17

CHAPTER

PART 5

PAYOUT POLICY AND CAPITAL STRUCTURE

# Does Debt Policy Matter?

**A firm's basic** resource is the stream of cash flows produced by its assets. When the firm is financed entirely by common stock, all those cash flows belong to the stockholders. When it issues both debt and equity securities, it splits the cash flows into two streams, a relatively safe stream that goes to the debtholders and a riskier stream that goes to the stockholders.

The firm's mix of debt and equity financing is called its capital structure. Of course capital structure is not just "debt versus equity." There are many different flavors of debt, at least two flavors of equity (common versus preferred), plus hybrids such as convertible bonds. The firm can issue dozens of distinct securities in countless combinations. It attempts to find the particular combination that maximizes the overall market value of the firm.

Are such attempts worthwhile? We must consider the possibility that *no* combination has any greater appeal than any other. Perhaps the really important decisions concern the company's assets, and decisions about capital structure are mere details—matters to be attended to but not worried about.

Modigliani and Miller (MM), who showed that payout policy doesn't matter in perfect capital markets, also showed that financing decisions don't matter in perfect markets. Their famous "proposition 1" states that a firm cannot change the total value of its securities just by splitting its cash flows into different streams: The firm's value is determined by its real assets, not by the securities it issues. Thus capital structure is irrelevant as long as the firm's investment decisions are taken as given.

MM's proposition 1 allows complete separation of investment and financing decisions. It implies that any firm could use the capital budgeting procedures presented in Chapters 5 through 12 without worrying about where the money for capital expenditures comes from. In those chapters, we assumed all-equity financing without really thinking about it. If MM are right, that is exactly the right approach. If the firm uses a mix of debt and equity financing, its overall cost of capital will be exactly the same as its cost of equity with all-equity financing.

We believe that in practice capital structure does matter, but we nevertheless devote all of this chapter to MM's argument. If you don't fully understand the conditions under which MM's theory holds, you won't fully understand why one capital structure is better than another. The financial manager needs to know what kinds of market imperfection to look for.

For example, the firm may invent some new security that a particular clientele of investors is willing to buy at a premium price, thereby increasing the overall market value of the firm. (We argue, however, that such financial innovations are easily copied and that any gains in value will be confined to the first few issuers.)

In Chapter 18 we undertake a detailed analysis of the imperfections that are most likely to make a difference, including taxes, the costs of bankruptcy and financial distress, the costs of writing and enforcing complicated debt contracts, differences created by imperfect information, and the effects of debt on incentives for management. In Chapter 19 we show how such imperfections (especially taxes) affect the weighted-average cost of capital and the value of the firm.

## 17-1 The Effect of Financial Leverage in a Competitive Tax-free Economy

Financial managers try to find the combination of securities that has the greatest overall appeal to investors—the combination that maximizes the market value of the firm. Before tackling this problem, we should check whether a policy that maximizes the total value of the firm's securities also maximizes the wealth of the shareholders.

Let $D$ and $E$ denote the market values of the outstanding debt and equity of the Wapshot Mining Company. Wapshot's 1,000 shares sell for \$50 apiece. Thus

$$E = 1{,}000 \times 50 = \$50{,}000$$

Wapshot has also borrowed \$25,000, and so $V$, the aggregate market value of all Wapshot's outstanding securities, is

$$V = D + E = \$75{,}000$$

Wapshot's stock is known as *levered equity*. Its stockholders face the benefits and costs of **financial leverage,** or *gearing*. Suppose that Wapshot "levers up" still further by borrowing an additional \$10,000 and paying the proceeds out to shareholders as a special dividend of \$10 per share. This substitutes debt for equity capital with no impact on Wapshot's assets.

What will Wapshot's equity be worth after the special dividend is paid? We have two unknowns, $E$ and $V$:

| | | |
|---|---|---|
| Old debt | \$25,000 | \$35,000 = $D$ |
| New debt | \$10,000 | |
| Equity | | ? = $E$ |
| Firm value | | ? = $V$ |

If $V$ is \$75,000 as before, then $E$ must be $V - D = 75{,}000 - 35{,}000 = \$40{,}000$. Stockholders have suffered a capital loss that exactly offsets the \$10,000 special dividend. But if $V$ *increases* to, say, \$80,000 as a result of the change in capital structure, then $E = \$45{,}000$ and the stockholders are \$5,000 ahead. In general, any increase or decrease in $V$ caused by a shift in capital structure accrues to the firm's stockholders. We conclude that a policy that maximizes the market value of the firm is also best for the firm's stockholders.

This conclusion rests on two important assumptions: first, that Wapshot can ignore payout policy and, second, that after the change in capital structure the old and new debt are *worth* \$35,000.

Payout policy may or may not be relevant, but there is no need to repeat the discussion of Chapter 16. We need only note that shifts in capital structure sometimes force important decisions about payout policy. Perhaps Wapshot's cash dividend has costs or benefits that should be considered in addition to any benefits achieved by its increased financial leverage.

Our second assumption that old and new debt ends up worth \$35,000 seems innocuous. But it could be wrong. Perhaps the new borrowing has increased the risk of the old bonds. If the holders of old bonds cannot demand a higher rate of interest to compensate for the increased risk, the value of their investment is reduced. In this case Wapshot's stockholders gain at the expense of the holders of old bonds even though the overall value of the firm is unchanged.

But this anticipates issues better left to Chapter 18. In this chapter we assume that any new issue of debt has no effect on the market value of existing debt.

## Enter Modigliani and Miller

Let us accept that the financial manager would like to find the combination of securities that maximizes the value of the firm. How is this done? MM's answer is that the financial manager should stop worrying: In a perfect market any combination of securities is as good as another. The value of the firm is unaffected by its choice of capital structure.[1]

You can see this by imagining two firms that generate the same stream of operating income and differ only in their capital structure. Firm U is unlevered. Therefore the total value of its equity $E_U$ is the same as the total value of the firm $V_U$. Firm, L, on the other hand, is levered. The value of its stock is, therefore, equal to the value of the firm less the value of the debt: $E_L = V_L - D_L$.

Now think which of these firms you would prefer to invest in. If you don't want to take much risk, you can buy common stock in the unlevered firm U. For example, if you buy 1% of firm U's shares, your investment is $.01V_U$ and you are entitled to 1% of the gross profits:

| Dollar Investment | Dollar Return |
|---|---|
| $.01V_U$ | $.01 \times$ Profits |

Now compare this with an alternative strategy. This is to purchase the same fraction of *both* the debt and the equity of firm L. Your investment and return would then be as follows:

| | Dollar Investment | Dollar Return |
|---|---|---|
| Debt | $.01D_L$ | $.01 \times$ Interest |
| Equity | $.01E_L$ | $.01 \times$ (Profits $-$ interest) |
| Total | $.01\,(D_L + E_L)$<br>$= .01V_L$ | $.01 \times$ Profits |

Both strategies offer the same payoff: 1% of the firm's profits. The law of one price tells us that in well-functioning markets two investments that offer the same payoff must have the same price. Therefore, $.01V_U$ must equal $.01V_L$: the value of the unlevered firm must equal the value of the levered firm.

Suppose that you are willing to run a little more risk. You decide to buy 1% of the outstanding shares in the *levered* firm. Your investment and return are now as follows:

| Dollar Investment | Dollar Return |
|---|---|
| $.01E_L$<br>$= .01(V_L - D_L)$ | $.01 \times$ (Profits $-$ interest) |

But there is an alternative strategy. This is to borrow $.01D_L$ on your own account and purchase 1% of the stock of the *unlevered* firm. In this case, your borrowing gives you an immediate cash *inflow* of $.01D_L$, but you have to pay interest on your loan equal to 1% of the interest that is paid by firm L. Your total investment and return are, therefore, as follows:

| | Dollar Investment | Dollar Return |
|---|---|---|
| Borrowing | $-.01D_L$ | $-.01 \times$ Interest |
| Equity | $.01V_U$ | $.01 \times$ Profits |
| Total | $.01(V_U - D_L)$ | $.01 \times$ (Profits $-$ interest) |

[1] F. Modigliani and M. H. Miller, "The Cost of Capital, Corporation Finance and the Theory of Investment," *American Economic Review* 48 (June 1958), pp. 261–297. MM's basic argument was anticipated in 1938 by J. B. Williams and to some extent by David Durand. See J. B. Williams, *The Theory of Investment Value* (Cambridge, MA: Harvard University Press, 1938) and D. Durand, "Cost of Debt and Equity Funds for Business: Trends and Problems of Measurement," *Conference on Research in Business Finance* (New York: National Bureau of Economic Research, 1952).

Again both strategies offer the same payoff: 1% of profits after interest. Therefore, both investments must have the same cost. The payoff $.01(V_U - D_L)$ must equal $.01(V_L - D_L)$ and $V_U$ must equal $V_L$.

It does not matter whether the world is full of risk-averse chickens or venturesome lions. All would agree that the value of the unlevered firm U must be equal to the value of the levered firm L. As long as investors can borrow or lend on their own account on the same terms as the firm, they can "undo" the effect of any changes in the firm's capital structure. This is the basis for MM's famous proposition 1: "The market value of any firm is independent of its capital structure."

## The Law of Conservation of Value

MM's argument that debt policy is irrelevant is an application of an astonishingly simple idea. If we have two streams of cash flow, $A$ and $B$, then the present value of $A + B$ is equal to the present value of $A$ plus the present value of $B$. We met this principle of *value additivity* in our discussion of capital budgeting, where we saw that the present value of two assets combined is equal to the sum of their present values considered separately.

In the present context we are not combining assets but splitting them up. But value additivity works just as well in reverse. We can slice a cash flow into as many parts as we like; the values of the parts will always sum back to the value of the unsliced stream. (Of course, we have to make sure that none of the stream is lost in the slicing. We cannot say, "The value of a pie is independent of how it is sliced," if the slicer is also a nibbler.)

This is really a *law of conservation of value.* The value of an asset is preserved regardless of the nature of the claims against it. Thus proposition 1: Firm value is determined on the *left-hand* side of the balance sheet by real assets—not by the proportions of debt and equity securities issued to buy the assets.

The simplest ideas often have the widest application. For example, we could apply the law of conservation of value to the choice between issuing preferred stock, common stock, or some combination. The law implies that the choice is irrelevant, assuming perfect capital markets and providing that the choice does not affect the firm's investment and operating policies. If the total value of the equity "pie" (preferred and common combined) is fixed, the firm's owners (its common stockholders) do not care how this pie is sliced.

The law also applies to the *mix* of debt securities issued by the firm. The choices of long-term versus short-term, secured versus unsecured, senior versus subordinated, and convertible versus nonconvertible debt all should have no effect on the overall value of the firm.

Combining assets and splitting them up will not affect values as long as they do not affect an investor's choice. When we showed that capital structure does not affect choice, we implicitly assumed that both companies and individuals can borrow and lend at the same risk-free rate of interest. As long as this is so, individuals can undo the effect of any changes in the firm's capital structure.

In practice corporate debt is not risk-free and firms cannot escape with rates of interest appropriate to a government security. Some people's initial reaction is that this alone invalidates MM's proposition. It is a natural mistake, but capital structure can be irrelevant even when debt is risky.

If a company borrows money, it does not *guarantee* repayment: It repays the debt in full only if its assets are worth more than the debt obligation. The shareholders in the company, therefore, have limited liability.

Many individuals would like to borrow with limited liability. They might, therefore, be prepared to pay a small premium for levered shares *if the supply of levered shares were* *insufficient to meet their needs.*[2] But there are literally thousands of common stocks of companies that borrow. Therefore it is unlikely that an issue of debt would induce them to pay a premium for *your* shares.[3]

## An Example of Proposition 1

Macbeth Spot Removers is reviewing its capital structure. Table 17.1 shows its current position. The company has no leverage and all the operating income is paid as dividends to the common stockholders (we assume still that there are no taxes). The expected earnings and dividends per share are $1.50, but this figure is by no means certain—it could turn out to be more or less than $1.50. The price of each share is $10. Since the firm expects to produce a level stream of earnings in perpetuity, the expected return on the share is equal to the earnings–price ratio, 1.50/10.00 = .15, or 15%.

Ms. Macbeth, the firm's president, has come to the conclusion that shareholders would be better off if the company had equal proportions of debt and equity. She therefore proposes to issue $5,000 of debt at an interest rate of 10% and use the proceeds to repurchase 500 shares. To support her proposal, Ms. Macbeth has analyzed the situation under different assumptions about operating income. The results of her calculations are shown in Table 17.2.

To see more clearly how leverage would affect earnings per share, Ms. Macbeth has also produced Figure 17.1. The brown line shows how earnings per share would vary with operating income under the firm's current all-equity financing. It is, therefore, simply a plot of the data in Table 17.1. The green line shows how earnings per share would vary given equal proportions of debt and equity. It is, therefore, a plot of the data in Table 17.2.

Ms. Macbeth reasons as follows: "It is clear that the effect of leverage depends on the company's income. If income is greater than $1,000, the return to the equityholder is *increased* by leverage. If it is less than $1,000, the return is *reduced* by leverage. The return is unaffected when operating income is exactly $1,000. At this point the return on the market value of the assets is 10%, which is exactly equal to the interest rate on the debt. Our capital structure decision, therefore, boils down to what we think about income prospects. Since we expect operating income to be above the $1,000 break-even point, I believe we can best help our shareholders by going ahead with the $5,000 debt issue."

**TABLE 17.1** Macbeth Spot Removers is entirely equity-financed. Although it expects to have an income of $1,500 a year in perpetuity, this income is not certain. This table shows the return to the stockholder under different assumptions about operating income. We assume no taxes.

| Data | | | | |
|---|---|---|---|---|
| Number of shares | 1,000 | | | |
| Price per share | $10 | | | |
| Market value of shares | $10,000 | | | |
| | | **Outcomes** | | |
| Operating income ($) | 500 | 1,000 | **1,500** | 2,000 |
| Earnings per share ($) | .50 | 1.00 | **1.50** | 2.00 |
| Return on shares (%) | 5 | 10 | **15** | 20 |
| | | | **Expected outcome** | |

[2] Of course, individuals could *create* limited liability if they chose. In other words, the lender could agree that borrowers need repay their debt in full only if the assets of company X are worth more than a certain amount. Presumably individuals don't enter into such arrangements because they can obtain limited liability more simply by investing in the stocks of levered companies.

[3] Capital structure is also irrelevant if each investor holds a fully diversified portfolio. In that case he or she owns *all* the risky securities offered by a company (both debt and equity). But anybody who owns *all* the risky securities doesn't care about how the cash flows are divided among different securities.

| Data | | | | |
|---|---|---|---|---|
| Number of shares | 500 | | | |
| Price per share | $10 | | | |
| Market value of shares | $5,000 | | | |
| Market value of debt | $5,000 | | | |
| Interest at 10% | $500 | | | |
| **Outcomes** | | | | |
| Operating income ($) | 500 | 1,000 | **1,500** | 2,000 |
| Interest ($) | 500 | 500 | **500** | 500 |
| Equity earnings ($) | 0 | 500 | **1,000** | 1,500 |
| Earnings per share ($) | 0 | 1 | **2** | 3 |
| Return on shares (%) | 0 | 10 | **20** | 30 |
| | | | **Expected outcome** | |

**TABLE 17.2** Macbeth Spot Removers is wondering whether to issue $5,000 of debt at an interest rate of 10% and repurchase 500 shares. This table shows the return to the shareholder under different assumptions about operating income.

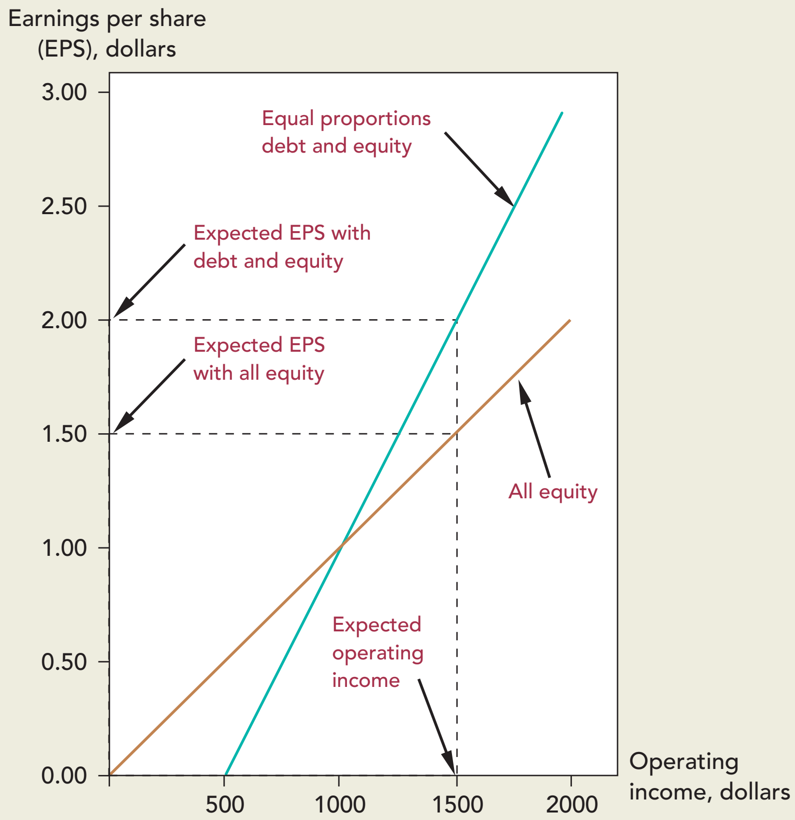



**FIGURE 17.1** Borrowing increases Macbeth's EPS (earnings per share) when operating income is greater than $1,000 and reduces EPS when operating income is less than $1,000. Expected EPS rises from $1.50 to $2.

As financial manager of Macbeth Spot Removers, you reply as follows: "I agree that leverage will help the shareholder as long as our income is greater than $1,000. But your argument ignores the fact that Macbeth's shareholders have the alternative of borrowing on their own account. For example, suppose that an investor borrows $10 and then invests $20 in two unlevered Macbeth shares. This person has to put up only $10 of his or her own

**TABLE 17.3**
Individual investors can replicate Macbeth's leverage.

| | Operating Income ($) | | | |
|---|---|---|---|---|
| | **500** | **1,000** | **1,500** | **2,000** |
| Earnings on two shares ($) | 1 | 2 | **3** | 4 |
| *Less* interest at 10% ($) | 1 | 1 | **1** | 1 |
| Net earnings on investment ($) | 0 | 1 | **2** | 3 |
| Return on $10 investment (%) | 0 | 10 | **20** | 30 |
| | | | **Expected outcome** | |

money. The payoff on the investment varies with Macbeth's operating income, as shown in Table 17.3. This is exactly the same set of payoffs as the investor would get by buying one share in the levered company. [Compare the last two lines of Tables 17.2 and 17.3.] Therefore, a share in the levered company must also sell for $10. If Macbeth goes ahead and borrows, it will not allow investors to do anything that they could not do already, and so it will not increase value."

The argument that you are using is exactly the same as the one MM used to prove proposition 1.

## 17-2 Financial Risk and Expected Returns

Consider now the implications of MM's proposition 1 for the expected returns on Macbeth stock:

| | Current Structure: All Equity | Proposed Structure: Equal Debt and Equity |
|---|---|---|
| Expected earnings per share ($) | 1.50 | 2.00 |
| Price per share ($) | 10 | 10 |
| Expected return on share (%) | 15 | 20 |

Leverage increases the expected stream of earnings per share but *not* the share price. The reason is that the change in the expected earnings stream is exactly offset by a change in the rate at which the earnings are discounted. The expected return on the share (which for a perpetuity is equal to the earnings–price ratio) increases from 15% to 20%. We now show how this comes about.

The expected return on Macbeth's assets $r_A$ is equal to the expected operating income divided by the total market value of the firm's securities:

$$\text{Expected return on assets} = r_A = \frac{\text{expected operating income}}{\text{market value of all securities}}$$

We have seen that in perfect capital markets the company's borrowing decision does not affect *either* the firm's operating income *or* the total market value of its securities. Therefore the borrowing decision also does not affect the expected return on the firm's assets $r_A$.

Suppose that an investor holds all of a company's debt and all of its equity. This investor is entitled to all the firm's operating income; therefore, the expected return on the portfolio is just $r_A$.

The expected return on a portfolio is equal to a weighted average of the expected returns on the individual holdings. Therefore the expected return on a portfolio consisting of *all* the firm's securities is

$$\text{Expected return on assets} = (\text{proportion in debt} \times \text{expected return on debt}) + (\text{proportion in equity} \times \text{expected return on equity})$$

$$r_A = \left(\frac{D}{D+E} \times r_D\right) + \left(\frac{E}{D+E} \times r_E\right)$$

This formula is of course an old friend from Chapter 9. The overall expected return $r_A$ is called the *company cost of capital* or the *weighted-average cost of capital* (WACC).

We can turn the formula around to solve for $r_E$, the expected return to equity for a levered firm:

$$\text{Expected return on equity} = \text{expected return on assets} + (\text{expected return on assets} - \text{expected return on debt}) \times \text{debt–equity ratio}$$

$$r_E = r_A + (r_A - r_D)\frac{D}{E}$$

## Proposition 2

This is MM's proposition 2: The expected rate of return on the common stock of a levered firm increases in proportion to the debt–equity ratio ($D/E$), expressed in market values; the rate of increase depends on the spread between $r_A$, the expected rate of return on a portfolio of all the firm's securities, and $r_D$, the expected return on the debt. Note that $r_E = r_A$ if the firm has no debt.

We can check out this formula for Macbeth Spot Removers. Before the decision to borrow

$$r_E = r_A = \frac{\text{expected operating income}}{\text{market value of all securities}}$$

$$= \frac{1{,}500}{10{,}000} = .15, \text{ or } 15\%$$

If the firm goes ahead with its plan to borrow, the expected return on assets $r_A$ is still 15%. The expected return on equity is

$$r_E = r_A + (r_A - r_D)\frac{D}{E}$$

$$= .15 + (.15 - .10)\frac{5{,}000}{5{,}000} = .20, \text{ or } 20\%$$

When the firm was unlevered, equity investors demanded a return of $r_A$. When the firm is levered, they require a premium of $(r_A - r_D)D/E$ to compensate for the extra risk.

MM's proposition 1 says that financial leverage has no effect on shareholders' wealth. Proposition 2 says that the rate of return they can expect to receive on their shares increases as the firm's debt–equity ratio increases. How can shareholders be indifferent to increased leverage when it increases expected return? The answer is that any increase in expected return is exactly offset by an increase in risk and therefore in shareholders' *required* rate of return.

Look at what happens to the risk of Macbeth shares if it moves to equal debt–equity proportions. Table 17.4 shows how a shortfall in operating income affects the payoff to the shareholders.

| If operating income falls from | | $1,500 | to | $500 | Change |
|---|---|---|---|---|---|
| No debt: | Earnings per share | $1.50 | | $.50 | −$1.00 |
| | Return | 15% | | 5% | −10% |
| 50% debt: | Earnings per share | $2.00 | | 0 | −$2.00 |
| | Return | 20% | | 0 | −20% |

**TABLE 17.4** Financial leverage increases the risk of Macbeth shares. A $1,000 drop in operating income reduces earnings per share by $1 with all-equity financing, but by $2 with 50% debt.

The debt–equity proportion does not affect the *dollar* risk borne by equityholders. Suppose operating income drops from $1,500 to $500. Under all-equity financing, equity earnings drop by $1 per share. There are 1,000 outstanding shares, and so *total* equity earnings fall by $1 × 1,000 = $1,000. With 50% debt, the same drop in operating income reduces earnings per share by $2. But there are only 500 shares outstanding, and so total equity income drops by $2 × 500 = $1,000, just as in the all-equity case.

However, the debt–equity choice does amplify the spread of *percentage* returns. If the firm is all-equity-financed, a decline of $1,000 in the operating income reduces the return on the shares by 10%. If the firm issues risk-free debt with a fixed interest payment of $500 a year, then a decline of $1,000 in the operating income reduces the return on the shares by 20%. In other words, the effect of the proposed leverage is to double the amplitude of the swings in Macbeth's shares. Whatever the beta of the firm's shares before the refinancing, it would be twice as high afterward.

Now you can see why investors require higher returns on levered equity. The required return simply rises to match the increased risk.

## EXAMPLE 17.1 ● Leverage and the Cost of Equity

Let us revisit a numerical example from Chapter 9. We looked at a company with the following market-value balance sheet:

| | | | | |
|---|---|---|---|---|
| Asset value | 100 | Debt ($D$) | 30 | at $r_D = 7.5\%$ |
| | | Equity ($E$) | 70 | at $r_E = 15\%$ |
| Asset value | 100 | Firm value ($V$) | 100 | |

and an overall cost of capital of:

$$r_A = r_D\frac{D}{V} + r_E\frac{E}{V}$$

$$= \left(7.5 \times \frac{30}{100}\right) + \left(15 \times \frac{70}{100}\right) = 12.75\%$$

If the firm is contemplating investment in a project that has the same risk as the firm's existing business, the opportunity cost of capital for this project is the same as the firm's cost of capital; in other words, it is 12.75%.

What would happen if the firm issued an additional 10 of debt and used the cash to repurchase 10 of its equity? The revised market-value balance sheet is

| | | | |
|---|---|---|---|
| Asset value | 100 | Debt (*D*) | 40 |
| | | Equity (*E*) | 60 |
| Asset value | 100 | Firm value (*V*) | 100 |

The change in financial structure does not affect the amount or risk of the cash flows on the total package of debt and equity. Therefore, if investors required a return of 12.75% on the total package before the refinancing, they must require a 12.75% return on the firm's assets afterward.

Although the required return on the *package* of debt and equity is unaffected, the change in financial structure does affect the required return on the individual securities. Since the company has more debt than before, the debtholders are likely to demand a higher interest rate. Suppose that the expected return on the debt rises to 7.875%. Now you can write down the basic equation for the return on assets

$$r_A = r_D \frac{D}{V} + r_E \frac{E}{V}$$

$$= \left(7.875 \times \frac{40}{100}\right) + \left(r_E \times \frac{60}{100}\right) = 12.75\%$$

and solve for the return on equity $r_E = 16.0\%$.

Increasing the amount of debt increased debtholder risk and led to a rise in the return that debtholders required ($r_{\text{debt}}$ rose from 7.5 to 7.875%). The higher leverage also made the equity riskier and increased the return that shareholders required ($r_E$ rose from 15% to 16%). The weighted-average return on debt and equity remained at 12.75%:

$$r_A = (r_D \times .4) + (r_E \times .6)$$

$$= (7.875 \times .4) + (16 \times 6) = 12.75\%$$

Suppose that the company decided instead to repay all its debt and to replace it with equity. In that case all the cash flows would go to the equityholders. The company cost of capital, $r_A$, would stay at 12.75%, and $r_E$ would also be 12.75%.

## How Changing Capital Structure Affects Beta

We have looked at how changes in financial structure affect expected return. Let us now look at the effect on beta.

The stockholders and debtholders both receive a share of the firm's cash flows, and both bear part of the risk. For example, if the firm's assets turn out to be worthless, there will be no cash to pay stockholders or debtholders. But debtholders usually bear much less risk than stockholders. Debt betas of large firms are typically in the range of .1 to .3.

If you owned a portfolio of all the firm's securities, you wouldn't share the cash flows with anyone. You wouldn't share the risks with anyone either; you would bear them all. Thus the firm's asset beta is equal to the beta of a portfolio of all the firm's debt and its equity.

The beta of this hypothetical portfolio is just a weighted average of the debt and equity betas:

$$\beta_A = \beta_{\text{portfolio}} = \beta_D \frac{D}{V} + \beta_E \frac{E}{V}$$

Think back to our example. If the debt before the refinancing has a beta of .1 and the equity has a beta of 1.1, then

$$\beta_A = \left(.1 \times \frac{30}{100}\right) + \left(1.1 \times \frac{70}{100}\right) = .8$$

What happens after the refinancing? The risk of the total package is unaffected, but both the debt and the equity are now more risky. Suppose that the debt beta increases to .2. We can work out the new equity beta:

$$\beta_A = \beta_{\text{portfolio}} = \beta_D \frac{D}{V} + \beta_E \frac{E}{V}$$

$$.8 = \left(.2 \times \frac{40}{100}\right) + \left(\beta_E \times \frac{60}{100}\right)$$

$$\beta_E = 1.2$$

Our example shows how borrowing creates financial leverage or gearing. Financial leverage does not affect the risk or the expected return on the firm's assets, but it does push up the risk of the common stock. Shareholders demand a correspondingly higher return because of this *financial risk.*

Now you can see how to *unlever* betas, that is, how to go from an observed $\beta_E$ to $\beta_A$. You have the equity beta, say, 1.2. You also need the debt beta, say, .2, and the relative market values of debt ($D/V$) and equity ($E/V$). If debt accounts for 40% of overall value $V$, then the unlevered beta is

$$\beta_A = \left(.2 \times \frac{40}{100}\right) + \left(1.2 \times \frac{60}{100}\right) = .8$$

This runs the previous example in reverse. Just remember the basic relationship:

$$\beta_A = \beta_{\text{portfolio}} = \beta_D\left(\frac{D}{V}\right) + \beta_E\left(\frac{E}{V}\right)$$

MM's propositions warn us that higher leverage increases both expected equity returns and equity risk. It does *not* increase shareholder value. Having worked through the example of Macbeth, this much should now seem obvious. But watch out for hidden changes in leverage, such as a decision to lease new equipment or to underfund the pension scheme. Do not interpret any resultant increase in the expected equity return as creating additional shareholder value.

## 17-3 The Weighted-Average Cost of Capital

What did financial experts think about debt policy before MM? It is not easy to say because with hindsight we see that they did not think too clearly.[4] However, a "traditional" position emerged in response to MM. To understand it, we have to return to the weighted-average cost of capital.

Figure 17.2 sums up the implications of MM's propositions for the costs of debt and equity and the weighted-average cost of capital. The figure assumes that the firm's bonds are essentially risk-free at low debt levels. Thus $r_D$ is independent of $D/E$, and $r_E$ increases linearly as $D/E$ increases. As the firm borrows more, the risk of default increases and the firm is required to pay higher rates of interest. Proposition 2 predicts that when this occurs

[4] Financial economists in 20 years may remark on Brealey, Myers, and Allen's blind spots and clumsy reasoning. On the other hand, they may not remember us at all.

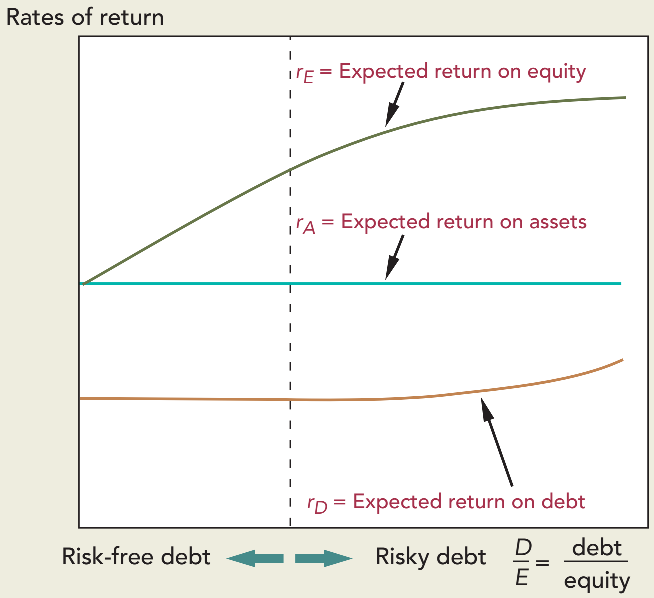



**FIGURE 17.2**

MM's proposition 2. The expected return on equity $r_E$ increases linearly with the debt–equity ratio so long as debt is risk-free. But if leverage increases the risk of the debt, debtholders demand a higher return on the debt. This causes the rate of increase in $r_E$ to slow down.

the rate of increase in $r_E$ slows down. This is also shown in Figure 17.2. The more debt the firm has, the less sensitive $r_E$ is to further borrowing.

Why does the slope of the $r_E$ line in Figure 17.2 taper off as $D/E$ increases? Essentially because holders of risky debt bear some of the firm's business risk. As the firm borrows more, more of that risk is transferred from stockholders to bondholders.

## Two Warnings

Sometimes the objective in financing decisions is stated not as "maximize overall market value" but as "minimize the weighted-average cost of capital." If MM's proposition 1 holds, then these are equivalent objectives. If MM's proposition 1 does *not* hold, then the capital structure that maximizes the value of the firm also minimizes the weighted-average cost of capital, *provided* that operating income is independent of capital structure. Remember that the weighted-average cost of capital is the expected rate of return on the market value of all of the firm's securities. Anything that increases the value of the firm reduces the weighted-average cost of capital if operating income is constant. But if operating income is varying too, all bets are off.

In Chapter 18 we show that financial leverage can affect operating income in several ways. Therefore maximizing the value of the firm is *not* always equivalent to minimizing the weighted-average cost of capital.

**Warning 1** Shareholders want management to increase the firm's value. They are more interested in being rich than in owning a firm with a low weighted-average cost of capital.

**Warning 2** Trying to minimize the weighted-average cost of capital seems to encourage logical short circuits like the following. Suppose that someone says, "Shareholders demand—and deserve—higher expected rates of return than bondholders do. Therefore debt is the cheaper capital source. We can reduce the weighted-average cost of capital by borrowing more." But this doesn't follow if the extra borrowing leads stockholders to demand a still higher expected rate of return. According to MM's proposition 2 the cost of equity capital $r_E$ increases by just enough to keep the weighted-average cost of capital constant.

This is not the only logical short circuit you are likely to encounter. We have cited two more in Problem 15 at the end of this chapter.

## Rates of Return on Levered Equity—The Traditional Position

You may ask why we have even mentioned the aim of minimizing the weighted-average cost of capital if it is often wrong or confusing. We had to because the traditionalists accept this objective and argue their case in terms of it.

The logical short circuit we just described rested on the assumption that $r_E$, the expected rate of return demanded by stockholders, does not rise, or rises very slowly, as the firm borrows more. Suppose, just for the sake of argument, that this is true. Then $r_A$, the weighted-average cost of capital, must decline as the debt–equity ratio rises.

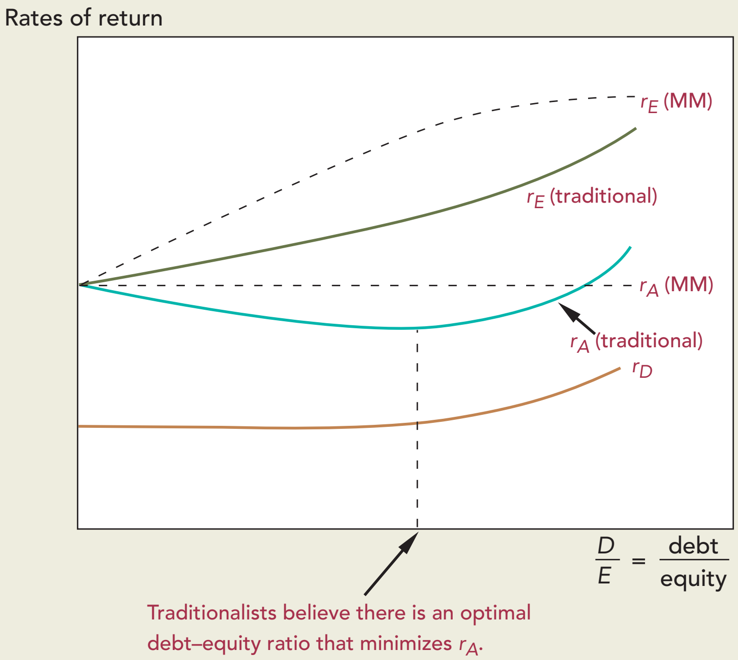
The traditionalists' position is shown in Figure 17.3. They say that a moderate degree of financial leverage may increase the expected equity return $r_E$, but not as much as predicted by MM's proposition 2. But irresponsible firms that borrow *excessively* find $r_E$ shooting up *faster* than MM predict. Therefore the weighted-average cost of capital declines at first, then rises. It reaches a minimum at some intermediate debt ratio. Remember that minimizing the weighted-average cost of capital is equivalent to maximizing firm value if operating income is not affected by borrowing.

Two arguments could be advanced in support of this position. First, perhaps investors do not notice or appreciate the financial risk created by moderate borrowing, although they wake up when debt is "excessive." If so, stockholders in moderately leveraged firms may accept a lower rate of return than they really should.

That seems naive.[5] The second argument is better. It accepts MM's reasoning as applied to perfect capital markets but holds that actual markets are imperfect. Because

**FIGURE 17.3**

The dashed lines show MM's view of the effect of leverage on the expected return on equity $r_E$ and the weighted-average cost of capital $r_A$. (See Figure 17.2.) The solid lines show the traditional view. Traditionalists say that borrowing at first increases $r_E$ more slowly than MM predict but that $r_E$ shoots up with excessive borrowing. If so, the weighted-average cost of capital can be minimized if you use just the right amount of debt.




[5] This first argument may reflect a confusion between financial risk and the risk of default. Default is not a serious threat when borrowing is moderate; stockholders worry about it only when the firm goes "too far." But stockholders bear financial risk—in the form of increased volatility of rates of return and a higher beta—even when the chance of default is nil.

of these imperfections, firms that borrow may provide a valuable service for investors. If so, levered shares might trade at premium prices compared to their theoretical values in perfect markets.

Suppose that corporations can borrow more cheaply than individuals. Then it would pay investors who want to borrow to do so indirectly by holding the stock of levered firms. They would be willing to live with expected rates of return that do not fully compensate them for the business and financial risk they bear.

Is corporate borrowing really cheaper? It's hard to say. Interest rates on home mortgages are not too different from rates on high-grade corporate bonds.[6] Rates on margin debt (borrowing from a stockbroker with the investor's shares tendered as security) are not too different from the rates firms pay banks for short-term loans.

There are some individuals who face relatively high interest rates, largely because of the costs lenders incur in making and servicing small loans. There are economies of scale in borrowing. A group of small investors could do better by borrowing via a corporation, in effect pooling their loans and saving transaction costs.[7]

Suppose that this class of investors is large, both in number and in the aggregate wealth it brings to capital markets. That creates a clientele for whom corporate borrowing is better than personal borrowing. That clientele would, in principle, be willing to pay a premium for the shares of a levered firm.

But maybe it doesn't *have* to pay a premium. Perhaps smart financial managers long ago recognized this clientele and shifted the capital structures of their firms to meet its needs. The shifts would not have been difficult or costly. But if the clientele is now satisfied, it no longer needs to pay a premium for levered shares. Only the financial managers who *first* recognized the clientele extracted any advantage from it.

Maybe the market for corporate leverage is like the market for automobiles. Americans need millions of automobiles and are willing to pay thousands of dollars apiece for them. But that doesn't mean that you could strike it rich by going into the automobile business. You're at least 80 years too late.

## Today's Unsatisfied Clienteles Are Probably Interested in Exotic Securities

So far we have made little progress in identifying cases where firm value might plausibly depend on financing. But our examples illustrate what smart financial managers look for. They look for an *unsatisfied* clientele, investors who want a particular kind of financial instrument but because of market imperfections can't get it or can't get it cheaply.

MM's proposition 1 is violated when the firm, by imaginative design of its capital structure, can offer some *financial service* that meets the needs of such a clientele. Either the service must be new and unique or the firm must find a way to provide some old service more cheaply than other firms or financial intermediaries can.

Now, is there an unsatisfied clientele for garden-variety debt or levered equity? We doubt it. But perhaps you can invent an exotic security and uncover a latent demand for it.

In the next several chapters we will encounter a number of new securities that have been invented by companies and advisers. These securities take the company's basic cash flows

[6] One of the authors once obtained a home mortgage at a rate 1/2 percentage point *less* than the contemporaneous yield on long-term AAA bonds.

[7] Even here there are alternatives to borrowing on personal account. Investors can draw down their savings accounts or sell a portion of their investment in bonds. The impact of reductions in lending on the investor's balance sheet and risk position is exactly the same as increases in borrowing.

and repackage them in ways that are thought to be more attractive to investors. However, while inventing these new securities is easy, it is more difficult to find investors who will rush to buy them.

## Imperfections and Opportunities

The most serious capital market imperfections are often those created by government. An imperfection that supports a violation of MM's proposition 1 *also* creates a money-making opportunity. Firms and intermediaries will find some way to reach the clientele of investors frustrated by the imperfection.

For many years the U.S. government imposed a limit on the rate of interest that could be paid on savings accounts. It did so to protect savings institutions by limiting competition for their depositors' money. The fear was that depositors would run off in search of higher yields, causing a cash drain that savings institutions would not be able to meet.

These regulations created an opportunity for firms and financial institutions to design new savings schemes that were not subject to the interest-rate ceilings. One invention was the *floating-rate note,* first issued in 1974 by Citicorp, and with terms designed to appeal to individual investors. Floating-rate notes are medium-term debt securities whose interest payments "float" with short-term interest rates. On the Citicorp issue, for example, the coupon rate used to calculate each semiannual interest payment was set at 1 percentage point above the contemporaneous yield on Treasury bills. The holder of the Citicorp note was therefore protected against fluctuating interest rates, because Citicorp sent a larger check when interest rates rose (and, of course, a smaller check when rates fell).

Citicorp evidently found an untapped clientele of investors, for it was able to raise $650 million in the first offering. The success of the issue suggests that Citicorp was able to add value by changing its capital structure. However, other companies were quick to jump on Citicorp's bandwagon, and within five months an additional $650 million of floating-rate notes were issued by other companies. By the mid-1980s about $43 billion of floating-rate securities were outstanding, and now floating-rate debt securities seem ubiquitous.

Interest-rate regulation also provided financial institutions with an opportunity to create value by offering money-market funds. These are mutual funds invested in Treasury bills, commercial paper, and other high-grade, short-term debt instruments. Any saver with a few thousand dollars to invest can gain access to these instruments through a money-market fund and can withdraw money at any time by writing a check against his or her fund balance. Thus the fund resembles a checking or savings account that pays close to market interest rates. These money-market funds have become enormously popular. By 2009 their assets had risen to $3.7 trillion.[8]

Long before interest-rate ceilings were finally removed, most of the gains had gone out of issuing the new securities to individual investors. Once the clientele was finally satisfied, MM's proposition 1 was restored (until the government creates a new imperfection). The moral of the story is this: If you ever find an unsatisfied clientele, do something right away, or capital markets will evolve and steal it from you.

This is actually an encouraging message for the economy as a whole. If MM are right, investors' demands for different types of securities are satisfied at minimal cost. The cost

[8] Money-market funds are not totally safe. In 2008 the Reserve Primary Fund incurred heavy losses on its holdings of Lehman Brothers debt and became only the second money-market fund in history to "break the buck" by paying investors 97 cents in the dollar.

of capital will reflect only business risk. Capital will flow to companies with positive-NPV investments, regardless of the companies' capital structures. This is the efficient outcome.

## 17-4 A Final Word on the After-Tax Weighted-Average Cost of Capital

MM left us a simple message. When the firm changes its mix of debt and equity securities, the risk and expected returns of these securities change, but the company's overall cost of capital does not change.

Now if you think that message is too neat and simple, you're right. The complications are spelled out in the next two chapters. But we must note one complication here: Interest paid on a firm's borrowing can be deducted from taxable income. Thus the *after-tax* cost of debt is $r_D(1 - T_c)$, where $T_c$ is the marginal corporate tax rate. So, when companies discount an average-risk project, they do not use the company cost of capital as we have just computed it. Instead they use the after-tax cost of debt to compute the after-tax weighted-average cost of capital or WACC:

$$\text{After-tax WACC} = r_D(1 - T_c)\frac{D}{V} + r_E\frac{E}{V}$$

We briefly introduced this formula in Chapter 9, where we used it to estimate the weighted-average cost of capital for Union Pacific. In 2009 Union Pacific's long-term borrowing rate was $r_D = 7.8\%$, and its estimated cost of equity was $r_E = 9.9\%$. With a 35% corporate tax rate, the after-tax cost of debt was $r_D(1 - T_c) = 7.8(1 - .35) = 5.1\%$. The ratio of debt to overall company value was $D/V = 31.5\%$. Therefore

$$\begin{aligned}\text{After-tax WACC} &= r_D(1 - T_c)\frac{D}{V} + r_E\frac{E}{V} \\ &= (1 - .35) \times 7.8 \times .315 + 9.9 \times .685 = 8.4\%\end{aligned}$$

MM's proposition 2 states that *in the absence of taxes* the company cost of capital stays the same regardless of the amount of leverage. But, if companies receive a tax shield on their interest payments, then the after-tax WACC declines as debt increases. This is illustrated in Figure 17.4, which shows how Union Pacific's WACC changes as the debt–equity ratio changes.

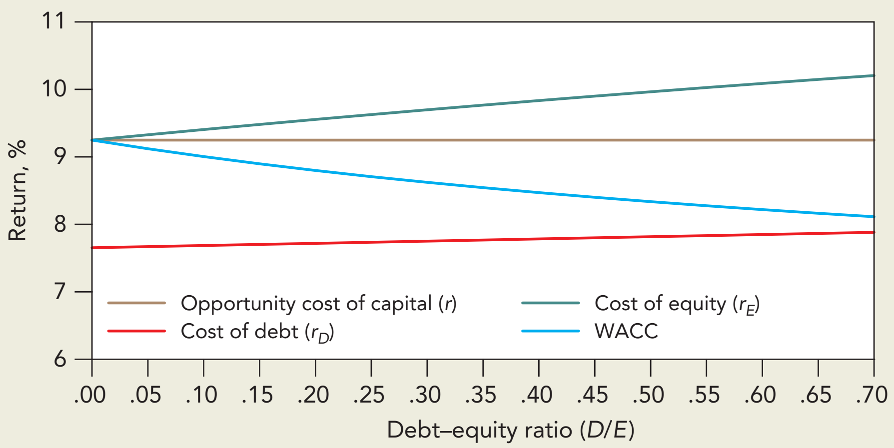



**FIGURE 17.4**

Estimated after-tax WACC for Union Pacific at different debt–equity ratios. The figure assumes $r_E = 9.9\%$ at a 31.5% debt ratio (equivalent to a 46% debt–equity ratio) and a borrowing rate of $r_D = 7.8\%$. Notice that the debt interest rate is assumed to increase with the debt–equity ratio.

## SUMMARY

Think of the financial manager as taking all of the firm's real assets and selling them to investors as a package of securities. Some financial managers choose the simplest package possible: all-equity financing. Some end up issuing dozens of debt and equity securities. The problem is to find the particular combination that maximizes the market value of the firm.

Modigliani and Miller's (MM's) famous proposition 1 states that no combination is better than any other—that the firm's overall market value (the value of all its securities) is independent of capital structure. Firms that borrow do offer investors a more complex menu of securities, but investors yawn in response. The menu is redundant. Any shift in capital structure can be duplicated or "undone" by investors. Why should they pay extra for borrowing indirectly (by holding shares in a levered firm) when they can borrow just as easily and cheaply on their own accounts?

MM agree that borrowing raises the expected rate of return on shareholders' investments. But it also increases the risk of the firm's shares. MM show that the higher risk exactly offsets the increase in expected return, leaving stockholders no better or worse off.

Proposition 1 is an extremely general result. It applies not just to the debt–equity tradeoff but to *any* choice of financing instruments. For example, MM would say that the choice between long-term and short-term debt has no effect on firm value.

The formal proofs of proposition 1 all depend on the assumption of perfect capital markets. MM's opponents, the "traditionalists," argue that market imperfections make personal borrowing excessively costly, risky, and inconvenient for some investors. This creates a natural clientele willing to pay a premium for shares of levered firms. The traditionalists say that firms should borrow to realize the premium.

But this argument is incomplete. There may be a clientele for levered equity, but that is not enough; the clientele has to be *unsatisfied.* There are already thousands of levered firms available for investment. Is there still an unsatiated clientele for garden-variety debt and equity? We doubt it.

Proposition 1 is violated when financial managers find an untapped demand and satisfy it by issuing something new and different. The argument between MM and the traditionalists finally boils down to whether this is difficult or easy. We lean toward MM's view: Finding unsatisfied clienteles and designing exotic securities to meet their needs is a game that's fun to play but hard to win.

If MM are right, the overall cost of capital—the expected rate of return on a portfolio of all the firm's outstanding securities—is the same regardless of the mix of securities issued to finance the firm. The overall cost of capital is usually called the company cost of capital or the weighted-average cost of capital (WACC). MM say that WACC doesn't depend on capital structure. But MM assume away lots of complications. The first complication is taxes. When we recognize that debt interest is tax-deductible, and compute WACC with the after-tax interest rate, WACC declines as the debt ratio increases. There is more—lots more—on taxes and other complications in the next two chapters.

## FURTHER READING

*The fall 1988 issue of the* Journal of Economic Perspectives *contains a collection of articles, including one by Modigliani and Miller, which review and assess the MM propositions. The summer 1989 issue of* Financial Management *contains three more articles under the heading "Reflections on the MM Propositions 30 Years Later."*

*Two surveys of financial innovation include:*

K. A. Karow, G. R. Erwin, and J. J. McConnell, "Survey of U.S. Corporate Financing Innovations: 1970–1997," *Journal of Applied Corporate Finance* 12 (Spring 1999), pp. 55–69.

P. Tufano, "Financial Innovation," in G. M. Constantinides, M. Harris, and R. Stulz (eds.), *Handbook of the Economics of Finance,* Vol 1A (Amsterdam: Elsevier/North-Holland, 2003).