

LEARNING OBJECTIVES

- L05-1** Leverage represents the use of fixed cost items to magnify the firm's results.
- L05-2** Break-even analysis allows the firm to determine the magnitude of operations necessary to avoid loss.
- L05-3** Operating leverage indicates the extent fixed assets (plant and equipment) are utilized by the firm.
- L05-4** Financial leverage shows how much debt the firm employs in its capital structure.
- L05-5** Combined leverage takes into account both the use of fixed assets and debt.
- L05-6** By increasing leverage, the firm increases its profit potential, but also its risk of failure.

5

Operating and Financial Leverage

In the physical sciences as well as in politics, the term **leverage** has been popularized to mean the use of special force and effects to produce more than normal results from a given course of action. In business the same concept is applied, with the emphasis on the employment of fixed cost items in anticipation of magnifying returns at high levels of operation. You should recognize that leverage is a two-edged sword—producing highly favorable results when things go well and quite the opposite under negative conditions.

Just ask the airline industry. Firms such as American Airlines, Delta, Southwest, and UAL were all flying high at the turn of the century because of favorable economic conditions, high capacity utilization, and relatively low interest rates on debt. Such was not the case in the next decade when high leverage in the form of high-cost fixed assets (airplanes) and high-cost debt was causing severe consequences in a weak economy. A series of bankruptcies followed as high fixed costs could not be overcome. TWA filed for bankruptcy in 2001, United Airlines and U.S. Airways in 2002, Northwest and Delta in 2005, Frontier in 2008, and finally American Airlines in 2011.

Between 2000 and 2005, Delta saw its EPS go from \$6.87 to a negative \$12.80. In 2007, American Airlines had a profit of \$504 million but lost close to \$6 billion over the next four years. As we noted, the company finally bit the bullet and declared bankruptcy in 2011. In all cases (TWA was bought by American), the airlines continued to operate; they restructured under the supervision of the bankruptcy court and eventually emerged as publicly traded companies again.

It is widely believed that massive consolidations (mergers) between the weak and the strong within the airline industry are necessary to create the profitability required for the purchase of new planes. The risk of being highly leveraged both operationally and financially remains a problem.

Assume you are approached with an opportunity to start your own business. You are to manufacture and market industrial parts, such as ball bearings, wheels, and casters. You are faced with two primary decisions.



First, you must determine the amount of fixed cost plant and equipment you wish to use in the production process. By installing modern, sophisticated equipment, you can virtually eliminate labor in the production of inventory. At high volume, you will do quite well, as most of your costs are fixed. At low volume, however, you could face difficulty in making your fixed payments for plant and equipment. If you decide to use expensive labor rather than machinery, you will lessen your opportunity for profit, but at the same time you will lower your exposure to risk (you can lay off part of the workforce).

Second, you must determine how you will finance the business. If you rely on debt financing and the business is successful, you will generate substantial profits as an owner, paying only the fixed costs of debt. Of course, if the business starts off poorly, the contractual obligations related to debt could mean bankruptcy. As an alternative, you might decide to sell equity rather than borrow, a step that will lower your own profit potential (you must share with others) but minimize your risk exposure.

In both decisions, you are making very explicit decisions about the use of leverage. To the extent that you go with a heavy commitment to fixed costs in the operation of the firm, you are employing operating leverage. To the extent that you utilize debt in the financing of the firm, you are engaging in financial leverage. We shall carefully examine each type of leverage and then show the combined effect of both.

Operating Leverage

Operating leverage reflects the extent to which fixed assets and associated fixed costs are utilized in the business. As indicated in Table 5-1, a firm's operational costs may be classified as fixed, variable, or semivariable.

Table 5-1 Classification of costs

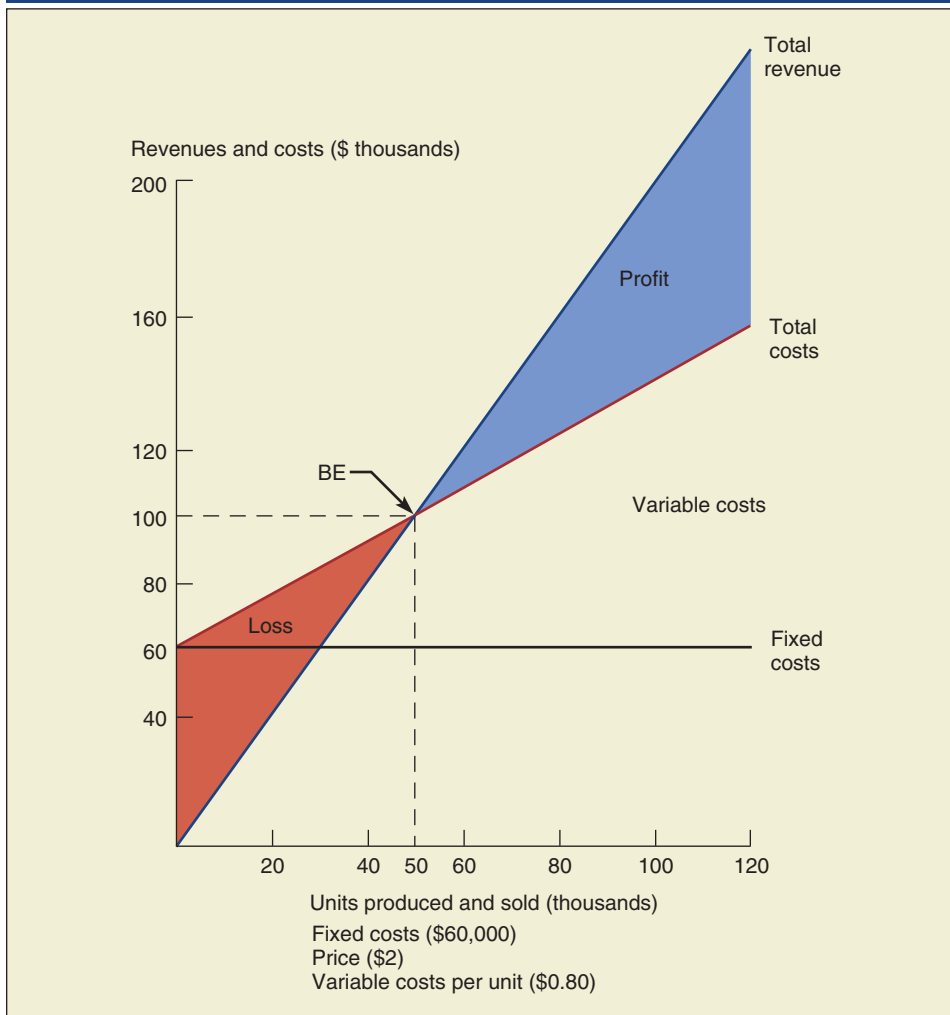
Fixed	Variable	Semivariable
Lease	Raw material	Utilities
Depreciation	Factory labor	Repairs and maintenance
Executive salaries	Sales commissions	
Property taxes		

For purposes of analysis, variable and semivariable costs will be combined. In order to evaluate the implications of heavy fixed asset use, we employ the technique of break-even analysis.

Break-Even Analysis

How much will changes in volume affect cost and profit? At what point does the firm break even? What is the most efficient level of fixed assets to employ in the firm? A break-even chart is presented in Figure 5-1 to answer some of these questions. The number of units produced and sold is shown along the horizontal axis, and revenue and costs are shown along the vertical axis.

Note, first of all, that our fixed costs are \$60,000, regardless of volume, and that our variable costs (at \$0.80 per unit) are added to fixed costs to determine total costs at any point. The total revenue line is determined by multiplying price (\$2) times volume.

Figure 5-1 Break-even chart: Leveraged firm

Of particular interest is the break-even (BE) point at 50,000 units, where the total costs and total revenue lines intersect. The numbers are as follows:

Units = 50,000				
Total Variable Costs (TVC)	Fixed Costs (FC)	Total Costs (TC)	Total Revenue (TR)	Operating Income (loss)
(50,000 × \$0.80) \$40,000	\$60,000	\$100,000	(50,000 × \$2) \$100,000	0

The break-even point for the company may also be determined by use of a simple formula—in which we divide fixed costs by the contribution margin on each unit sold, with the **contribution margin** defined as price minus variable cost per unit. The formula is shown at the top of the next page.

$$\text{BE (units)} = \frac{\text{Fixed costs}}{\text{Contribution margin}} = \frac{\text{Fixed costs}}{\text{Price} - \text{Variable cost per unit}} = \frac{\text{FC}}{P - VC} \quad (5-1)$$

$$\frac{\$60,000}{\$2.00 - \$0.80} = \frac{\$60,000}{\$1.20} = 50,000 \text{ units}$$

Since we are getting a \$1.20 contribution toward covering fixed costs from each unit sold, minimum sales of 50,000 units will allow us to cover our fixed costs (50,000 units \times \$1.20 = \$60,000 fixed costs). Beyond this point, we move into a highly profitable range in which each unit of sales brings a profit of \$1.20 to the company. As sales increase from 50,000 to 60,000 units, operating profits increase by \$12,000 as indicated in Table 5-2; as sales increase from 60,000 to 80,000 units, profits increase by another \$24,000; and so on. As further indicated in Table 5-2, at low volumes such as 40,000 or 20,000 units our losses are substantial (\$12,000 and \$36,000 in the red).

Table 5-2 Volume-cost-profit analysis: Leveraged firm

Units Sold	Total Variable Costs	Fixed Costs	Total Costs	Total Revenue	Operating Income (loss)
0	\$ 0	\$60,000	\$ 60,000	\$ 0	\$(60,000)
20,000	16,000	60,000	76,000	40,000	(36,000)
40,000	32,000	60,000	92,000	80,000	(12,000)
50,000	40,000	60,000	100,000	100,000	0
60,000	48,000	60,000	108,000	120,000	12,000
80,000	64,000	60,000	124,000	160,000	36,000
100,000	80,000	60,000	140,000	200,000	60,000

It is assumed that the firm depicted in Figure 5-1 on page 127 is operating with a high degree of leverage. The situation is analogous to that of an airline that must carry a certain number of people to break even, but beyond that point is in a very profitable range. This has certainly been the case with Southwest Airlines, which has its home office in Dallas, Texas, but also flies to many other states. The airline systematically offers lower fares than American, Delta, and other airlines to ensure maximum capacity utilization.

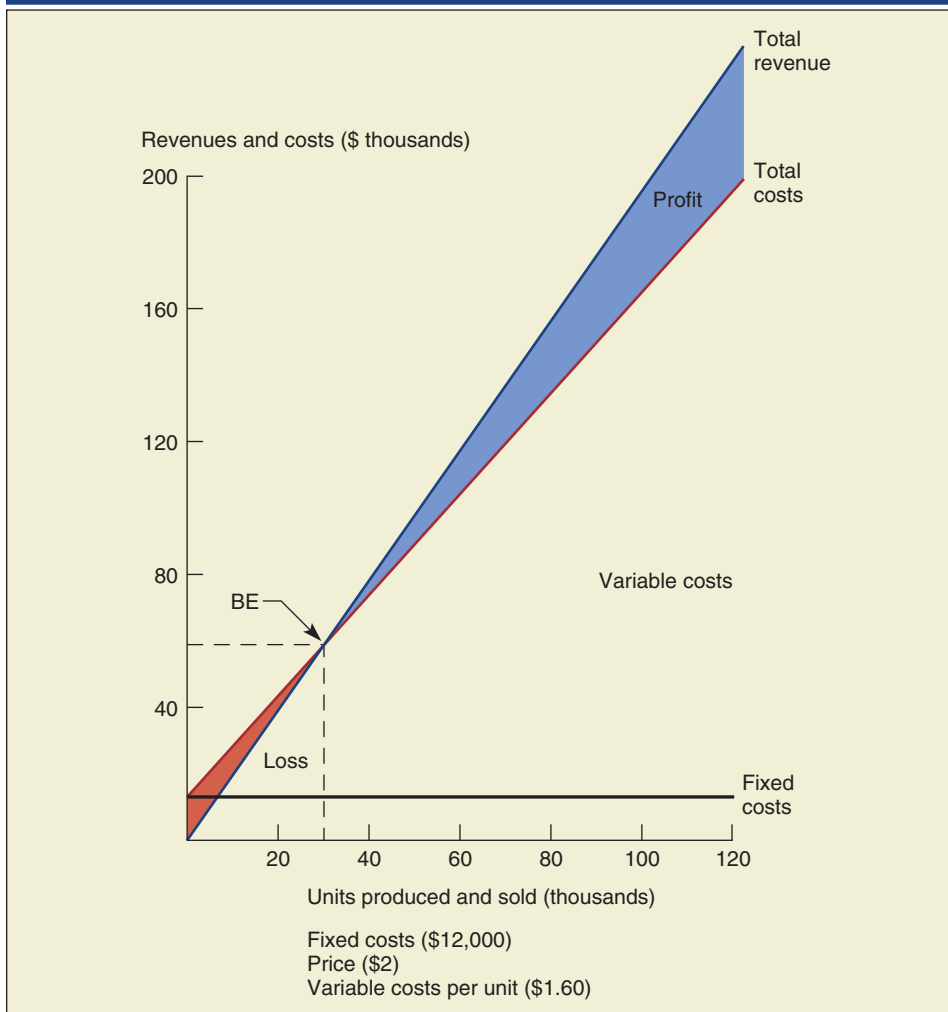
A More Conservative Approach

Not all firms would choose to operate at the high degree of operating leverage exhibited in Figure 5-1. Fear of not reaching the 50,000-unit break-even level might discourage some companies from heavy utilization of fixed assets. More expensive variable costs might be substituted for automated plant and equipment. Assume fixed costs for a more conservative firm can be reduced to \$12,000—but variable costs will go from \$0.80 to \$1.60. If the same price assumption of \$2 per unit is employed, the break-even level is 30,000 units, as shown at the top of the next page.

$$\begin{aligned} \text{BE (units)} &= \frac{\text{Fixed costs}}{\text{Price} - \text{Variable cost per unit}} = \frac{\text{FC}}{P - \text{VC}} = \frac{\$12,000}{\$2 - \$1.60} \\ &= \frac{\$12,000}{\$0.40} \\ &= 30,000 \text{ units} \end{aligned}$$

With fixed costs reduced from \$60,000 to \$12,000, the loss potential is small. Furthermore, the break-even level of operations is a comparatively low 30,000 units. Nevertheless, the use of a virtually unleveraged approach has cut into the potential profitability of the more conservative firm, as indicated in Figure 5-2.

Figure 5-2 Break-even chart: Conservative firm



Even at high levels of operation, the potential profit in Figure 5-2 is rather small. As indicated in Table 5-3 on the next page, at a 100,000-unit volume, operating income is only \$28,000—some \$32,000 less than that for the “leveraged” firm previously analyzed in Table 5-2.

Table 5-3 Volume-cost-profit analysis: Conservative firm

Units Sold	Total Variable Costs	Fixed Costs	Total Costs	Total Revenue	Operating Income (loss)
0	\$ 0	\$12,000	\$ 12,000	\$ 0	\$(12,000)
20,000	32,000	12,000	44,000	40,000	(4,000)
30,000	48,000	12,000	60,000	60,000	0
40,000	64,000	12,000	76,000	80,000	4,000
60,000	96,000	12,000	108,000	120,000	12,000
80,000	128,000	12,000	140,000	160,000	20,000
100,000	160,000	12,000	172,000	200,000	28,000

The Risk Factor

Whether management follows the path of the leveraged firm or of the more conservative firm depends on its perceptions about the future. If the vice president of finance is apprehensive about economic conditions, the conservative plan may be undertaken. For a growing business in times of relative prosperity, management might maintain a more aggressive, leveraged position. The firm's competitive position within its industry will also be a factor. Does the firm desire to merely maintain stability or to become a market leader? To a certain extent, management should tailor the use of leverage to meet its own risk-taking desires. Those who are risk averse (prefer less risk to more risk) should anticipate a particularly high return before contracting for heavy fixed costs. Others, less averse to risk, may be willing to leverage under more normal conditions. Simply taking risks is not a virtue—our prisons are full of risk takers. The important idea, which is stressed throughout the text, is to match an acceptable return with the desired level of risk.

Cash Break-Even Analysis

Our discussion to this point has dealt with break-even analysis in terms of accounting flows rather than cash flows. For example, depreciation has been implicitly included in fixed expenses, but it represents a noncash accounting entry rather than an explicit expenditure of funds. To the extent that we were doing break-even analysis on a strictly cash basis, depreciation would be excluded from fixed expenses. In the previous example of the leveraged firm in Formula 5-1 on page 128, if we eliminate \$20,000 of “assumed” depreciation from fixed costs, the break-even level is reduced from 50,000 units to 33,333 units.

$$\frac{FC}{P - VC} = \frac{(\$60,000 - \$20,000)}{\$2.00 - \$0.80} = \frac{\$40,000}{\$1.20} = 33,333 \text{ units}$$

Other adjustments could also be made for noncash items. For example, sales may initially take the form of accounts receivable rather than cash, and the same can be said for the purchase of materials and accounts payable. An actual weekly or monthly cash budget would be necessary to isolate these items.

While cash break-even analysis is helpful in analyzing the short-term outlook of the firm, particularly when it may be in trouble, break-even analysis is normally

conducted on the basis of accounting flows rather than strictly cash flows. Most of the assumptions throughout the chapter are based on concepts broader than pure cash flows.

Degree of Operating Leverage

Degree of operating leverage (DOL) may be defined as the percentage change in operating income that occurs as a result of a percentage change in units sold.

$$\text{DOL} = \frac{\text{Percent change in operating income}}{\text{Percent change in unit volume}} \quad (5-2)$$

Highly leveraged firms, such as Ford Motor Company or Dow Chemical, are likely to enjoy a rather substantial increase in income as volume expands, while more conservative firms will participate in an increase to a lesser extent. Degree of operating leverage should be computed only over a profitable range of operations. However, the closer DOL is computed to the company break-even point, the higher the number will be due to a large percentage increase in operating income.¹

Let us apply the formula to the leveraged and conservative firms previously discussed. Their income or losses at various levels of operation are summarized in Table 5-4.

Table 5-4 Operating income or loss

Units	Leveraged Firm (Table 5-2)	Conservative Firm (Table 5-3)
0	\$(60,000)	\$(12,000)
20,000	(36,000)	(4,000)
40,000	(12,000)	4,000
60,000	12,000	12,000
80,000	36,000	20,000
100,000	60,000	28,000

We will now consider what happens to operating income as volume moves from 80,000 to 100,000 units for each firm. We will compute the degree of operating leverage (DOL) using Formula 5-2.

Leveraged Firm

$$\begin{aligned} \text{DOL} &= \frac{\text{Percent change in operating income}}{\text{Percent change in unit volume}} = \frac{\frac{\$24,000}{\$36,000} \times 100}{\frac{20,000}{80,000} \times 100} \\ &= \frac{67\%}{25\%} = 2.7 \end{aligned}$$

¹While the value of DOL varies at each level of output, the beginning level of volume determines the DOL regardless of the location of the endpoint.

Conservative Firm

$$\begin{aligned} \text{DOL} &= \frac{\text{Percent change in operating income}}{\text{Percent change in unit volume}} = \frac{\frac{\$8,000}{\$20,000} \times 100}{\frac{\$20,000}{80,000} \times 100} \\ &= \frac{40\%}{25\%} = 1.6 \end{aligned}$$

We see that the DOL is much greater for the leveraged firm, indicating at 80,000 units a 1 percent increase in volume will produce a 2.7 percent change in operating income, versus a 1.6 percent increase for the conservative firm.

The formula for degree of operating leverage may be algebraically manipulated to read:

$$\text{DOL} = \frac{Q(P - VC)}{Q(P - VC) - FC} \quad (5-3)$$

where

Q = Quantity at which DOL is computed.

P = Price per unit.

VC = Variable costs per unit.

FC = Fixed costs.

Using the newly stated formula for the first firm at $Q = 80,000$, with $P = \$2$, $VC = \$0.80$, and $FC = \$60,000$:

$$\begin{aligned} \text{DOL} &= \frac{80,000(\$2.00 - \$0.80)}{80,000(\$2.00 - \$0.80) - \$60,000} \\ &= \frac{80,000(\$1.20)}{80,000(\$1.20) - \$60,000} = \frac{\$96,000}{\$96,000 - \$60,000} \\ \text{DOL} &= 2.7 \end{aligned}$$

We once again derive an answer of 2.7.² The same type of calculation could also be performed for the conservative firm.

²The formula for DOL may also be rewritten as:

$$\text{DOL} = \frac{Q(P - VC)}{Q(P - VC) - FC} = \frac{Q(P) - Q(VC)}{Q(P) - Q(VC) - FC}$$

We can rewrite the second terms as:

$QP = S$, or Sales (Quantity \times Price)

$Q(VC) = \text{TVC}$, or Total variable costs (Quantity \times Variable costs per unit)

$FC = \text{Total fixed costs}$ (remains the same term)

We then have:

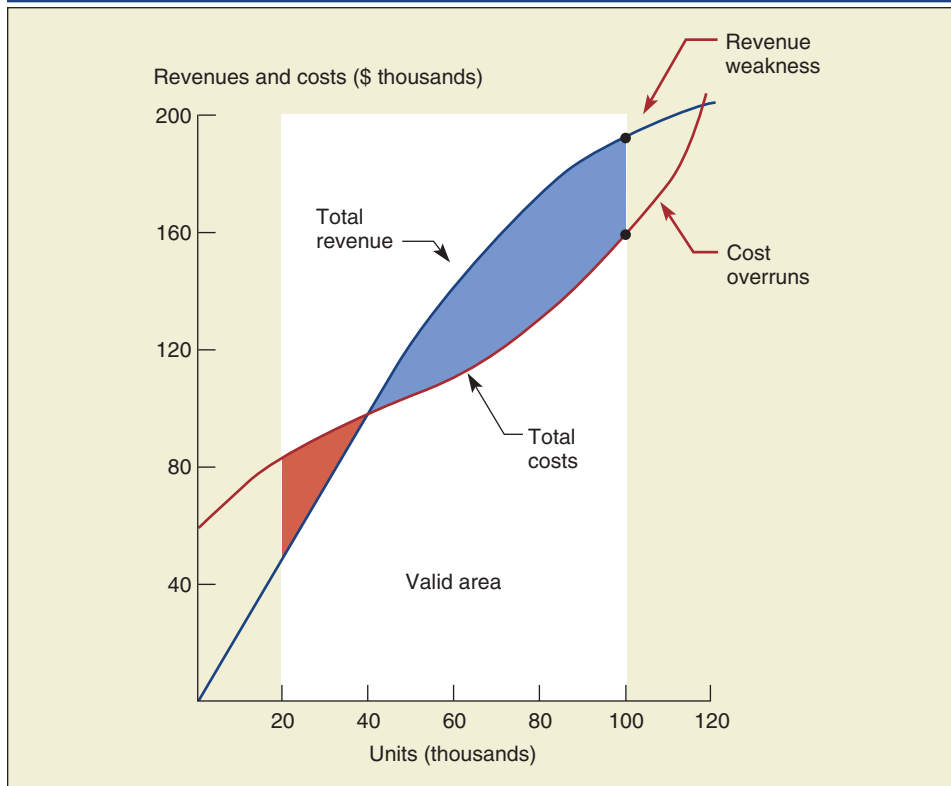
$$\text{DOL} = \frac{S - \text{TVC}}{S - \text{TVC} - FC}, \text{ or } \frac{\$160,000 - \$64,000}{\$160,000 - \$64,000 - \$60,000} = \frac{\$96,000}{\$36,000} = 2.7$$

Limitations of Analysis

Throughout our analysis of operating leverage, we have assumed that a constant or linear function exists for revenues and costs as volume changes. For example, we have used \$2 as the hypothetical sales price at all levels of operation. In the “real world,” however, we may face price weakness as we attempt to capture an increasing market for our product, or we may face cost overruns as we move beyond an optimum-size operation. Relationships are not so fixed as we have assumed.

Nevertheless, the basic patterns we have studied are reasonably valid for most firms over an extended operating range (in our example, that might be between 20,000 and 100,000 units). It is only at the extreme levels that linear assumptions fully break down, as indicated in Figure 5-3.

Figure 5-3 Nonlinear break-even analysis



Having discussed the effect of fixed costs on the operations of the firm (operating leverage), we now turn to the second form of leverage. **Financial leverage** reflects the amount of debt used in the capital structure of the firm. Because debt carries a fixed obligation of interest payments, we have the opportunity to greatly magnify our results at various levels of operations. You may have heard of the real estate developer who borrows 100 percent of the costs of his project and will enjoy an infinite return on his zero investment if all goes well. If it doesn't, then he is in serious trouble or bankruptcy.

It is helpful to think of *operating leverage* as primarily affecting the left-hand side of the balance sheet and *financial leverage* as affecting the right-hand side.

**Financial
Leverage**

BALANCE SHEET	
Assets	Liabilities and Net Worth
Operating leverage	Financial leverage

Whereas operating leverage influences the mix of plant and equipment, financial leverage determines how the operation is to be financed. It is possible for two firms to have equal operating capabilities and yet show widely different results because of the use of financial leverage.

Impact on Earnings

In studying the impact of financial leverage, we shall examine two financial plans for a firm, each employing a significantly different amount of debt in the capital structure. Financing totaling \$200,000 is required to carry the assets of the firm. The facts are presented below.

	Total Assets—\$200,000			
	Plan A (leveraged)		Plan B (conservative)	
Debt (8% interest)	\$150,000	(\$12,000 interest)	\$ 50,000	(\$4,000 interest)
Common stock	50,000	(8,000 shares at \$6.25)	150,000	(24,000 shares at \$6.25)
Total financing	\$200,000		\$200,000	

Under *leveraged* Plan A we will borrow \$150,000 and sell 8,000 shares of stock at \$6.25 to raise an additional \$50,000, whereas *conservative* Plan B calls for borrowing only \$50,000 and acquiring an additional \$150,000 in stock with 24,000 shares.

In Table 5-5, we compute earnings per share for the two plans at various levels of “earnings before interest and taxes” (EBIT). These earnings (EBIT) represent the operating income of the firm—before deductions have been made for financial charges or taxes. We assume EBIT levels of 0, \$12,000, \$16,000, \$36,000, and \$60,000.

The impact of the two financing plans is dramatic. Although both plans assume the same operating income, or EBIT, for comparative purposes at each level (say \$36,000 in calculation 4) the reported income per share is vastly different (\$1.50 versus \$0.67). It is also evident the conservative plan will produce better results at low income levels—but the leveraged plan will generate much better earnings per share as operating income, or EBIT, goes up. The firm would be indifferent between the two plans at an EBIT level of \$16,000 as shown in Table 5-5.

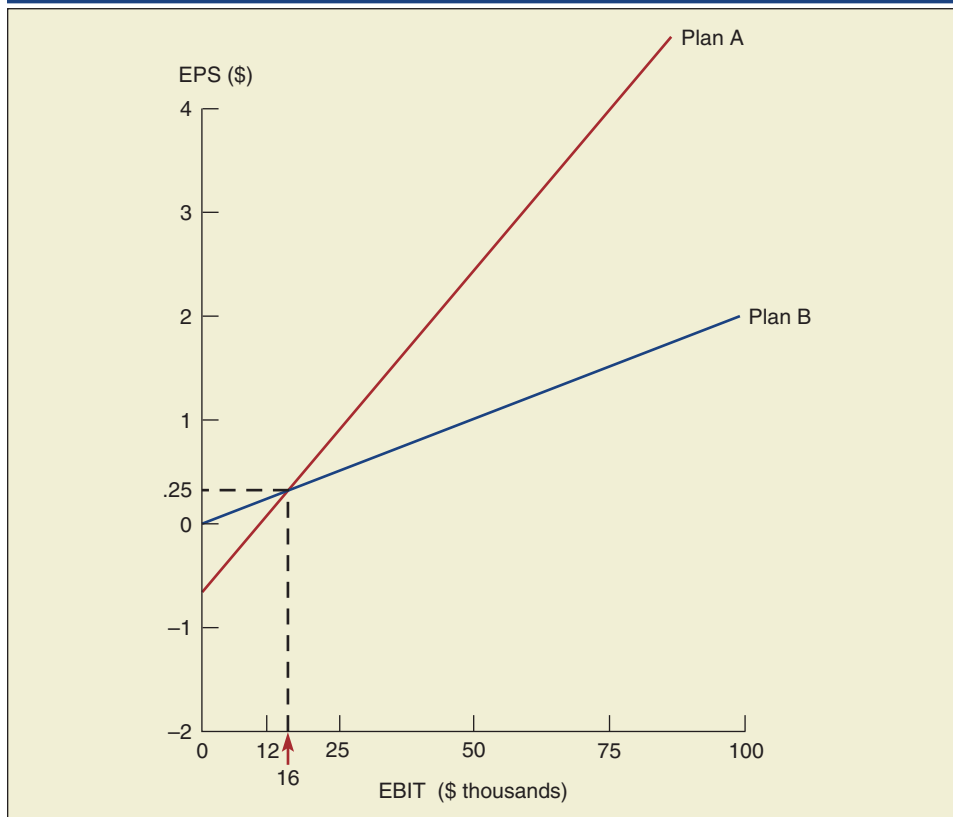
In Figure 5-4 on page 136, we graphically demonstrate the effect of the two financing plans on earnings per share and the indifference point at an EBIT of \$16 (thousand).

With an EBIT of \$16,000, we are earning 8 percent on total assets of \$200,000—precisely the percentage cost of borrowed funds to the firm. The use or nonuse of debt does not influence the answer. Beyond \$16,000, Plan A, employing heavy financial leverage, really goes to work, allowing the firm to greatly expand earnings per share as a result of a change in EBIT. For example, at the EBIT level of \$36,000, an 18 percent return on assets of \$200,000 takes place—and financial leverage is clearly working to our benefit as earnings greatly expand.

Table 5-5 Impact of financing plan on earnings per share

	Plan A (leveraged)	Plan B (conservative)
1. EBIT (0)		
Earnings before interest and taxes (EBIT)	0	0
– Interest (<i>I</i>)	<u>\$(12,000)</u>	<u>\$ (4,000)</u>
Earnings before taxes (EBT)	<u>\$(12,000)</u>	<u>\$ (4,000)</u>
– Taxes (<i>T</i>)*	<u>(6,000)</u>	<u>(2,000)</u>
Earnings after taxes (EAT)	<u>\$ (6,000)</u>	<u>\$ (2,000)</u>
Shares	8,000	24,000
Earnings per share (EPS)	\$(0.75)	\$(0.08)
2. EBIT (\$12,000)		
Earnings before interest and taxes (EBIT)	\$ 12,000	\$ 12,000
– Interest (<i>I</i>)	<u>12,000</u>	<u>4,000</u>
Earnings before taxes (EBT)	<u>\$ 0</u>	<u>\$ 8,000</u>
– Taxes (<i>T</i>)	<u>0</u>	<u>4,000</u>
Earnings after taxes (EAT)	<u>\$ 0</u>	<u>\$ 4,000</u>
Shares	8,000	24,000
Earnings per share (EPS)	\$0	\$0.17
3. EBIT (\$16,000)		
Earnings before interest and taxes (EBIT)	\$ 16,000	\$ 16,000
– Interest (<i>I</i>)	<u>12,000</u>	<u>4,000</u>
Earnings before taxes (EBT)	<u>\$ 4,000</u>	<u>\$ 12,000</u>
– Taxes (<i>T</i>)	<u>2,000</u>	<u>6,000</u>
Earnings after taxes (EAT)	<u>\$ 2,000</u>	<u>\$ 6,000</u>
Shares	8,000	24,000
Earnings per share (EPS)	\$0.25	\$0.25
4. EBIT (\$36,000)		
Earnings before interest and taxes (EBIT)	\$ 36,000	\$ 36,000
– Interest (<i>I</i>)	<u>12,000</u>	<u>4,000</u>
Earnings before taxes (EBT)	<u>\$ 24,000</u>	<u>\$ 32,000</u>
– Taxes (<i>T</i>)	<u>12,000</u>	<u>16,000</u>
Earnings after taxes (EAT)	<u>\$ 12,000</u>	<u>\$ 16,000</u>
Shares	8,000	24,000
Earnings per share (EPS)	\$1.50	\$0.67
5. EBIT (\$60,000)		
Earnings before interest and taxes (EBIT)	\$ 60,000	\$ 60,000
– Interest (<i>I</i>)	<u>12,000</u>	<u>4,000</u>
Earnings before taxes (EBT)	<u>\$ 48,000</u>	<u>\$ 56,000</u>
– Taxes (<i>T</i>)	<u>24,000</u>	<u>28,000</u>
Earnings after taxes (EAT)	<u>\$ 24,000</u>	<u>\$ 28,000</u>
Shares	8,000	24,000
Earnings per share (EPS)	\$3.00	\$1.17

*The assumption is that large losses can be written off against other income, perhaps in other years, thus providing the firm with a tax savings benefit. The tax rate is 50 percent for ease of computation.

Figure 5-4 Financing plans and earnings per share

Degree of Financial Leverage

As was true of operating leverage, degree of financial leverage measures the effect of a change in one variable on another variable. **Degree of financial leverage (DFL)** may be defined as the percentage change in earnings (EPS) that occurs as a result of a percentage change in earnings before interest and taxes (EBIT).

$$DFL = \frac{\text{Percent change in EPS}}{\text{Percent change in EBIT}} \quad (5-4)$$

For purposes of computation, the formula for DFL may be conveniently restated as:

$$DFL = \frac{EBIT}{EBIT - I} \quad (5-5)$$

Let's compute the degrees of financial leverage for Plan A and Plan B, previously presented in Table 5-5 on page 135, at an EBIT level of \$36,000. Plan A calls for \$12,000 of interest at all levels of financing, and Plan B requires \$4,000.

Plan A (Leveraged)

$$DFL = \frac{EBIT}{EBIT - I} = \frac{\$36,000}{\$36,000 - \$12,000} = \frac{\$36,000}{\$24,000} = 1.5$$

Plan B (Conservative)

$$\text{DFL} = \frac{\text{EBIT}}{\text{EBIT} - I} = \frac{\$36,000}{\$36,000 - \$4,000} = \frac{\$36,000}{\$32,000} = 1.1$$

As expected, Plan A has a much higher degree of financial leverage. At an EBIT level of \$36,000, a 1 percent increase in earnings will produce a 1.5 percent increase in earnings per share under Plan A, but only a 1.1 percent increase under Plan B. DFL may be computed for any level of operation, and it will change from point to point, but Plan A will always exceed Plan B.

Limitations to Use of Financial Leverage

Alert students may quickly observe that if debt is such a good thing, why sell any stock? (Perhaps one share to yourself.) With exclusive debt financing at an EBIT level of \$36,000, we would have a degree of financial leverage factor (DFL) of 1.8.

$$\text{DFL} = \frac{\text{EBIT}}{\text{EBIT} - I} = \frac{\$36,000}{\$36,000 - \$16,000} = \frac{\$36,000}{\$20,000} = 1.8$$

(With no stock, we would borrow the full \$200,000.)

$$(8\% \times \$200,000 = \$16,000 \text{ interest})$$

As stressed throughout the text, debt financing and financial leverage offer unique advantages, but only up to a point—beyond that point, debt financing may be detrimental to the firm. For example, as we expand the use of debt in our capital structure, lenders will perceive a greater financial risk for the firm. For that reason, they may raise the average interest rate to be paid and they may demand that certain restrictions be placed on the corporation. Furthermore, concerned common stockholders may drive down the price of the stock—forcing us away from the *objective of maximizing the firm's overall value* in the market. The impact of financial leverage must be carefully weighed by firms with high debt such as UAL (United Airlines).

This is not to say that financial leverage does not work to the benefit of the firm—it does if properly used. Further discussion of appropriate debt-equity mixes is covered in Chapter 11, “Cost of Capital.” For now, we accept the virtues of financial leverage, knowing that all good things must be used in moderation. For firms that are in industries that offer some degree of stability, are in a positive stage of growth, and are operating in favorable economic conditions, the use of debt is recommended.

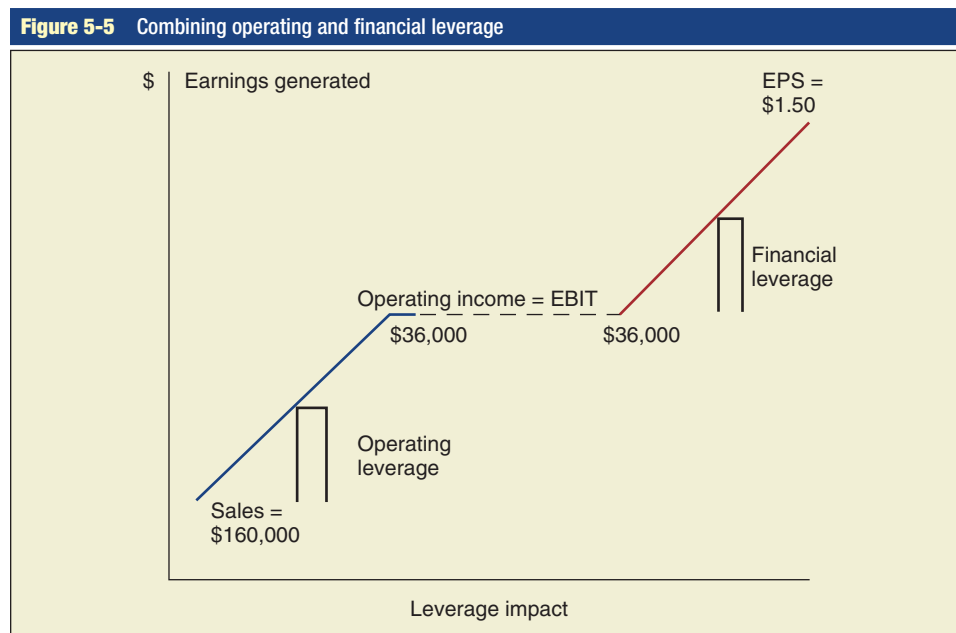
If both operating and financial leverage allow us to magnify our returns, then we will get maximum leverage through their combined use in the form of **combined leverage**. We have said that operating leverage affects primarily the asset structure of the firm, while financial leverage affects the debt-equity mix. From an income statement viewpoint, operating leverage determines return from operations, while financial leverage determines how the “fruits of our labor” will be allocated to debt holders and, more importantly, to stockholders in the form of earnings per share. Table 5-6 shows the combined influence of operating and financial leverage on the income statement.

**Combining
Operating
and Financial
Leverage**

The values in Table 5-6 are drawn from earlier material in the chapter (Tables 5-2 and 5-5). We assumed in both cases a high degree of operating and financial leverage (i.e., the leveraged firm). The sales volume is 80,000 units.

Sales (total revenue) (80,000 units @ \$2)	\$160,000	} Operating leverage
– Fixed costs	60,000	
– Variable costs (\$0.80 per unit)	<u>64,000</u>	
Operating income	\$ 36,000	
Earnings before interest and taxes	\$ 36,000	} Financial leverage
– Interest	<u>12,000</u>	
Earnings before taxes	\$ 24,000	
– Taxes	<u>12,000</u>	
Earnings after taxes	\$ 12,000	
Shares	8,000	
Earnings per share	\$1.50	

You will observe, first, that operating leverage influences the top half of the income statement—determining operating income. The last item under operating leverage, operating income, then becomes the initial item for determining financial leverage. “Operating income” and “Earnings before interest and taxes” are one and the same, representing the return to the corporation after production, marketing, and so forth—but before interest and taxes are paid. In the second half of the income statement, we then show the extent to which earnings before interest and taxes are translated into earnings per share. A graphical representation of these points is provided in Figure 5-5.





Why Japanese Firms Tend to Be So Competitive

What do firms such as Sony, Honda, Fujitsu, Hitachi, and Mitsubishi have in common? Not only are they all Japanese companies, but they are also highly leveraged, both from operational and financing perspectives.

Japanese companies are world leaders in bringing high technology into their firms to replace slower, more expensive labor. They are known for automated factories, laser technology, robotics, memory chips, digital processing, and other scientific endeavors. Furthermore, the country has government groups such as the Ministry of International Trade and Industry (MITI) and the Science and Technology Agency encouraging further investment and growth through government grants and shared research.

To enjoy the benefits of this technology, Japanese firms have a high fixed cost commitment. Obviously high initial cost technology cannot easily be “laid off” if business slows down. Even the labor necessary to design and operate the technology has somewhat of a fixed cost element associated with it. Unlike in the United States, workers are not normally laid off and many people in Japan consider their jobs to represent a lifetime commitment from their employers.

Not only does the Japanese economy have high operating leverage as described above, but Japanese companies also have high financial leverage. The typical Japanese company has a debt-to-equity ratio two to three times higher than its counterparts in the United States. The reason is that credit tends to be more available in Japan because of the traditional relationship between an industrial

firm and its bank. They both may be part of the same cartel or trading company with interlocking directors (directors that serve on both boards). Under such an arrangement, a bank is willing to make a larger loan commitment to an industrial firm and there’s a shared humiliation if the credit arrangement goes badly. Contrast this to the United States, where a lending institution such as Citibank or Bank of America has extensive provisions and covenants in its loan agreements and is prepared to move in immediately at the first sign of a borrower’s weakness. None of these comments imply that Japanese firms do not default on their loans. There were, in fact, a number of bad loans sitting on the books of Japanese banks in the 2000s.

The key point is that Japanese firms have high operating leverage as well as high financial leverage and that makes them act very competitively. If a firm has a combined leverage of 6 or 8 times, as many Japanese companies do, the loss of unit sales can be disastrous. Leverage not only magnifies returns as volume increases, but magnifies losses as volume decreases. As an example, a Japanese firm that is in danger of losing an order to a U.S. firm for computer chips is likely to drastically cut prices or take whatever action is necessary to maintain its sales volume. A general rule of business is that firms that are exposed to high leverage are likely to act aggressively to cover their large fixed costs and this rule certainly applies to leading Japanese firms. This, of course, may well be a virtue because it ensures that a firm will remain market oriented and progressive.

SONY

FUJITSU

HITACHI

www.sony.com

www.honda.com

www.fujitsu.com

www.hitachi.com

www.mitsubishi.com

Degree of combined leverage (DCL) uses the entire income statement and shows the impact of a change in sales or volume on bottom-line earnings per share. Degree of operating leverage and degree of financial leverage are, in effect, being combined. Table 5-7 shows what happens to profitability as the firm’s sales go from \$160,000 (80,000 units) to \$200,000 (100,000 units).

The formula for degree of combined leverage is stated as:

$$\text{Degree of combined leverage (DCL)} = \frac{\text{Percent change in EPS}}{\text{Percent change in sales (or volume)}} \quad (5-6)$$

Degree of
Combined
Leverage



Table 5-7 Operating and financial leverage

	80,000 units	100,000 units
Sales—\$2 per unit	\$160,000	\$200,000
– Fixed costs	60,000	60,000
– Variable costs (\$0.80 per unit)	64,000	80,000
Operating income = EBIT	\$ 36,000	\$ 60,000
– Interest	12,000	12,000
Earnings before taxes	\$ 24,000	\$ 48,000
– Taxes	12,000	24,000
Earnings after taxes	\$ 12,000	\$ 24,000
Shares	8,000	8,000
Earnings per share	\$ 1.50	\$ 3.00

Using data from Table 5-7:

$$\frac{\text{Percent change in EPS}}{\text{Percent change in sales}} = \frac{\frac{\$1.50}{\$1.50} \times 100}{\frac{\$40,000}{\$160,000} \times 100} = \frac{100\%}{25\%} = 4$$

Every percentage point change in sales will be reflected in a 4 percent change in earnings per share at this level of operation (quite an impact).

An algebraic statement of the formula is:

$$\text{DCL} = \frac{Q(P - VC)}{Q(P - VC) - FC - I} \quad (5-7)$$

From Table 5-7: Beginning Q (Quantity) = 80,000; P (Price per unit) = \$2.00; VC (Variable costs per unit) = \$0.80; FC (Fixed costs) = \$60,000; and I (Interest) = \$12,000.

$$\begin{aligned} \text{DCL} &= \frac{80,000(\$2.00 - \$0.80)}{80,000(\$2.00 - \$0.80) - \$60,000 - \$12,000} \\ &= \frac{80,000(\$1.20)}{80,000(\$1.20) - \$72,000} \\ \text{DCL} &= \frac{\$96,000}{\$96,000 - \$72,000} = \frac{\$96,000}{\$24,000} = 4 \end{aligned}$$

The answer is once again shown to be 4.³

³The formula for DCL may also be rewritten as:

$$\text{DCL} = \frac{Q(P - VC)}{Q(P - VC) - FC - I} = \frac{Q(P) - Q(VC)}{Q(P) - Q(VC) - FC - I}$$

We can rewrite the second terms as:

$$\begin{aligned} Q(P) &= S, \text{ or Sales (Quantity} \times \text{Price)} \\ Q(VC) &= \text{TVC, or Total variable costs (Quantity} \times \text{Variable costs per unit)} \\ FC &= \text{Total fixed costs (remains the same term)} \\ I &= \text{Interest (remains the same term)} \end{aligned}$$

We then have:

$$\text{DCL} = \frac{S - \text{TVC}}{S - \text{TVC} - FC - I} \text{, or } \frac{\$160,000 - \$64,000}{\$160,000 - \$64,000 - \$60,000 - \$12,000} = \frac{\$96,000}{\$24,000} = 4$$

Operating and Financial Leverage—Wockhardt, India | managerial

To calculate the degree of operating and financial leverage, the analyst needs sales or revenues, operating income (EBIT), interest expense (*I*), net income (NI), and earnings per share (EPS). This information is available to external analysts from the income statement, but the calculations are based on year-end data. If operating costs rise or fall during the next year, the profit margin will rise or fall with that change and the degree of operating leverage will be affected.

The degree of financial leverage is also based on year-end data and assumes that variables such as interest rates, the amount of debt, and the number of shares stay the same. However, in the real world, these variables change from year to year. What happens when these variables change? For example, the debt-to-asset ratio, the cost of debt, and the number of shares outstanding affect financial leverage. Let's look at an example. Wockhardt is among the top five pharmaceutical companies in India, and is listed on the Bombay Stock Exchange (BSE).

Wockhardt's sales increased 16.1 percent from 2011 to 2012, and operating income went up 54.7 percent for a degree of operating leverage of 3.4 times. After a rough period precipitated by high levels of debt, Wockhardt restructured and sold some of its assets to reduce its debt burden. Wockhardt currently has very low levels of debt, but the after-tax profit margin, despite being low, was nearly four times that of the previous year. In 2011 it was 2 percent and grew to 8 percent in 2012; the degree of financial leverage was five times. This is because as the operating income (EBIT) went up 54.7 percent, earnings per share went up 276.7 percent. When operating and financial leverage are combined, the degree of combined leverage was a healthy 17 times. So, for every 1 percent that Wockhardt's sales increased, earnings per share increased 17.17 percent.

If analysts had predicted that these leverage factors could be used to predict performance from 2012 to 2013, they would have been disappointed. Wockhardt had another good

WOCKHARDT						
	2011	2012	% Change 2011–2012	2012	2013	% Change 2012–2013
Sales (in crores of Rupees).....	3767	4374	16.1%	4374	5661	29.4%
Operating income (EBIT)	932	1442	54.7%	1442	2139	48.3%
Operating profit margin	25%	33%		33%	38%	
Interest expense	267.1	269	0.7%	269	215	–19.9%
Net income	90.52	343	278.6%	343	1594	365.2%
Aftertax profit margin = NI/Revenue	2%	8%		8%	28%	
Long-term debt	195.65	208	6.3%	208	201	–3.5%
EPS	8.27	31	276.7%	31	143	360.2%
Shares outstanding	109435903	109980633	0.5%	109980633	111212751	1.1%
					1232118	
DOL (operating leverage) = % Change in EBIT/% Change in revenues =			3.40			1.64
DFL (financial leverage) = % Change in earnings per share/% Change in			5.06			7.45
DCL (combined leverage) = % Change in EPS/% Change in revenues =			17.17			12.24
DCL (combined leverage) = DCL = DOL × DFL =			17.17			12.24
Exchange rate 2011: USD1 = INR 44.61						
Exchange rate 2012: USD1 = INR 50.83						
Exchange rate 2013: USD1 = INR 54.275						
INR 1 Crore = INR 10,000,000						
INR = INDIAN RUPEE						

(continued)

(continued)

increase in sales in 2013, but the operating profit margin increased marginally as costs rose on account of exceptional items, (mostly related to product testing and compliance with regulation) on a sales increase of 29.4 percent for a degree of operating leverage of 1.64 times. This was nearly half of the previous year because the increase in sales did not result in an equal increase in operating profit. However, there was very little debt on the balance sheet and Wockhardt's long-term debt went down to INR 201 crores in 2013 and shares outstanding only increased by 1.23 million. Moreover, the after-tax profit margin increased over three times the previous year to 28 percent. The combined effect created an increased degree of financial

leverage of 7.45. This means that for every 1 percent change in earnings, EPS increased 7.45 times. The financial leverage combined with operating leverage resulted in a good but lower than before combined leverage of 12.24 times. So, for every 1 percent that sales went up, EPS went up a modest 12.24 percent.

Wockhardt has used its operating and financial leverage to position itself competitively in a way that allows it to exploit the future growth in the market, whilst sacrificing little growth. A strategic move, which most analysts agree, is a sound one.

Source: Wockhardt annual reports for 2012 and 2013.

A Word of Caution

In a sense, we are piling risk on risk as the two different forms of leverage are combined. Perhaps a firm carrying heavy operating leverage may wish to moderate its position financially, and vice versa. One thing is certain—the decision will have a major impact on the operations of the firm.

SUMMARY

Leverage may be defined as the use of fixed cost items to magnify returns at high levels of operation. Operating leverage primarily affects fixed versus variable cost utilization in the operation of the firm. An important concept—degree of operating leverage (DOL)—measures the percentage change in operating income as a result of a percentage change in volume. The heavier the utilization of fixed cost assets, the higher DOL is likely to be.

Financial leverage reflects the extent to which debt is used in the capital structure of the firm. Substantial use of debt will place a great burden on the firm at low levels of profitability, but it will help to magnify earnings per share as volume or operating income increases. We combine operating leverage and financial leverage to assess the impact of all types of fixed costs on the firm. There is a multiplier effect when we use the two different types of leverage.

Because leverage is a two-edged sword, management must be sure the level of risk assumed is in accord with its desires for risk and its perceptions of the future. High operating leverage may be balanced off against lower financial leverage if this is deemed desirable, and vice versa.

REVIEW OF FORMULAS

$$1. \quad BE = \frac{FC}{P - VC} \quad (5-1)$$

BE is break-even point

FC is fixed costs

P is price per unit

VC is variable cost per unit

$$2. \text{ DOL} = \frac{Q(P - VC)}{Q(P - VC) - FC} \quad (5-3)$$

DOL is degree of operating leverage
 Q is quantity at which DOL is computed
 P is price per unit
 VC is variable cost per unit
 FC is fixed costs

$$3. \text{ DOL} = \frac{S - TVC}{S - TVC - FC} \quad (\text{Footnote 2})$$

DOL is degree of operating leverage
 S is sales (QP) at which DOL is computed
 TVC is total variable costs
 FC is fixed costs

$$4. \text{ DFL} = \frac{\text{EBIT}}{\text{EBIT} - I} \quad (5-5)$$

DFL is degree of financial leverage
 EBIT is earnings before interest and taxes
 I is interest

$$5. \text{ DCL} = \frac{Q(P - VC)}{Q(P - VC) - FC - I} \quad (5-7)$$

DCL is degree of combined leverage
 Q is quantity at which DCL is computed
 P is price per unit
 VC is variable cost per unit
 FC is fixed costs
 I is interest

$$6. \text{ DCL} = \frac{S - TVC}{S - TVC - FC - I} \quad (\text{Footnote 3})$$

DCL is degree of combined leverage
 S is sales (QP) at which DCL is computed
 TVC is total variable costs
 FC is fixed costs
 I is interest

LIST OF TERMS

leverage	125	financial leverage	133
operating leverage	126	degree of financial leverage (DFL)	136
contribution margin	127	combined leverage	137
degree of operating leverage (DOL)	131	degree of combined leverage (DCL)	139

DISCUSSION QUESTIONS

1. Discuss the various uses for break-even analysis. (LO5-2)
2. What factors would cause a difference in the use of financial leverage for a utility company and an automobile company? (LO5-1)
3. Explain how the break-even point and operating leverage are affected by the choice of manufacturing facilities (labor intensive versus capital intensive). (LO5-2)
4. What role does depreciation play in break-even analysis based on accounting flows? Based on cash flows? Which perspective is longer term in nature? (LO5-2)
5. What does risk taking have to do with the use of operating and financial leverage? (LO5-6)
6. Discuss the limitations of financial leverage. (LO5-4)
7. How does the interest rate on new debt influence the use of financial leverage? (LO5-4)
8. Explain how combined leverage brings together operating income and earnings per share. (LO5-5)
9. Explain why operating leverage decreases as a company increases sales and shifts away from the break-even point. (LO5-3)
10. When you are considering two different financing plans, does being at the level where earnings per share are equal between the two plans always mean you are indifferent as to which plan is selected? (LO5-4)

PRACTICE PROBLEMS AND SOLUTIONS

Degree of leverage
(LO5-2 & 5-5)

1. Meyer Appliance Company makes cooling fans. The firm's income statement is as follows:

Sales (7,000 fans at \$20)	\$140,000
Less: Variable costs (7,000 fans at \$8)	56,000
Fixed costs	44,000
Earnings before interest and taxes (EBIT)	\$ 40,000
– Interest (I)	10,000
Earnings before taxes (EBT)	\$ 30,000
– Taxes (T)	6,000
Earnings after taxes (EAT)	\$ 24,000

Compute:

- a. Degree of operating leverage.
- b. Degree of financial leverage.
- c. Degree of combined leverage.
- d. The break-even point.

2. Hubball Resources has the following capital structure:

Debt @ 8%	\$300,000
Common stock, \$10 par (shares 50,000)	500,000
Total	\$800,000

Earnings per share
and financial
leverage
(LO5-3)

- a. Compute earnings per share if earnings before interest and taxes is \$64,000. (Assume a 20 percent tax rate.)
- b. Assume debt goes up by \$200,000, common stock goes down by \$200,000, and the interest rate on the new debt is 10 percent. The tax rate remains at 20 percent. The par value on the common stock is still \$10. Compute earnings per share if earnings before interest and taxes is \$80,000.

Solutions

$$1. a. \text{DOL} = \frac{Q(P - VC)}{Q(P - VC) - FC} = \frac{7,000 (\$20 - \$8)}{7,000 (\$20 - \$8) - \$44,000}$$

$$= \frac{7,000 (\$12)}{7,000 (\$12) - \$44,000} = \frac{\$84,000}{\$84,000 - \$44,000} = \frac{\$84,000}{\$40,000} = 2.10x$$

$$b. \text{DFL} = \frac{\text{EBIT}}{\text{EBIT} - I} = \frac{\$40,000}{\$40,000 - \$10,000} = \frac{\$40,000}{\$30,000} = 1.33x$$

$$c. \text{DCL} = \frac{Q(P - VC)}{Q(P - VC) - FC - I} = \frac{7,000 (\$20 - \$8)}{7,000 (\$20 - \$8) - \$44,000 - \$10,000}$$

$$= \frac{7,000 (\$12)}{7,000 (\$12) - \$54,000} = \frac{\$84,000}{\$84,000 - \$54,000}$$

$$= \frac{\$84,000}{\$30,000} = 2.80x$$

$$d. \text{BE} = \frac{FC}{P - VC} = \frac{\$44,000}{\$20 - \$8} = \frac{\$44,000}{\$12} = 3,667 \text{ shares}$$

2. a.

Earnings before interest and taxes (EBIT)	\$64,000
– Interest (I)	24,000*
Earnings before taxes (EBT)	\$40,000
– Taxes (T) 20%	8,000
Earnings after taxes (EAT)	\$32,000
Shares	50,000
Earnings per share (EPS)	\$.64

*8 percent interest \times \$300,000 debt = \$24,000.

b.

Earnings before interest and taxes (EBIT)	\$80,000
– Interest (I)	44,000*
Earnings before taxes (EBT)	\$36,000
– Taxes (T) 20%	7,200
Earnings after taxes (EAT)	\$28,800
Shares	30,000 [†]
Earnings per share (EPS)	\$.96

*Interest on old debt (\$24,000) + interest on new debt (\$20,000). 10 percent × \$200,000.
The total is \$44,000.
[†] 50,000 shares reduced by (\$200,000/\$10 par value) = 50,000 – 20,000 = 30,000.

PROBLEMS



Selected problems are available with Connect. Please see the preface for more information.

Basic Problems

Break-even analysis (LO5-2)

- Shock Electronics sells portable heaters for \$71 per unit, and the variable cost to produce them is \$40. Mr. Amps estimates that the fixed costs are \$124,000.
 - Compute the break-even point in units.
 - Fill in the following table (in dollars) to illustrate that the break-even point has been achieved.

Sales	_____
– Fixed costs	_____
– Total variable costs	_____
Net profit (loss)	_____

Break-even analysis (LO5-2)

- The Hartnett Corporation manufactures baseball bats with Pudge Rodriguez’s autograph stamped on them. Each bat sells for \$35 and has a variable cost of \$22. There are \$97,500 in fixed costs involved in the production process.
 - Compute the break-even point in units.
 - Find the sales (in units) needed to earn a profit of \$262,500.

Break-even analysis (LO5-2)

- Therapeutic Systems sells its products for \$30 per unit. It has the following costs:

Rent	\$230,000
Factory labor	\$12.50 per unit
Executives under contract	\$514,600
Raw material	\$2.90 per unit

Separate the expenses between fixed and variable costs per unit. Using this information and the sales price per unit of \$30, compute the break-even point.

Break-even analysis (LO5-2)

- Draw two break-even graphs—one for a conservative firm using labor-intensive production and another for a capital-intensive firm. Assuming these companies compete within the same industry and have identical sales, explain the impact of changes in sales volume on both firms’ profits.

5. Eaton Tool Company has fixed costs of \$255,000, sells its units for \$66, and has variable costs of \$36 per unit.
- Compute the break-even point.
 - Ms. Eaton comes up with a new plan to cut fixed costs to \$200,000. However, more labor will now be required, which will increase variable costs per unit to \$39. The sales price will remain at \$66. What is the new break-even point?
 - Under the new plan, what is likely to happen to profitability at very high volume levels (compared to the old plan)?
6. Shawn Pen & Pencil Sets Inc. has fixed costs of \$99,000. Its product currently sells for \$5 per unit and has variable costs of \$3.00 per unit. Mr. Bic, the head of manufacturing, proposes to buy new equipment that will cost \$310,000 and drive up fixed costs to \$147,500. Although the price will remain at \$5 per unit, the increased automation will reduce costs per unit to \$2.50.
- As a result of Bic's suggestion, will the break-even point go up or down? Compute the necessary numbers.
7. Calloway Cab Company determines its break-even strictly on the basis of cash expenditures related to fixed costs. Its total fixed costs are \$450,000, but 5 percent of this value is represented by depreciation. Its contribution margin (price minus variable cost) for each unit is \$4.10. How many units does the firm need to sell to reach the cash break-even point?
8. Air Purifier Inc. computes its break-even point strictly on the basis of cash expenditures related to fixed costs. Its total fixed costs are \$2,650,000, but 10 percent of this value is represented by depreciation. Its contribution margin (price minus variable cost) for each unit is \$80. How many units does the firm need to sell to reach the cash break-even point?
9. Boise Timber Co. computes its break-even point strictly on the basis of cash expenditures related to fixed costs. Its total fixed costs are \$6,500,000, but 10 percent of this value is represented by depreciation. Its contribution margin (price minus variable cost) for each unit is \$9. How many units does the firm need to sell to reach the cash break-even point?

Break-even
analysis
(LO5-2)

Break-even
analysis
(LO5-2)

Cash break-even
analysis
(LO5-2)

Cash break-even
analysis
(LO5-2)

Cash break-even
analysis
(LO5-2)

Intermediate Problems

10. The Sterling Tire Company's income statement for 2013 is as follows:

Degree of leverage
(LO5-2 & 5-5)

STERLING TIRE COMPANY	
Income Statement	
For the Year Ended December 31, 2013	
Sales (30,000 tires at \$80 each)	\$2,400,000
Less: Variable costs (30,000 tires at \$40)	1,200,000
Fixed costs	500,000
Earnings before interest and taxes (EBIT)	\$ 700,000
Interest expense	55,000
Earnings before taxes (EBT)	\$ 645,000
Income tax expense (20%)	129,000
Earnings after taxes (EAT)	\$ 516,000

Given this income statement, compute the following:

- Degree of operating leverage.
- Degree of financial leverage.
- Degree of combined leverage.
- Break-even point in units.



Degree of leverage
(LO5-2 & 5-5)

- The Harding Company manufactures skates. The company's income statement for 2013 is as follows:

HARDING COMPANY	
Income Statement	
For the Year Ended December 31, 2013	
Sales (10,500 skates @ \$60 each)	\$630,000
Less: Variable costs (10,500 skates at \$25)	262,500
Fixed costs	200,000
Earnings before interest and taxes (EBIT)	<u>\$167,500</u>
Interest expense	62,500
Earnings before taxes (EBT)	<u>\$105,000</u>
Income tax expense (30%)	31,500
Earnings after taxes (EAT)	<u>\$ 73,500</u>

Given this income statement, compute the following:

- Degree of operating leverage.
- Degree of financial leverage.
- Degree of combined leverage.
- Break-even point in units (number of skates).

Break-even point
and degree of
leverage
(LO5-2 & 5-5)

- Healthy Foods Inc. sells 60-pound bags of grapes to the military for \$15 a bag. The fixed costs of this operation are \$90,000, while the variable costs of grapes are \$.15 per pound.
 - What is the break-even point in bags?
 - Calculate the profit or loss on 14,000 bags and on 35,000 bags.
 - What is the degree of operating leverage at 21,000 bags and at 35,000 bags? Why does the degree of operating leverage change as the quantity sold increases?
 - If Healthy Foods has an annual interest expense of \$17,000, calculate the degree of financial leverage at both 21,000 and 35,000 bags.
 - What is the degree of combined leverage at both sales levels?
- United Snack Company sells 50-pound bags of peanuts to university dormitories for \$20 a bag. The fixed costs of this operation are \$176,250, while the variable costs of peanuts are \$.15 per pound.
 - What is the break-even point in bags?
 - Calculate the profit or loss on 7,000 bags and on 20,000 bags.
 - What is the degree of operating leverage at 19,000 bags and at 24,000 bags? Why does the degree of operating leverage change as the quantity sold increases?
 - If United Snack Company has an annual interest expense of \$15,000, calculate the degree of financial leverage at both 19,000 and 24,000 bags.
 - What is the degree of combined leverage at both sales levels?

Break-even point
and degree of
leverage
(LO5-2 & 5-5)

14. International Data Systems information on revenue and costs is only relevant up to a sales volume of 120,000 units. After 120,000 units, the market becomes saturated and the price per unit falls from \$8.00 to \$5.80. Also, there are cost overruns at a production volume of over 120,000 units, and variable cost per unit goes up from \$4.00 to \$3.20. Fixed costs remain the same at \$70,000.
- Compute operating income at 120,000 units.
 - Compute operating income at 220,000 units.
15. U.S. Steel has the following income statement data:

Units Sold	Total Variable Costs	Fixed Costs	Total Costs	Total Revenue	Operating Income (Loss)
60,000	\$120,000	\$50,000	\$170,000	\$360,000	\$190,000
80,000	160,000	50,000	210,000	480,000	270,000

- Compute DOL based on the following formula (see page 132 for an example):

$$\text{DOL} = \frac{\text{Percent change in operating income}}{\text{Percent change in units sold}}$$

- Confirm that your answer to part *a* is correct by recomputing DOL using Formula 5-3. There may be a slight difference due to rounding.

$$\text{DOL} = \frac{Q(P - VC)}{Q(P - VC) - FC}$$

Q represents beginning units sold (all calculations should be done at this level). *P* can be found by dividing total revenue by units sold. *VC* can be found by dividing total variable costs by units sold.

16. Lenow's Drug Stores and Hall's Pharmaceuticals are competitors in the discount drug chain store business. The separate capital structures for Lenow and Hall are presented below.

Lenow		Hall	
Debt @ 10%	\$100,000	Debt @ 10%	\$200,000
Common stock, \$10 par	200,000	Common stock, \$10 par	100,000
Total	\$300,000	Total	\$300,000
Shares	20,000	Common shares	10,000

- Compute earnings per share if earnings before interest and taxes are \$20,000, \$30,000, and \$120,000 (assume a 30 percent tax rate).
- Explain the relationship between earnings per share and the level of EBIT.
- If the cost of debt went up to 12 percent and all other factors remained equal, what would be the break-even level for EBIT?

Nonlinear breakeven analysis (LO5-2)

Use of different formulas for operating leverage (LO5-3)

Earnings per share and financial leverage (LO5-4)

P/E ratio
(LO5-6)

17. The capital structure for Cain Supplies is presented below. Compute the stock price for Cain if it sells at 19 times earnings per share and EBIT is \$50,000. The tax rate is 20 percent.

Cain	
Debt @ 9%	\$100,000
Common stock, \$10 par	200,000
Total	\$300,000
Common shares	20,000

Advanced Problems

**Leverage and
stockholder wealth**
(LO5-4)

18. Sterling Optical and Royal Optical both make glass frames and each is able to generate earnings before interest and taxes of \$105,600. The separate capital structures for Sterling and Royal are shown next:

Sterling		Royal	
Debt @ 8%	\$ 792,000	Debt @ 8%	\$ 264,000
Common stock, \$5 par	528,000	Common stock, \$5 par	1,056,000
Total	\$1,320,000	Total	\$1,320,000
Common shares	105,600	Common shares	211,200

- Compute earnings per share for both firms. Assume a 20 percent tax rate.
 - In part *a*, you should have gotten the same answer for both companies' earnings per share. Assuming a P/E ratio of 19 for each company, what would its stock price be?
 - Now as part of your analysis, assume the P/E ratio would be 13 for the riskier company in terms of heavy debt utilization in the capital structure and 23 for the less risky company. What would the stock prices for the two firms be under these assumptions? (Note: Although interest rates also would likely be different based on risk, we will hold them constant for ease of analysis.)
 - Based on the evidence in part *c*, should management only be concerned about the impact of financing plans on earnings per share or should stockholders' wealth maximization (stock price) be considered as well?
19. Firms in Japan often employ both high operating and financial leverage because of the use of modern technology and close borrower–lender relationships. Assume the Mitaka Company has a sales volume of 130,000 units at a price of \$30 per unit; variable costs are \$10 per unit, and fixed costs are \$1,850,000. Interest expense is \$405,000. What is the degree of combined leverage for this Japanese firm?
20. Sinclair Manufacturing and Boswell Brothers Inc. are both involved in the production of brick for the homebuilding industry. Their financial information is as follows:

**Japanese firm and
combined leverage**
(LO5-5)

**Combining
operating and
financial leverage**
(LO5-5)

Capital Structure		
	Sinclair	Boswell
Debt @ 10%	\$ 2,100,000	0
Common stock, \$10 per share	1,400,000	\$ 3,500,000
Total	\$ 3,500,000	\$ 3,500,000
Common shares	140,000	350,000
Operating Plan		
Sales (75,000 units at \$15 each)	\$ 1,125,000	\$ 1,125,000
Less: Variable costs	900,000	450,000
	(\$12 per unit)	(\$6 per unit)
Fixed costs	0	325,000
Earnings before interest and taxes (EBIT)	\$ 225,000	\$ 350,000

- a. If you combine Sinclair's capital structure with Boswell's operating plan, what is the degree of combined leverage? (Round to two places to the right of the decimal point.)
 - b. If you combine Boswell's capital structure with Sinclair's operating plan, what is the degree of combined leverage?
 - c. Explain why you got the results you did in part *b*.
 - d. In part *b*, if sales double, by what percentage will EPS increase?
21. DeSoto Tools Inc. is planning to expand production. The expansion will cost \$300,000, which can be financed either by bonds at an interest rate of 14 percent or by selling 10,000 shares of common stock at \$30 per share. The current income statement before expansion is as follows:

Expansion and
leverage
(LO5-5)

DeSOTO TOOLS, INC.		
Income Statement		
201X		
Sales		\$1,500,000
Less: Variable costs	\$450,000	
Fixed costs	550,000	1,000,000
Earnings before interest and taxes		\$ 500,000
Less: Interest expense		100,000
Earnings before taxes		\$ 400,000
Less: Taxes @ 34%		136,000
Earnings after taxes		\$ 264,000
Shares		100,000
Earnings per share		\$ 2.64

After the expansion, sales are expected to increase by \$1,000,000. Variable costs will remain at 30 percent of sales, and fixed costs will increase to \$800,000. The tax rate is 34 percent.

- a. Calculate the degree of operating leverage, the degree of financial leverage, and the degree of combined leverage before expansion. (For the degree of operating leverage, use the formula developed in footnote 2; for the degree of combined leverage, use the formula developed in footnote 3. These instructions apply throughout this problem.)

Leverage analysis
with actual
companies
(LO5-6)

Leverage and
sensitivity analysis
(LO5-6)

Leverage and
sensitivity analysis
(LO5-6)

- b. Construct the income statement for the two alternative financing plans.
 - c. Calculate the degree of operating leverage, the degree of financial leverage, and the degree of combined leverage, after expansion.
 - d. Explain which financing plan you favor and the risks involved with each plan.
22. Using Standard & Poor's data or annual reports, compare the financial and operating leverage of Chevron, Eastman Kodak, and Delta Airlines for the most current year. Explain the relationship between operating and financial leverage for each company and the resultant combined leverage. What accounts for the differences in leverage of these companies?

23. Dickinson Company has \$11,860,000 million in assets. Currently half of these assets are financed with long-term debt at 9.3 percent and half with common stock having a par value of \$8. Ms. Smith, vice-president of finance, wishes to analyze two refinancing plans, one with more debt (D) and one with more equity (E). The company earns a return on assets before interest and taxes of 9.3 percent. The tax rate is 40 percent.

Under Plan D, a \$2,965,000 million long-term bond would be sold at an interest rate of 11.3 percent and 370,625 shares of stock would be purchased in the market at \$8 per share and retired.

Under Plan E, 370,625 shares of stock would be sold at \$8 per share and the \$2,965,000 in proceeds would be used to reduce long-term debt.

- a. How would each of these plans affect earnings per share? Consider the current plan and the two new plans.
 - b. Which plan would be most favorable if return on assets fell to 4.65 percent? Increased to 14.3 percent? Consider the current plan and the two new plans.
 - c. If the market price for common stock rose to \$10 before the restructuring, which plan would then be most attractive? Continue to assume that \$2,965,000 million in debt will be used to retire stock in Plan D and \$2,965,000 million of new equity will be sold to retire debt in Plan E. Also assume for calculations in part c that return on assets is 9.3 percent.
24. Edsel Research Labs has \$27 million in assets. Currently half of these assets are financed with long-term debt at 5 percent and half with common stock having a par value of \$10. Ms. Edsel, the Vice-President of Finance, wishes to analyze two refinancing plans, one with more debt (D) and one with more equity (E). The company earns a return on assets before interest and taxes of 5 percent. The tax rate is 30 percent.
- Under Plan D, a \$6.75 million long-term bond would be sold at an interest rate of 11 percent and 675,000 shares of stock would be purchased in the market at \$10 per share and retired. Under Plan E, 675,000 shares of stock would be sold at \$10 per share and the \$6,750,000 in proceeds would be used to reduce long-term debt.
- a. How would each of these plans affect earnings per share? Consider the current plan and the two new plans. Which plan(s) would produce the highest EPS?

- b. Which plan would be most favorable if return on assets increased to 8 percent? Compare the current plan and the two new plans. What has caused the plans to give different EPS numbers?
- c. Assuming return on assets is back to the original 5 percent, but the interest rate on new debt in Plan D is 7 percent, which of the three plans will produce the highest EPS? Why?
25. The Lopez-Portillo Company has \$11.6 million in assets, 60 percent financed by debt, and 40 percent financed by common stock. The interest rate on the debt is 14 percent and the par value of the stock is \$10 per share. President Lopez-Portillo is considering two financing plans for an expansion to \$23 million in assets.

Leverage and
sensitivity analysis
(LO5-6)

Under Plan A, the debt-to-total-assets ratio will be maintained, but new debt will cost a whopping 17 percent! Under Plan B, only new common stock at \$10 per share will be issued. The tax rate is 30 percent.

- a. If EBIT is 11 percent on total assets, compute earnings per share (EPS) before the expansion and under the two alternatives.
- b. What is the degree of financial leverage under each of the three plans?
- c. If stock could be sold at \$20 per share due to increased expectations for the firm's sales and earnings, what impact would this have on earnings per share for the two expansion alternatives? Compute earnings per share for each.
- d. Explain why corporate financial officers are concerned about their stock values.
26. Mr. Gold is in the widget business. He currently sells 1.5 million widgets a year at \$6 each. His variable cost to produce the widgets is \$4 per unit, and he has \$1,550,000 in fixed costs. His sales-to-assets ratio is six times, and 30 percent of his assets are financed with 10 percent debt, with the balance financed by common stock at \$10 par value per share. The tax rate is 35 percent.

Operating leverage
and ratios
(LO5-6)

His brother-in-law, Mr. Silverman, says he is doing it all wrong. By reducing his price to \$5.00 a widget, he could increase his volume of units sold by 60 percent. Fixed costs would remain constant, and variable costs would remain \$4 per unit. His sales-to-assets ratio would be 7.5 times. Furthermore, he could increase his debt-to-assets ratio to 50 percent, with the balance in common stock. It is assumed that the interest rate would go up by 1 percent and the price of stock would remain constant.

- a. Compute earnings per share under the Gold plan.
- b. Compute earnings per share under the Silverman plan.
- c. Mr. Gold's wife, the chief financial officer, does not think that fixed costs would remain constant under the Silverman plan but that they would go up by 15 percent. If this is the case, should Mr. Gold shift to the Silverman plan, based on earnings per share?

Expansion, break-even analysis, and leverage

(LO5-2, 5-3, & 5-4)

27. Delsing Canning Company is considering an expansion of its facilities. Its current income statement is as follows:

Sales	\$6,500,000
Less: Variable expense (50% of sales)	3,250,000
Fixed expense	1,950,000
Earnings before interest and taxes (EBIT)	\$1,300,000
Interest (10% cost)	500,000
Earnings before taxes (EBT)	\$ 800,000
Tax (30%)	240,000
Earnings after taxes (EAT)	<u>\$ 560,000</u>
Shares of common stock—350,000	
Earnings per share	<u>\$1.60</u>

The company is currently financed with 50 percent debt and 50 percent equity (common stock, par value of \$10). In order to expand the facilities, Mr. Delsing estimates a need for \$3.5 million in additional financing. His investment banker has laid out three plans for him to consider:

1. Sell \$3.5 million of debt at 11 percent.
2. Sell \$3.5 million of common stock at \$25 per share.
3. Sell \$1.75 million of debt at 10 percent and \$1.75 million of common stock at \$40 per share.

Variable costs are expected to stay at 50 percent of sales, while fixed expenses will increase to \$2,450,000 per year. Delsing is not sure how much this expansion will add to sales, but he estimates that sales will rise by \$1.75 million per year for the next five years.

Delsing is interested in a thorough analysis of his expansion plans and methods of financing. He would like you to analyze the following:

- a. The break-even point for operating expenses before and after expansion (in sales dollars).
- b. The degree of operating leverage before and after expansion. Assume sales of \$6.5 million before expansion and \$7.5 million after expansion. Use the formula in footnote 2 of the chapter.
- c. The degree of financial leverage before expansion and for all three methods of financing after expansion. Assume sales of \$7.5 million for this question.
- d. Compute EPS under all three methods of financing the expansion at \$7.5 million in sales (first year) and \$10.4 million in sales (last year).
- e. What can we learn from the answer to part *d* about the advisability of the three methods of financing the expansion?

COMPREHENSIVE PROBLEM

Ryan Boot Company
(Review of Chapters
2 through 5)
(Multiple LOs from
Chapters 2–5)

- a. Analyze Ryan Boot Company, using ratio analysis. Compute the ratios on page 156 for Ryan and compare them to the industry data that is given. Discuss the weak points, strong points, and what you think should be done to improve the company's performance.
- b. In your analysis, calculate the overall break-even point in sales dollars and the cash break-even point. Also compute the degree of operating leverage, degree of

financial leverage, and degree of combined leverage. (Use footnote 2 for DOL and footnote 3 for DCL.)

- c. Use the information in parts *a* and *b* to discuss the risk associated with this company. Given the risk, decide whether a bank should loan funds to Ryan Boot.

Ryan Boot Company is trying to plan the funds needed for 2014. The management anticipates an increase in sales of 20 percent, which can be absorbed *without increasing fixed assets*.

- d. What would be Ryan's needs for external funds based on the current balance sheet? Compute RNF (required new funds). Notes payable (current) and bonds are not part of the liability calculation.
- e. What would be the required new funds if the company brings its ratios into line with the industry average during 2014? Specifically examine receivables turnover, inventory turnover, and the profit margin. Use the new values to recompute the factors in RNF (assume liabilities stay the same).

RYAN BOOT COMPANY

Balance Sheet

December 31, 2013

Assets		Liabilities and Stockholders' Equity	
Cash	\$ 50,000	Accounts payable	\$2,200,000
Marketable securities	80,000	Accrued expenses	150,000
Accounts receivable	3,000,000	Notes payable (current)	400,000
Inventory	1,000,000	Bonds (10%)	2,500,000
Gross plant and equipment Less:	6,000,000	Common stock (1.7 million shares, par value \$1)	1,700,000
Accumulated depreciation	<u>2,000,000</u>	Retained earnings	<u>1,180,000</u>
Total assets	<u>\$8,130,000</u>	Total liabilities and stockholders' equity	<u>\$8,130,000</u>

Income Statement—2013

Sales (credit)	\$7,000,000
Fixed costs*	2,100,000
Variable costs (0.60)	<u>4,200,000</u>
Earnings before interest and taxes	\$ 700,000
Less: Interest	<u>250,000</u>
Earnings before taxes	\$ 450,000
Less: Taxes @ 35%	<u>157,500</u>
Earnings after taxes	\$ 292,500
Dividends (40% payout)	117,000
Increased retained earnings	<u>\$ 175,500</u>

*Fixed costs include (a) lease expense of \$200,000 and (b) depreciation of \$500,000.

Note: Ryan Boots also has \$65,000 per year in sinking fund obligations associated with its bond issue. The sinking fund represents an annual repayment of the principal amount of the bond. It is not tax-deductible.

Ratios		
	Ryan Boot (to be filled in)	Industry
Profit margin	_____	5.75%
Return on assets	_____	6.90%
Return on equity	_____	9.20%
Receivables turnover	_____	4.35 ×
Inventory turnover	_____	6.50 ×
Fixed-asset turnover	_____	1.85 ×
Total-asset turnover	_____	1.20 ×
Current ratio	_____	1.45 ×
Quick ratio	_____	1.10 ×
Debt to total assets	_____	25.05%
Interest coverage	_____	5.35 ×
Fixed charge coverage	_____	4.62 ×

- f. Do not calculate, only comment on these questions. How would required new funds change if the company:
- (1) Were at full capacity?
 - (2) Raised the dividend payout ratio?
 - (3) Suffered a decreased growth in sales?
 - (4) Faced an accelerated inflation rate?

WEB EXERCISE

1. At the start of the chapter, we talked about how risky and volatile airlines' operations were. Let's examine this further. Go to finance.yahoo.com. Enter UAL for United Continental Holdings in the "Get Quotes" box. Go to "Company" along the left-hand margin.
2. Click on "Profile" in the left-hand column and write a one-paragraph description of the company.
3. Scroll down and click on the "Income Statement." Describe the pattern of change for "Total Revenue" and "Income from Continuing Operations" in one paragraph.
4. Go to the "Balance Sheet." In one sentence, describe the pattern of change in Stockholders' Equity and indicate whether this does or does not appear to be a matter of concern.
5. Click on "Analyst Estimates." Do UAL's earnings estimates appear to be more or less promising for the future?
6. Finally, click on "Competitors." How does UAL compare to the other airlines and the industry in terms of Operating Margin?

Note: Occasionally a topic we have listed may have been deleted, updated, or moved into a different location on a Web site. If you click on the site map or site index, you will be introduced to a table of contents that should aid you in finding the topic you are looking for.