

## CHAPTER 15

# Capital Structure Decisions

*What is the difference between bankruptcy and a liquidity crisis? Although that question may sound like the first line of a joke, the answer isn't very funny for many companies. An economic bankruptcy means that the market value of a company's assets (which is determined by the cash flows those assets are expected to produce) is less than the amount owed to creditors. A legal bankruptcy occurs when a filing is made in bankruptcy court to protect a company from its creditors until an orderly reorganization or liquidation can be arranged.*

*A liquidity crisis occurs when a company doesn't have access to enough cash to make payments to creditors as the payments come due in the near future. In normal times, a strong company (one whose market value of assets far exceeds the amount owed to creditors) can usually borrow money in the short-term credit markets to meet any urgent liquidity needs. Thus, a liquidity crisis usually doesn't trigger a bankruptcy.*

*However, 2008 and the first half of 2009 were anything but usual. Many companies had loaded up on debt during the boom years prior to 2007, and much of that was short-term debt. When the mortgage crisis began in late 2007 and spread like wildfire through the financial sector, many financial institutions virtually stopped providing short-term credit as they tried to stave off their own bankruptcies. As a result, many nonfinancial companies faced liquidity crises. Even worse, consumer demand began to drop and investors' risk aversion began to rise, leading to falling market values of assets and triggering economic and legal bankruptcy for many companies.*

*Lehman Brothers and Washington Mutual each filed for bankruptcy in 2008 and have the distinction of being the two largest firms to fail, with assets of \$691 billion and \$328 billion, respectively. But the economic crisis has claimed plenty of nonfinancial firms, too, such as General Motors, Chrysler, Masonite Corporation, Trump Entertainment Resorts, Pilgrim's Pride, and Circuit City.*

*Many other companies are scrambling to reduce their liquidity problems. For example, in early 2009, Black & Decker issued about \$350 million in 5-year notes and used the proceeds to pay off some of its commercial paper. Even though the interest rate on Black & Decker's 5-year notes was higher than the rates on its commercial paper, B&D doesn't have to repay the note until 2014, whereas it had to refinance the commercial paper each time it came due.*

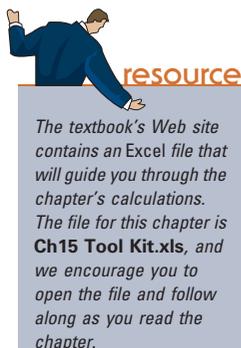
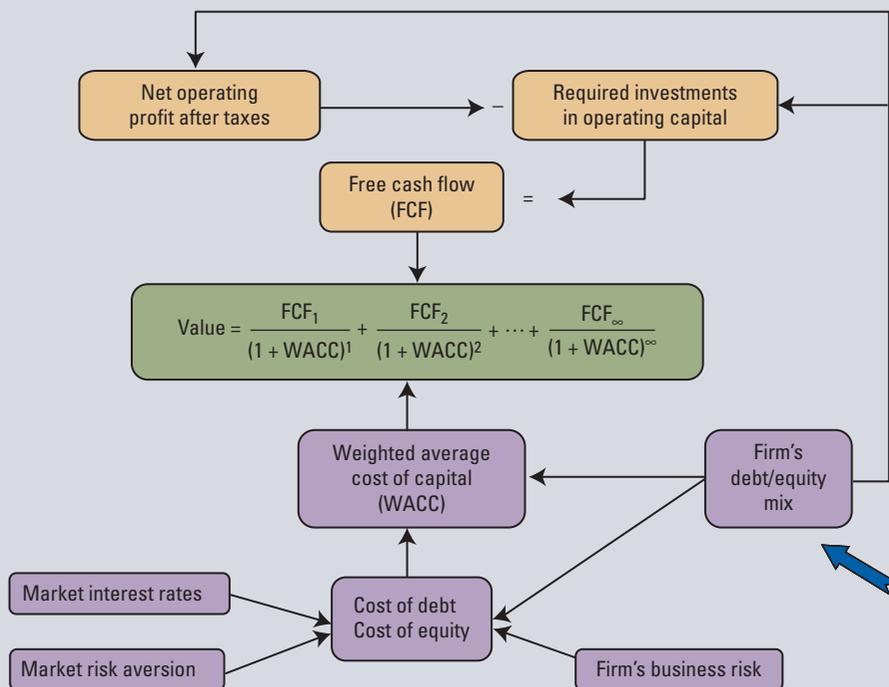
*As you read the chapter, think of these companies that suffered or failed because they mismanaged their capital structure decisions.*

*Sources: See [www.bankruptcydata.com](http://www.bankruptcydata.com) and the Black & Decker press release of April 23, 2009.*

## Corporate Valuation and Capital Structure

A firm's financing choices obviously have a direct effect on the weighted average cost of capital (WACC). Financing choices also have an indirect effect on the costs of debt and equity because they change the risk

and required returns of debt and equity. Financing choices can also affect free cash flows if the probability of bankruptcy becomes high. This chapter focuses on the debt–equity choice and its effect on value.



As we saw in Chapters 12 and 13, growth in sales requires growth in operating capital, often requiring that external funds must be raised through a combination of equity and debt. The firm's mixture of debt and equity is called its **capital structure**. Although actual levels of debt and equity may vary somewhat over time, most firms try to keep their financing mix close to a **target capital structure**. A firm's **capital structure decision** includes its choice of a target capital structure, the average maturity of its debt, and the specific types of financing it decides to use at any particular time. As with operating decisions, managers should make capital structure decisions that are designed to maximize the firm's intrinsic value.

### 15.1 A PREVIEW OF CAPITAL STRUCTURE ISSUES

Recall from Chapter 13 that the value of a firm's operations is the present value of its expected future free cash flows (FCF) discounted at its weighted average cost of capital (WACC):

$$V_{op} = \sum_{t=1}^{\infty} \frac{FCF_t}{(1+WACC)^t} \quad (15-1)$$

The WACC depends on the percentages of debt and common equity ( $w_d$  and  $w_s$ ), the cost of debt ( $r_d$ ), the cost of stock ( $r_s$ ), and the corporate tax rate ( $T$ ):

$$WACC = w_d(1 - T)r_d + w_s r_s \quad (15-2)$$

As these equations show, the only way any decision can change a firm's value is by affecting either free cash flows or the cost of capital. We discuss below some of the ways that a higher proportion of debt can affect WACC and/or FCF.

### Debt Increases the Cost of Stock, $r_s$

Debtholders have a claim on the company's cash flows that is prior to shareholders, who are entitled only to any residual cash flow after debtholders have been paid. As we show later in a numerical example, the "fixed" claim of the debtholders causes the "residual" claim of the stockholders to become riskier, and this increases the cost of stock,  $r_s$ .

### Debt Reduces the Taxes a Company Pays

Imagine that a company's cash flows are a pie and that three different groups get pieces of the pie. The first piece goes to the government in the form of taxes, the second goes to debtholders, and the third to shareholders. Companies can deduct interest expenses when calculating taxable income, which reduces the government's piece of the pie and leaves more pie available to debtholders and investors. This reduction in taxes reduces the after-tax cost of debt, as shown in Equation 15-2.

### The Risk of Bankruptcy Increases the Cost of Debt, $r_d$

As debt increases, the probability of financial distress, or even bankruptcy, goes up. With higher bankruptcy risk, debtholders will insist on a higher interest rate, which increases the pre-tax cost of debt,  $r_d$ .

### The Net Effect on the Weighted Average Cost of Capital

As Equation 15-2 shows, the WACC is a weighted average of relatively low-cost debt and high-cost equity. If we increase the proportion of debt, then the weight of low-cost debt ( $w_d$ ) increases and the weight of high-cost equity ( $w_s$ ) decreases. If all else remained the same, then the WACC would fall and the value of the firm in Equation 15-1 would increase. But the previous paragraphs show that all else doesn't remain the same: both  $r_d$  and  $r_s$  increase. It should be clear that changing the capital structure affects all the variables in the WACC equation, but it's not easy to say whether those changes increase the WACC, decrease it, or balance out exactly and thus leave the WACC unchanged. We'll return to this issue later when discussing capital structure theory.

### Bankruptcy Risk Reduces Free Cash Flow

As the risk of bankruptcy increases, some customers may choose to buy from another company, which hurts sales. This, in turn, decreases net operating profit after taxes (NOPAT), thus reducing FCF. Financial distress also hurts the productivity of

workers and managers, who spend more time worrying about their next job than attending to their current job. Again, this reduces NOPAT and FCF. Finally, suppliers tighten their credit standards, which reduces accounts payable and causes net operating working capital to increase, thus reducing FCF. Therefore, the risk of bankruptcy can decrease FCF and reduce the value of the firm.

## Bankruptcy Risk Affects Agency Costs

Higher levels of debt may affect the behavior of managers in two opposing ways. First, when times are good, managers may waste cash flow on perquisites and unnecessary expenditures. This is an agency cost, as described in Chapter 13. The good news is that the threat of bankruptcy reduces such wasteful spending, which increases FCF.

But the bad news is that a manager may become gun-shy and reject positive-NPV projects if they are risky. From the stockholder's point of view, it would be unfortunate if a risky project caused the company to go into bankruptcy, but note that other companies in the stockholder's portfolio may be taking on risky projects that turn out to be successful. Since most stockholders are well diversified, they can afford for a manager to take on risky but positive-NPV projects. But a manager's reputation and wealth are generally tied to a single company, so the project may be unacceptably risky from the manager's point of view. Thus, high debt can cause managers to forgo positive-NPV projects unless they are extremely safe. This is called the **underinvestment problem**, and it is another type of agency cost. Notice that debt can reduce one aspect of agency costs (wasteful spending) but may increase another (underinvestment), so the net effect on value isn't clear.

## Issuing Equity Conveys a Signal to the Marketplace

Managers are in a better position to forecast a company's free cash flow than are investors, and academics call this **informational asymmetry**. Suppose a company's stock price is \$50 per share. If managers are willing to issue new stock at \$50 per share, investors reason that no one would sell anything for less than its true value. Therefore, the true value of the shares as seen by the managers with their superior information must be less than or equal to \$50. Thus, investors perceive an equity issue as a negative signal, and this usually causes the stock price to fall.<sup>1</sup>

In addition to affecting investors' perceptions, capital structure choices also affect FCF and risk, as discussed earlier. The following section focuses on the way that capital structure affects risk.

## A Quick Overview of Actual Debt Ratios

For the average company in the S&P 500, the ratio of long-term debt to equity was about 92% in the summer of 2009. This means that the typical company had about \$0.92 in debt for every dollar of equity. However, Table 15-1 shows that there are wide divergences in the average ratios for different business sectors and for different companies within a sector. For example, the technology sector has a very low average ratio (23%) while the utilities sector has a much higher ratio (177%). Even so, within each sector there are some companies with low levels of debt and others with high

<sup>1</sup>An exception to this rule is any situation with little informational asymmetry, such as a regulated utility. Also, some companies, such as start-ups or high-tech ventures, are unable to find willing lenders and therefore must issue equity; we discuss this later in the chapter.

**TABLE 15-1** Long-Term Debt-to-Equity Ratios for Selected Firms and Industries

SECTOR AND COMPANY	LONG-TERM DEBT-TO-EQUITY RATIO	SECTOR AND COMPANY	LONG-TERM DEBT-TO-EQUITY RATIO
<b>Technology</b>	<b>23%</b>	<b>Capital Goods</b>	<b>38%</b>
Microsoft (MSFT)	0	Winnebago Industries (WGO)	0
Ricoh (RICTEYR.Lp)	25	Caterpillar Inc. (CAT)	375
<b>Energy</b>	<b>64</b>	<b>Consumer/Noncyclical</b>	<b>38</b>
ExxonMobil (XOM)	6	Starbucks (SBUX)	21
Chesapeake Energy (CHK)	87	Kellogg Company (K)	280
<b>Transportation</b>	<b>84</b>	<b>Services</b>	<b>84</b>
United Parcel Service (UPS)	115	Administaff, Inc. (ASF)	0
Continental Airlines (CAL)	5,115	Republic Services (RSG)	99
<b>Basic Materials</b>	<b>45</b>	<b>Utilities</b>	<b>177</b>
Anglo American PLC (AAUK)	36	Reliant Energy, Inc. (RRI)	96
Century Aluminum (CENX)	29	CMS Energy (CMS)	227

*Source:* For updates on a company's ratio, go to <http://www.reuters.com> and enter the ticker symbol for a stock quote. Click on Ratios (on the left) for updates on the sector ratio.

levels. For example, the average debt ratio for the consumer/noncyclical sector is 38%, but in this sector Starbucks has a ratio of 21% while Kellogg has a ratio of 280%. Why do we see such variation across companies and business sectors? Can a company make itself more valuable through its choice of debt ratio? We address those questions in the rest of this chapter, beginning with a description of business risk and financial risk.

### Self-Test

Briefly describe some ways in which the capital structure decision can affect the WACC and FCF.

## 15.2 BUSINESS RISK AND FINANCIAL RISK

Business risk and financial risk combine to determine the total risk of a firm's future return on equity, as we explained in the next sections.

### Business Risk

**Business risk** is the risk a firm's common stockholders would face if the firm had no debt. In other words, it is the risk inherent in the firm's operations, which arises from uncertainty about future operating profits and capital requirements.

Business risk depends on a number of factors, beginning with variability in product demand. For example, General Motors has more demand variability than does Kroger: When times are tough, consumers quit buying cars but they still buy food. Second, most firms are exposed to variability in sales prices and input costs. Some firms with strong brand identity like Apple may be able to pass unexpected costs through to their customers, and firms with strong market power like Wal-Mart may be able to keep their input costs low, but variability in prices and costs adds significant risk to most firms' operations. Third, firms that are slower to bring new

products to market have greater business risk: Think of GM's relatively sluggish time to bring a new model to the market versus that of Toyota. Being faster to the market allows Toyota to more quickly respond to changes in consumer desires. Fourth, international operations add the risk of currency fluctuations and political risk. Fifth, if a high percentage of a firm's costs are fixed and hence do not decline when demand falls, then the firm has high *operating leverage*, which increases its business risk. We focus on operating leverage in the next section.

## Operating Leverage

A high degree of **operating leverage** implies that a relatively small change in sales results in a relatively large change in EBIT, net operating profits after taxes (NOPAT), and return on invested capital (ROIC). Other things held constant, the higher a firm's fixed costs, the greater its operating leverage. Higher fixed costs are generally associated with (1) highly automated, capital intensive firms; (2) businesses that employ highly skilled workers who must be retained and paid even when sales are low; and (3) firms with high product development costs that must be maintained to complete ongoing R&D projects.

To illustrate the relative impact of fixed versus variable costs, consider Strasburg Electronics Company, a manufacturer of components used in cell phones. Strasburg is considering several different operating technologies and several different financing alternatives. We will analyze its financing choices in the next section, but for now we focus on its operating plans.

Each of Strasburg's plans requires a capital investment of \$200 million; assume for now that Strasburg will finance its choice entirely with equity.<sup>2</sup> Each plan is expected to produce 100 million units per year at a sales price of \$2 per unit. As shown in Figure 15-1, Plan A's technology requires a smaller annual fixed cost than Plan U's, but Plan A has higher variable costs. (We denote the second plan with U because it has no financial leverage, and we denote the third plan with L because it does have financial leverage; Plan L is discussed in the next section.) Figure 15-1 also shows the projected income statements and selected performance measures for the first year. Notice that Plan U has higher net income, higher net operating profit after taxes (NOPAT), higher return on equity (ROE), and higher return on invested capital than does Plan A. So at first blush it seems that Strasburg should accept Plan U instead of Plan A.

Notice that the projections in Figure 15-1 are based on the 110 million units that are expected to be sold. But what if demand is lower than expected? It often is useful to know how far sales can fall before operating profits become negative. The **operating break-even point** occurs when earnings before interest and taxes (EBIT) equal zero (P, Q, V, and F are defined in Figure 15-1):<sup>3</sup>

$$\text{EBIT} = \text{PQ} - \text{VQ} - \text{F} = 0$$

(15-3)

<sup>2</sup>Strasburg has improved its supply chain operations to such an extent that its operating current assets are not larger than its operating current liabilities. In fact, its Op CA = Op CL = \$10 million. Recall that net operating working capital (NOWC) is the difference between Op CA and Op CL, so Strasburg has NOWC = 0. Even though Strasburg's plans require \$210 million in assets, they also generate \$10 million in spontaneous operating liabilities, so Strasburg's investors must put up only \$200 million in some combination of debt and equity.

<sup>3</sup>This definition of the break-even point does not include any fixed financial costs because it focuses on operating profits. We could also examine net income, in which case a levered firm would suffer an accounting loss even at the operating break-even point. We introduce financial costs shortly.

FIGURE 15-1

Illustration of Operating and Financial Leverage (Millions of Dollars and Millions of Units, Except Per Unit Data)

	A	B	C	D	E
<b>23</b>	<b>Input Data</b>		<u>Plan A</u>	<u>Plan U</u>	<u>Plan L</u>
<b>24</b>	Required capital		\$200	\$200	\$200
<b>25</b>	Book equity		\$200	\$200	\$150
<b>26</b>	Debt				\$50
<b>27</b>	Interest rate		8%	8%	8%
<b>28</b>	Sales price (P)		\$2.00	\$2.00	\$2.00
<b>29</b>	Tax rate (T)		40%	40%	40%
<b>30</b>	Expected units sold (Q)		110	110	110
<b>31</b>	Fixed costs (F)		\$20	\$60	\$60
<b>32</b>	Variable costs (V)		\$1.50	\$1.00	\$1.00
<b>33</b>					
<b>34</b>	<b>Income Statements</b>		<u>Plan A</u>	<u>Plan U</u>	<u>Plan L</u>
<b>35</b>	Sales revenue (P×Q)		\$220.0	\$220.0	\$220.0
<b>36</b>	Fixed costs		\$20.0	\$60.0	\$60.0
<b>37</b>	Variable costs (V×Q)		\$165.0	\$110.0	\$110.0
<b>38</b>	EBIT		\$35.0	\$50.0	\$50.0
<b>39</b>	Interest		\$0.0	\$0.0	\$4.0
<b>40</b>	EBT		\$35.0	\$50.0	\$46.0
<b>41</b>	Tax		\$14.0	\$20.0	\$18.4
<b>42</b>	Net income		\$21.0	\$30.0	\$27.6
<b>43</b>					
<b>44</b>	<b>Key Performance Measures</b>		<u>Plan A</u>	<u>Plan U</u>	<u>Plan L</u>
<b>45</b>	NOPAT = EBIT(1-T)		\$21.0	\$30.0	\$30.0
<b>46</b>	ROIC = NOPAT/Capital		10.5%	15.0%	15.0%
<b>47</b>	ROE = NI/Equity		10.5%	15.0%	18.4%

If we solve for the break-even quantity,  $Q_{BE}$ , we get this expression:

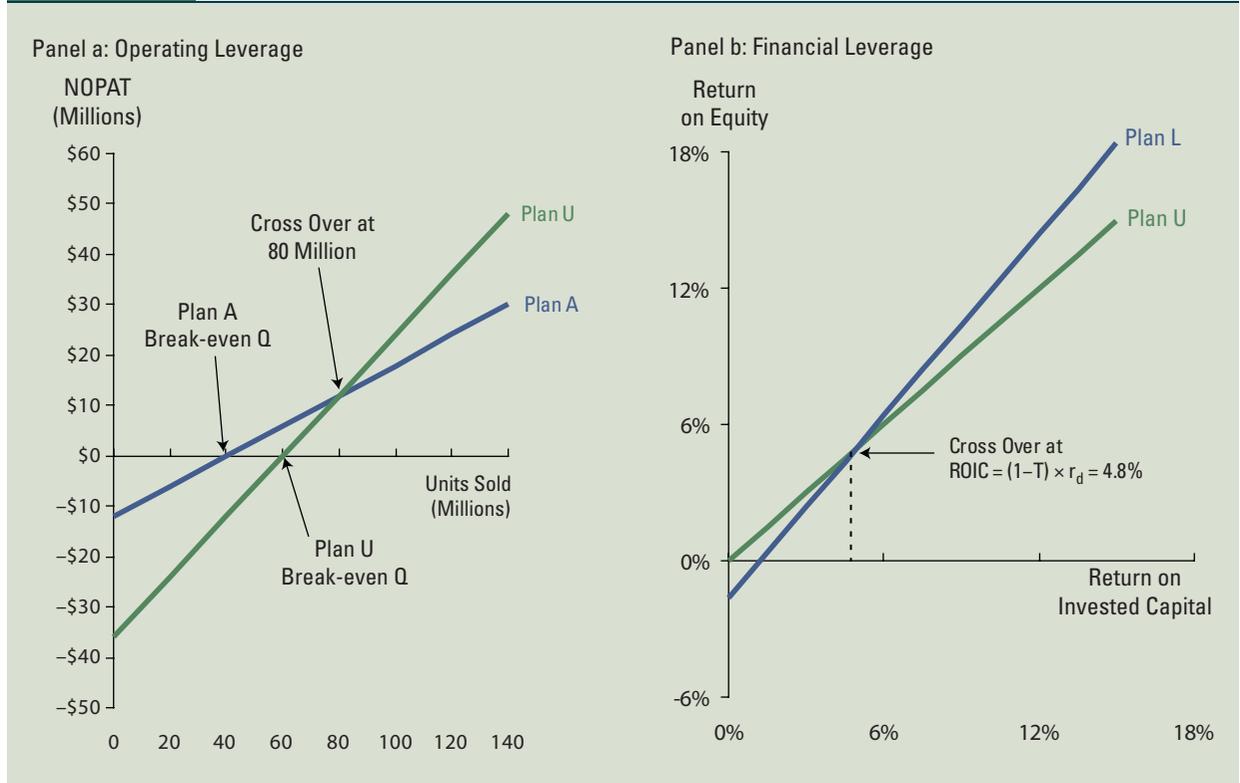
$$Q_{BE} = \frac{F}{P - V} \quad (15-4)$$

The break-even quantities for Plans A and U are

$$\text{Plan A: } Q_{BE} = \frac{\$20,000}{\$2.00 - \$1.50} = 40,000 \text{ units}$$

$$\text{Plan U: } Q_{BE} = \frac{\$60,000}{\$2.00 - \$1.00} = 60,000 \text{ units}$$

Plan A will be profitable if unit sales are above 40,000, whereas Plan U requires sales of 60,000 units before it is profitable. This difference is because Plan U has higher fixed costs, so more units must be sold to cover these fixed costs. Panel a of Figure 15-2 illustrates the operating profitability of these two plans for different levels of unit sales. (We discuss Panel b in the next section.) Suppose sales are at 80 million units. In this case, the NOPAT is identical for each plan. As unit sales begin to climb above 80 million, both plans increase in profitability, but

**FIGURE 15-2** Operating Leverage and Financial Leverage


NOPAT increases more for Plan U than for Plan A. If sales fall below 80 million then both plans become less profitable, but NOPAT decreases more for Plan U than for Plan A. This illustrates that the combination of higher fixed costs and lower variable costs of Plan U magnifies its gain or loss relative to Plan A. In other words, because Plan U has higher operating leverage, it also has greater business risk.

Notice that business risk is being driven by variability in the number of units that can be sold. It would be straightforward to estimate a probability for each possible level of sales and then calculate the standard deviation of the resulting NOPATs in exactly the same way that we calculated project risk using scenario analysis in Chapter 11. This would produce a quantitative estimate of business risk.<sup>4</sup> However, for most purposes it is sufficient to recognize that business risk increases if operating leverage increases and then use that insight qualitatively rather than quantitatively when evaluating plans with different degrees of operating leverage.

<sup>4</sup>For this example, we could also directly express the standard deviation of NOPAT,  $\sigma_{\text{NOPAT}}$ , in terms of the standard deviation of unit sales,  $\sigma_Q$ :  $\sigma_{\text{NOPAT}} = (P - V)(1 - T) \times \sigma_Q$ . We could also express the standard deviation of ROIC as  $\sigma_{\text{ROIC}} = [(P - V)(1 - T)/\text{Capital}] \times \sigma_Q$ . As this shows, volatility in NOPAT (and ROIC) is driven by volatility in unit sales, with a bigger spread between price and variable costs leading to higher volatility. Also, there are several other ways to calculate measures of operating leverage, as we explain in *Web Extension 15A*.

## Financial Risk

**Financial risk** is the additional risk placed on the common stockholders as a result of the decision to finance with debt.<sup>5</sup> Conceptually, stockholders face a certain amount of risk that is inherent in a firm's operations—this is its business risk, which is defined as the uncertainty in projections of future EBIT, NOPAT, and ROIC. If a firm uses debt (financial leverage), then the business risk is concentrated on the common stockholders. To illustrate, suppose ten people decide to form a corporation to manufacture flash memory drives. There is a certain amount of business risk in the operation. If the firm is capitalized only with common equity and if each person buys 10% of the stock, then each investor shares equally in the business risk. However, suppose the firm is capitalized with 50% debt and 50% equity, with five of the investors putting up their money by purchasing debt and the other five putting up their money by purchasing equity. In this case, the five debtholders are paid before the five stockholders, so *virtually all* of the business risk is borne by the stockholders. Thus, the use of debt, or **financial leverage**, concentrates business risk on stockholders.<sup>6</sup>

To illustrate the impact of financial risk, we can extend the Strasburg Electronics example. Strasburg initially decided to use the technology of Plan U, which is unlevered (financed with all equity), but now it's considering financing the technology with \$150 million of equity and \$50 million of debt at an 8% interest rate, as shown for Plan L in Figure 15-1 (recall that L denotes leverage). Compare Plans U and L. Notice that the ROIC of 15% is the same for the two plans because the financing choice doesn't affect operations. Plan L has lower net income (\$27.6 million versus \$30 million) because it must pay interest, but it has a higher ROE (18.4%) because the net income is shared over a smaller equity base.<sup>7</sup>

Suppose Strasburg is a zero-growth company and pays out all net income as dividends. This means that Plan U has net income of \$30 million available for distribution to its investors. Plan L has \$27.6 million net income available to pay as dividends and it already pays \$4 million in interest to its debtholders, so its total distribution is  $\$27.6 + \$4 = \$31.6$  million. How is it that Plan L is able to distribute a larger total amount to investors? Look closely at the taxes paid under the two plans. Plan L pays only \$18.4 million in tax while Plan U pays \$20 million. The \$1.6 million difference is because interest payments are deductible for tax purposes. Because Plan L pays less in taxes, an extra \$1.6 million is available to distribute to investors. If our analysis ended here, we would choose Plan L over Plan U because Plan L distributes more cash to investors and provides a higher ROE for its equity holders.

But there is more to the story. Just as operating leverage adds risk, so does financial leverage. We used the Data Table feature in the file *Ch15 Tool Kit.xls* to generate performance measures for plans U and L at different levels of unit sales, which lead to different levels of ROIC. Panel b of Figure 15-2 shows the ROE of Plan L versus its ROIC. (Keep in mind that the ROIC for Plan U is the same as for Plan L because leverage doesn't affect operating performance; also, Plan U's ROE is the same as its ROIC because it has no leverage.)

<sup>5</sup>Preferred stock also adds to financial risk. To simplify matters, we examine only debt and common equity in this chapter.

<sup>6</sup>Holders of corporate debt generally do bear some business risk, because they may lose some of their investment if the firm goes bankrupt. We discuss this in more depth later in the chapter.

<sup>7</sup>Recall that Strasburg's operating CA are equal to its operating CL. Strasburg has no short-term investments, so its book values of debt and equity must sum up to the amount of operating capital it uses.

Notice that for an ROIC of 4.8%, which is the after-tax cost of debt, Plan U (with no leverage) and Plan L (with leverage) have the same ROE. As ROIC increases above 6%, the ROE increases for each plan, but more for Plan L than for Plan U. However, if ROIC falls below 6%, then the ROE falls further for Plan L than for Plan U. Thus, financial leverage magnifies the ROE for good or ill, depending on the ROIC, and so increases the risk of a levered firm relative to an unlevered firm.<sup>8</sup>

We see, then, that using leverage has both good and bad effects: If expected ROIC is greater than the after-tax cost of debt, then higher leverage increases expected ROE but also increases risk.

## Strasburg's Valuation Analysis

Strasburg decided to go with Plan L, the one with high operating leverage and \$50 million in debt financing. This resulted in a stock price of \$20 per share. With 10 million shares, Strasburg's market value of equity is  $\$20(10) = \$200$  million. Strasburg has no short-term investments, so Strasburg's total enterprise value is the sum of its debt and equity:  $V = \$50 + \$200 = \$250$  million. Notice that this is greater than the required investment, which means that the plan has a positive NPV; another way to view this is that Strasburg's Market Value Added (MVA) is positive. In terms of market values, Strasburg's capital structure has 20% debt ( $w_d = \$50/\$250 = 0.20$ ) and 80% equity ( $w_s = \$200/\$250 = 0.80$ ). These calculations are reported in Figure 15-3.

Is this the optimal capital structure? We will address the question in more detail later, but for now let's focus on understanding Strasburg's current valuation, beginning with its cost of capital. Strasburg has a beta of 1.25. We can use the Capital Asset Pricing Model (CAPM) to estimate the cost of equity. The risk-free rate,  $r_{RF}$ , is 6.3% and the market risk premium,  $RP_M$ , is 6%, so the cost of equity is

$$r_s = r_{RF} + b(RP_M) = 6.3\% + 1.25(6\%) = 13.8\%$$

The weighted average cost of capital is

$$\begin{aligned} \text{WACC} &= w_d(1 - T)r_d + w_s r_s \\ &= 20\%(1 - 0.40)(8\%) + 80\%(13.8\%) \\ &= 12\% \end{aligned}$$

As shown in Figure 15-1, Plan L has a NOPAT of \$30 million. Strasburg expects zero growth, which means there are no required investments in capital. Therefore, FCF is equal to NOPAT. Using the constant growth formula, the value of operations is

$$V_{op} = \frac{\text{FCF}(1 + g)}{\text{WACC} - g} = \frac{\$30(1 + 0)}{0.12 - 0} = \$250$$

Figure 15-3 illustrates the calculation of the intrinsic stock price. For Strasburg, the intrinsic stock price and the market price are each equal to \$20. Can Strasburg increase its value by changing its capital structure? The next section discusses how the trade-off between risk and return affects the value of the firm, and Section 15.5 estimates the optimal capital structure for Strasburg.

<sup>8</sup>We could also express the standard deviation of ROE,  $\sigma_{ROE}$ , in terms of the standard deviation of ROIC:  $\sigma_{ROE} = (\text{Capital/Equity}) \times \sigma_{ROIC} = (\text{Capital/Equity}) \times [(P - V)(1 - T)/\text{Capital}] \times \sigma_Q$ . Thus, volatility in ROE is due to the amount of financial leverage, the amount of operating leverage, and the underlying risk in units sold. This is similar in spirit to the Du Pont model discussed in Chapter 3.

**FIGURE 15-3** Strasburg's Valuation Analysis (Millions of Dollars Except Per Share Data)

	A	B	C	D
103	Input Data (Millions Except Per Share Data)			
104	Tax rate			40.00%
105	Debt (D)			\$50.00
106	Number of shares (n)			10.00
107	Stock price per share (P)			\$20.00
108	NOPAT			\$30.00
109	Free Cash Flow (FCF)			\$30.00
110	Growth rate in FCF			0.00%
111	Capital Structure (Millions Except Per Share Data)			
112	Market value of equity ( $S = P \times n$ )			\$200.00
114	Total value ( $V = D + S$ )			\$250.00
115	Percent financed with debt ( $w_d = D/V$ )			20%
116	Percent financed with stock ( $w_s = S/V$ )			80%
117	Cost of Capital			
118	Cost of debt ( $r_d$ )			8.00%
120	Beta (b)			1.25
121	Risk-free rate ( $r_{RF}$ )			6.30%
122	Market risk premium ( $RP_M$ )			6.00%
123	Cost of equity ( $r_s = r_{RF} + b \times RP_M$ )			13.80%
124	WACC			12.00%
125	Intrinsic Valuation (Millions Except Per Share Data)			
126	Value of operations:			
127				
128				
129		$V_{op} = [FCF(1+g)]/(WACC-g)$		\$250.00
130		+ Value of ST investments		\$0.00
131		Total intrinsic value of firm		\$250.00
132		- Debt		\$50.00
133		Intrinsic value of equity		\$200.00
134		÷ Number of shares		10.00
135		Intrinsic price per share		\$20.00

**Self-Test**

What is business risk, and how can it be measured?

What are some determinants of business risk?

How does operating leverage affect business risk?

What is financial risk, and how does it arise?

Explain this statement: "Using leverage has both good and bad effects."

A firm has fixed operating costs of \$100,000 and variable costs of \$4 per unit. If it sells the product for \$6 per unit, what is the break-even quantity? (**50,000**)

## 15.3 CAPITAL STRUCTURE THEORY

In the previous section, we showed how capital structure choices affect a firm's ROE and its risk. For a number of reasons, we would expect capital structures to vary considerably across industries. For example, pharmaceutical companies generally have very different capital structures than airline companies. Moreover, capital structures vary among firms within a given industry. What factors explain these differences? In

an attempt to answer this question, academics and practitioners have developed a number of theories, and the theories have been subjected to many empirical tests. The following sections examine several of these theories.<sup>9</sup>

## Modigliani and Miller: No Taxes

Modern capital structure theory began in 1958, when Professors Franco Modigliani and Merton Miller (hereafter MM) published what has been called the most influential finance article ever written.<sup>10</sup> MM's study was based on some strong assumptions, which included the following:

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

Modigliani and Miller imagined two hypothetical portfolios. The first contains all the equity of an unlevered firm, so the portfolio's value is  $V_U$ , the value of an unlevered firm. Because the firm has no growth (which means it does not need to invest in any new net assets) and because it pays no taxes, the firm can pay out all of its EBIT in the form of dividends. Therefore, the cash flow from owning this first portfolio is equal to EBIT.

Now consider a second firm that is identical to the unlevered firm *except* that it is partially financed with debt. The second portfolio contains all of the levered firm's stock ( $S_L$ ) and debt ( $D$ ), so the portfolio's value is  $V_L$ , the total value of the levered firm. If the interest rate is  $r_d$ , then the levered firm pays out interest in the amount  $r_d D$ . Because the firm is not growing and pays no taxes, it can pay out dividends in the amount  $EBIT - r_d D$ . If you owned all of the firm's debt and equity, your cash flow would be equal to the sum of the interest and dividends:  $r_d D + (EBIT - r_d D) = EBIT$ . Therefore, the cash flow from owning this second portfolio is equal to EBIT.

Notice that the cash flow of each portfolio is equal to EBIT. Thus, MM concluded that two portfolios producing the same cash flows must have the same value:<sup>11</sup>

$$V_L = V_U = S_L + D$$

(15-5)

<sup>9</sup>For additional discussion of capital structure theories, see John C. Easterwood and Palani-Rajan Kadanakkam, "The Role of Private and Public Debt in Corporate Capital Structures," *Financial Management*, Autumn 1991, pp. 49–57; Gerald T. Garvey, "Leveraging the Underinvestment Problem: How High Debt and Management Shareholdings Solve the Agency Costs of Free Cash Flow," *Journal of Financial Research*, Summer 1992, pp. 149–166; Milton Harris and Artur Raviv, "Capital Structure and the Informational Role of Debt," *Journal of Finance*, June 1990, pp. 321–349; and Ronen Israel, "Capital Structure and the Market for Corporate Control: The Defensive Role of Debt Financing," *Journal of Finance*, September 1991, pp. 1391–1409.

<sup>10</sup>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. Modigliani and Miller each won a Nobel Prize for their work.

<sup>11</sup>They actually showed that if the values of the two portfolios differed, then an investor could engage in riskless arbitrage: The investor could create a trading strategy (buying one portfolio and selling the other) that had no risk, required none of the investor's own cash, and resulted in a positive cash flow for the investor. This would be such a desirable strategy that everyone would try to implement it. But if everyone tries to buy the same portfolio, its price will be driven up by market demand, and if everyone tries to sell a portfolio, its price will be driven down. The net result of the trading activity would be to change the portfolio's values until they were equal and no more arbitrage was possible.

## Yogi Berra on the MM Proposition

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

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

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

<sup>a</sup>Lee Green, *Sportswit* (New York: Fawcett Crest, 1984), p. 228.

Source: “Yogi Berra on the MM Proposition,” *Journal of Applied Corporate Finance*, Winter 1995, p. 6. Reprinted by permission of Stern Stewart Management.

Given their assumptions, MM proved that a firm’s value is unaffected by its capital structure.

Recall that the WACC is a combination of the cost of debt and the relatively higher cost of equity,  $r_s$ . As leverage increases, more weight is given to low-cost debt but equity becomes riskier, which drives up  $r_s$ . Under MM’s assumptions,  $r_s$  increases by exactly enough to keep the WACC constant. Put another way: If MM’s assumptions are correct, then it doesn’t matter how a firm finances its operations and so capital structure decisions are irrelevant.

Even though some of their assumptions are obviously unrealistic, MM’s irrelevance result is extremely important. By indicating the conditions under which capital structure is irrelevant, MM also provided us with clues about what is required for capital structure to be relevant and hence to affect a firm’s value. The work of MM marked the beginning of modern capital structure research, and subsequent research has focused on relaxing the MM assumptions in order to develop a more realistic theory of capital structure.

Modigliani and Miller’s thought process was just as important as their conclusion. It seems simple now, but their idea that two portfolios with identical cash flows must also have identical values changed the entire financial world because it led to the development of options and derivatives. It is no surprise that Modigliani and Miller received Nobel awards for their work.

## Modigliani and Miller II: The Effect of Corporate Taxes

In 1963, MM published a follow-up paper in which they relaxed the assumption that there are no corporate taxes.<sup>12</sup> The Tax Code allows corporations to deduct interest payments as an expense, but dividend payments to stockholders are not deductible. The differential treatment encourages corporations to use debt in their capital structures. This means that interest payments reduce the taxes paid by a corporation, and if a corporation pays less to the government then more of its cash flow is available for its investors. In other words, the tax deductibility of the interest payments shields the firm’s pre-tax income.

<sup>12</sup>Franco Modigliani and Merton H. Miller, “Corporate Income Taxes and the Cost of Capital: A Correction,” *American Economic Review*, June 1963, pp. 433–443.

As in their earlier paper, MM introduced a second important way of looking at the effect of capital structure: The value of a levered firm is the value of an otherwise identical unlevered firm plus the value of any “side effects.” While others have expanded on this idea by considering other side effects, MM focused on the tax shield:

$$V_L = V_U + \text{Value of side effects} = V_U + \text{PV of tax shield} \quad (15-6)$$

Under their assumptions, they showed that the present value of the tax shield is equal to the corporate tax rate,  $T$ , multiplied by the amount of debt,  $D$ :

$$V_L = V_U + TD \quad (15-7)$$

With a tax rate of about 40%, this implies that every dollar of debt adds about 40 cents of value to the firm, and this leads to the conclusion that the optimal capital structure is virtually 100% debt. MM also showed that the cost of equity,  $r_s$ , increases as leverage increases but that it doesn’t increase quite as fast as it would if there were no taxes. As a result, under MM with corporate taxes the WACC falls as debt is added.

### Miller: The Effect of Corporate and Personal Taxes

Merton Miller (this time without Modigliani) later brought in the effects of personal taxes.<sup>13</sup> The income from bonds is generally interest, which is taxed as personal income at rates ( $T_d$ ) going up to 35%, while income from stocks generally comes partly from dividends and partly from capital gains. Long-term capital gains are taxed at a rate of 15%, and this tax is deferred until the stock is sold and the gain realized. If stock is held until the owner dies, no capital gains tax whatsoever must be paid. So, on average, returns on stocks are taxed at lower effective rates ( $T_s$ ) than returns on debt.<sup>14</sup>

Because of the tax situation, Miller argued that investors are willing to accept relatively low before-tax returns on stock relative to the before-tax returns on bonds. (The situation here is similar to that with tax-exempt municipal bonds as discussed in Chapter 5 and preferred stocks held by corporate investors as discussed in Chapter 7.) For example, an investor might require a return of 10% on Strasburg’s bonds, and if stock income were taxed at the same rate as bond income, the required rate of return on Strasburg’s stock might be 16% because of the stock’s greater risk. However, in view of the favorable treatment of income on the stock, investors might be willing to accept a before-tax return of only 14% on the stock.

Thus, as Miller pointed out, (1) the *deductibility of interest* favors the use of debt financing, but (2) the *more favorable tax treatment of income from stock* lowers the required rate of return on stock and thus favors the use of equity financing.

Miller showed that the net impact of corporate and personal taxes is given by this equation:

<sup>13</sup>See Merton H. Miller, “Debt and Taxes,” *Journal of Finance*, May 1977, pp. 261–275.

<sup>14</sup>The Tax Code isn’t quite as simple as this. An increasing number of investors face the Alternative Minimum Tax (AMT); see **Web Extension 2A** for a discussion. The AMT imposes a 28% tax rate on most income and an effective rate of 22% on long-term capital gains and dividends. Under the AMT there is still a spread between the tax rates on interest income and stock income, but the spread is narrower. See Leonard Burman, William Gale, Greg Leiserson, and Jeffrey Rohaly, “The AMT: What’s Wrong and How to Fix It,” *National Tax Journal*, September 2007, pp. 385–405.

$$V_L = V_U + \left[ 1 - \frac{(1 - T_c)(1 - T_s)}{(1 - T_d)} \right] D \quad (15-8)$$

Here  $T_c$  is the corporate tax rate,  $T_s$  is the personal tax rate on income from stocks, and  $T_d$  is the tax rate on income from debt. Miller argued that the marginal tax rates on stock and debt balance out in such a way that the bracketed term in Equation 15-8 is zero and so  $V_L = V_U$ , but most observers believe there is still a tax advantage to debt if reasonable values of tax rates are assumed. For example, if the marginal corporate tax rate is 40%, the marginal rate on debt is 30%, and the marginal rate on stock is 12%, then the advantage of debt financing is

$$\begin{aligned} V_L &= V_U + \left[ 1 - \frac{(1 - 0.40)(1 - 0.12)}{(1 - 0.30)} \right] D \\ &= V_U + 0.25D \end{aligned} \quad (15-8a)$$

Thus it appears that the presence of personal taxes reduces but does not completely eliminate the advantage of debt financing.

### Trade-off Theory

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

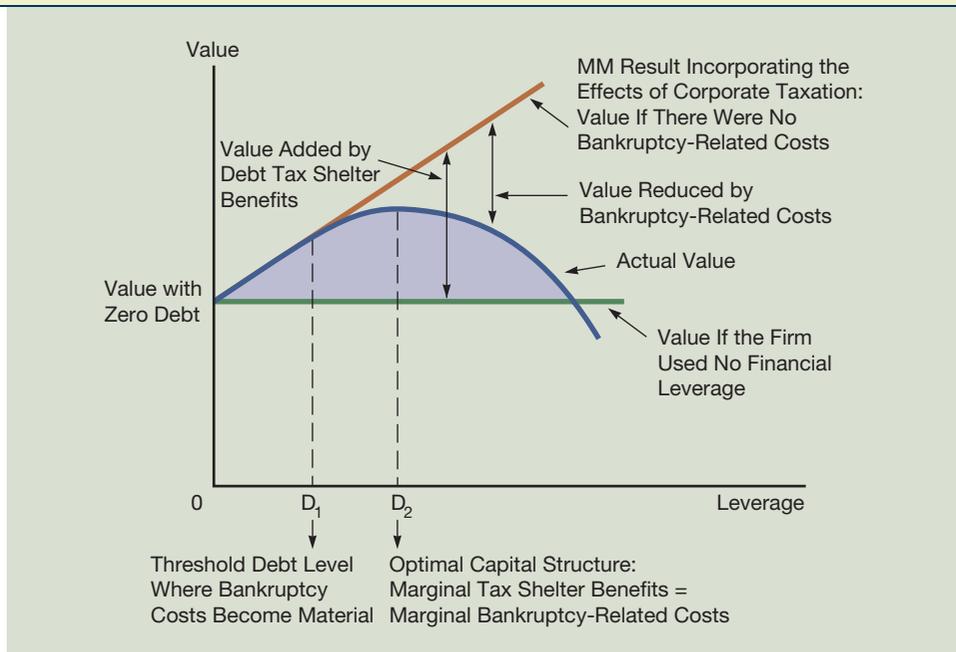
Note, too, that the *threat of bankruptcy*, not just bankruptcy per se, causes many of these same problems. Key employees jump ship, suppliers refuse to grant credit, customers seek more stable suppliers, and lenders demand higher interest rates and impose more restrictive loan covenants if potential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

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

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

The preceding arguments led to the development of what is called the trade-off theory of leverage, in which firms trade off the benefits of debt financing (favorable corporate tax treatment) against higher interest rates and bankruptcy costs. In essence, the **trade-off theory** says that the value of a levered firm is equal to the

FIGURE 15-4 Effect of Financial Leverage on Value



value of an unlevered firm plus the value of any side effects, which include the tax shield and the expected costs due to financial distress. A summary of the trade-off theory is expressed graphically in Figure 15-4, and a list of observations about the figure follows here.

1. Under the assumptions of the MM model with corporate taxes, a firm's value increases linearly for every dollar of debt. The line labeled "MM Result Incorporating the Effects of Corporate Taxation" in Figure 15-4 expresses the relationship between value and debt under those assumptions.
2. There is some threshold level of debt, labeled  $D_1$  in Figure 15-4, below which the probability of bankruptcy is so low as to be immaterial. Beyond  $D_1$ , however, expected bankruptcy-related costs become increasingly important, and they reduce the tax benefits of debt at an increasing rate. In the range from  $D_1$  to  $D_2$ , expected bankruptcy-related costs reduce but do not completely offset the tax benefits of debt, so the stock price rises (but at a decreasing rate) as the debt ratio increases. However, beyond  $D_2$ , expected bankruptcy-related costs exceed the tax benefits, so from this point on increasing the debt ratio lowers the value of the stock. Therefore,  $D_2$  is the optimal capital structure. Of course,  $D_1$  and  $D_2$  vary from firm to firm, depending on their business risks and bankruptcy costs.
3. Although theoretical and empirical work confirm the general shape of the curve in Figure 15-4, this graph must be taken as an approximation and not as a precisely defined function.

## Signaling Theory

It was assumed by MM that investors have the same information about a firm's prospects as its managers—this is called **symmetric information**. However, managers in fact often have better information than outside investors. This is called **asymmetric information**,

and it has an important effect on the optimal capital structure. To see why, consider two situations, one in which the company's managers know that its prospects are extremely positive (Firm P) and one in which the managers know that the future looks negative (Firm N).

Suppose, for example, that Firm P's R&D labs have just discovered a nonpatentable cure for the common cold. They want to keep the new product a secret as long as possible to delay competitors' entry into the market. New plants must be built to make the new product, so capital must be raised. How should Firm P's management raise the needed capital? If it sells stock then, when profits from the new product start flowing in, the price of the stock would rise sharply and the purchasers of the new stock would make a bonanza. The current stockholders (including the managers) would also do well, but not as well as they would have done if the company had not sold stock before the price increased, because then they would not have had to share the benefits of the new product with the new stockholders. Therefore, *we should expect a firm with very positive prospects to avoid selling stock and instead to raise required new capital by other means, including debt usage beyond the normal target capital structure.*<sup>15</sup>

Now let's consider Firm N. Suppose its managers have information that new orders are off sharply because a competitor has installed new technology that has improved its products' quality. Firm N must upgrade its own facilities, at a high cost, just to maintain its current sales. As a result, its return on investment will fall (but not by as much as if it took no action, which would lead to a 100% loss through bankruptcy). How should Firm N raise the needed capital? Here the situation is just the reverse of that facing Firm P, which did not want to sell stock so as to avoid having to share the benefits of future developments. *A firm with negative prospects would want to sell stock, which would mean bringing in new investors to share the losses.*<sup>16</sup> The conclusion from all this is that firms with extremely bright prospects prefer not to finance through new stock offerings, whereas firms with poor prospects like to finance with outside equity. How should you, as an investor, react to this conclusion? You ought to say: "If I see that a company plans to issue new stock, this should worry me because I know that management would not want to issue stock if future prospects looked good. However, management *would* want to issue stock if things looked bad. Therefore, I should lower my estimate of the firm's value, other things held constant, if it plans to issue new stock."

If you gave this answer then your views are consistent with those of sophisticated portfolio managers. In a nutshell: *The announcement of a stock offering is generally taken as a **signal** that the firm's prospects as seen by its own management are not good; conversely, a debt offering is taken as a positive signal.* Notice that Firm N's managers cannot make a false signal to investors by mimicking Firm P and issuing debt. With its unfavorable future prospects, issuing debt could soon force Firm N into bankruptcy. Given the resulting damage to the personal wealth and reputations of N's managers, they cannot afford to mimic Firm P. All of this suggests that when a firm announces a new stock offering, more often than not the price of its stock will decline. Empirical studies have shown that this is indeed true.

## Reserve Borrowing Capacity

Because issuing stock sends a negative signal and tends to depress the stock price even if the company's true prospects are bright, a company should try to maintain a **reserve**

<sup>15</sup>It would be illegal for Firm P's managers to personally purchase more shares on the basis of their inside knowledge of the new product.

<sup>16</sup>Of course, Firm N would have to make certain disclosures when it offered new shares to the public, but it might be able to meet the legal requirements without fully disclosing management's worst fears.

**borrowing capacity** so that debt can be used if an especially good investment opportunity comes along. This means that *firms should, in normal times, use more equity and less debt than is suggested by the tax benefit–bankruptcy cost trade-off model depicted in Figure 15-4.*

## The Pecking Order Hypothesis

The presence of flotation costs and asymmetric information may cause a firm to raise capital according to a **pecking order**. In this situation, a firm first raises capital internally by reinvesting its net income and selling its short-term marketable securities. When that supply of funds has been exhausted, the firm will issue debt and perhaps preferred stock. Only as a last resort will the firm issue common stock.<sup>17</sup>

## Using Debt Financing to Constrain Managers

Agency problems may arise if managers and shareholders have different objectives. Such conflicts are particularly likely when the firm's managers have too much cash at their disposal. Managers often use excess cash to finance pet projects or for perquisites such as nicer offices, corporate jets, and sky boxes at sports arenas—none of which have much to do with maximizing stock prices. Even worse, managers might be tempted to pay too much for an acquisition, something that could cost shareholders hundreds of millions of dollars. By contrast, managers with limited “excess cash flow” are less able to make wasteful expenditures.

Firms can reduce excess cash flow in a variety of ways. One way is to funnel some of it back to shareholders through higher dividends or stock repurchases. Another alternative is to shift the capital structure toward more debt in the hope that higher debt service requirements will force managers to be more disciplined. If debt is not serviced as required then the firm will be forced into bankruptcy, in which case its managers would likely lose their jobs. Therefore, a manager is less likely to buy an expensive new corporate jet if the firm has large debt service requirements that could cost the manager his or her job. In short, high levels of debt **bond the cash flow**, since much of it is precommitted to servicing the debt.

A **leveraged buyout (LBO)** is one way to bond cash flow. In an LBO, a large amount of debt and a small amount of cash are used to finance the purchase of a company's shares, after which the firm “goes private.” The first wave of LBOs was in the mid-1980s; private equity funds led the buyouts of the late 1990s and early 2000s. Many of these LBOs were specifically designed to reduce corporate waste. As noted, high debt payments force managers to conserve cash by eliminating unnecessary expenditures.

Of course, increasing debt and reducing the available cash flow has its downside: It increases the risk of bankruptcy. Ben Bernanke, current (summer 2009) chairman of the Fed, has argued that adding debt to a firm's capital structure is like putting a dagger into the steering wheel of a car.<sup>18</sup> The dagger—which points toward your stomach—motivates you to drive more carefully, but you may get stabbed if someone runs into you—even if you are being careful. The analogy applies to corporations in the following sense: Higher debt forces managers to be more careful with shareholders' money, but even well-run firms could face bankruptcy (get stabbed) if some event beyond their control occurs: a war, an earthquake, a strike, or a recession. To complete the analogy, the capital structure decision comes down to deciding how long a dagger stockholders should use to keep managers in line.

<sup>17</sup>For more information, see Jonathon Baskin, “An Empirical Investigation of the Pecking Order Hypothesis,” *Financial Management*, Spring 1989, pp. 26–35.

<sup>18</sup>See Ben Bernanke, “Is There Too Much Corporate Debt?” *Federal Reserve Bank of Philadelphia Business Review*, September/October 1989, pp. 3–13.

Finally, too much debt may overconstrain managers. A large portion of a manager's personal wealth and reputation is tied to a single company, so managers are not well diversified. When faced with a positive-NPV project that is risky, a manager may decide that it's not worth taking on the risk even though well-diversified stockholders would find the risk acceptable. As previously mentioned, this is an underinvestment problem. The more debt the firm has, the greater the likelihood of financial distress and thus the greater the likelihood that managers will forgo risky projects even if they have positive NPVs.

## The Investment Opportunity Set and Reserve Borrowing Capacity

Bankruptcy and financial distress are costly, and, as just reiterated, this can discourage highly levered firms from undertaking risky new investments. If potential new investments, although risky, have positive net present values, then high levels of debt can be doubly costly—the expected financial distress and bankruptcy costs are high, and the firm loses potential value by not making some potentially profitable investments. On the other hand, if a firm has very few profitable investment opportunities then high levels of debt can keep managers from wasting money by investing in poor projects. For such companies, increases in the debt ratio can actually increase the value of the firm.

Thus, in addition to the tax, signaling, bankruptcy, and managerial constraint effects discussed previously, the firm's optimal capital structure is related to its set of investment opportunities. Firms with many profitable opportunities should maintain their ability to invest by using low levels of debt, which is also consistent with maintaining reserve borrowing capacity. Firms with few profitable investment opportunities should use high levels of debt (which have high interest payments) to impose managerial constraint.<sup>19</sup>

## Windows of Opportunity

If markets are efficient, then security prices should reflect all available information; hence they are neither underpriced nor overpriced (except during the time it takes prices to move to a new equilibrium caused by the release of new information). The *windows of opportunity theory* states that managers don't believe this and supposes instead that stock prices and interest rates are sometimes either too low or too high relative to their true fundamental values. In particular, the theory suggests that managers issue equity when they believe stock market prices are abnormally high and issue debt when they believe interest rates are abnormally low. In other words, they try to time the market.<sup>20</sup> Notice that this differs from signaling theory because no asymmetric information is involved: These managers aren't basing their beliefs on insider information, just on a difference of opinion with the market consensus.

### Self-Test

Why does the MM theory with corporate taxes lead to 100% debt?  
 Explain how *asymmetric information* and *signals* affect capital structure decisions.  
 What is meant by *reserve borrowing capacity*, and why is it important to firms?  
 How can the use of debt serve to discipline managers?

<sup>19</sup>See Michael J. Barclay and Clifford W. Smith, Jr., "The Capital Structure Puzzle: Another Look at the Evidence," *Journal of Applied Corporate Finance*, Spring 1999, pp. 8–20.

<sup>20</sup>See Malcolm Baker and Jeffrey Wurgler, "Market Timing and Capital Structure," *Journal of Finance*, February 2002, pp. 1–32.

## 15.4 CAPITAL STRUCTURE EVIDENCE AND IMPLICATIONS

There have been hundreds, perhaps even thousands, of papers testing the capital structure theories described in the previous section. We can cover only the highlights here, beginning with the empirical evidence.<sup>21</sup>

### Empirical Evidence

Studies show that firms do benefit from the tax deductibility of interest payments, with a typical firm increasing in value by about \$0.10 for every dollar of debt. This is much less than the corporate tax rate, which supports the Miller model (with corporate and personal taxes) more than the MM model (with only corporate taxes). Recent evidence shows that the cost of bankruptcies can be as much as 10% to 20% of the firm's value.<sup>22</sup> Thus, the evidence shows the existence of tax benefits and financial distress costs, which provides support for the trade-off theory.

A particularly interesting study by Professors Mehotra, Mikkelson, and Partch examined the capital structure of firms that were spun off from their parents.<sup>23</sup> The financing choices of existing firms might be influenced by their past financing choices and by the costs of moving from one capital structure to another, but because spin-offs are newly created companies, managers can choose a capital structure without regard to these issues. The study found that more profitable firms (which have a lower expected probability of bankruptcy) and more asset-intensive firms (which have better collateral and thus a lower cost of bankruptcy should one occur) have higher levels of debt. These findings support the trade-off theory.

However, there is also evidence that is inconsistent with the static optimal target capital structure implied by the trade-off theory. For example, stock prices are volatile, which frequently causes a firm's actual market-based debt ratio to deviate from its target. However, such deviations don't cause firms to immediately return to their target by issuing or repurchasing securities. Instead, firms tend to make a partial adjustment each year, moving about one-third of the way toward their target capital structure.<sup>24</sup> This evidence supports the idea of a more dynamic trade-off theory in which firms have target capital structures but don't strive to maintain them too closely.

If a stock price has a big run-up, which reduces the debt ratio, then the trade-off theory suggests that the firm should issue debt to return to its target. However, firms tend to do the opposite, issuing stock after big run-ups. This is much more consistent with the windows of opportunity theory, with managers trying to time the market by issuing stock when they perceive the market to be overvalued. Furthermore, firms tend to issue debt when stock prices and interest rates are low. The maturity of the issued debt seems to reflect an attempt to time interest rates: Firms tend to issue short-term debt if the term structure is upward sloping but long-term debt if the

<sup>21</sup>This section also draws heavily from Barclay and Smith, "The Capital Structure Puzzle," cited in footnote 19; Jay Ritter, ed., *Recent Developments in Corporate Finance* (Northampton, MA: Edward Elgar Publishing Inc., 2005); and a presentation by Jay Ritter at the 2003 FMA meeting, "The Windows of Opportunity Theory of Capital Structure."

<sup>22</sup>The *expected cost* of financial distress is the product of bankruptcy costs and the probability of bankruptcy. At moderate levels of debt with low probabilities of bankruptcy, the expected cost of financial distress would be much less than the actual bankruptcy costs if the firm failed.

<sup>23</sup>See V. Mehotra, W. Mikkelson, and M. Partch, "The Design of Financial Policies in Corporate Spin-offs," *Review of Financial Studies*, Winter 2003, pp. 1359–1388.

<sup>24</sup>See Mark Flannery and Kasturi Rangan, "Partial Adjustment toward Target Capital Structures," *Journal of Financial Economics*, Vol. 79, 2006, pp. 469–506.

term structure is flat. Again, these facts suggest that managers try to time the market, which is consistent with the windows of opportunity theory.

Firms issue equity much less frequently than debt. On the surface, this seems to support both the pecking order hypothesis and the signaling hypothesis. The pecking order hypothesis predicts that firms with a high level of informational asymmetry, which causes equity issuances to be costly, should issue debt before issuing equity. Yet we often see the opposite, with high-growth firms (which usually have greater informational asymmetry) issuing more equity than debt. Also, many highly profitable firms could afford to issue debt (which comes before equity in the pecking order) but instead choose to issue equity. With respect to the signaling hypothesis, consider the case of firms that have large increases in earnings that were unanticipated by the market. If managers have superior information, then they will anticipate these upcoming performance improvements and issue debt before the increase. Such firms do, in fact, tend to issue debt slightly more frequently than other firms, but the difference isn't economically meaningful.

Many firms have less debt than might be expected, and many have large amounts of short-term investments. This is especially true for firms with high market/book ratios (which indicate many growth options as well as informational asymmetry). This behavior is consistent with the hypothesis that investment opportunities influence attempts to maintain reserve borrowing capacity. It is also consistent with tax considerations, since low-growth firms (which have more debt) are more likely to benefit from the tax shield. This behavior is not consistent with the pecking order hypothesis, where low-growth firms (which often have high free cash flow) would be able to avoid issuing debt by raising funds internally.

To summarize these results, it appears that firms try to capture debt's tax benefits while avoiding financial distress costs. However, they also allow their debt ratios to deviate from the static optimal target ratio implied by the trade-off theory. There is a little evidence indicating that firms follow a pecking order and use security issuances as signals, but there is much more evidence in support of the windows of opportunity theory. Finally, it appears that firms often maintain reserve borrowing capacity, especially firms with many growth opportunities or problems with informational asymmetry.<sup>25</sup>

## Implications for Managers

Managers should explicitly consider tax benefits when making capital structure decisions. Tax benefits obviously are more valuable for firms with high tax rates. Firms can utilize tax loss carryforwards and carrybacks, but the time value of money means that tax benefits are more valuable for firms with stable, positive pre-tax income. Therefore, a firm whose sales are relatively stable can safely take on more debt and incur higher fixed charges than a company with volatile sales. Other things being equal, a firm with less operating leverage is better able to employ financial leverage because it will have less business risk and less volatile earnings.

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<sup>25</sup>For more on empirical tests of capital structure theory, see Gregor Andrade and Steven Kaplan, "How Costly Is Financial (Not Economic) Distress? Evidence from Highly Leveraged Transactions That Became Distressed," *Journal of Finance*, Vol. 53, 1998, pp. 1443–1493; Malcolm Baker, Robin Greenwood, and Jeffrey Wurgler, "The Maturity of Debt Issues and Predictable Variation in Bond Returns," *Journal of Financial Economics*, November 2003, pp. 261–291; Murray Z. Frank and Vidhan K. Goyal, "Testing the Pecking Order Theory of Capital Structure," *Journal of Financial Economics*, February 2003, pp. 217–248; and Michael Long and Ileen Malitz, "The Investment-Financing Nexus: Some Empirical Evidence," *Midland Corporate Finance Journal*, Fall 1985, pp. 53–59.

## Taking a Look at Global Capital Structures

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

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

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

Country	Book Value Debt Ratio
Canada	32%
France	18
Germany	11
Italy	21
Japan	21
United Kingdom	10
United States	25

*Source:* Raghuram G. Rajan and Luigi Zingales, “What Do We Know about Capital Structure? Some Evidence from International Data,” *The Journal of Finance*, Vol. 50, no. 5 (December 1995), pp. 1421–1460. Reprinted by permission of John Wiley & Sons, Inc.

Managers should also consider the expected cost of financial distress, which depends on the probability and cost of distress. Notice that stable sales and lower operating leverage provide tax benefits but also reduce the *probability* of financial distress. One *cost* of financial distress comes from lost investment opportunities. Firms with profitable investment opportunities need to be able to fund them, either by holding higher levels of marketable securities or by maintaining excess borrowing capacity. An astute corporate treasurer made this statement to the authors:

*Our company can earn a lot more money from good capital budgeting and operating decisions than from good financing decisions. Indeed, we are not sure exactly how financing decisions affect our stock price, but we know for sure that having to turn down a promising venture because funds are not available will reduce our long-run profitability.*

Another cost of financial distress is the possibility of being forced to sell assets to meet liquidity needs. General-purpose assets that can be used by many businesses are relatively liquid and make good collateral, in contrast to special-purpose assets. Thus, real estate companies are usually highly leveraged whereas companies involved in technological research are not.

Asymmetric information also has a bearing on capital structure decisions. For example, suppose a firm has just successfully completed an R&D program, and it forecasts higher earnings in the immediate future. However, the new earnings are not yet anticipated by investors and hence are not reflected in the stock price. This company should not issue stock—it should finance with debt until the higher earnings materialize and are reflected in the stock price. Then it could issue common stock, retire the debt, and return to its target capital structure.

Managers should consider conditions in the stock and bond markets. For example, during a recent credit crunch, the junk bond market dried up and there was simply no market at a “reasonable” interest rate for any new long-term bonds rated below BBB. Therefore, low-rated companies in need of capital were forced to go to the stock market or to the short-term debt market, regardless of their target capital structures. When conditions eased, however, these companies sold bonds to get their capital structures back on target.

Finally, managers should always consider lenders' and rating agencies' attitudes. For example, one large utility was recently told by Moody's and Standard & Poor's that its bonds would be downgraded if it issued more debt. This influenced the utility's decision to finance its expansion with common equity. This doesn't mean that managers should never increase debt if it will cause their bond rating to fall, but managers should always factor this into their decision making.<sup>26</sup>

### Self-Test

Which capital structure theories does the empirical evidence seem to support?  
What issues should managers consider when making capital structure decisions?

## 15.5 ESTIMATING THE OPTIMAL CAPITAL STRUCTURE

Managers should choose the capital structure that maximizes shareholders' wealth. The basic approach is to consider a trial capital structure, based on the market values of the debt and equity, and then estimate the wealth of the shareholders under this capital structure. This approach is repeated until an optimal capital structure is identified. There are several steps in the analysis of each potential capital structure: (1) Estimate the interest rate the firm will pay. (2) Estimate the cost of equity. (3) Estimate the weighted average cost of capital. (4) Estimate the value of operations, which is the present value of free cash flows discounted by the new WACC. The objective is to find the amount of debt financing that maximizes the value of operations. As we will show, this is also the capital structure that maximizes shareholder wealth and the intrinsic stock price. The following sections explain each of these steps, using the company we considered earlier, Strasburg Electronics.

### Estimating the Cost of Debt, $r_D$

Recall that Strasburg chose Plan L, with high operating leverage and a capital structure consisting of 20% debt. The CFO asked Strasburg's investment bankers to estimate the cost of debt at different capital structures. The investment bankers began by analyzing industry conditions and prospects. They appraised Strasburg's business risk based on its past financial statements and its current technology and customer base. The bankers also forecasted financial statements with different capital structures and analyzed such key ratios as the current ratio and the times-interest-earned ratio. Finally, they factored in current conditions in the financial markets, including interest rates paid by firms in Strasburg's industry. Based on their analysis and judgment, they estimated interest rates at various capital structures as shown in Row 2 of Figure 15-5, starting with a 7.7% cost of debt for the first dollar of debt. This rate increases to 16% if the firm finances 60% of its capital structure with debt. Strasburg's current situation is in Column D and is shown in blue. (We will explain all the rows in Figure 15-5 in the following discussion.)

### Estimating the Cost of Equity, $r_S$

An increase in the debt ratio also increases the risk faced by shareholders, and this has an effect on the cost of equity,  $r_S$ . Recall from Chapter 6 that a stock's beta is the relevant measure of risk for diversified investors. Moreover, it has been

<sup>26</sup>For some insights into how practicing financial managers view the capital structure decision, see John Graham and Campbell Harvey, "The Theory and Practice of Corporate Finance: Evidence from the Field," *Journal of Financial Economics*, Vol. 60, 2001, pp. 187–243; Ravindra R. Kamath, "Long-Term Financing Decisions: Views and Practices of Financial Managers of NYSE Firms," *Financial Review*, May 1997, pp. 331–356; and Edgar Norton, "Factors Affecting Capital Structure Decisions," *Financial Review*, August 1991, pp. 431–446.

FIGURE 15-5 Estimating Strasburg's Optimal Capital Structure (Millions of Dollars)

	A	B	C	D	E	F	G	H
	Percent of Firm Financed with Debt ( $w_d$ )							
	0%	10%	20%	30%	40%	50%	60%	
1. $w_s$	100.00%	90.00%	80.00%	70.00%	60.00%	50.00%	40.00%	
2. $r_d$	7.70%	7.80%	8.00%	8.50%	9.90%	12.00%	16.00%	
3. $b$	1.09	1.16	1.25	1.37	1.52	1.74	2.07	
4. $r_s$	12.82%	13.26%	13.80%	14.50%	15.43%	16.73%	18.69%	
5. $r_d(1-T)$	4.62%	4.68%	4.80%	5.10%	5.94%	7.20%	9.60%	
6. WACC	12.82%	12.40%	12.00%	11.68%	11.63%	11.97%	13.24%	
7. $V_{op}$	\$233.98	\$241.96	\$250.00	\$256.87	\$257.86	\$250.68	\$226.65	
8. Debt	\$0.00	\$24.20	\$50.00	\$77.06	\$103.14	\$125.34	\$135.99	
9. Equity	\$233.98	\$217.76	\$200.00	\$179.81	\$154.72	\$125.34	\$90.66	
10. # shares	12.72	11.34	10.00	8.69	7.44	6.25	5.13	
11. Stock price	\$18.40	\$19.20	\$20.00	\$20.69	\$20.79	\$20.07	\$17.66	
12. Net income	\$30.00	\$28.87	\$27.60	\$26.07	\$23.87	\$20.98	\$16.95	
13. EPS	\$2.36	\$2.54	\$2.76	\$3.00	\$3.21	\$3.36	\$3.30	

## Notes:

- The percent financed with equity is:  $w_s = 1 - w_d$ .
- The interest rate on debt,  $r_d$ , is obtained from investment bankers.
- Beta is estimated using Hamada's formula, the unlevered beta of 1.09, and a tax rate of 40%:  $b = b_U \times [1 + (1 - T)(w_d/w_s)]$ .
- The cost of equity is estimated using the CAPM formula with a risk-free rate of 6.3% and a market risk premium of 6%:  $r_s = r_{RF} + (RP_M)b$ .
- The after-tax cost of debt is:  $r_d(1 - T)$ , where  $T = 40\%$ .
- The weighted average cost of capital is calculated as  $WACC = w_s r_s + w_d r_d(1 - T)$ .
- The value of the firm's operations is calculated as  $V_{op} = [FCF(1 + g)] / (WACC - g)$ , where  $FCF = \$30$  million and  $g = 0$ .
- Debt =  $w_d \times V_{op}$ .
- The intrinsic value of equity after the recapitalization and repurchase is  $S_{Post} = w_s \times V_{op}$ .
- The number of shares after the recap has been completed is found using this equation:  $n_{Post} = n_{Prior} \times [(V_{opNew} - D_{New}) / (V_{opNew} - D_{Old})]$ . The subscript "Old" indicates values from the original capital structure, where  $w_d = 20\%$ ; the subscript "New" indicates values at the current capital structure after the recap and repurchase; and the subscript "Post" indicates values after the recap and repurchase.
- The price after the recap and repurchase is  $P_{Post} = S_{Post} / n_{Post}$  but we can also find the price as  $P_{Post} = (V_{opNew} - D_{Old}) / n_{Prior}$ .
- EBIT is \$50 million; see Figure 15-1. Net income is  $NI = (EBIT - r_d D)(1 - T)$ .
- Earnings per share is  $EPS = NI / n_{Post}$ .

demonstrated, both theoretically and empirically, that beta increases with financial leverage. The Hamada equation specifies the effect of financial leverage on beta:<sup>27</sup>

$$b = b_U [1 + (1 - T)(D/S)] \quad (15-9)$$

Here  $D$  is the market value of the debt and  $S$  is the market value of the equity. The Hamada equation shows how increases in the market value debt/equity ratio increase beta. Here  $b_U$  is the firm's **unlevered beta** coefficient—that is, the beta it would have if it had no debt. In that case, beta would depend entirely on business risk and thus be a measure of the firm's "basic business risk."

<sup>27</sup>See Robert S. Hamada, "Portfolio Analysis, Market Equilibrium, and Corporation Finance," *Journal of Finance*, March 1969, pp. 13–31. For a comprehensive framework, see Robert A. Taggart, Jr., "Consistent Valuation and Cost of Capital Expressions with Corporate and Personal Taxes," *Financial Management*, Autumn 1991, pp. 8–20.

Sometimes it is more convenient to work with the percentages of debt and equity at which the firm is financed ( $w_d$  and  $w_s$ ) rather than the dollar values of  $D$  and  $S$ . Notice that  $w_d$  and  $w_s$  are defined as  $D/(D + S)$  and  $S/(D + S)$ , respectively. This means that the ratio  $w_d/w_s$  is equal to the ratio  $D/S$ . Substituting these values gives us another form of Hamada's formula:

$$b = b_U[1 + (1 - T)(w_d/w_s)] \quad (15-9a)$$

Often we know the current capital structure and beta but wish to know the unlevered beta. We find this by rearranging Equation 15-9a as follows:

$$b_U = b/[1 + (1 - T)(w_d/w_s)] \quad (15-10)$$

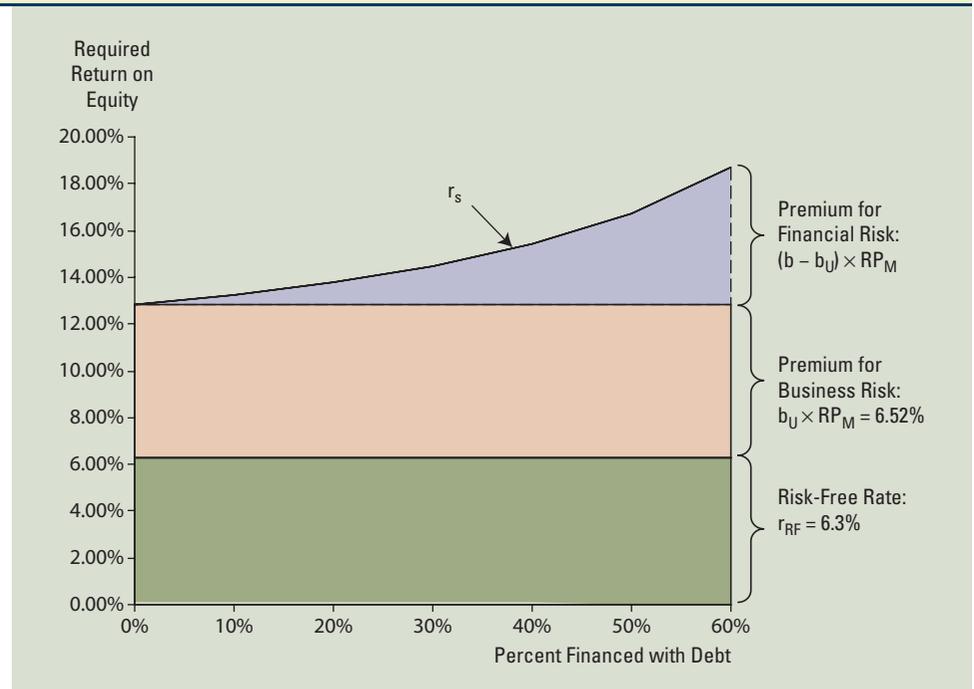
For Strasburg, the unlevered beta is

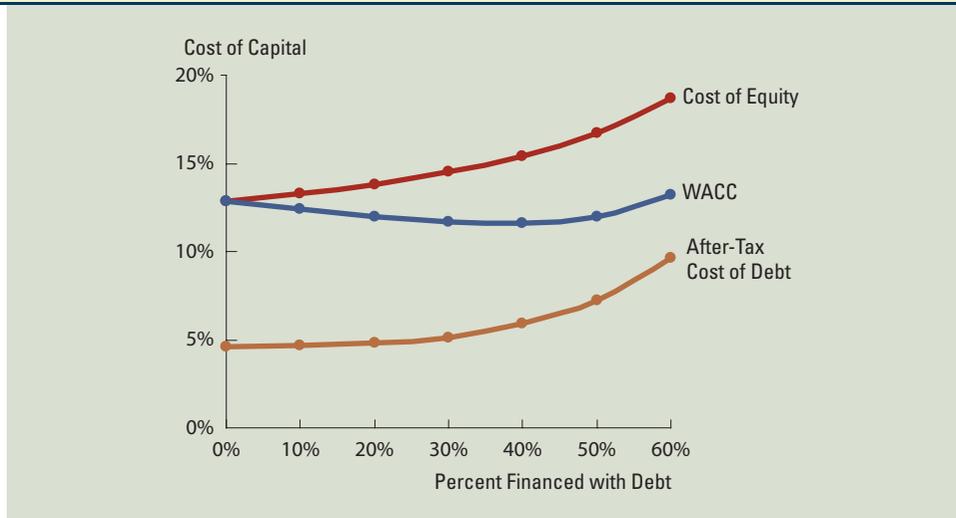
$$\begin{aligned} b_U &= 1.25/[1 + (1 - 0.40)(0.20/0.80)] \\ &= 1.087 \end{aligned}$$

Using this unlevered beta, we can then apply Hamada's formula in Equation 15-9a to determine estimates of Strasburg's beta for different capital structures. These results are reported in Line 3 of Figure 15-5.

Recall from Section 15.2 that the risk-free rate is 6.3% and the market risk premium is 6%. We can use the CAPM and the previously estimated betas to estimate Strasburg's cost of equity for different capital structures (which cause Strasburg's beta to change). These results are shown in Line 4 of Figure 15-5. As expected, Strasburg's cost of equity increases as its debt increases. Figure 15-6 graphs Strasburg's required return on equity at different debt ratios. Observe that the cost of equity consists of the 6.3% risk-free rate, a

**FIGURE 15-6** Strasburg's Required Rate of Return on Equity at Different Debt Levels



**FIGURE 15-7** Effects of Capital Structure on the Cost of Capital

constant premium for business risk in the amount of  $RP_M(b_U) = 6.522\%$ , and a premium for financial risk in the amount of  $RP_M(b - b_U)$  that starts at zero (because  $b = b_U$  for zero debt) but rises at an increasing rate as the debt ratio increases.

### Estimating the Weighted Average Cost of Capital, WACC

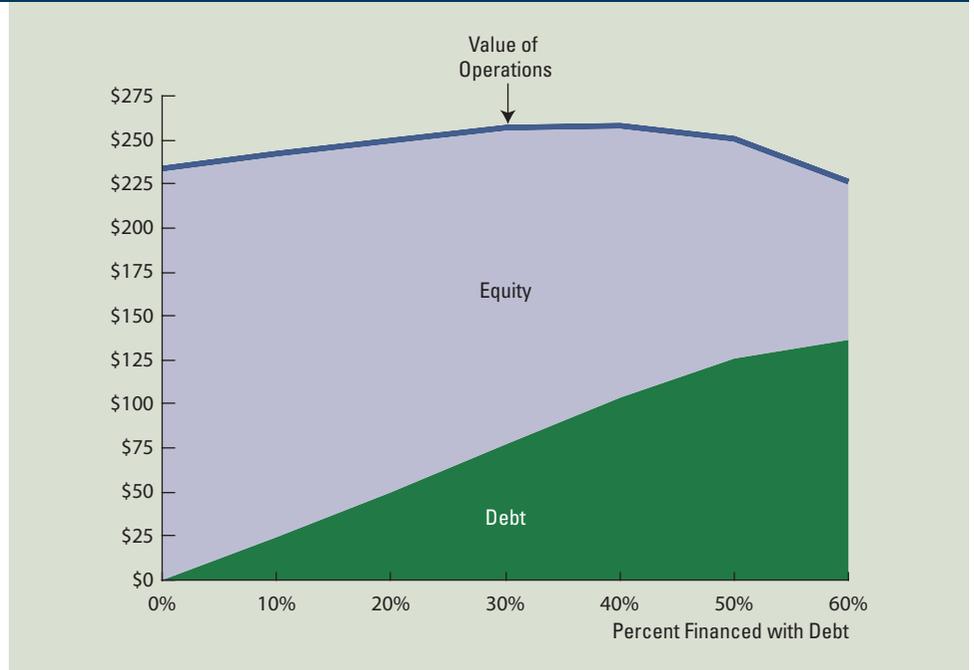
Line 6 of Figure 15-5 shows Strasburg's weighted average cost of capital, WACC, at different capital structures. As the debt ratio increases, the costs of both debt and equity rise, at first slowly but then at an accelerating rate. Eventually, the increasing costs of these two components offset the fact that more debt (which is still less costly than equity) is being used. At 40% debt, Strasburg's WACC hits a minimum of 11.63%; Column F is shown in red to indicate that it is the capital structure with the minimum WACC. Notice that the WACC begins to increase for capital structures with more than 40% debt. Figure 15-7 shows how the WACC changes as debt increases.

Note too that, even though the component cost of equity is always higher than that of debt, only using debt would not maximize value. If Strasburg were to issue more than 40% debt, then the costs of both debt and equity would increase in such a way that the overall WACC would increase, because the cost of debt would increase by more than the cost of equity.

### Estimating the Firm's Value

As we showed in Section 15.2, Strasburg currently has a \$250 million intrinsic value of operations:  $w_d = 20\%$ ,  $WACC = 12\%$ ,  $FCF = \$30$  million, and zero growth in FCF. Using the same approach as in Section 15.2 we can use the data in Figure 15-5 to estimate Strasburg's value of operations at different capital structures; these results are reported in Line 7 of Figure 15-5 and are graphed in Figure 15-8.<sup>28</sup> The maximum value of \$257.86 million occurs at a capital structure with 40% debt, which also is the capital structure that minimizes the WACC.

<sup>28</sup>In this analysis we assume that Strasburg's expected EBIT and FCF are constant for the various capital structures. In a more refined analysis we might try to estimate any possible declines in FCF at high levels of debt as the threat of bankruptcy becomes imminent.

**FIGURE 15-8** Effects of Capital Structure on the Value of Operations

Notice that the value of the firm initially increases but then begins to fall. As discussed earlier, the value initially rises because the WACC initially falls. But the rising costs of equity and debt eventually cause the WACC to increase, causing the value of the firm to fall. Notice how flat the curve is around the optimal level of debt. Thus, it doesn't make a great deal of difference whether Strasburg's capital structure has 30% debt or 40% debt. Also, notice that the maximum value is about 10% greater than the value with no debt. Although this example is for a single company, the results are typical: The optimal capital structure can add 7% to 15% more value relative to zero debt, and there is a fairly wide range of  $w_d$  (from about 20% to 50%) over which value changes very little.

Figures 15-5 and 15-8 also show the values of debt and equity for each capital structure. The value of debt is found by multiplying the value of operations by the percentage of the firm that is financed by debt:  $\text{Debt} = w_d \times V_{op}$ . The intrinsic value of equity is found in a similar manner:  $S = w_s \times V_{op}$ . Even though the intrinsic value of equity falls as debt increases, the wealth of shareholders is maximized at the maximum value of operations, as we explain in the next section.

**Self-Test**

What happens to the costs of debt and equity when the leverage increases? Explain. Use the Hamada equation to calculate the unlevered beta for JAB Industries, assuming the following data: Levered beta =  $b = 1.4$ ;  $T = 40\%$ ;  $w_d = 45\%$ . **(0.939)** Suppose  $r_{RF} = 6\%$  and  $RP_M = 5\%$ . What would be the cost of equity for JAB Industries if it had no debt? **(10.7%)** If  $w_d$  were 45%? **(13.0%)**

## 15.6 ANATOMY OF A RECAPITALIZATION

Strasburg should **recapitalize**, meaning that it should issue enough additional debt to optimize its capital structure, and then use the debt proceeds to repurchase stock. As shown in Figure 15-5, a capital structure with 40% debt is optimal. But before

**FIGURE 15-9 Anatomy of a Recapitalization (Millions, Except Per Share Data)**

	A	B	C	D	E	F
				Before	After Debt	
				Issuing	Issue, But	
				Additional	Prior to	Post
				Debt	Repurchase	Repurchase
				(1)	(2)	(3)
		Percent financed with debt: $w_d$		20%	40%	40%
		Value of operations		\$250.00	\$257.86	\$257.86
		+ Value of ST investments		0.00	53.14	0.00
		Total intrinsic value of firm		\$250.00	\$311.00	\$257.86
		– Debt		50.00	103.14	103.14
		Intrinsic value of equity		\$200.00	\$207.86	\$154.72
		÷ Number of shares		10.00	10.00	7.44
		Intrinsic price per share		\$20.00	\$20.79	\$20.79
		Value of stock		\$200.00	\$207.86	\$154.72
		+ Cash distributed in repurchase		0.00	0.00	53.14
		Wealth of shareholders		\$200.00	\$207.86	\$207.86

**Notes:**

1. The value of ST investments in Column 2 is equal to the amount of cash raised by issuing additional debt but that has not been used to repurchase shares:  $ST\ investments = D_{New} - D_{Old}$ .
2. The value of ST investments in Column 3 is zero because the funds have been used to repurchase shares of stock.
3. The number of shares in Column 3 reflects the shares repurchased:  $n_{Post} = n_{Prior} - (Cash_{Rep}/P_{Prior}) = n_{Prior} - [(D_{New} - D_{Old})/P_{Prior}]$ .

tackling the **recap**, as it is commonly called, let's consider the sequence of events, starting with the situation before Strasburg issues any additional debt. Figure 15-3 shows the valuation analysis of Strasburg at a capital structure consisting of 20% debt and 80% equity. These results are repeated in Column 1 of Figure 15-9, along with the shareholder wealth, which consists entirely of \$200 million in stock before the repurchase. The next step is to examine the impact of Strasburg's debt issuance.

## Strasburg Issues New Debt but Has Not Yet Repurchased Stock

The next step in the recap is to issue debt and announce the firm's intent to repurchase stock with the newly issued debt. At the optimal capital structure of 40% debt, the value of the firm's operations is \$257.86 million, as calculated in Figure 15-5 and repeated in Column 2 of Figure 15-9. This value of operations is greater than the \$250 million value of operations for  $w_d = 20\%$  because the WACC is lower. Notice that Strasburg raised its debt from \$50 million to \$103.14 million, an increase of \$53.14 million. Because Column 2 reports data prior to the repurchase, Strasburg has short-term investments in the amount of \$53.14 million, the amount that was raised in the debt issuance but that has not yet been used to repurchase stock.<sup>29</sup> As Figure 15-9 shows, Strasburg's intrinsic value of equity is \$207.86 million.

<sup>29</sup>These calculations are shown in the *Excel* file *Ch15 Tool Kit.xls* on the textbook's Web site. The values reported in the text are rounded, but the values used in calculations in the spreadsheet are not rounded.

Because Strasburg has not yet repurchased any stock, it still has 10 million shares outstanding. Therefore, the price per share after the debt issue but prior to the repurchase is

$$\begin{aligned} P_{\text{Prior}} &= S_{\text{Prior}}/n_{\text{Prior}} \\ &= \$207.86/10 = \$20.79 \end{aligned}$$

Column 2 of Figure 15-9 summarizes these calculations and also shows the wealth of the shareholders. The shareholders own Strasburg's equity, which is worth \$207.86 million. Strasburg has not yet made any cash distributions to shareholders, so the total wealth of shareholders is \$207.86 million. The new wealth of \$207.86 million is greater than the initial wealth of \$200 million, so the recapitalization has added value to Strasburg's shareholders. Notice also that the recapitalization caused the intrinsic stock price to increase from \$20.00 to \$20.79.

Summarizing these results, we see that the issuance of debt and the resulting change in the optimal capital structure caused (1) the WACC to decrease, (2) the value of operations to increase, (3) shareholder wealth to increase, and (4) the stock price to increase.

## Strasburg Repurchases Stock

What happens to the stock price during the repurchase? Recall from Chapter 14 that a repurchase does not change the stock price. It is true that the additional debt will change the WACC and the stock price prior to the repurchase ( $P_{\text{Prior}}$ ), but the subsequent repurchase itself will not affect the post-repurchase stock price ( $P_{\text{Post}}$ ).<sup>30</sup> Therefore,  $P_{\text{Post}} = P_{\text{Prior}}$ . (Keep in mind that  $P_{\text{Prior}}$  is the price immediately prior to the repurchase, not the price prior to the event that led to the cash available for the repurchase, such as the issuance of debt in this example.)

Strasburg uses the entire amount of cash raised by the debt issue to repurchase stock. The total cash raised is equal to  $D_{\text{New}} - D_{\text{Old}}$ . The number of shares repurchased is equal to the cash raised by issuing debt divided by the repurchase price:

$$\text{Number of shares repurchased} = \frac{D_{\text{New}} - D_{\text{Old}}}{P_{\text{Prior}}} \quad (15-11)$$

Strasburg repurchases  $(\$103.14 - \$50)/\$20.79 = 2.56$  million shares of stock.

The number of remaining shares after the repurchase,  $n_{\text{Post}}$ , is equal to the initial number of shares minus the number that is repurchased:

$$\begin{aligned} n_{\text{Post}} &= \text{Number of outstanding shares remaining after the repurchase} \\ &= n_{\text{Prior}} - \text{Number of shares repurchased} \\ &= n_{\text{Prior}} - \frac{D_{\text{New}} - D_{\text{Old}}}{P_{\text{Prior}}} \end{aligned} \quad (15-12)$$

For Strasburg, the number of remaining shares after the repurchase is

$$\begin{aligned} n_{\text{Post}} &= n_{\text{Prior}} - (D_{\text{New}} - D_{\text{Old}})/P_{\text{Prior}} \\ &= 10 - (\$103.14 - \$50)/\$20.79 \\ &= 7.44 \text{ million} \end{aligned}$$

<sup>30</sup>As we discussed in Chapter 14, a stock repurchase may be a signal of a company's future prospects or it may be the way a company "announces" a change in capital structure, and either of these situations could have an impact on estimated free cash flows or WACC. However, neither situation applies to Strasburg.

Column 3 of Figure 15-9 summarizes these post-repurchase results. The repurchase doesn't change the value of operations, which remains at \$257.86 million. However, the short-term investments are sold and the cash is used to repurchase stock. Strasburg is left with no short-term investments, so the intrinsic value of equity is:

$$S_{\text{Post}} = \$257.86 - \$103.14 = \$154.72 \text{ million}$$

After the repurchase, Strasburg has 7.44 million shares of stock. We can verify that the intrinsic stock price has not changed:<sup>31</sup>

$$P_{\text{Post}} = S_{\text{Post}}/n_{\text{Post}} = \$154.72/7.44 = \$20.79$$

Shareholders now own an equity position in the company worth only \$154.72 million, but they have received a cash distribution in the amount of \$53.14 million, so their total wealth is equal to the value of their equity plus the amount of cash they received:  $\$154.72 + \$53.14 = \$207.86$ .

Here are some points worth noting. As shown in Column 3 of Figure 15-9, the change in capital structure clearly added wealth to the shareholders, increased the price per share, and increased the cash (in the form of short-term investments) temporarily held by the company. However, the repurchase itself did not affect shareholder wealth or the price per share. The repurchase did reduce the cash held by the company and the number of shares outstanding, but shareholder wealth stayed constant. After the repurchase, shareholders directly own the funds used in the repurchase; before the repurchase, shareholders indirectly own the funds. In either case, shareholders own the funds. The repurchase simply takes them out of the company's account and puts them into the shareholders' personal accounts.

The approach we've described here is based on the corporate valuation model, and it will always provide the correct value for  $S_{\text{Post}}$ ,  $n_{\text{Post}}$ , and  $P_{\text{Post}}$ . However, there is a quicker way to calculate these values if the firm has no short-term investments either before or after the recap (other than the temporary short-term investments held between the time debt was issued and shares repurchased). After the recap is completed, the percentage of equity in the capital structure, based on market values, is equal to  $1 - w_d$  if the firm holds no other short-term investments. Therefore, the value of equity after the repurchase is

$$S_{\text{Post}} = V_{\text{opNew}}(1 - w_d) \quad (15-13)$$

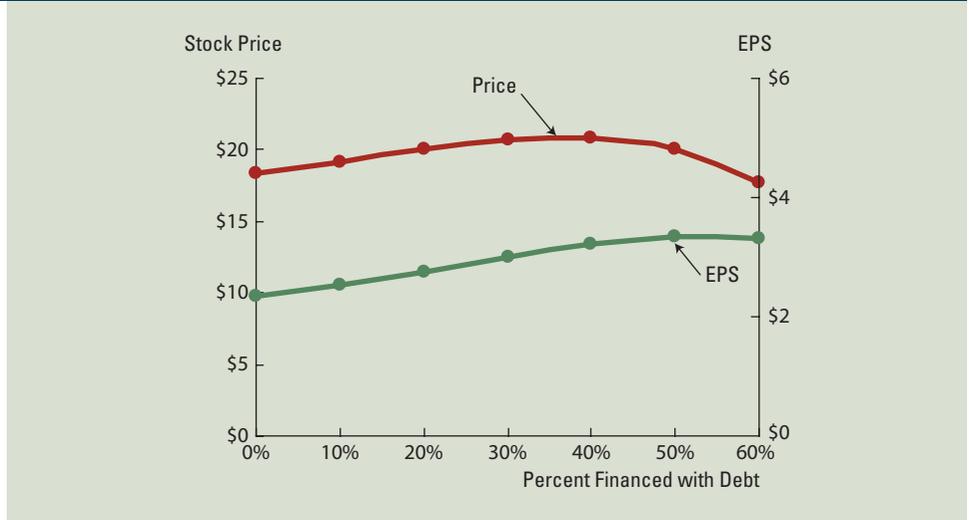
where we use the subscript "New" to indicate the value of operations at the new capital structure and the subscript "Post" to indicate the post-repurchase intrinsic value of equity.

The post-repurchase number of shares can found using this equation:

$$n_{\text{Post}} = n_{\text{Prior}} \left[ \frac{V_{\text{opNew}} - D_{\text{New}}}{V_{\text{opNew}} - D_{\text{Old}}} \right] \quad (15-14)$$

Given the value of equity and the number of shares, it is straightforward to calculate the intrinsic price per share as  $P_{\text{Post}} = S_{\text{Post}}/n_{\text{Post}}$ . But we can also calculate the post-repurchase price using

<sup>31</sup>There may be a small rounding difference due to using rounded numbers in intermediate steps. See the Excel file *Ch15 Tool Kit.xls* for the exact calculations.

**FIGURE 15-10** Effects of Capital Structure on Stock Price and Earnings per Share

$$P_{\text{Post}} = \frac{V_{\text{opNew}} - D_{\text{Old}}}{n_{\text{Prior}}}$$

(15-15)

Figure 15-5 reports the number of shares and the intrinsic price per share in Lines 9–10. Notice that the number of shares goes down as debt goes up because the debt proceeds are used to buy back stock. Notice also that the capital structure that maximizes stock price,  $w_d = 40\%$ , is the same capital structure that optimizes the WACC and the value of operations.

Figure 15-5 also reports the earnings per share for the different levels of debt. Figure 15-10 graphs the intrinsic price per share and the earnings per share. Notice that the maximum earnings per share is at 50% debt even though the optimal capital structure is at 40% debt. This means that maximizing EPS will not maximize shareholder wealth.

## Recapitalizations: A Post-Mortem

In Chapter 13, we looked at value-based management and saw how companies can increase their value by improving their operations. Yet there is good news and bad news regarding this connection. The good news is that small improvements in operations can lead to huge increases in value. The bad news is that it's often difficult to improve operations, especially if the company is already well managed and is in a competitive industry.

If instead you seek to increase a firm's value by changing its capital structure, we again have good news and bad news. The good news is that changing capital structure is easy—just call an investment banker and issue debt (or issue equity if the firm has too much debt). The bad news is that this will add only a relatively small amount of value. Of course, any additional value is better than none, so it's hard to understand why there are some mature firms with zero debt.



## THE GLOBAL ECONOMIC CRISIS

### Deleveraging

Many households, nonfinancial businesses, and financial institutions loaded up on easy credit during the run-up to the global economic crisis and found themselves with too much debt during the recession that began in 2007. The process of reducing debt is called *deleveraging*, and it is painful for individuals and the economy.

The debt-to-income ratio for households increased from around 80%–90% during the 1990s to a peak of 133% in 2007. To deleverage, many households are cutting spending on consumer goods and paying off some of their debt. This belt-tightening is difficult for the individual households, but it also is difficult for the economy because decreased spending leads to economic contraction and job losses. Other households are deleveraging by declaring bankruptcy, with over 1.4 million people filing in 2008 and even more expected to file by the end of 2009.

Like individuals, business can deleverage by paying off debt or by declaring bankruptcy, and many are doing

so during this global economic crisis. But businesses can also deleverage by issuing equity. For example, Wells Fargo and Morgan Stanley issued over \$12 billion in stock in May of 2009; nonfinancial companies either issuing equity or planning to do so include Vulcan Materials and Callaway Golf, with the proceeds being used to reduce debt. A problem with deleveraging via stock issuances is that the stock price usually has been beaten down so much by the time of deleveraging that the new investors get a larger stake in the company, which dilutes the existing stockholders. But the bottom line is that dilution is better than bankruptcy!

*Sources: Reuven Glick and Kevin J. Lansing, "U.S. Household Deleveraging and Future Consumption Growth," FRBSF Economic Letter, May 15, 2009, <http://www.frbsf.org/publications/economics/letter/2009/el2009-16.pdf>; and BankruptcyAction.com, <http://www.bankruptcyaction.com/USbankstats.htm>, May 2009.*

Finally, some firms have more debt than is optimal and should recapitalize to a lower debt level. This is called *deleveraging*. We can use exactly the same approach and the same formulas as we used for Strasburg. The difference is that the debt will go down and the number of shares will go up. In other words, the company will issue new shares of stock and then use the proceeds to pay off debt, resulting in a capital structure with less debt and lower interest payments.

#### Self-Test

A firm's value of operations is equal to \$800 million after a recapitalization (the firm had no debt before the recap). The firm raised \$200 million in new debt and used this to buy back stock. The firm had no short-term investments before or after the recap. After the recap,  $w_d = 25\%$ . The firm had 10 million shares before the recap. What is S (the value of equity after the recap)? (**\$600 million**) What is P (the stock price after the recap)? (**\$80/share**) What is n (the number of remaining shares after the recap)? (**7.5 million**)

## Summary

This chapter examined the effects of financial leverage on stock prices, earnings per share, and the cost of capital. The key concepts covered are listed below.

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

- Several factors influence a firm's capital structure. These include its (1) **business risk**, (2) **tax position**, (3) need for **financial flexibility**, (4) **managerial conservatism or aggressiveness**, and (5) **growth opportunities**.
- **Business risk** is the risk inherent in the firm's operations if it uses no debt. A firm will have little business risk if the demand for its products is stable, if the prices of its inputs and products remain relatively constant, if it can adjust its prices freely if costs increase, and if a high percentage of its costs are variable and hence will decrease if sales decrease. Other things the same, the lower a firm's business risk, the higher its optimal debt ratio.
- **Financial leverage** is the extent to which fixed-income securities (debt and preferred stock) are used in a firm's capital structure. **Financial risk** is the added risk borne by stockholders as a result of financial leverage.
- **Operating leverage** is the extent to which fixed costs are used in a firm's operations. In business terminology, a high degree of operating leverage, other factors held constant, implies that a relatively small change in sales results in a large change in ROIC. *Web Extension 15A* describes additional measures of operating and financial leverage.
- Modigliani and Miller showed that if there are no taxes, then the value of a levered firm is equal to the value of an otherwise identical but unlevered firm:

$$V_L = V_U$$

- If there are only corporate taxes, Modigliani and Miller showed that a firm's value increases as it adds debt due to the interest rate deductibility of debt:

$$V_L = V_U + TD$$

- If there are personal and corporate taxes, Miller showed that

$$V_L = V_U + \left[ 1 - \frac{(1 - T_c)(1 - T_s)}{(1 - T_d)} \right] D$$

- The **Hamada equation** shows the effect of financial leverage on beta as follows:

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

Firms can use their current beta, tax rate, and debt/equity ratio to derive their **unlevered beta**,  $b_U$ , as follows:

$$b_U = b/[1 + (1 - T)(D/S)] = b/[1 + (1 - T)(w_d/w_s)]$$

- **The trade-off theory of capital structure** states that debt initially adds value because interest is **tax deductible** but that debt also brings costs associated with actual or potential bankruptcy. The optimal capital structure strikes a balance between the tax benefits of debt and the costs associated with bankruptcy.
- A firm's decision to use debt versus stock to raise new capital sends a **signal** to investors. A stock issue is viewed as a negative signal, whereas a debt issuance is a positive (or at least a neutral) signal. As a result, companies try to avoid having to issue stock by maintaining a **reserve borrowing capacity**, and this means using less debt in "normal" times than the trade-off theory would suggest.
- A firm's owners may decide to use a relatively large amount of debt to constrain the managers. A **high debt ratio raises the threat of bankruptcy**, which not only carries a cost but also forces managers to be more careful and less wasteful with shareholders' money. Many of the corporate takeovers and leveraged buy-outs in recent years were designed to improve efficiency by reducing the cash flow available to managers.

## Questions

- (15-1) Define each of the following terms:
- Capital structure; business risk; financial risk
  - Operating leverage; financial leverage; break-even point
  - Reserve borrowing capacity
- (15-2) What term refers to the uncertainty inherent in projections of future ROIC?
- (15-3) Firms with relatively high nonfinancial fixed costs are said to have a high degree of what?
- (15-4) “One type of leverage affects both EBIT and EPS. The other type affects only EPS.” Explain this statement.
- (15-5) Why is the following statement true? “Other things being the same, firms with relatively stable sales are able to carry relatively high debt ratios.”
- (15-6) Why do public utility companies usually have capital structures that are different from those of retail firms?
- (15-7) Why is EBIT generally considered to be independent of financial leverage? Why might EBIT actually be influenced by financial leverage at high debt levels?
- (15-8) If a firm went from zero debt to successively higher levels of debt, why would you expect its stock price to first rise, then hit a peak, and then begin to decline?

## Self-Test Problems

Solutions Appear in Appendix A

- (ST-1) Optimal Capital Structure
- The Rogers Company is currently in this situation: (1) EBIT = \$4.7 million; (2) tax rate,  $T = 40\%$ ; (3) value of debt,  $D = \$2$  million; (4)  $r_D = 10\%$ ; (5)  $r_S = 15\%$ ; (6) shares of stock outstanding,  $n = 600,000$ ; and stock price,  $P = \$30$ . The firm’s market is stable and it expects no growth, so all earnings are paid out as dividends. The debt consists of perpetual bonds.
- What is the total market value of the firm’s stock,  $S$ , and the firm’s total market value,  $V$ ?
  - What is the firm’s weighted average cost of capital?
  - Suppose the firm can increase its debt so that its capital structure has 50% debt, based on market values (it will issue debt and buy back stock). At this level of debt, its cost of equity rises to 18.5% and its interest rate on all debt will rise to 12% (it will have to call and refund the old debt). What is the WACC under this capital structure? What is the total value? How much debt will it issue, and what is the stock price after the repurchase? How many shares will remain outstanding after the repurchase?
- (ST-2) Hamada Equation
- Lighter Industrial Corporation (LIC) is considering a large-scale recapitalization. Currently, LIC is financed with 25% debt and 75% equity. LIC is considering increasing its level of debt until it is financed with 60% debt and 40% equity. The beta on its common stock at the current level of debt is 1.5, the risk-free rate is 6%, the market risk premium is 4%, and LIC faces a 40% federal-plus-state tax rate.
- What is LIC’s current cost of equity?
  - What is LIC’s unlevered beta?
  - What will be the new beta and new cost of equity if LIC recapitalizes?

## Problems

## Answers Appear in Appendix B

## EASY PROBLEMS 1–6

- (15–1) Shapland Inc. has fixed operating costs of \$500,000 and variable costs of \$50 per unit. If it sells the product for \$75 per unit, what is the break-even quantity?  
Break-even Quantity
- (15–2) Counts Accounting has a beta of 1.15. The tax rate is 40%, and Counts is financed with 20% debt. What is Counts's unlevered beta?  
Unlevered Beta
- (15–3) Ethier Enterprise has an unlevered beta of 1.0. Ethier is financed with 50% debt and has a levered beta of 1.6. If the risk-free rate is 5.5% and the market risk premium is 6%, how much is the additional premium that Ethier's shareholders require to be compensated for financial risk?  
Premium for Financial Risk
- (15–4) Nichols Corporation's value of operations is equal to \$500 million after a recapitalization (the firm had no debt before the recap). It raised \$200 million in new debt and used this to buy back stock. Nichols had no short-term investments before or after the recap. After the recap,  $w_d = 40\%$ . What is S (the value of equity after the recap)?  
Value of Equity after Recapitalization
- (15–5) Lee Manufacturing's value of operations is equal to \$900 million after a recapitalization (the firm had no debt before the recap). Lee raised \$300 million in new debt and used this to buy back stock. Lee had no short-term investments before or after the recap. After the recap,  $w_d = 1/3$ . The firm had 30 million shares before the recap. What is P (the stock price after the recap)?  
Stock Price after Recapitalization
- (15–6) Dye Trucking raised \$150 million in new debt and used this to buy back stock. After the recap, Dye's stock price is \$7.50. If Dye had 60 million shares of stock before the recap, how many shares does it have after the recap?  
Shares Remaining after Recapitalization

## INTERMEDIATE PROBLEMS 7–8

- (15–7) Schweser Satellites Inc. produces satellite earth stations that sell for \$100,000 each. The firm's fixed costs, F, are \$2 million, 50 earth stations are produced and sold each year, profits total \$500,000, and the firm's assets (all equity financed) are \$5 million. The firm estimates that it can change its production process, adding \$4 million to investment and \$500,000 to fixed operating costs. This change will (1) reduce variable costs per unit by \$10,000 and (2) increase output by 20 units, but (3) the sales price on all units will have to be lowered to \$95,000 to permit sales of the additional output. The firm has tax loss carryforwards that render its tax rate zero, its cost of equity is 16%, and it uses no debt.
- What is the incremental profit? To get a rough idea of the project's profitability, what is the project's expected rate of return for the next year (defined as the incremental profit divided by the investment)? Should the firm make the investment?
  - Would the firm's break-even point increase or decrease if it made the change?
  - Would the new situation expose the firm to more or less business risk than the old one?
- (15–8) The Rivoli Company has no debt outstanding, and its financial position is given by the following data:  
Capital Structure Analysis

Assets (book = market)	\$3,000,000
EBIT	\$500,000
Cost of equity, $r_s$	10%
Stock price, $P_0$	\$15
Shares outstanding, $n_0$	200,000
Tax rate, $T$ (federal-plus-state)	40%

The firm is considering selling bonds and simultaneously repurchasing some of its stock. If it moves to a capital structure with 30% debt based on market values, its cost of equity,  $r_s$ , will increase to 11% to reflect the increased risk. Bonds can be sold at a cost,  $r_d$ , of 7%. Rivoli is a no-growth firm. Hence, all its earnings are paid out as dividends. Earnings are expected to be constant over time.

- What effect would this use of leverage have on the value of the firm?
- What would be the price of Rivoli's stock?
- What happens to the firm's earnings per share after the recapitalization?
- The \$500,000 EBIT given previously is actually the expected value from the following probability distribution:

Probability	EBIT
0.10	(\$ 100,000)
0.20	200,000
0.40	500,000
0.20	800,000
0.10	1,100,000

Determine the times-interest-earned ratio for each probability. What is the probability of not covering the interest payment at the 30% debt level?

#### CHALLENGING PROBLEMS

9–11

(15–9)

Capital Structure  
Analysis

Pettit Printing Company has a total market value of \$100 million, consisting of 1 million shares selling for \$50 per share and \$50 million of 10% perpetual bonds now selling at par. The company's EBIT is \$13.24 million, and its tax rate is 15%. Pettit can change its capital structure either by increasing its debt to 70% (based on market values) or decreasing it to 30%. If it decides to *increase* its use of leverage, it must call its old bonds and issue new ones with a 12% coupon. If it decides to *decrease* its leverage, it will call its old bonds and replace them with new 8% coupon bonds. The company will sell or repurchase stock at the new equilibrium price to complete the capital structure change.

The firm pays out all earnings as dividends; hence its stock is a zero-growth stock. Its current cost of equity,  $r_s$ , is 14%. If it increases leverage,  $r_s$  will be 16%. If it decreases leverage,  $r_s$  will be 13%. What is the firm's WACC and total corporate value under each capital structure?

(15–10)

Optimal Capital  
Structure with Hamada

Beckman Engineering and Associates (BEA) is considering a change in its capital structure. BEA currently has \$20 million in debt carrying a rate of 8%, and its stock price is \$40 per share with 2 million shares outstanding. BEA is a zero-growth firm and pays out all of its earnings as dividends. The firm's EBIT is \$14.933 million, and it faces a 40% federal-plus-state tax rate. The market risk premium is 4%, and the risk-free rate is 6%. BEA is considering increasing its debt level to a capital structure

with 40% debt, based on market values, and repurchasing shares with the extra money that it borrows. BEA will have to retire the old debt in order to issue new debt, and the rate on the new debt will be 9%. BEA has a beta of 1.0.

- What is BEA's unlevered beta? Use market value  $D/S$  when unlevering.
- What are BEA's new beta and cost of equity if it has 40% debt?
- What are BEA's WACC and total value of the firm with 40% debt?

**(15-11)**  
WACC and Optimal  
Capital Structure

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

Market Debt- to-Value Ratio ( $w_d$ )	Market Equity- to-Value Ratio ( $w_s$ )	Market Debt- to-Equity Ratio ( $D/S$ )	Bond Rating	Before-Tax Cost of Debt ( $r_d$ )
0.0	1.0	0.00	A	7.0%
0.2	0.8	0.25	BBB	8.0
0.4	0.6	0.67	BB	10.0
0.6	0.4	1.50	C	12.0
0.8	0.2	4.00	D	15.0

Elliott uses the CAPM to estimate its cost of common equity,  $r_s$ . The company estimates that the risk-free rate is 5%; the market risk premium is 6%, and the company's tax rate is 40%. Elliott estimates that if it had no debt, its "unlevered" beta,  $b_U$ , would be 1.2. Based on this information, what is the firm's optimal capital structure, and what would be the weighted average cost of capital at the optimal capital structure?

## SPREADSHEET PROBLEM

**(15-12)**  
Build a Model: WACC  
and Optimal Capital  
Structure



Start with the partial model in the file *Ch15 P12 Build a Model.xls* on the textbook's Web site. Reacher Technology has consulted with investment bankers and determined the interest rate it would pay for different capital structures, as shown in the following table. Data for the risk-free rate, the market risk premium, an estimate of Reacher's unlevered beta, and the tax rate are also shown. Based on this information, what is the firm's optimal capital structure, and what is the weighted average cost of capital at the optimal structure?

Percent Financed with Debt ( $w_d$ )	Before-Tax Cost Debt ( $r_d$ )	Input Data	
0%	6.0%	Risk-free rate	4.5%
10	6.1	Market risk premium	5.5%
20	7.0	Unlevered beta	0.8
30	8.0	Tax rate	40.0%
40	10.0		
50	12.5		
60	15.5		
70	18.0		

Use the Thomson ONE—Business School Edition online database to work this chapter's questions.

## EXPLORING THE CAPITAL STRUCTURES FOR THREE GLOBAL AUTO COMPANIES

The following discussion questions demonstrate how we can evaluate the capital structures for three global automobile companies: Ford (F), BMW (BMW), and Toyota (J:TYMO). As you gather information on these companies, be mindful of the currencies in which these companies' financial data are reported.

### Thomson ONE—BSE Discussion Questions

1. To get an overall picture of each company's capital structure, it is helpful to see a chart that summarizes the company's capital structure over the past decade. To obtain this chart, choose a company to start with and select FINANCIALS. Next, select MORE>THOMSON REPORTS & CHARTS>CAPITAL STRUCTURE. This should generate a chart that plots the company's long-term debt, common equity, and total current liabilities over the past decade. What, if any, are the major trends that emerge from looking at these charts? Do these companies tend to have relatively high or relatively low levels of debt? Do these companies have significant levels of current liabilities? Have their capital structures changed over time? (Note that an alternative chart can be found by selecting FINANCIALS>FUNDAMENTAL RATIOS>WORLDSCOPE RATIOS>DEBT TO ASSETS & EQUITY RATIOS.)
2. To obtain more details about the companies' capital structures over the past five years, select FINANCIALS>FUNDAMENTAL RATIOS>THOMSON RATIOS. From here you can select ANNUAL RATIOS and/or 5 YEAR AVERAGE RATIOS REPORT. In each case, you can scroll down and look for Leverage Ratios. Here you will find a variety of leverage ratios for the past 5 years. (Notice that these two pages offer different information. The ANNUAL RATIOS page offers year-end leverage ratios, whereas the 5 YEAR AVERAGE RATIOS REPORT offers the average ratio over the previous 5 years for each calendar date. In other words, the 5 YEAR AVERAGE RATIOS REPORT smoothes the changes in capital structure over the reporting period.) Do these ratios suggest that the company has significantly changed its capital structure over the past 5 years? If so, what factors could possibly explain this shift? (Financial statements might be useful for detecting any shifts that may have led to the company's changing capital structure. You may also consult the company's annual report to see if there is any discussion and/or explanation for these changes. Both the historical financial statements and annual report information can be found via Thomson ONE).
3. Repeat this procedure for the other auto companies. Do you find similar capital structures for each of the four companies? Do you find that the capital structures have moved in the same direction over the past 5 years, or have the different companies changed their capital structures in different ways over the past 5 years?
4. The financial ratios investigated thus far are based on book values of debt and equity. Determine whether using the market value of equity (market capitalization found on the OVERVIEW page) makes a significant difference in the most recent year's "LT

Debt Pct Common Equity” and “Total Debt Pct Total Assets.” (Note: “LT Debt” is defined by Thomson ONE as the “Long Term Debt” listed on the balance sheet, while “Total Debt” is defined as “Long Term Debt” plus “ST Debt & Current Portion Due LT Debt.”) Are there big differences between the capital structures measured on a book or market basis?

5. You can also use Thomson ONE to search for companies with either very large or very small debt ratios. For example, if you want to find the top 50 companies with the highest debt ratio, select: SEARCH FOR COMPANIES>ADVANCED SEARCH>ALL COMPANIES>THOMSON FINANCIAL>RATIOS>LEVERAGE. From here, select “LT Debt Pct Total Cap 5 Yr. Avg.” (This will focus in on the average capital structure over the past 5 years, which may give us a better indication of the company’s long-run target capital structure.) Once you click on SELECT, you should see the Search Expression Builder screen. From here, you go to Rank and select the top 50 by typing “50” in the box below rank and then clicking on ADD. You can easily change this to also select the bottom 50 (or perhaps the bottom 5% or 10%). Take a close look at the resulting firms by clicking on SEARCH. Do you observe any differences between the types of firms that have high debt levels and the types of firms that have low debt levels? Are these patterns similar to what you expect after reading the chapter? (As a quick review, you may want to look at the average capital structures for different industries, which are summarized in the text.) Note: The searches are cumulative, so that if you ask for the top 10% of the database and follow that by asking for the bottom 5%, you will be shown the bottom 5% of the top 10%. In other words, you would only see a small subset of the firms you are asking for. Hence, *when beginning a new search, clear all existing searches first.*
6. From the submenu just above the list of firms, you may choose a number of options. “List” displays a list of the firms and allows you to access a firm report. “Profiles” provides key information about the firms, such as ticker, country, exchange, and industry code. “Financials” gives a couple of key financial figures (expressed in U.S. dollars) from the firms’ balance sheets and income statements. “Market Data” includes the firms’ market capitalization, current price, P/E ratio, EPS, and so forth. “Report Writer” allows you to create customized company reports.

## Mini Case

Assume you have just been hired as a business manager of PizzaPalace, a regional pizza restaurant chain. The company’s EBIT was \$50 million last year and is not expected to grow. The firm is currently financed with all equity, and it has 10 million shares outstanding. When you took your corporate finance course, your instructor stated that most firms’ owners would be financially better off if the firms used some debt. When you suggested this to your new boss, he encouraged you to pursue the idea. As a first step, assume that you obtained from the firm’s investment banker the following estimated costs of debt for the firm at different capital structures:

Percent Financed with Debt, $w_d$	$r_d$
0%	—
20	8.0%
30	8.5
40	10.0
50	12.0

If the company were to recapitalize, then debt would be issued and the funds received would be used to repurchase stock. PizzaPalace is in the 40% state-plus-federal corporate tax bracket, its beta is 1.0, the risk-free rate is 6%, and the market risk premium is 6%.

- a. Provide a brief overview of capital structure effects. Be sure to identify the ways in which capital structure can affect the weighted average cost of capital and free cash flows.
- b. (1) What is business risk? What factors influence a firm's business risk?  
(2) What is operating leverage, and how does it affect a firm's business risk? Show the operating break-even point if a company has fixed costs of \$200, a sales price of \$15, and variable costs of \$10.
- c. Now, to develop an example that can be presented to PizzaPalace's management to illustrate the effects of financial leverage, consider two hypothetical firms: Firm U, which uses no debt financing, and Firm L, which uses \$10,000 of 12% debt. Both firms have \$20,000 in assets, a 40% tax rate, and an expected EBIT of \$3,000.
  - (1) Construct partial income statements, which start with EBIT, for the two firms.
  - (2) Now calculate ROE for both firms.
  - (3) What does this example illustrate about the impact of financial leverage on ROE?
- d. Explain the difference between financial risk and business risk.
- e. What happens to ROE for Firm U and Firm L if EBIT falls to \$2,000? What does this imply about the impact of leverage on risk and return?
- f. What does capital structure theory attempt to do? What lessons can be learned from capital structure theory? Be sure to address the MM models.
- g. What does the empirical evidence say about capital structure theory? What are the implications for managers?
- h. With the preceding points in mind, now consider the optimal capital structure for PizzaPalace.
  - (1) For each capital structure under consideration, calculate the levered beta, the cost of equity, and the WACC.
  - (2) Now calculate the corporate value for each capital structure.
- i. Describe the recapitalization process and apply it to PizzaPalace. Calculate the resulting value of the debt that will be issued, the resulting market value of equity, the price per share, the number of shares repurchased, and the remaining shares. Considering only the capital structures under analysis, what is PizzaPalace's optimal capital structure?

## SELECTED ADDITIONAL CASES

*The following cases from Textchoice, Cengage Learning's online library, cover many of the concepts discussed in this chapter and are available at <http://www.textchoice2.com>.*

**Klein-Brigham Series:**

Case 9, "Kleen Kar, Inc.," Case 43, "Mountain Springs, Inc.," and Case 57, "Greta Cosmetics, Inc.," each present a situation similar to the Strasburg example in the text. Case 74, "The Western Company," and Case 99, "Moore Plumbing Supply," explore capital structure policies.

**Brigham-Buzzard Series:**

Case 8, "Powerline Network Corporation (Operating Leverage, Financial Leverage, and the Optimal Capital Structure)."