth. The use of an EPS-maximizing approach generally ignores risk. If investors did not require risk premiums (additional returns) as the firm increased the proportion of debt in its capital structure, a strategy involving maximizing EPS would also maximize owner wealth. But because risk premiums increase with increases in financial leverage, the maximization of EPS *does not* ensure owner wealth maximization. To select the best capital structure, both return (EPS) and risk (via the required return, k_s) must be integrated into a valuation framework consistent with the capital structure theory presented earlier.

Review Question

12–13 Explain the *EBIT–EPS approach* to capital structure. Include in your explanation a graph indicating the *financial breakeven point;* label the axes. Is this approach consistent with maximization of the owners' wealth?

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23. The degree of financial leverage (DFL) is reflected in the slope of the EBIT–EPS function. The steeper the slope, the greater the degree of financial leverage, because the change in EPS (y axis) that results from a given change in EBIT (x axis) increases with increasing slope and decreases with decreasing slope.

LG6 12.4 Choosing the Optimal Capital Structure

A wealth maximization framework for use in making capital structure decisions should include the two key factors of return and risk. This section describes the procedures for linking to market value the return and risk associated with alternative capital structures.

Linkage

To determine the firm's value under alternative capital structures, the firm must find the level of return that must be earned to compensate owners for the risk being incurred. Such a framework is consistent with the overall valuation framework developed in Chapters 6 and 7 and applied to capital budgeting decisions in Chapters 9 and 10.

The required return associated with a given level of financial risk can be estimated in a number of ways. Theoretically, the preferred approach would be first to estimate the beta associated with each alternative capital structure and then to use the CAPM framework presented in Equation 5.8 to calculate the required return, k_s. A more operational approach involves linking the financial risk associated with each capital structure alternative directly to the required return. Such an approach is similar to the CAPM-type approach demonstrated in Chapter 10 for linking project risk and required return (RADR). Here it involves estimating the required return associated with each level of financial risk, as measured by a statistic such as the coefficient of variation of EPS. Regardless of the approach used, one would expect the required return to increase as the financial risk increases.

EXAMPLE Cooke Company, using as risk measures the coefficients of variation of EPS associated with each of the seven alternative capital structures, estimated the associated required returns. These are shown in Table 12.14. As expected, the estimated

TABLE 12.14 Required Returns for Cooke Company's Alternative Capital Structures

Capital structure debt ratio	Coefficient of variation of EPS (from column 3 of Table 12.13) (1)	Estimated required return, k_s (2)
0%	0.71	11.5%
10	0.74	11.7
20	0.78	12.1
30	0.83	12.5
40	0.91	14.0
50	1.07	16.5
60	1.40	19.0

required return of owners, k_s, increases with increasing risk, as measured by the coefficient of variation of EPS.

Estimating Value

The value of the firm associated with alternative capital structures can be estimated by using one of the standard valuation models. If, for simplicity, we assume that all earnings are paid out as dividends, we can use a zero-growth valuation model such as that developed in Chapter 7. The model, originally stated in Equation 7.3, is restated here with EPS substituted for dividends (because in each year the dividends would equal EPS):

$$P_0 = \frac{\text{EPS}}{k_s} \tag{12.12}$$

By substituting the expected level of EPS and the associated required return, k_s, into Equation 12.12, we can estimate the per-share value of the firm, P_0.

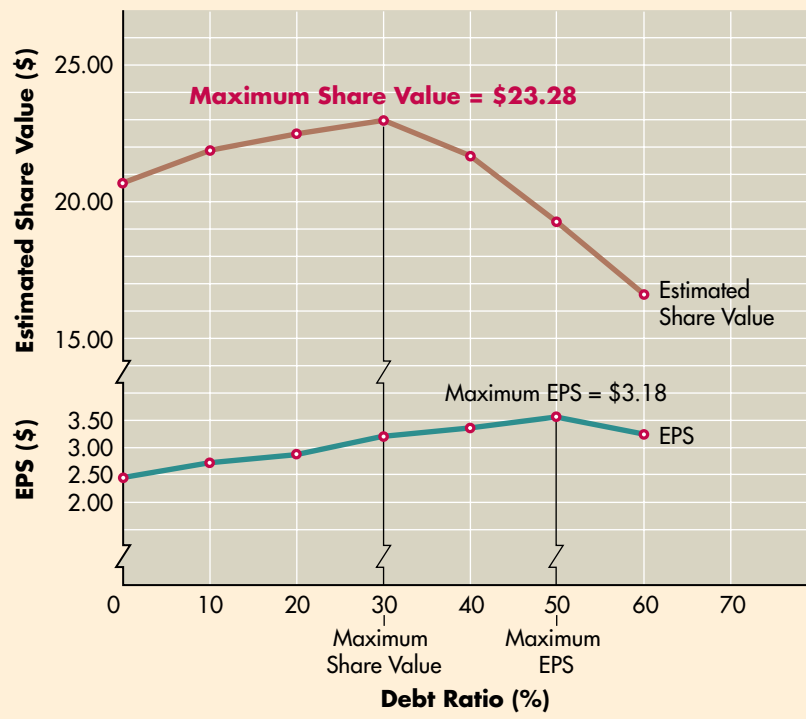
EXAMPLE We can now estimate the value of Cooke Company's stock under each of the alternative capital structures. Substituting the expected EPS (column 1 of Table 12.13) and the required returns, k_s (column 2 of Table 12.14), into Equation 12.12 for each of the capital structures, we obtain the share values given in column 3 of Table 12.15. Plotting the resulting share values against the associated debt ratios, as shown in Figure 12.7, clearly illustrates that the maximum share value occurs at the capital structure associated with a debt ratio of 30%.

TABLE 12.15 Calculation of Share Value Estimates Associated with Alternative Capital Structures for Cooke Company

Capital structure debt ratio	Expected EPS (from column 1 of Table 12.13) (1)	Estimated required return, k_s (from column 2 of Table 12.14) (2)	Estimated share value [(1) ÷ (2)] (3)
0%	$2.40	.115	$20.87
10	2.55	.117	21.79
20	2.72	.121	22.48
30	2.91	.125	23.28
40	3.12	.140	22.29
50	3.18	.165	19.27
60	3.03	.190	15.95

FIGURE 12.7

Estimating Value
Estimated share value and EPS for alternative capital structures for Cooke Company



Maximizing Value versus Maximizing EPS

Throughout this text, the goal of the financial manager has been specified as maximizing owner wealth, not profit. Although there is some relationship between expected profit and value, there is no reason to believe that profit-maximizing strategies necessarily result in wealth maximization. It is therefore the wealth of the owners as reflected in the estimated share value that should serve as the criterion for selecting the best capital structure. A final look at Cooke Company will highlight this point.

EXAMPLE

Further analysis of Figure 12.7 clearly shows that although the firm's profits (EPS) are maximized at a debt ratio of 50%, share value is maximized at a 30% debt ratio. Therefore, the preferred capital structure would be the 30% debt ratio. The two approaches provide different conclusions because EPS maximization does not consider risk.

Some Other Important Considerations

Because there is really no practical way to calculate the optimal capital structure, any quantitative analysis of capital structure must be tempered with other important considerations. Some of the more important additional factors involved in capital structure decisions are summarized in Table 12.16.

TABLE 12.16 Important Factors to Consider in Making Capital Structure Decisions

Concern	Factor	Description
Business risk	Revenue stability	Firms that have stable and predictable revenues can more safely undertake highly leveraged capital structures than can firms with volatile patterns of sales revenue. Firms with growing sales tend to benefit from added debt because they can reap the positive benefits of financial leverage, which magnifies the effect of these increases.
	Cash flow	When considering a new capital structure, the firm must focus on its ability to generate the cash flows necessary to meet obligations. Cash forecasts reflecting an ability to service debts (and preferred stock) must support any shift in capital structure.
Agency costs	Contractual obligations	A firm may be contractually constrained with respect to the type of funds that it can raise. For example, a firm might be prohibited from selling additional debt except when the claims of holders of such debt are made subordinate to the existing debt. Contractual constraints on the sale of additional stock, as well as on the ability to distribute dividends on stock, might also exist.
	Management preferences	Occasionally, a firm will impose an internal constraint on the use of debt to limit its risk exposure to a level deemed acceptable to management. In other words, because of risk aversion, the firm's management constrains the firm's capital structure at a level that may or may not be the true optimum.
	Control	A management concerned about control may prefer to issue debt rather than (voting) common stock. Under favorable market conditions, a firm that wanted to sell equity could make a *preemptive offering* or issue *nonvoting shares* (see Chapter 7), allowing each shareholder to maintain proportionate ownership. Generally, only in closely held firms or firms threatened by takeover does control become a major concern in the capital structure decision.
Asymmetric information	External risk assessment	The firm's ability to raise funds quickly and at favorable rates depends on the external risk assessments of lenders and bond raters. The firm must therefore consider the impact of capital structure decisions both on share value and on published financial statements from which lenders and raters assess the firm's risk.
	Timing	At times when the general level of interest rates is low, debt financing might be more attractive; when interest rates are high, the sale of stock may be more appealing. Sometimes both debt and equity capital become unavailable at what would be viewed as reasonable terms. General economic conditions—especially those of the capital market—can thus significantly affect capital structure decisions.

Review Questions

12–14 Why do *maximizing EPS* and *maximizing value* not necessarily lead to the same conclusion about the optimal capital structure?

12–15 What important factors in addition to quantitative factors should a firm consider when it is making a capital structure decision?

SUMMARY

FOCUS ON VALUE

The amount of leverage (fixed-cost assets or funds) employed by a firm directly affects its risk, return, and share value. Generally, higher leverage raises, and lower leverage reduces, risk and return. Operating leverage is concerned with the level of fixed operating costs; financial leverage focuses on fixed financial costs, particularly interest on debt and any preferred stock dividends. The firm's financial leverage is determined by its capital structure—its mix of long-term debt and equity financing. Because of its fixed interest payments, the more debt a firm employs relative to its equity, the greater its financial leverage. The value of the firm is clearly affected by its degree of operating leverage and by the composition of its capital structure. The financial manager must therefore carefully consider the types of operating and financial costs it incurs, recognizing that with greater fixed costs comes higher risk. Major decisions with regard to both operating cost structure and capital structure must therefore focus on their impact on the firm's value. Only those leverage and capital structure decisions that are consistent with the firm's goal of **maximizing its stock price** should be implemented.

REVIEW OF LEARNING GOALS

LG1 **Discuss the role of breakeven analysis, the operating breakeven point, and the effect of changing costs on it.** Breakeven analysis measures the level of sales necessary to cover total operating costs. The operating breakeven point may be calculated algebraically, by dividing fixed operating costs by the difference between the sale price per unit and variable operating cost per unit, or it may be determined graphically. The operating breakeven point increases with increased fixed and variable operating costs and decreases with an increase in sale price, and vice versa.

LG2 **Understand operating, financial, and total leverage and the relationships among them.** Operating leverage is the use of fixed operating costs by the firm to magnify the effects of changes in sales on EBIT. The higher the fixed operating costs, the greater the operating leverage. Financial leverage is the use of fixed financial costs by the firm to magnify the effects of changes in EBIT on EPS. The higher the fixed financial costs—typically, interest on debt and preferred stock dividends—the greater the financial leverage. The total leverage of the firm is the use of fixed costs—both operating and financial—to magnify the effects of changes in sales on EPS. Total leverage reflects the combined effect of operating and financial leverage.

LG3 **Describe the types of capital, external assessment of capital structure, the capital structure of non-U.S. firms, and capital structure theory.** Two basic types of capital—debt capital and equity capital—make up a firm's capital structure. They differ with respect to voice in management, claims on income and assets, maturity, and tax treatment. Capital structure can be externally assessed by using financial ratios—debt ratio, times interest earned ratio, and fixed-payment coverage ratio. Non-U.S. companies tend to have much higher degrees of indebtedness than do their U.S. counterparts, primarily because U.S. capital markets are much more developed. Similarities between U.S. corporations and those of other countries include industry patterns of capital structure, large multinational company capital structures, and the trend toward greater reliance

on securities issuance and less reliance on banks for financing.

Research suggests that there is an optimal capital structure that balances the firm's benefits and costs of debt financing. The major benefit of debt financing is the tax shield. The costs of debt financing include the probability of bankruptcy, caused by business and financial risk; agency costs imposed by lenders; and asymmetric information, which typically causes firms to raise funds in a pecking order of retained earnings, then debt, and finally external equity financing, in order to send positive signals to the market and thereby enhance the wealth of shareholders.

LG4 **Explain the optimal capital structure using a graphical view of the firm's cost-of-capital functions and a zero-growth valuation model.** The zero-growth valuation model can be used to define the firm's value as its after-tax EBIT divided by its weighted average cost of capital. Assuming that EBIT is constant, the value of the firm is maximized by minimizing its weighted average cost of capital (WACC). The optimal capital structure is the one that minimizes the WACC. Graphically, although both debt and equity costs rise with increasing financial leverage, the lower cost of debt causes the WACC to decline and then rise with increasing financial leverage. As a result, the firm's WACC exhibits a U-shape, whose minimum value defines the optimal capital structure that maximizes owner wealth.

LG5 **Discuss the EBIT–EPS approach to capital structure.** The EBIT–EPS approach evaluates capital structures in light of the returns they provide the firm's owners and their degree of financial risk. Under the EBIT–EPS approach, the preferred capital structure is the one that is expected to provide maximum EPS over the firm's expected range of EBIT. Graphically, this approach reflects risk in terms of the financial breakeven point and the slope of the capital structure line. The major shortcoming of EBIT–EPS analysis is that it concentrates on maximizing earnings rather than owners' wealth.

LG6 **Review the return and risk of alternative capital structures, their linkage to market value, and other important considerations related to capital structure.** The best capital structure can be selected by using a valuation model to link return and risk factors. The preferred capital structure is the one that results in the highest estimated share value, not the highest EPS. Other important nonquantitative factors, such as revenue stability, cash flow, contractual obligations, management preferences, control, external risk assessment, and timing, must also be considered when making capital structure decisions.

SELF-TEST PROBLEMS (Solutions in Appendix B)

LG1 LG2 **ST 12–1 Breakeven point and all forms of leverage** TOR most recently sold 100,000 units at $7.50 each; its variable operating costs are $3.00 per unit, and its fixed operating costs are $250,000. Annual interest charges total $80,000, and the firm has 8,000 shares of $5 (annual dividend) preferred stock outstanding. It currently has 20,000 shares of common stock outstanding. Assume that the firm has a 40% tax rate.

a. At what level of sales (in units) would the firm break even on operations (that is, EBIT = $0)?

b. Calculate the firm's earnings per share (EPS) in tabular form at (1) the current level of sales and (2) a 120,000-unit sales level.

c. Using the current *$750,000 level of sales as a base,* calculate the firm's degree of operating leverage (DOL).

d. Using the EBIT *associated with the $750,000 level of sales as a base,* calculate the firm's degree of financial leverage (DFL).
e. Use the degree of total leverage (DTL) concept to determine the effect (in percentage terms) of a 50% increase in TOR's sales *from the $750,000 base level* on its earnings per share.

LG5 **ST 12–2 EBIT–EPS analysis** Newlin Electronics is considering additional financing of $10,000. It currently has $50,000 of 12% (annual interest) bonds and 10,000 shares of common stock outstanding. The firm can obtain the financing through a 12% (annual interest) bond issue or through the sale of 1,000 shares of common stock. The firm has a 40% tax rate.
a. Calculate two EBIT–EPS coordinates for each plan by selecting any two EBIT values and finding their associated EPS values.
b. Plot the two financing plans on a set of EBIT–EPS axes.
c. On the basis of your graph in part **b,** at what level of EBIT does the bond plan become superior to the stock plan?

LG3 LG6 **ST 12–3 Optimal capital structure** Hawaiian Macadamia Nut Company has collected the following data with respect to its capital structure, expected earnings per share, and required return.

Capital structure debt ratio	Expected earnings per share	Required return, k_s
0%	$3.12	13%
10	3.90	15
20	4.80	16
30	5.44	17
40	5.51	19
50	5.00	20
60	4.40	22

a. Compute the estimated share value associated with each of the capital structures, using the simplified method described in this chapter (see Equation 12.12).
b. Determine the optimal capital structure on the basis of (1) maximization of expected earnings per share and (2) maximization of share value.
c. Which capital structure do you recommend? Why?

PROBLEMS

LG1 **12–1 Breakeven point—Algebraic** Kate Rowland wishes to estimate the number of flower arrangements she must sell at $24.95 to break even. She has estimated fixed operating costs of $12,350 per year and variable operating costs of $15.45 per arrangement. How many flower arrangements must Kate sell to break even on operating costs?

LG1 **12–2 Breakeven comparisons—Algebraic** Given the price and cost data shown in the accompanying table for each of the three firms, F, G, and H, answer the following questions.

Firm	F	G	H
Sale price per unit	$ 18.00	$ 21.00	$ 30.00
Variable operating cost per unit	6.75	13.50	12.00
Fixed operating cost	45,000	30,000	90,000

a. What is the operating breakeven point in units for each firm?
b. How would you rank these firms in terms of their risk?

LG1 **12–3 Breakeven point—Algebraic and graphical** Fine Leather Enterprises sells its single product for $129.00 per unit. The firm's fixed operating costs are $473,000 annually, and its variable operating costs are $86.00 per unit.
a. Find the firm's operating breakeven point in units.
b. Label the *x* axis "Sales (units)" and the *y* axis "Costs/Revenues ($)," and then graph the firm's sales revenue, total operating cost, and fixed operating cost functions on these axes. In addition, label the operating breakeven point and the areas of loss and profit (EBIT).

LG1 **12–4 Breakeven analysis** Barry Carter is considering opening a record store. He wants to estimate the number of CDs he must sell to break even. The CDs will be sold for $13.98 each, variable operating costs are $10.48 per CD, and annual fixed operating costs are $73,500.
a. Find the operating breakeven point in number of CDs.
b. Calculate the total operating costs at the breakeven volume found in part **a.**
c. If Barry estimates that at a minimum he can sell 2,000 CDs *per month,* should he go into the record business?
d. How much EBIT will Barry realize if he sells the minimum 2,000 CDs per month noted in part **c**?

LG1 **12–5 Breakeven point—Changing costs/revenues** JWG Company publishes *Creative Crosswords*. Last year the book of puzzles sold for $10 with variable operating cost per book of $8 and fixed operating costs of $40,000. How many books must JWG sell this year to achieve the breakeven point for the stated operating costs, given the following different circumstances?
a. All figures remain the same as last year.
b. Fixed operating costs increase to $44,000; all other figures remain the same.
c. The selling price increases to $10.50; all costs remain the same as last year.
d. Variable operating cost per book increases to $8.50; all other figures remain the same.
e. What conclusions about the operating breakeven point can be drawn from your answers?

LG1 **12–6 Breakeven analysis** Molly Jasper and her sister, Caitlin Peters, got into the novelties business almost by accident. Molly, a talented sculptor, often made little figurines as gifts for friends. Occasionally, she and Caitlin would set up a booth at a crafts fair and sell a few of the figurines along with jewelry that Caitlin made. Little by little, demand for the figurines, now called Mollycaits, grew, and the sisters began to reproduce some of the favorites in resin, using molds of the originals. The day came when a buyer for a major department store offered them a contract to produce 1,500 figurines of various designs for $10,000. Molly and Caitlin realized that it was time to get down to business. To make bookkeeping simpler, Molly had priced all of the figurines at $8.00. Variable operating costs amounted to an average of $6.00 per unit. In order to produce the order, Molly and Caitlin would have to rent industrial facilities for a month, which would cost them $4,000.

a. Calculate Mollycait's operating breakeven point.
b. Calculate Mollycait's EBIT on the department store order.
c. If Molly renegotiates the contract at a price of $10.00, what will the EBIT be?
d. If the store refuses to pay more than $8.00 per unit but is willing to negotiate quantity, what quantity of figurines will result in an EBIT of $4,000?
e. At this time, Mollycaits come in 15 different varieties. Whereas the average variable cost per unit is $6.00, the actual cost varies from unit to unit. What recommendation would you have for Molly and Caitlin with regard to pricing and/or the numbers and types of units that they offer for sale?

LG2 **12–7 EBIT sensitivity** Stewart Industries sells its finished product for $9 per unit. Its fixed operating costs are $20,000, and the variable operating cost per unit is $5.

a. Calculate the firm's earnings before interest and taxes (EBIT) for sales of 10,000 units.
b. Calculate the firm's EBIT for sales of 8,000 and 12,000 units, respectively.
c. Calculate the percentage changes in sales (from the 10,000-unit base level) and associated percentage changes in EBIT for the shifts in sales indicated in part **b.**
d. On the basis of your findings in part **c,** comment on the sensitivity of changes in EBIT in response to changes in sales.

LG2 **12–8 Degree of operating leverage** Grey Products has fixed operating costs of $380,000, variable operating costs of $16 per unit, and a selling price of $63.50 per unit.

a. Calculate the operating breakeven point in units.
b. Calculate the firm's EBIT at 9,000, 10,000, and 11,000 units, respectively.
c. With 10,000 units as a base, what are the percentage changes in units sold and EBIT as sales move from the base to the other sales levels used in part **b?**
d. Use the percentages computed in part **c** to determine the degree of operating leverage (DOL).

e. Use the formula for degree of operating leverage to determine the DOL at 10,000 units.

LG2 **12–9 Degree of operating leverage—Graphical** Levin Corporation has fixed operating costs of $72,000, variable operating costs of $6.75 per unit, and a selling price of $9.75 per unit.

a. Calculate the operating breakeven point in units.
b. Compute the degree of operating leverage (DOL) for the following unit sales levels: 25,000, 30,000, 40,000. Use the formula given in the chapter.
c. Graph the DOL figures that you computed in part **b** (on the *y* axis) against sales levels (on the *x* axis).
d. Compute the degree of operating leverage at 24,000 units; add this point to your graph.
e. What principle do your graph and figures illustrate?

LG2 **12–10 EPS calculations** Southland Industries has $60,000 of 16% (annual interest) bonds outstanding, 1,500 shares of preferred stock paying an annual dividend of $5 per share, and 4,000 shares of common stock outstanding. Assuming that the firm has a 40% tax rate, compute earnings per share (EPS) for the following levels of EBIT:

a. $24,600
b. $30,600
c. $35,000

LG2 **12–11 Degree of financial leverage** Northwestern Savings and Loan has a current capital structure consisting of $250,000 of 16% (annual interest) debt and 2,000 shares of common stock. The firm pays taxes at the rate of 40%.

a. Using EBIT values of $80,000 and $120,000, determine the associated earnings per share (EPS).
b. Using $80,000 of EBIT as a base, calculate the degree of financial leverage (DFL).
c. Rework parts **a** and **b** assuming that the firm has $100,000 of 16% (annual interest) debt and 3,000 shares of common stock.

LG2 LG5 **12–12 DFL and graphical display of financing plans** Wells and Associates has EBIT of $67,500. Interest costs are $22,500, and the firm has 15,000 shares of common stock outstanding. Assume a 40% tax rate.

a. Use the degree of financial leverage (DFL) formula to calculate the DFL for the firm.
b. Using a set of EBIT–EPS axes, plot Wells and Associates' financing plan.
c. If the firm also has 1,000 shares of preferred stock paying a $6.00 annual dividend per share, what is the DFL?
d. Plot the financing plan, including the 1,000 shares of $6.00 preferred stock, on the axes used in part **b.**
e. Briefly discuss the graph of the two financing plans.

LG1 LG2 **12–13 Integrative—Multiple leverage measures** Play-More Toys produces inflatable beach balls, selling 400,000 balls a year. Each ball produced has a variable oper-

ating cost of $0.84 and sells for $1.00. Fixed operating costs are $28,000. The firm has annual interest charges of $6,000, preferred dividends of $2,000, and a 40% tax rate.

a. Calculate the operating breakeven point in units.
b. Use the degree of operating leverage (DOL) formula to calculate DOL.
c. Use the degree of financial leverage (DFL) formula to calculate DFL.
d. Use the degree of total leverage (DTL) formula to calculate DTL. Compare this to the product of DOL and DFL calculated in parts **b** and **c.**

LG2 **12–14 Integrative—Leverage and risk** Firm R has sales of 100,000 units at $2.00 per unit, variable operating costs of $1.70 per unit, and fixed operating costs of $6,000. Interest is $10,000 per year. Firm W has sales of 100,000 units at $2.50 per unit, variable operating costs of $1.00 per unit, and fixed operating costs of $62,500. Interest is $17,500 per year. Assume that both firms are in the 40% tax bracket.

a. Compute the degree of operating, financial, and total leverage for firm R.
b. Compute the degree of operating, financial, and total leverage for firm W.
c. Compare the relative risks of the two firms.
d. Discuss the principles of leverage that your answers illustrate.

LG1 LG2 **12–15 Integrative—Multiple leverage measures and prediction** Carolina Fastener, Inc., makes a patented marine bulkhead latch that wholesales for $6.00. Each latch has variable operating costs of $3.50. Fixed operating costs are $50,000 per year. The firm pays $13,000 interest and preferred dividends of $7,000 per year. At this point, the firm is selling 30,000 latches a year and is taxed at 40%.

a. Calculate Carolina Fastener's operating breakeven point.
b. On the basis of the firm's current sales of 30,000 units per year and its interest and preferred dividend costs, calculate its EBIT and net profits.
c. Calculate the firm's degree of operating leverage (DOL).
d. Calculate the firm's degree of financial leverage (DFL).
e. Calculate the firm's degree of total leverage (DTL).
f. Carolina Fastener has entered into a contract to produce and sell an additional 15,000 latches in the coming year. Use the DOL, DFL, and DTL to predict and calculate the changes in EBIT and net profit. Check your work by a simple calculation of Carolina Fastener's EBIT and net profit, using the basic information given.

LG3 **12–16 Various capital structures** Charter Enterprises currently has $1 million in total assets and is totally equity-financed. It is contemplating a change in capital structure. Compute the amount of debt and equity that would be outstanding if the firm were to shift to each of the following debt ratios: 10, 20, 30, 40, 50, 60, and 90%. (*Note:* The amount of total assets would not change.) Is there a limit to the debt ratio's value?

LG3 **12–17 Debt and financial risk** Tower Interiors has made the forecast of sales shown in the following table. Also given is the probability of each level of sales.

Sales	Probability
$200,000	.20
300,000	.60
400,000	.20

The firm has fixed operating costs of $75,000 and variable operating costs equal to 70% of the sales level. The company pays $12,000 in interest per period. The tax rate is 40%.

a. Compute the earnings before interest and taxes (EBIT) for each level of sales.

b. Compute the earnings per share (EPS) for each level of sales, the expected EPS, the standard deviation of the EPS, and the coefficient of variation of EPS, assuming that there are 10,000 shares of common stock outstanding.

c. Tower has the opportunity to reduce leverage to zero and pay no interest. This will require that the number of shares outstanding be increased to 15,000. Repeat part **b** under this assumption.

d. Compare your findings in parts **b** and **c,** and comment on the effect of the reduction of debt to zero on the firm's financial risk.

LG4 **12–18 EPS and optimal debt ratio** Williams Glassware has estimated, at various debt ratios, the expected earnings per share and the standard deviation of the earnings per share as shown in the following table.

Debt ratio	Earnings per share (EPS)	Standard deviation of EPS
0%	$2.30	$1.15
20	3.00	1.80
40	3.50	2.80
60	3.95	3.95
80	3.80	5.53

a. Estimate the optimal debt ratio on the basis of the relationship between earnings per share and the debt ratio. You will probably find it helpful to graph the relationship.

b. Graph the relationship between the coefficient of variation and the debt ratio. Label the areas associated with business risk and financial risk.

LG5 **12–19 EBIT–EPS and capital structure** Data-Check is considering two capital structures. The key information is shown in the following table. Assume a 40% tax rate.

Source of capital	Structure A	Structure B
Long-term debt	$100,000 at 16% coupon rate	$200,000 at 17% coupon rate
Common stock	4,000 shares	2,000 shares

a. Calculate two EBIT–EPS coordinates for each of the structures by selecting any two EBIT values and finding their associated EPS values.
b. Plot the two capital structures on a set of EBIT–EPS axes.
c. Indicate over what EBIT range, if any, each structure is preferred.
d. Discuss the leverage and risk aspects of each structure.
e. If the firm is fairly certain that its EBIT will exceed $75,000, which structure would you recommend? Why?

LG5

12–20 EBIT–EPS and preferred stock Litho-Print is considering two possible capital structures, A and B, shown in the following table. Assume a 40% tax rate.

Source of capital	Structure A	Structure B
Long-term debt	$75,000 at 16% coupon rate	$50,000 at 15% coupon rate
Preferred stock	$10,000 with an 18% annual dividend	$15,000 with an 18% annual dividend
Common stock	8,000 shares	10,000 shares

a. Calculate two EBIT–EPS coordinates for each of the structures by selecting any two EBIT values and finding their associated EPS values.
b. Graph the two capital structures on the same set of EBIT–EPS axes.
c. Discuss the leverage and risk associated with each of the structures.
d. Over what range of EBIT is each structure preferred?
e. Which structure do you recommend if the firm expects its EBIT to be $35,000? Explain.

LG3 LG4 LG6

12–21 Integrative—Optimal capital structure Medallion Cooling Systems, Inc., has total assets of $10,000,000, EBIT of $2,000,000, and preferred dividends of $200,000 and is taxed at a rate of 40%. In an effort to determine the optimal capital structure, the firm has assembled data on the cost of debt, the number of common shares for various levels of indebtedness, and the overall required return on investment:

Capital structure debt ratio	Cost of debt, k_d	Number of common shares	Required return, k_s
0%	0%	200,000	12%
15	8	170,000	13
30	9	140,000	14
45	12	110,000	16
60	15	80,000	20

a. Calculate earnings per share for each level of indebtedness.
b. Use Equation 12.12 and the earnings per share calculated in part **a** to calculate a price per share for each level of indebtedness.
c. Choose the optimal capital structure. Justify your choice.

LG3 LG4 LG6 **12–22 Integrative—Optimal capital structure** Nelson Corporation has made the following forecast of sales, with the associated probabilities of occurrence noted.

Sales	Probability
$200,000	.20
300,000	.60
400,000	.20

The company has fixed operating costs of $100,000 per year, and variable operating costs represent 40% of sales. The existing capital structure consists of 25,000 shares of common stock that have a $10 per share book value. No other capital items are outstanding. The marketplace has assigned the following required returns to risky earnings per share.

Coefficient of variation of EPS	Estimated required return, k_s
0.43	15%
0.47	16
0.51	17
0.56	18
0.60	22
0.64	24

The company is contemplating *shifting its capital structure* by substituting debt in the capital structure for common stock. The three different debt ratios under consideration are shown in the following table, along with an estimate, for each ratio, of the corresponding required interest rate on *all* debt.

Debt ratio	Interest rate on *all* debt
20%	10%
40	12
60	14

The tax rate is 40%. The market value of the equity for a leveraged firm can be found by using the simplified method (see Equation 12.12).

a. Calculate the expected earnings per share (EPS), the standard deviation of EPS, and the coefficient of variation of EPS for the three proposed capital structures.

b. Determine the optimal capital structure, assuming (1) maximization of earnings per share and (2) maximization of share value.

c. Construct a graph (similar to Figure 12.7) showing the relationships in part **b.** (*Note:* You will probably have to sketch the lines, because you have only three data points.)

LG3 LG4 LG5 LG6

12–23 Integrative—Optimal capital structure The board of directors of Morales Publishing, Inc., has commissioned a capital structure study. The company has total assets of $40,000,000. It has earnings before interest and taxes of $8,000,000 and is taxed at 40%.

a. Create a spreadsheet like the one in Table 12.10 showing values of debt and equity as well as the total number of shares, assuming a book value of $25 per share.

% Debt	Total assets	$ Debt	$ Equity	No. of shares @ $25
0%	$40,000,000	$_____	$_____	_____
10	40,000,000	_____	_____	_____
20	40,000,000	_____	_____	_____
30	40,000,000	_____	_____	_____
40	40,000,000	_____	_____	_____
50	40,000,000	_____	_____	_____
60	40,000,000	_____	_____	_____

b. Given the before-tax cost of debt at various levels of indebtedness, calculate the yearly interest expenses.

% Debt	$ Total debt	Before-tax cost of debt, k_d	$ Interest expense
0%	$_____	0.0%	$_____
10	_____	7.5	_____
20	_____	8.0	_____
30	_____	9.0	_____
40	_____	11.0	_____
50	_____	12.5	_____
60	_____	15.5	_____

c. Using EBIT of $8,000,000, a 40% tax rate, and the information developed in parts **a** and **b**, calculate the most likely earnings per share for the firm at various levels of indebtedness. Mark the level of indebtedness that maximizes EPS.

% Debt	EBIT	Interest expense	EBT	Taxes	Net income	No. of shares	EPS
0%	$8,000,000	_____	_____	_____	_____	_____	_____
10	8,000,000	_____	_____	_____	_____	_____	_____
20	8,000,000	_____	_____	_____	_____	_____	_____
30	8,000,000	_____	_____	_____	_____	_____	_____
40	8,000,000	_____	_____	_____	_____	_____	_____
50	8,000,000	_____	_____	_____	_____	_____	_____
60	8,000,000	_____	_____	_____	_____	_____	_____

d. Using the EPS developed in part **c**, the estimates of required return, k_s, and Equation 12.12, estimate the value per share at various levels of indebtedness. Mark the level of indebtedness that results in the maximum price per share, P_0.

Debt	EPS	k_s	P_0
0%	_____	10.0%	_____
10	_____	10.3	_____
20	_____	10.9	_____
30	_____	11.4	_____
40	_____	12.6	_____
50	_____	14.8	_____
60	_____	17.5	_____

e. Prepare a recommendation to the board of directors of Morales Publishing, Inc., that specifies the degree of indebtedness that will accomplish the firm's goal of optimizing shareholder wealth. Use your findings in parts **a** through **d** to justify your recommendation.

LG3 LG4 LG5 LG6

12–24 Integrative—Optimal capital structure Country Textiles, which has fixed operating costs of $300,000 and variable operating costs equal to 40% of sales, has made the following three sales estimates, with their probabilities noted.

Sales	Probability
$ 600,000	.30
900,000	.40
1,200,000	.30

The firm wishes to analyze five possible capital structures—0, 15, 30, 45, and 60% debt ratios. The firm's total assets of $1 million are assumed to be constant. Its common stock has a book value of $25 per share, and the firm is in the 40% tax bracket. The following additional data have been gathered for use in analyzing the five capital structures under consideration.

Capital structure debt ratio	Before-tax cost of debt, k_d	Required return, k_s
0%	0.0%	10.0%
15	8.0	10.5
30	10.0	11.6
45	13.0	14.0
60	17.0	20.0

a. Calculate the level of EBIT associated with each of the three levels of sales.
b. Calculate the amount of debt, the amount of equity, and the number of shares of common stock outstanding for each of the capital structures being considered.

c. Calculate the annual interest on the debt under each of the capital structures being considered. (*Note:* The before-tax cost of debt, k_d, is the interest rate applicable to *all* debt associated with the corresponding debt ratio.)

d. Calculate the EPS associated with each of the three levels of EBIT calculated in part **a** for each of the five capital structures being considered.

e. Calculate (1) the expected EPS, (2) the standard deviation of EPS, and (3) the coefficient of variation of EPS for each of the capital structures, using your findings in part **d.**

f. Plot the expected EPS and coefficient of variation of EPS against the capital structures (x axis) on separate sets of axes, and comment on the return and risk relative to capital structure.

g. Using the EBIT–EPS data developed in part **d,** plot the 0, 30, and 60% capital structures on the same set of EBIT–EPS axes, and discuss the ranges over which each is preferred. What is the major problem with the use of this approach?

h. Using the valuation model given in Equation 12.12 and your findings in part **e,** estimate the share value for each of the capital structures being considered.

i. Compare and contrast your findings in parts **f** and **h.** Which structure is preferred if the goal is to maximize EPS? Which structure is preferred if the goal is to maximize share value? Which capital structure do you recommend? Explain.

CHAPTER 12 CASE Evaluating Tampa Manufacturing's Capital Structure

Tampa Manufacturing, an established producer of printing equipment, expects its sales to remain flat for the next 3 to 5 years because of both a weak economic outlook and an expectation of little new printing technology development over that period. On the basis of this scenario, the firm's management has been instructed by its board to institute programs that will allow it to operate more efficiently, earn higher profits, and, most important, maximize share value. In this regard, the firm's chief financial officer (CFO), Jon Lawson, has been charged with evaluating the firm's capital structure. Lawson believes that the current capital structure, which contains 10% debt and 90% equity, may lack adequate financial leverage. To evaluate the firm's capital structure, Lawson has gathered the data summarized in the following table on the current capital structure (10% debt ratio) and two alternative capital structures—A (30% debt ratio) and B (50% debt ratio)—that he would like to consider.

	Capital structure[a]		
Source of capital	Current (10% debt)	A (30% debt)	B (50% debt)
Long-term debt	$1,000,000	$3,000,000	$5,000,000
Coupon interest rate[b]	9%	10%	12%
Common stock	100,000 shares	70,000 shares	40,000 shares
Required return on equity, k_s[c]	12%	13%	18%

[a]These structures are based on maintaining the firm's current level of $10,000,000 of total financing.
[b]Interest rate applicable to *all* debt.
[c]Market-based return for the given level of risk.

Lawson expects the firm's earnings before interest and taxes (EBIT) to remain at its current level of $1,200,000. The firm has a 40% tax rate.

Required

a. Use the current level of EBIT to calculate the times interest earned ratio for each capital structure. Evaluate the current and two alternative capital structures using the times interest earned and debt ratios.
b. Prepare a single EBIT–EPS graph showing the current and two alternative capital structures.
c. On the basis of the graph in part **b,** which capital structure will maximize Tampa's earnings per share (EPS) at its expected level of EBIT of $1,200,000? Why might this *not* be the best capital structure?
d. Using the zero-growth valuation model given in Equation 12.12, find the market value of Tampa's equity under each of the three capital structures at the $1,200,000 level of expected EBIT.
e. On the basis of your findings in parts **c** and **d,** which capital structure would you recommend? Why?

WEB EXERCISE

Go to the Web site *www.smartmoney.com*. In the column on the right under **Quotes & Research** enter the symbol **DIS;** click on **Stock Snapshot;** and then click on **Go**.

1. What is the name of the company? Click on **Financials**.
2. What are the 5-year high and the 5-year low for the company's debt/equity ratio (the ratio of long-term debt to stockholders' equity)?

At the bottom of this page under **Stock Search,** enter the next stock symbol from the list below and then click on **Submit**. Enter the name of the company in the matrix below and then click on **Financials**. Enter the 5-year high and low for the debt/equity ratio in the matrix for each of the stock symbols.

		Debt/equity ratio	
Symbol	Company name	5-yr. low	5-yr. high
DIS			
AIT			
MRK			
LG			
LUV			
IBM			
GE			
BUD			
PFE			
INTC			

3. Which of the companies have high debt/equity ratios?
4. Which of the companies have low debt/equity ratios?
5. Why do the companies that have a low debt/equity ratio use more equity even though it is more expensive than debt?

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.