Principles *of* Corporate Finance

THIRTEENTH EDITION

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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's shareholders do not gain or lose from payout policy and, second, that after the change in capital structure the old and new debt are together *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 plus 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 equity 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 $0.01V_U$ and you are entitled to 1% of the gross profits:

Dollar Investment	Dollar Return
$0.01V_U$	$0.01 \times$ 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 are then:

	Dollar Investment	Dollar Return
Debt	$0.01D_L$	$0.01 \times$ Interest
Equity	$0.01E_L$	$0.01 \times$ (Profits – interest)
Total	$0.01(D_L + E_L)$	$0.01 \times$ Profits
	$= 0.01V_L$	

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, $0.01V_U$ must equal $0.01V_L$: 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:

Dollar Investment	Dollar Return
$0.01E_L$	$0.01 \times$ (Profits – interest)
$= 0.01(V_L - D_L)$	

Again, 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.[2] In this case, your strategy gives you 1% of

[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, pp. 215–262).

[2] Rather than borrow on your own account, you might be able to lend $.01\,D_L$ less than you currently do. The effect is the same.

the profits from V_U, 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 net return are:

	Dollar Investment	Dollar Return
Borrowing	$-0.01D_L$	$-0.01 \times$ Interest
Equity	$0.01V_U$	$0.01 \times$ Profits
Total	$0.01(V_U - D_L)$	$0.01 \times$ (Profits – interest)

Again, both strategies offer the same payoff: 1% of profits after interest. Therefore, both investments must have the same cost. The investment $0.01(V_U - D_L)$ must equal $0.01(V_L - D_L)$ 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 how MM arrived at their 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. That's common sense: If you have a dollar in your left pocket and a dollar in your right, your total wealth is \$2. 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 raising \$100 million by 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 equity 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 investors' choices. 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 premium for levered shares *if the supply of levered shares were insufficient to meet their needs.*[3] 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.[4]

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. Because 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 concluded 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 illustrate 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

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 (\$)	0.50	1.00	1.50	2.00
Return on shares (%)	5	10	15	20
			Expected outcome	

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.

[3] Of course, individuals could *create* limited liability if they chose. In other words, the lender could agree that borrowers need to 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.

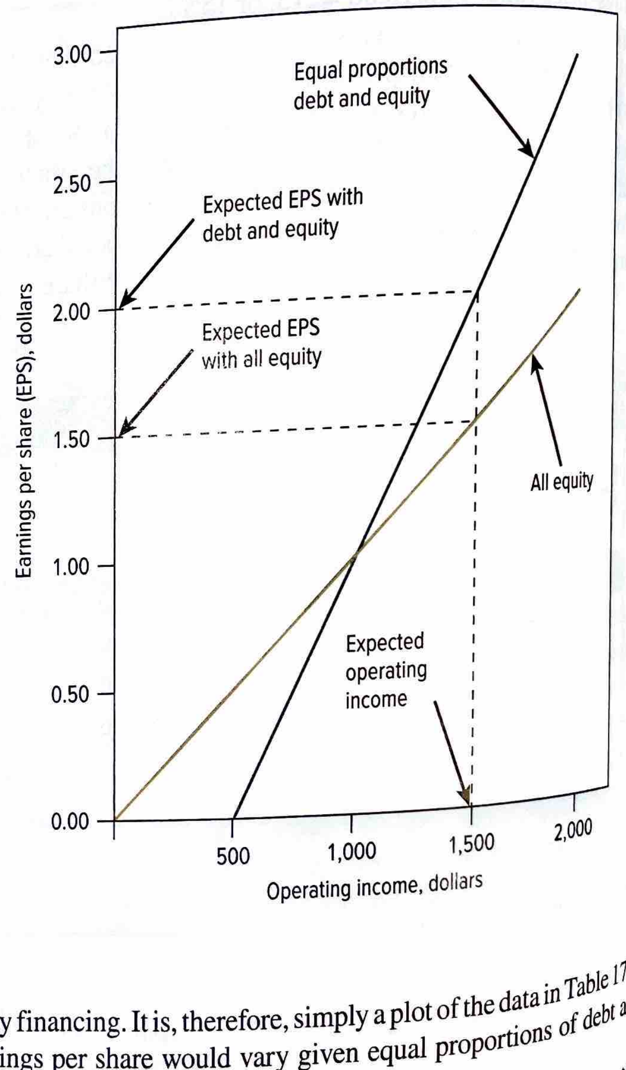
[4] Capital structure is also irrelevant if each investor holds a fully diversified portfolio. In that case he or she owns *all* the risky securities offered by a company (both debt and equity). But anybody who owns *all* the risky securities doesn't care about how the cash flows are divided among different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

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.

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	

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.



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*

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	

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 the company's 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."

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 puts up $10 of his or her own money, borrows a further $10, and then invests the total in two unlevered Macbeth shares. 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%, but 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.

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.

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

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 financial risk and therefore in shareholders' *required* rate of return.

You can see financial risk at work in our Macbeth example. Compare the risk of earnings per share in Table 17.2 versus Table 17.1. Or look at Table 17.4, which shows how a shortfall in operating income affects the payoff to the shareholders. If the firm is all-equity-financed, a decline of $1,000 in the operating income reduces the return on the shares by 10 percentage points. 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 percentage points. 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 financial risk.

Leverage and the Cost of Equity

Consider a company with the following market-value balance sheet:

Asset value	$100	Debt (*D*)	$33.3	at $r_D = 7.25\%$
		Equity (*E*)	$66.7	at $r_E = 15.5\%$
Asset value	$100	Firm value (*V*)	$100	

and an overall cost of capital of

$$r_A = r_D\, D/V + r_E\, E/V$$
$$= (7.25 \times 33.3/100) + (15.5 \times 66.7/100) = 12.75\%$$

If the firm is considering a project that has the same risk as the firm's existing business, the appropriate discount rate for the cash flows is 12.75%, the firm's cost of capital.

Suppose the firm changes its capital structure by issuing more debt and using the proceeds to repurchase stock. The implications of MM's Proposition 2 are shown in Figure 17.2. The required return on equity increases with the debt-equity ratio (*D/E*).[5] Yet, no matter how much

[5] Note that the firm's debt ratio (D/V) of .333 corresponds to a debt-equity ratio (D/E) of .333/.667 = .5. Figure 17.2 shows that the required return on equity is 15.5% when the debt-equity ratio = .5.

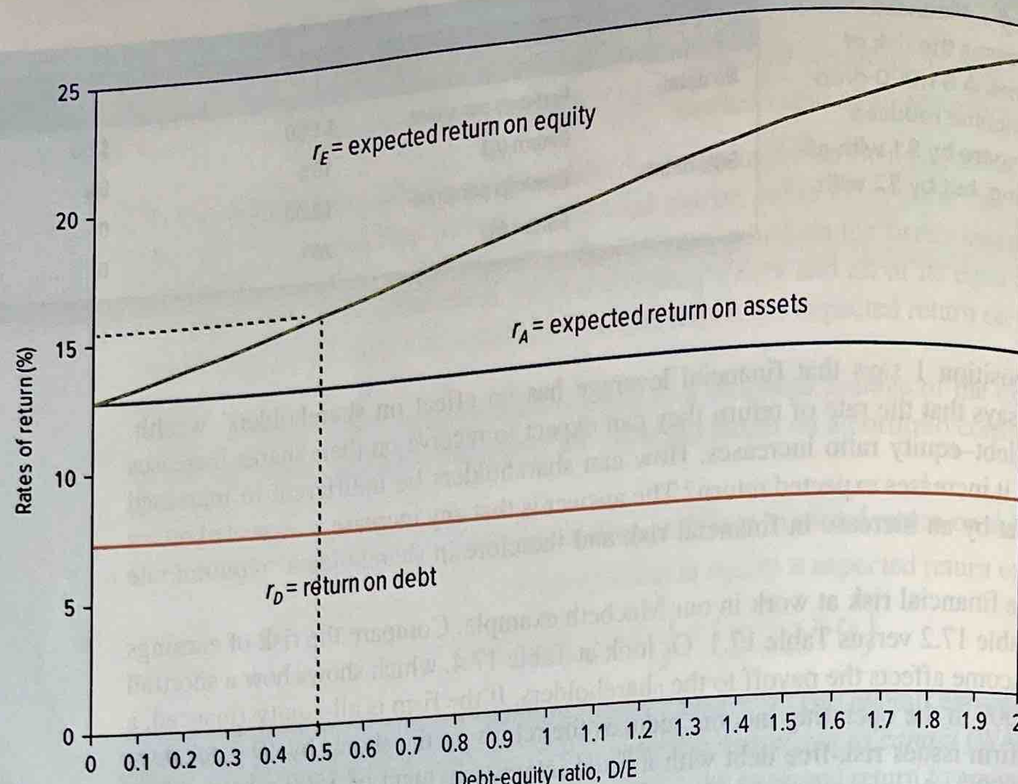


FIGURE 17.2 MM's proposition 2 predicts that if debt is risk-free, the required return on equity r_E increases linearly with the debt-equity ratio, but the return on the package of debt and equity does not change

the firm borrows, the required return on the package of debt and equity, r_A, remains constant at 12.75%. How is it possible for the required return on the package to stay constant when the required return on the individual securities is changing? Answer: Because the proportions of debt and equity in the package are also changing. More debt means that the cost of equity increases but at the same time the *proportion* of equity declines.

In Figure 17.2, we have drawn the rate of interest on the debt as constant no matter how much the firm borrows. This is not wholly realistic. It is true that most large, conservative companies could borrow a little more or less without noticeably affecting the interest rate that they pay. But at higher debt levels, lenders become concerned that they may not get their money back, and they demand higher rates of interest to compensate. Figure 17.3 modifies Figure 17.2 to account for this. You can see that as the firm borrows more, the risk of the debt slowly increases. Proposition 2 continues to predict that the expected return on the package of debt and equity does not change. However, the slope of the r_E line now tapers off as D/E increases. Why? Essentially because holders of risky debt begin to bear part of the firm's operating risk. As the firm borrows more, more of that risk is transferred from stockholders to bondholders.

Let's assume that the firm issues an additional $16.7 of debt and uses the cash to repurchase $16.7 of its equity. The revised market-value balance sheet has debt of $50 rather than $33.3:

Asset value	$100	Debt (*D*)	$50
		Equity (*E*)	$50
Asset value	$100	Firm value (*V*)	$100

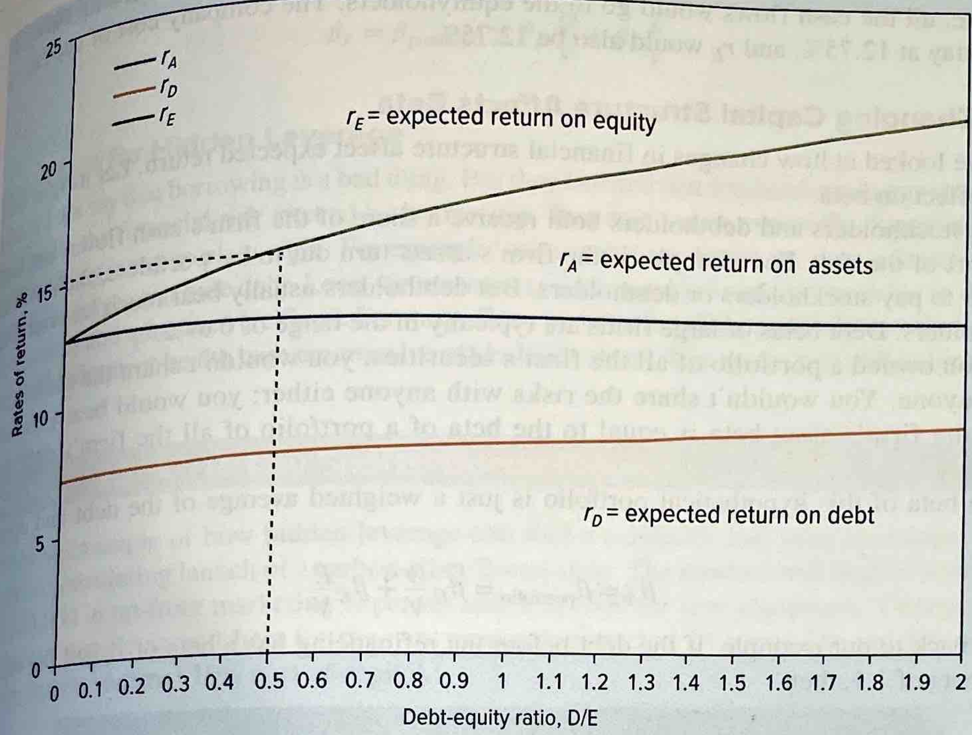


FIGURE 17.3
If leverage increases, the risk of the debt increases and debtholders demand a higher interest rate. As lenders take on the extra risk, the expected return on equity increases more slowly. MM's proposition 2 continues to predict that the expected return on the package of debt and equity is unchanged.

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. Because 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 8%. Now you can write down the basic equation for the return on assets:

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

$$= \left(8.0 \times \frac{50}{100}\right) + \left(r_E \times \frac{50}{100}\right) = 12.75\%$$

Solving for the return on equity gives $r_E = 17.5\%$.

Increasing the amount of debt increased debtholder risk and led to a rise in the return that debtholders required (r_D rose from 7.25% to 8.0%). The higher leverage also made the equity riskier and increased the return that shareholders required (r_E rose from 15.5% to 17.5%). However, the weighted-average return on debt and equity was unchanged at 12.75%:

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

$$= \left(8.0 \times \frac{50}{100}\right) + \left(17.5 \times \frac{50}{100}\right) = 12.75\%$$

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 0 to .2.[6]

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

$$\beta_A = \left(.1 \times \frac{33.3}{100}\right) + \left(1.1 \times \frac{66.7}{100}\right) = .767$$

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 stays at .1. We can work out the new equity beta:

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

$$.767 = \left(.1 \times \frac{50}{100}\right) + \left(\beta_E \times \frac{50}{100}\right)$$

Solve for the formula for β_E. You will see that it parallels MM's proposition 2 exactly:

$$\beta_E = \beta_A + (\beta_A - \beta_D)D/V = .767 + (.767 - .1)(50/50) = 1.43$$

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*.

You can use our formulas to *unlever* betas—that is, to go from an observed β_E to β_A. You have the equity beta of 1.43. You also need the debt beta, here .1, and the relative market values of debt (*D/V*) and equity (*E/V*). If debt accounts for 50% of overall value *V*, then the unlevered beta is

$$\beta_A = \left(.1 \times \frac{50}{100}\right) + \left(1.43 \times \frac{50}{100}\right) = .767$$

[6]Debt betas are often close to zero but can move into positive territory for two reasons. First, if the risk of default increases, more of the firm's business risk is shifted to lenders. Thus, "junk" debt issues typically have positive betas. Second, changes in interest rates can affect both stock and bond prices, creating a positive correlation between returns on bonds and returns on the stock market. This second reason is most important when long-term interest rates are unusually volatile, as in the United States in the 1970s and early 1980s.