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CHAPTER 15

Capital Structure Decisions

A bankruptcy and a liquidity crisis are very different. An *economic* bankruptcy means that the intrinsic 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 company files in bankruptcy court for protection from its creditors until it can arrange an orderly reorganization or liquidation. 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 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.

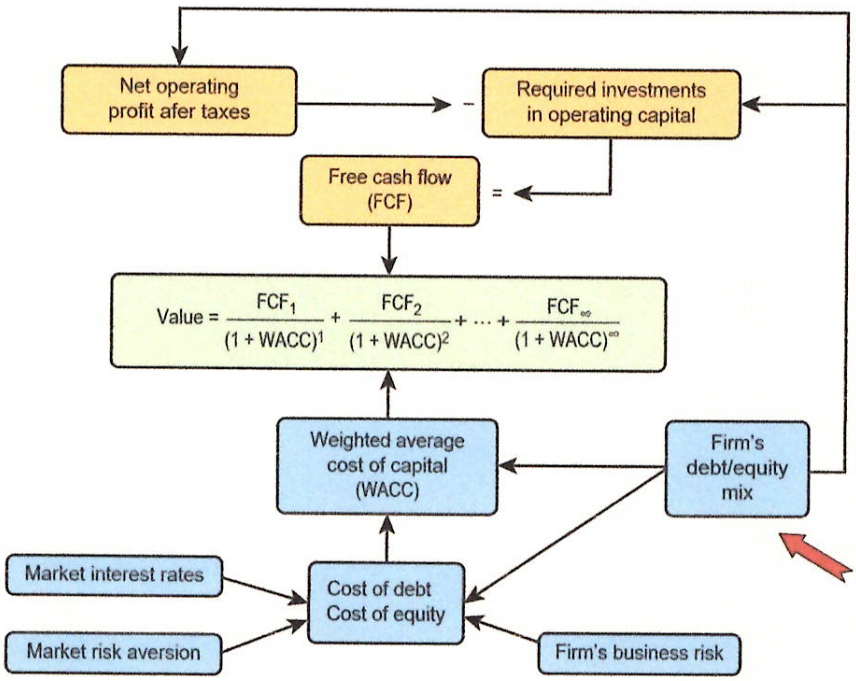
The economic crisis drove many companies into bankruptcy, including Lehman Brothers, Washington Mutual, General Motors, Chrysler, Pilgrim's Pride, and Circuit City. Many other companies scrambled to reduce their liquidity problems. For example, Black & Decker (B&D) issued about $350 million in 5-year 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 did not have to repay the note for five years, 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** 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.



resource

The textbook's Web site contains an Excel file that will guide you through the chapter's calculations. The file for this chapter is ***Ch15 Tool Kit.xlsx****, and we encourage you to open the file and follow along as you read the chapter.*

As explained in Chapter 12, growth in sales requires growth in operating capital, and this often requires that external funds 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 An Overview of Capital Structure

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):

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

The WACC of a firm financed only by debt and common stock depends on the percentages of debt and common stock (w_d and w_s), the cost of debt (r_d), the cost of stock (r_s), and the corporate tax rate (T):

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

As these equations show, the only way any decision can change the value of operations is by changing either expected free cash flows or the cost of capital. As you read the chapter, think about the ways the capital structure choices can affect FCF or the WACC.

Table 15-1 shows that the average long-term debt-to-equity ratio diverges widely for different business sectors, ranging from 7% in Health Care to 80% in Utilities. However, sub-sector industries within a sector also have a wide dispersion of ratios. For example, the Consumer Discretionary sector's average is 38%, but two of its sub-sectors are *Advertising* and *Apparel, Accessories & Luxury (AA&L) Goods,* which have average ratios of 12% and 46%, respectively. Companies within a sub-sector also have considerable variation: Coach and Tiffany are in the *AA&L Goods* sub-sector, but Coach has no debt and Tiffany has a 31% ratio. 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 these questions in the rest of this chapter, beginning with a description of business risk and financial risk.

TABLE 15-1
Long-Term Debt-to-Equity Ratios for Business Sectors, Selected Sub-Sectors, and Selected Firms

	Long-Term Debt-to-Equity Ratio		
Name of Sector	**Company**	**Sub-Sector**	**Sector**
Consumer Discretionary			38%
Selected Sub-Sectors in Consumer Discretionary:			
Advertising		*12%*	
Apparel, Accessories & Luxury (AA&L) Goods		*46%*	
Selected Companies in AA&L Goods			
Coach	0%		
Tiffany	31%		
Consumer Staples			10%
Energy			38%
Financials			26%
Health Care			7%
Industrials			50%
Information Technology			14%
Materials			50%
Telecommunications Services			79%
Utilities			80%

Source: For updates on a company's ratio, go to **www.reuters.com** and enter the ticker symbol for a stock quote. Click the Financials tab for updates on company and sector ratios.

SELF-TEST

What are some ways in which the capital structure decisions can affect the value of operations?

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 explain in the next sections.

15-2a Business Risk and Operating Leverage

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 and production costs. 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.

A high degree of **operating leverage** implies that a relatively small change in sales results in a relatively large change in earnings before interest and taxes (EBIT), net operating profits after taxes (NOPAT), return on invested capital (ROIC), return on assets (ROA), and return on equity (ROE). 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 will focus on its operating plans.

Strasburg is comparing two plans, each requiring a capital investment of $200 million; assume for now that Strasburg will finance its choice entirely with equity. Each plan is expected to produce 110 million units (Q) per year at a sales price (P) of $2 per unit. As shown in Figure 15-1, Plan A's technology requires a smaller annual fixed cost (F) than Plan U's, but Plan A has higher variable costs (V). (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's performance measures are superior to Plan A's if the expected sales occur.

Notice that the projections in Figure 15-1 are based on the 110 million units 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:[1]

$$EBIT = PQ - VQ - F = 0 \qquad (15\text{-}3)$$

[1]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 firm with debt would have negative net income 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
14	*1. Input Data*		Plan A	Plan U	Plan L
15	Required operating current assets		$3	$3	$3
16	Required long-term assets		$199	$199	$199
17	Total assets		$202	$202	$202
18	Resulting operating current liabilities		$2	$2	$2
19	Required capital (TA Op. CL)		$200	$200	$200
20	Book equity		$200	$200	$150
21	Debt		$0	$0	$50
22	Interest rate		8%	8%	8%
23	Sales price (P)		$2.00	$2.00	$2.00
24	Tax rate (T)		40%	40%	40%
25	Expected units sold (Q)		110	110	110
26	Fixed costs (F)		$20	$60	$60
27	Variable costs (V)		$1.50	$1.00	$1.00
28	*2. Income Statements*		Plan A	Plan U	Plan L
29	Sales revenue (P x Q)		$220.0	$220.0	$220.0
30	Fixed costs		20.0	60.0	60.0
31	Variable costs (V x Q)		165.0	110.0	110.0
32	EBIT		$35.0	$50.0	$50.0
33	Interest		0.0	0.0	4.0
34	Pre-tax earnings		$35.0	$50.0	$46.0
35	Tax		14.0	20.0	18.4
36	Net income		$21.0	$30.0	$27.6
37	*3. Key Performance Measures*		Plan A	Plan U	Plan L
38	NOPAT = EBIT(1 T)		$21.0	$30.0	$30.0
39	ROIC = NOPAT/Capital		10.5%	15.0%	15.0%
40	ROA = NI/Total assets		10.4%	14.9%	13.7%
41	ROE = NI/Equity		10.5%	15.0%	18.4%

Source: See the file ***Ch15 Tool Kit.xlsx***. Numbers are reported as rounded values for clarity, but are calculated using *Excel*'s full precision. Thus, intermediate calculations using the figure's rounded values will be inexact.

Note: ROA is not exactly equal to ROE for Plan L or Plan U, because total assets are not quite equal to equity for these plans. This is because the operating current liabilities, such as accounts payable and accruals, reduce the required equity capital investment.

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

$$Q_{BE} = \frac{F}{P - V} \tag{15-4}$$

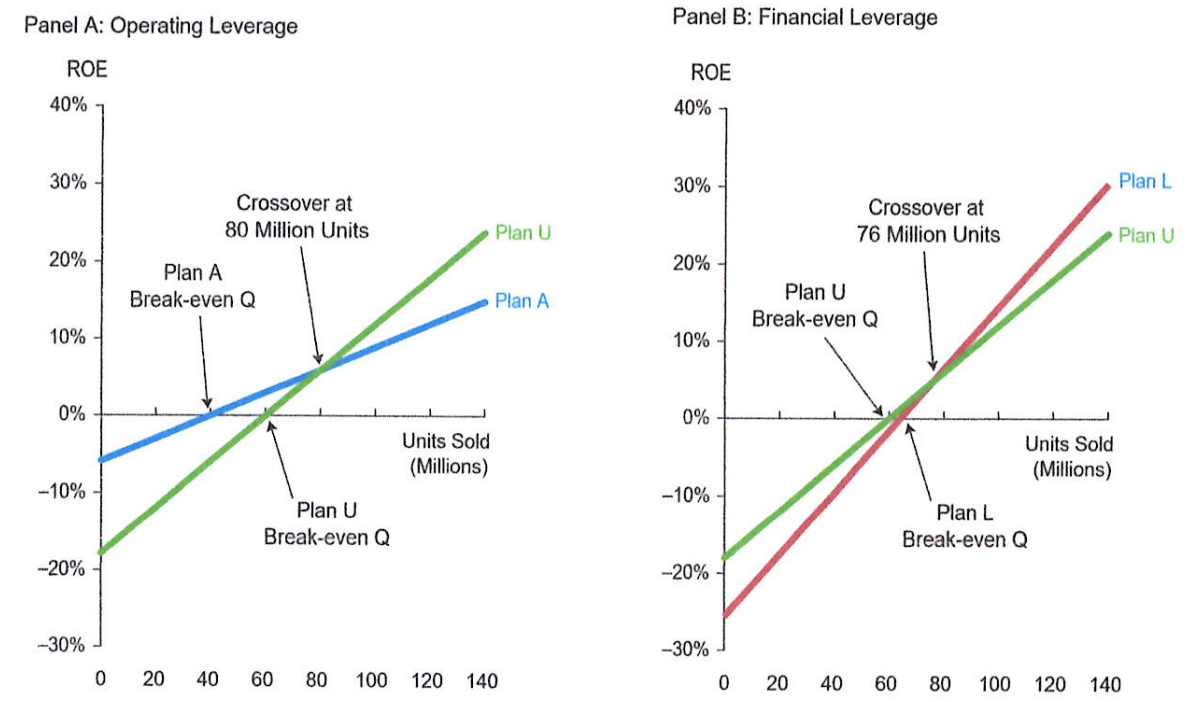
The break-even quantities for Plans A and U are:

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

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

Plan A will be profitable if unit sales are above 40 million, whereas Plan U requires sales of 60 million units before it is profitable. This difference occurs because Plan U has higher

FIGURE 15-2
Operating Leverage and Financial Leverage



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. Because these companies have no debt, the return on assets and the return on equity measure operating profitability; we report ROE instead of ROA to facilitate comparisons when we discuss financial risk in the next section.

Suppose sales are at 80 million units. In this case, the ROE is identical for each plan. As unit sales begin to climb above 80 million, both plans increase in profitability, but ROE increases more for Plan U than for Plan A. If sales fall below 80 million, then both plans become less profitable, but ROE 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.

15-2b Financial Risk and Financial Leverage

Financial risk is the additional risk placed on the common stockholders as a result of the decision to finance with debt.[2] 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.

[2]Preferred stock also adds to financial risk. To simplify matters, we examine only debt and common equity in this chapter.

MM models by relaxing the assumptions. The following sections describe the important developments in capital structure theory.

15-4a 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 **financial distress costs**. 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. Therefore, even the threat of bankruptcy can cause free cash flows to fall, causing further declines in a company's value.

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 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 15-3, 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 15-3 expresses the relationship between value and debt under those assumptions.
2. There is some threshold level of debt, labeled D_1 in Figure 15-3, 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

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:

$$V_L = V_U + \left[1 - \frac{(1 - 0.40)(1 - 0.12)}{(1 - 0.30)}\right]D \quad (15\text{-}10a)$$
$$= V_U + 0.25D$$

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

The Miller model has several important implications, as follows.

1. The bracketed term in Equation 15-10,
$$\left[1 - \frac{(1 - T_c)(1 - T_s)}{(1 - T_d)}\right]$$
when multiplied by D, represents the gain from leverage. The bracketed term thus replaces the corporate tax rate, T, in the earlier MM model with corporate taxes: $V_L = V_U + TD$.
2. If we ignore all taxes (i.e., if $T_c = T_s = T_d = 0$), then the bracketed term is zero, so in this case Equation 15-10 is the same as the original MM model without taxes.
3. If we ignore personal taxes (i.e., if $T_s = T_d = 0$), then the bracketed term reduces to $[1 - (1 - T_c)] = T_c$, so in this case Equation 15-10 is the same as the MM model with corporate taxes.
4. If the effective personal tax rates on stock and bond incomes were equal (i.e., if $T_s = T_d$), then $(1 - T_s)$ and $(1 - T_d)$ would cancel and so the bracketed term would again reduce to T_c.
5. If $(1 - T_c)(1 - T_s) = (1 - T_d)$, then the bracketed term would be zero, and so the value of using leverage would also be zero. This implies that the tax advantage of debt to the firm would be exactly offset by the personal tax advantage of equity. Under this condition, capital structure would have no effect on a firm's value or its cost of capital, so we would be back to MM's original zero-tax proposition.

SELF-TEST

What does the MM theory with no taxes state about the value of a levered firm versus the value of an otherwise identical but unlevered firm? What does this imply about the optimal capital structure?

Why does the MM theory with corporate taxes lead to 100% debt?

What does the Miller model with personal and corporate taxes imply about value relative to the MM model with just corporate taxes?

15-4 Capital Structure Theory: Beyond the Modigliani and Miller Models

The MM's models are important because they guided subsequent research in terms of methodology: Compare levered firms with unlevered firms and look for side effects. Also, the unrealistic MM assumptions provided a place for subsequent researchers to extend the

This is the MM Proposition I with corporate taxes. 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 WACC falls as debt is added. This is because the cost of equity, r_s, doesn't increase quite as fast as it would if there were no taxes. Equation 15-9 is a version of Proposition II with corporate taxes included:

$$r_{sL} = r_{sU} + (r_{sU} - r_d)(1 - T)(D/S) \quad (15\text{-}9)$$

15-3c Miller: The Effect of Corporate and Personal Taxes

Merton Miller (this time without Modigliani) later brought in the effects of personal taxes.[11] The income from bonds is generally interest, which is taxed as personal income at rates (T_d) going up to 39.6%, while income from stocks generally comes partly from dividends and partly from capital gains. Long-term capital gains are taxed at a rate of 20%, 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.[12]

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, discussed in Chapter 5, and preferred stocks held by corporate investors, 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, the tax code has two opposite implications. First, the *corporate deductibility of interest* favors the use of debt financing. Second, the *more favorable personal 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, which is called the **Miller model**:

$$V_L = V_U + \left[1 - \frac{(1 - T_c)(1 - T_s)}{(1 - T_d)}\right] D \quad (15\text{-}10)$$

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

[11] See Merton H. Miller, "Debt and Taxes," *Journal of Finance*, May 1977, pp. 261–275.

[12] 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.

15-3b Modigliani and Miller: 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.[10] 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 a corporation pays, and if a corporation pays less to the government, then more of its cash flow is available for investors. In other words, the tax deductibility of the interest payments shields the firm's pre-tax income.

To illustrate, look at Figure 15-1 and see that Plan U (with no debt) pays taxes of $20, but Plan L (with leverage) pays taxes of only $18.40. What happens to the difference of $1.60 = $20 – $18.40? This extra amount is paid out to investors! Notice that Plan U has $30 of net income for shareholders, but Plan L has $4 of interest for debtholders and $27.60 of net income for shareholders for a combined total of $31.60, which is exactly $1.60 more than Plan U. With more cash flows available for investors, a levered firm's total value should be greater than that of an unlevered firm, and this is what MM showed.

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:

$$V_L = V_U + \text{Value of side effects} = V_U + \text{Present value of tax shield} \quad (15\text{-}7)$$

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:

$$V_L = V_U + TD \quad (15\text{-}8)$$

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."[a]

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.

[a]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.

[10]Franco Modigliani and Merton H. Miller, "Corporate Income Taxes and the Cost of Capital: A Correction," *American Economic Review*, June 1963, pp. 433–443.

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:[8]

$$V_L = V_U = S_L + D \tag{15-5}$$

Given their assumptions, MM proved that a firm's value is unaffected by its capital structure.[9] This result is often called the **MM Proposition I** without taxes.

MM assumed that debt doesn't affect EBIT and they prove that debt doesn't affect value. Therefore, debt doesn't affect the weighted average cost of capital (WACC). 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 by exactly enough to keep the WACC constant.

MM showed that a constant WACC implies that the cost of equity to a levered firm, r_{sL}, is equal to:

$$r_{sL} = r_{sU} + (r_{sU} - r_d)(D/E) \tag{15-6}$$

Here r_{sU} is the cost of equity to an identical but unlevered firm, D is the market value of debt, S is the market value of equity, and r_d is the cost of debt (which is assumed to be constant for all degrees of leverage). Equation 15-6 is called the **MM Proposition II** without taxes.

Taken together, the two MM propositions imply that using more debt in the capital structure will not increase the value of the firm, because the benefits of cheaper debt will be exactly offset by an increase in the riskiness of the equity and hence in its cost. Thus, MM argued that, *in a world without taxes, both the value of a firm and its WACC would be unaffected by its capital structure.*

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.

[8]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 short) 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 short sell a portfolio, its price will be driven down. The net result of the trading activity would be to change the portfolios' values until they were equal and no more arbitrage was possible.

[9]See ***Web Extension 15B*** for a more formal derivation of this result and for derivations of the other MM and Miller models.

15-3 Capital Structure Theory: The Modigliani and Miller Models

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. We discuss theories and empirical evidence in the following sections, beginning with the work of Professors Franco Modigliani and Merton Miller.[6]

15-3a Modigliani and Miller: No Taxes

Modern capital structure theory began in 1958, when Modigliani and Miller (hereafter, MM) published what has been called the most influential finance article ever written.[7] 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. Earnings before interest and taxes (EBIT) do not grow and are 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_dD. Because the firm is not growing and pays no taxes, it can pay out dividends in the amount $EBIT - r_dD$. 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: $r_dD + (EBIT - r_dD) = EBIT$. Therefore, the cash flow from owning this second portfolio is equal to EBIT.

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[6]For additional discussion of capital structure theories, see John C. Easterwood and Palani-Rajan Kadapakkam, "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.

[7]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.

To illustrate, suppose 10 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.[3]

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). Section 3 shows that Plan L's NOPAT and ROIC are identical to those of Plan U—financing choices don't affect operations. However, Plan L has a lower ROA (13.7% versus 14.9%) and lower net income ($27.6 versus $30) because it must pay interest. Despite the lower net income, Plan L has a higher ROE (18.4% versus 15%) because the net income is shared by a smaller equity base.[4]

But there is more to the story than just a higher ROE with financial leverage. Just as operating leverage adds risk, so does financial leverage. We used the Data Table feature in the file ***Ch15 Tool Kit.xlsx*** to generate performance measures for plans U and L at different levels of unit sales. Panel B of Figure 15-2 shows the ROE of Plan L versus quantity sold.

When the quantity sold is 76 million, the crossover point in Panel B of Figure 15-2, both plans have an ROE and ROIC of 4.8%. (See the ***Tool Kit*** for the calculations.) The after-tax cost of debt also is $8\%(1 - 0.40) = 4.8\%$, which is no coincidence. As sales increase above 76 million units and ROIC increases above 4.8%, the ROE increases for each plan, but more for Plan L than for Plan U. However, if sales fall below 76 million units and ROIC falls below 4.8%, 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.

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.[5]

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)**

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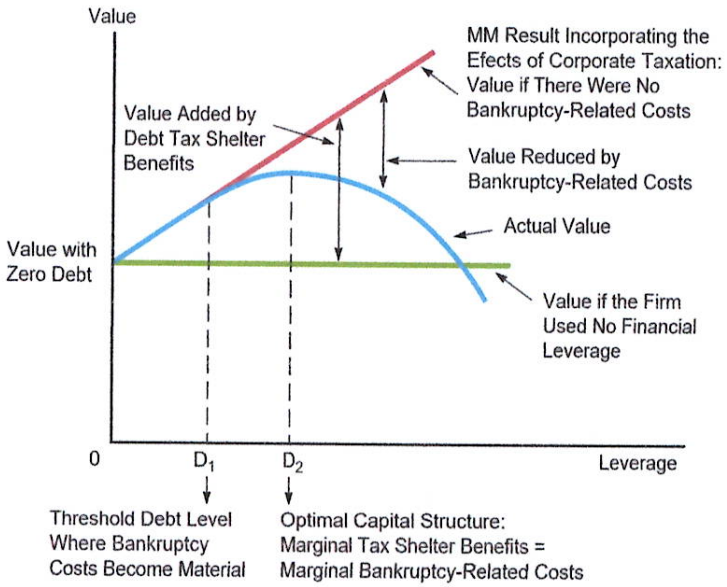
[3]Holders of corporate debt generally do bear some business risk, because they may lose some of their investment if the firm goes bankrupt. We discuss this in more depth later in the chapter.

[4]Recall that Strasburg has $202 million in total assets, all of which are operating assets. With $2 million in operating current liabilities, Strasburg has $202 – $2 = $200 million in operating capital, which must be financed with a combination of debt and equity.

[5]It is possible to calculate measures of operating leverage, financial leverage, and total leverage as the percentage change in an output given a percentage change in an input. See ***Web Extension 15A*** for details.

FIGURE 15-3
Effect of Financial Leverage on Value



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 confirms the general shape of the curve in Figure 15-3, this graph must be taken as an approximation and not as a precisely defined function.

15-4b Signaling Theory

MM assumed 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 cure for the common cold. Firm P can't provide investors with any details about the product because that might give competitors an advantage. But if they don't provide details, then investors will underestimate the value of the discovery. Given the inability to provide accurate, verifiable information to the market, how should Firm P's management raise the needed capital?

Suppose Firm P issues stock. 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.[13]

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!*[14] 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.* This is the essence of the capital structure **signaling theory**, which suggests that firms should issue debt rather than stock. 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.

15-4c 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 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 15-3.*

15-4d 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

[13]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.

[14]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.

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.[15]

15-4e 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 skyboxes 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*, because 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, former 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.[16] 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.

Finally, too much debt may overly constrain 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. 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. This is called the **underinvestment problem**.

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[15]For more information, see Jonathon Baskin, "An Empirical Investigation of the Pecking Order Hypothesis," *Financial Management*, Spring 1989, pp. 26–35.

[16]See Ben Bernanke, "Is There Too Much Corporate Debt?" *Federal Reserve Bank of Philadelphia Business Review*, September/October 1989, pp. 3–13.