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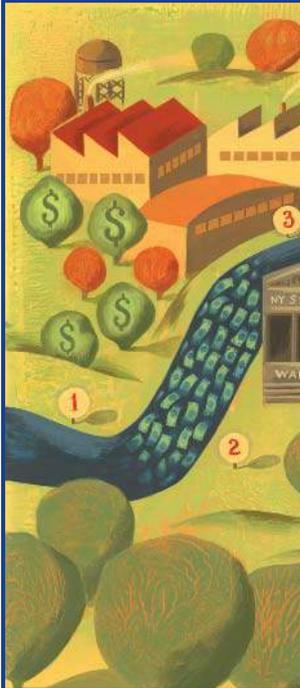
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LONG-TERM
FINANCING
ISSUES

Chapter 14 Capital Structure and Leverage

Chapter 15 Dividends

CHAPTER OUTLINE



Background

- The Central Issue
- Risk in the Context of Leverage
- Leverage and Risk—Two Kinds of Each
- Our Approach to Leverage

Financial Leverage

- The Effect of Financial Leverage
- Financial Leverage and Financial Risk
- Putting the Ideas Together—The Effect on Stock Price
- The Degree of Financial Leverage (DFL)—A Measurement

- EBIT–EPS Analysis

Operating Leverage

- Terminology and Definitions
- Breakeven Analysis
- Breakeven Diagrams

- The Effect of Operating Leverage
- The Degree of Operating Leverage (DOL)—A Measurement
- Comparing Operating and Financial Leverage
- The Compounding Effect of Operating and Financial Leverage

Capital Structure Theory

- Background—The Value of the Firm
- The Early Theory by Modigliani and Miller
- Relaxing the Assumptions—More Insights
- An Insight into Mergers and Acquisitions

We introduced the idea of capital structure in Chapter 13 as a necessary underpinning to the cost of capital concept. In this chapter we'll discover there's a great deal more to capital structure than calculating the WACC. In fact, its management is one of the most important things financial executives do.

Used properly, capital structure management can be an effective approach to improving financial performance. It can turn good results into better ones, and can even raise the price of a company's stock.

However, the technique has to be used with caution because its benefits come at a price. The cost of improving performance with capital structure can be increased risk. And risk, as we've already learned, is a serious problem. In this chapter, we'll learn all about the benefits and the costs of managing results through capital structure.

BACKGROUND

In Chapter 13, we said capital structure describes the mix of debt, preferred stock, and equity a firm employs. In this chapter we'll simplify that definition by assuming preferred stock is essentially a form of debt.¹ Hence, from here on when we refer to capital structure, we'll mean the mix of just two components, debt and equity, within capital.

1. This assumption is based on the fact that preferred stock dividends are fixed in amount, and in that respect are more like interest payments than like common stock dividends.

You can think of debt and preferred stock as offering investors returns that are more or less constant regardless of how the company is doing financially. Equity, on the other hand, offers a return that tends to vary with the business's performance.

Financial leverage refers to debt in the capital structure. It **multiplies** the **effectiveness** of equity but adds risk.

Capital restructuring involves changing leverage by **shifting the mix** of debt and equity.

Under certain conditions, **changing leverage** increases stock price. An **optimal capital structure** maximizes stock price.

Operating income (EBIT) is **unaffected** by **financial leverage**.

“Leverage” is a general term that refers to an ability to multiply the effect of some effort. The term comes from physics where a lever is used to multiply force. *Financial leverage* refers to using borrowed money to multiply the effectiveness of the equity invested in a business enterprise.

The borrowed money with which financial leverage is concerned is the debt in a company’s capital structure. Hence, the terms “financial leverage” and “capital structure” are somewhat synonymous. To be leveraged means to have debt. To be unleveraged means to operate with only equity capital.

The idea is quantified by the percentage of debt within total capital (debt + equity). Thus, 10% financial leverage implies a capital structure that’s 10% debt and 90% equity.

THE CENTRAL ISSUE

The study of capital structure revolves around a central question: Can the use of debt (leverage) increase the value of a firm’s equity? Stated slightly differently: Can it increase stock price?

We need to be sure we understand exactly what this question means. To illustrate, think about a firm with \$1 million in equity capital and no debt. Then suppose it borrows \$.25 million, buys up a quarter of its own stock, and retires the shares. In effect it has traded a quarter of its equity for debt. The procedure is called a **capital restructuring**.

Intuitively, the process shouldn’t affect the price of the shares still outstanding. Three quarters of the original shares now represent three quarters of the former equity, so nothing should have changed on a per-share basis.

But in fact, adding financial leverage in the manner we’ve just described often increases the price of the remaining shares and the value of the firm. However, the effect isn’t consistent, and there are circumstances under which adding leverage decreases stock price and a firm’s value.

In other words, there’s a relationship between capital structure and stock price, but it’s neither precise nor totally understood. Study in the field attempts to explain the nature of the relationship and predict when additional financial leverage will increase or decrease price and value.

In particular, we want to discover whether there’s an *optimal capital structure* that maximizes stock price, all other things held constant.

After covering a little more background, we’ll look at an example to see just how leverage works.

RISK IN THE CONTEXT OF LEVERAGE

In earlier chapters we learned that risk and return are related and have a great deal to do with determining stock prices. Here again, we’ll find that risk plays an important role in setting values. In fact, leverage influences stock price because it alters the risk/return relationship in an equity investment. We’ll understand that better as we go along.

Measures of Performance

We’ll often refer to EBIT, ROE, and EPS in this chapter, so it’s worthwhile to review their meaning.

EBIT, earnings before interest and taxes, is also called “operating income.” It’s the lowest line on the income statement that’s independent of financing. In other words, because EBIT is above interest expense, it is unaffected by whether the firm is leveraged or not.

ROE and EPS are return on equity and earnings per share, respectively. They're defined as follows

$$\text{ROE} = \frac{\text{EAT}}{\text{equity}} \quad \text{EPS} = \frac{\text{EAT}}{\text{number of shares}}$$

where EAT is earnings after tax, the bottom line of the income statement (also called “net income”).

ROE and EPS are *overall* measures of business performance in that they include both the results of operations and the effects of financing. Both measures are important to investors when they consider buying a company's stock, but EPS is especially significant. It is usually taken as an indication of the future earning power of the firm and is therefore a major determinant of the stock's market price.

EBIT, ROE, and EPS were treated in Chapters 2 and 3, on pages 29 and 90–91. It's not a bad idea to review those pages now.

Redefining Risk for Leverage-Related Issues

We're used to thinking of risk in finance as *variation* in the return on an investment. In this chapter we'll narrow our focus and think of risk as variation in financial performance measured by variation in ROE and EPS. This notion is separable into two pieces, business risk and financial risk.

Business Risk

Business risk is variation in a firm's operating performance as measured by EBIT. It arises from variations in revenues, costs, and expenses. Hence, **business risk** is *defined* as variation in EBIT itself.²

Financial Risk

In an unleveraged firm (one with no debt), the variation in ROE and EPS is identical to the variation in EBIT. In a leveraged firm, the variation in ROE and EPS is always *greater than* the variation in EBIT. Further, the more leverage the firm uses, the larger is the incremental variation.

This leads to the definition of *financial risk* as the *additional* variation in ROE and EPS that arises as a result of using financial leverage (debt). The idea is illustrated in Figure 14.1. The left column shows that business operations produce EBIT, to which we add financing to produce ROE and EPS. In other words, EBIT measures operations, but ROE and EPS measure *overall* performance, which is a combination of operations and financing.

The second and third columns show the sources of variation in the measures and how that variation is defined as risk. It's important to notice that business risk flows down into ROE and EPS by itself. Financial risk is *added* only if there is debt financing.

LEVERAGE AND RISK—TWO KINDS OF EACH

From what we said in the last section it's clear that financial leverage is associated with, and indeed causes, financial risk. We've also defined business risk as the variation in EBIT. It turns out there's another type of leverage, which has an influence on

2. Be careful not to confuse the business risk we're talking about here with the broader concept of business-specific risk from Chapter 9. Business-specific risk includes variation in EBIT as well as other things tied to a specific company or industry. For example, concern over the possibility of federal regulation of an industry could depress stock prices even though financial results are unchanged. Federal regulation or the threat of it would then be an element of business-specific risk, but not business risk as we're defining it here.

Investors regard **EPS** as an important indicator of **future profitability**.

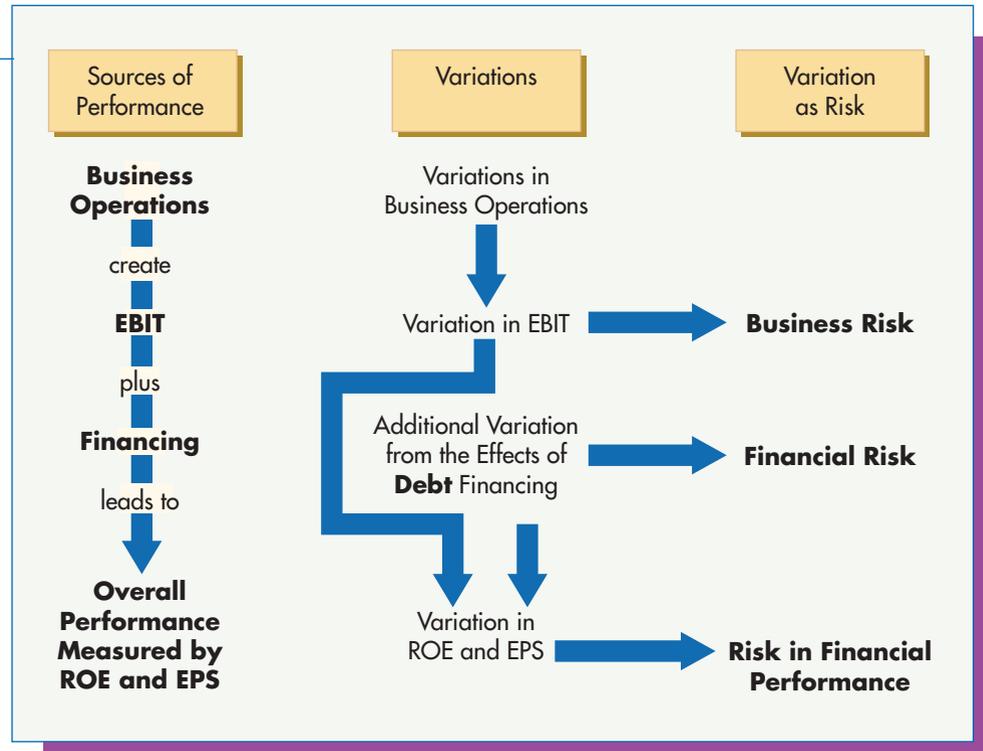
Leverage-related risk is **variation in ROE and EPS**.

Business risk is the **variation in EBIT**.

Financial risk is the **additional** variation in ROE and EPS brought about by **financial leverage**.

Figure 14.1

Business and Financial Risk



business risk that's similar to the influence financial leverage has on financial risk. This concept is called *operating leverage*.

Operating leverage is related to a company's **cost structure** rather than to its capital structure. Cost structure describes the relative amounts of *fixed* and *variable* cost in productive and administrative processes.

When the term "leverage" is used by itself, it generally refers to financial leverage, which is the more important concept. We'll discuss operating leverage, and relate it to financial leverage later in this chapter.

OUR APPROACH TO LEVERAGE

In the remainder of this chapter we'll take an in-depth look at leverage. We'll begin by examining how financial leverage works in practical, real-world terms. Then we'll have an equally pragmatic look at operating leverage. After examining both, we'll make a comparison between them and look at how they interact.

Then we'll spend some time studying capital structure theory. We'll do that without much mathematics, but when we're done we'll have a good grasp of the approach taken by sophisticated scholars. We'll also see that the theoretical results are essentially the same as those we arrived at intuitively, but for somewhat different reasons.

FINANCIAL LEVERAGE

Now that we've developed the appropriate background, we can begin an investigation into just why leverage does what it does. We'll begin with an intuitive explanation.

THE EFFECT OF FINANCIAL LEVERAGE

The underlying reason that leverage may increase stock prices is that under certain conditions it improves financial performance measured in terms of ROE and EPS.

Table 14.1

Effect of Increasing Financial Leverage When the Return on Capital Employed Exceeds the Cost of Debt

Leverage Analysis			
Arizona Balloon Corporation			
(\$000)			
	Leverage Scenarios		
	1	2	3
	0% Debt	50% Debt	80% Debt
Capital			
Debt	\$ —	\$ 500	\$ 800
Equity	<u>1,000</u>	<u>500</u>	<u>200</u>
Total	\$1,000	\$1,000	\$1,000
Shares @ \$10	100,000	50,000	20,000
Revenue	\$1,000	\$1,000	\$1,000
Cost/expense	<u>800</u>	<u>800</u>	<u>800</u>
EBIT	\$ 200	\$ 200	\$ 200
Interest (10%)	<u>—</u>	<u>50</u>	<u>80</u>
EBT	\$ 200	\$ 150	\$ 120
Tax (40%)	<u>80</u>	<u>60</u>	<u>48</u>
EAT	\$ 120	\$ 90	\$ 72
ROE	12%	18%	36%
EPS	\$ 1.20	\$ 1.80	\$ 3.60

However, it sometimes makes performance worse and always increases risk. Hence, it's not immediately clear when leverage will be a benefit and when it won't.

To understand how leverage works, we'll examine the financial results of a rising young company, the Arizona Balloon Corporation, ABC for short, which sells hot air balloon rides in the Arizona desert. We'll look at how ABC performs under three assumptions about its use of leverage. We'll examine a case with no debt, one with 50% debt, and a highly leveraged situation with 80% debt.

Each scenario is represented by a column in Table 14.1. The capital structures are shown at the top of each column along with the number of shares of stock outstanding. Moving from left to right, the share numbers are calculated by assuming borrowed money is used to retire stock that can be bought at its book value of \$10 per share.

The issue we want to explore is what happens to financial performance as we vary leverage while holding the level of operating income (EBIT) constant. In other words, given some level of EBIT, are we better off with more or less leverage?

To answer that question we'll assume EBIT of \$200,000, as displayed toward the middle of each column. The next four lines complete the income statement. Interest is 10% of debt and taxes are figured at a 40% rate.

Return on equity (ROE) and earnings per share (EPS) are displayed next. These are the performance measures in which we're most interested.

The Good News about Financial Leverage

The important thing to observe in the table is the progression of ROE and EPS as we move to the right. As leverage increases, both measures go up dramatically.

Notice why this happens in terms of computations. ROE and EPS are calculated by dividing EAT by equity and the number of shares, respectively.

As debt is added, EAT declines because of increasing interest charges. However, equity and the number of shares outstanding shrink as debt replaces equity in the capital structure and shares are retired. In this case, equity and shares are shrinking proportionately faster than earnings, so the ratios increase.

This is the good news about leverage. If basic profitability is good, a dollar-for-dollar replacement of equity with debt improves financial performance as measured by ROE and EPS.³ Then if investors react positively to the increases they may bid up the price of ABC's stock.

When **profitability** is good, **EPS** and **ROE** increase as leverage increases.

The Return on Capital versus the Cost of Debt

The benefit of leverage illustrated in Table 14.1 makes sense because ABC's operating income (EBIT) represents an after-tax return on capital that exceeds its cost of debt. In other words, the company makes more with borrowed money than it pays for the privilege of borrowing.

The after-tax return on capital can be measured by a ratio called "the return on capital employed (ROCE)." The ROCE looks at the profitability of operations without regard to how the firm is financed, but does so after tax. This amounts to calculating what the after-tax earnings on EBIT would be if there were no deductible interest, and then dividing by total capital.

The resulting number is comparable to the return on assets, the return on equity, or the after-tax cost of debt. The computation is given by equation 14.1.

$$(14.1) \quad \text{ROCE} = \frac{\text{EBIT} (1 - T)}{\text{debt} + \text{equity}}$$

Calculating equation 14.1 for any of the columns in Table 14.1 yields 12%. This says that ABC is able to earn 12% after tax on any capital it uses.

If you're a little confused by the ROCE concept, just concentrate on the first column. In that case, because there are no debt and no interest, the ROCE is simply the ROE, which is 12%.

Now notice that ABC's after-tax cost of debt is

$$k_d(1 - T) = 10\%(1 - .4) = 6\%$$

where k_d is the interest rate the company pays and T is the tax rate. This is only half of what the business earns on its capital, so it makes sense to use someone else's (borrowed) money.

Whenever a firm can earn an ROCE that exceeds its after-tax borrowing rate, it *seems* to make sense to use as much borrowed money as possible. In this case, every dollar borrowed frees up a dollar of equity and earns ABC's owners the 6% difference.

We'll learn shortly that other things affect the advisability of borrowing, but it's a basic truth that recorded financial results improve as equity is traded evenly for debt if the ROCE exceeds the after-tax cost of debt.

The Other Side of the Coin—The Bad News about Leverage

Unfortunately, leverage works in two directions. When a company is earning an ROCE that's *less* than the after-tax cost of debt, leverage makes results worse! To see

The **ROCE** measures the profitability of **operations** before financing charges on a basis **comparable** to **ROE**.

When the **ROCE** **exceeds** the after-tax **cost of debt**, more leverage **improves** **ROE** and **EPS**.

3. A moderating effect that's not included in the illustration is that interest rates generally go up at high levels of debt. That means the interest cost might really be somewhat higher in the third column than the amount shown. However, the effect is unlikely to reverse the trend of increasing ROE and EPS shown.

Table 14.2

Effect of Increasing Financial Leverage When the Cost of Debt Exceeds the Return on Capital Employed

Leverage Analysis			
Arizona Balloon Corporation			
(\$'000)			
	Leverage Scenarios		
	1	2	3
	0% Debt	50% Debt	80% Debt
Capital			
Debt	\$ —	\$ 500	\$ 800
Equity	<u>1,000</u>	<u>500</u>	<u>200</u>
Total	\$1,000	\$1,000	\$1,000
Shares @ \$10	100,000	50,000	20,000
Revenue	\$ 800	\$ 800	\$ 800
Cost/expense	<u>720</u>	<u>720</u>	<u>720</u>
EBIT	\$ 80	\$ 80	\$ 80
Interest (10%)	<u>—</u>	<u>50</u>	<u>80</u>
EBT	\$ 80	\$ 30	—
Tax (40%)	<u>32</u>	<u>12</u>	<u>—</u>
EAT	\$ 48	\$ 18	—
ROE	4.8%	3.6%	0%
EPS	\$.48	\$.36	\$ 0.00

that, we'll reconstruct Table 14.1 assuming bad weather causes a downturn in ABC's balloon business. The result is displayed in Table 14.2.

Assume revenues and earnings fall off to the point where the ROCE is just 4.8% (see the ROE in the first column of Table 14.2). That's less than the 6% cost of debt.

Now look at the progression from column to column as the firm moves from equity into debt. ROE and EPS *decrease* with increasing leverage. That's because the firm is earning less on capital (4.8%) than it's paying for the use of borrowed funds (6%).

This is another basic truth about leverage. Results are worse when ROCE is less than the after-tax cost of debt. This can cause investors to bid the price of the firm's stock down. Clearly it doesn't make much sense to increase leverage intentionally in this situation, and financial managers don't do it unless something else makes borrowing unavoidable.

Managing through Leverage

The foregoing suggests that under certain conditions management may be able to manipulate financial results and stock price by changing the firm's capital structure. This is indeed true, but it has to be done with some caution.

It takes time to change capital structure, but operating results can turn around overnight. That means a firm can expand leverage during good times and then be caught by an unexpected business downturn. When that happens, there may be a precipitous drop in ROE and EPS as well as in stock price.

The following example illustrates the management of EPS.

When **ROCE is less than** the after-tax **cost of debt**, more leverage makes **ROE and EPS worse**.

from the **CFO**

Example 14.1 Selected financial information for the Albany Corporation follows.

**Albany Corporation at \$10M Debt
(\$000 except per-share amounts)**

EBIT	\$23,700	Debt	\$ 10,000
Interest (@ 12%)	<u>1,200</u>	Equity	<u>90,000</u>
EBT	\$22,500	Capital	\$100,000
Tax (@ 40%)	<u>9,000</u>	Number of shares =	9,000,000
EAT	\$13,500		

stock price = \$10 per share

$$\text{ROE} = \frac{\text{EAT}}{\text{equity}} = \frac{\$13,500}{\$90,000} = 15\%$$

$$\text{EPS} = \frac{\text{EAT}}{\text{number of shares}} = \frac{\$13,500}{9,000,000} = \$1.50$$

Notice that Albany's total capital is \$100 million. It pays 12% interest on debt of \$10 million and its combined state and federal tax rate is 40%. The company's stock is selling at its book value of \$10 per share. The treasurer feels debt can be traded for equity without immediately affecting the price of the stock or the rate at which the firm can borrow.

Management believes it is in the best interest of the company and its stockholders to move the firm's EPS from its current level up to \$2 per share. However, no opportunities are available to increase operating profit (EBIT) above the current level of \$23.7 million.

Will borrowing more money and retiring stock raise Albany's EPS, and if so, what capital structure will achieve an EPS of \$2?

SOLUTION: EPS will increase if the ROCE exceeds the after-tax cost of debt. Calculate ROCE by writing equation 14.1 and substituting from the problem (\$ million).

$$\begin{aligned} \text{ROCE} &= \frac{\text{EBIT}(1-T)}{\text{debt} + \text{equity}} \\ &= \frac{\$23.7\text{M}(1-.4)}{\$100.0\text{M}} = \frac{\$14.2\text{M}}{\$100.0\text{M}} \\ &= 14.2\% \end{aligned}$$

The after-tax cost of debt is the interest rate paid times 1 minus the tax rate.

$$k_d(1 - T) = 12\%(1 - .4) = 7.2\% < 14.2\%$$

Hence, trading equity for debt will improve EPS.

The second part of the question asks us to find the capital structure that results in an EPS of \$2.00. Conceptually the easiest way to do that is trial and error. Simply choose a series of debt levels and recompute the financial results until a value is found that yields EPS=\$2.00.

Let's begin with an arbitrary \$20 million increase in debt to \$30 million. Because Albany's stock is selling for its book value of \$10, every \$10 borrowed will retire one share of stock and reduce equity by the same \$10. Hence, the new equity will be \$70 million. The revised interest expense is (\$30 million \times .12 =) \$3.6 million. From there the calculations are straightforward.

Albany Corporation at \$30 Million Debt
(**\$000 except per-share amounts**)

EBIT	\$23,700	Debt	\$ 30,000
Interest (@ 12%)	<u>3,600</u>	Equity	<u>70,000</u>
EBT	\$20,100	Capital	\$100,000
Tax (@ 40%)	<u>8,040</u>	Number of shares =	7,000,000
EAT	\$12,060		

$$\text{ROE} = \frac{\text{EAT}}{\text{equity}} = \frac{\$12,060}{\$70,000} = 17.2\%$$

$$\text{EPS} = \frac{\text{EAT}}{\text{number of shares}} = \frac{\$12,060}{7,000,000 \text{ shares}} = \$1.72$$

The resulting EPS of \$1.72 is less than the \$2.00 target. This implies that more than \$30 million in debt will be required. As an exercise, show that \$45 million is very close to the right level.

An Alternate Approach (optional)

An algebraic approach is available which is computationally more efficient even though it's mathematically a bit complex. We're going to present the technique here to demonstrate an important analytical tool for solving financial problems. The idea is to write ratios and/or parts of financial statements as equations which can be used to solve for unknown financial quantities. Those not mathematically inclined can skip to the next section without loss of continuity.

In this case we'll use the definition of some ratios, the income statement from EBIT to EAT, the relation between debt and interest, and the definition of capital to construct an equation that will lead us to the exact level of debt we need.

We'll begin by noticing that there's a simple relationship between EPS, ROE, and book value per share.

$$\text{EPS} = \text{ROE} \times \text{book value per share.}$$

Convince yourself that this is true by substituting the definitions of these ratios found on pages 90–92.

Since Albany's stock is selling at its book value of \$10.00, retiring shares won't change that value, so we can write

$$(a) \quad \text{EPS} = \text{ROE}(\$10) = \frac{\text{EAT}}{\text{equity}} (\$10.00)$$

Next consider the bottom part of Albany's income statement. EAT can be written as

$$\text{EAT} = (\text{EBIT} - I)(1 - T)$$

where I is interest and T is the tax rate. $(\text{EBIT} - I)$ is earnings before tax (EBT), which is adjusted to earnings after tax by multiplying by $(1 - T)$.

Interest is debt times the interest rate, k_d , so we can write

$$I = k_d (\text{debt})$$

Substituting this into the expression for EAT yields

$$\text{EAT} = [\text{EBIT} - (k_d)(\text{debt})] (1 - T)$$

Further, total capital is debt plus equity, so

$$\text{equity} = \text{total capital} - \text{debt}$$

Substituting these expressions for EAT and equity into (a), yields

$$\text{EPS} = \frac{[\text{EBIT} - (k_d)(\text{debt})](1 - T)}{\text{total capital} - \text{debt}} \quad (\$10.00)$$

Everything in this equation except debt is available in the problem. If we treat debt as the unknown and set EPS equal to \$2.00, we have a single equation in a single unknown, the solution to which is the value of debt at which EPS is exactly \$2.00. Substituting we have

$$\$2.00 = \frac{[\$23,700,000 - (.12)(\text{debt})](1 - .4)}{\$100,000,000 - \text{debt}} \quad (\$10.00)$$

from which

$$\text{debt} = \$45,156,250$$

Hence, the capital structure that produces a \$2.00 EPS is roughly 45% debt–55% equity.

FINANCIAL LEVERAGE AND FINANCIAL RISK

Tables 14.1 and 14.2 show that financial leverage is a two-edged sword. It multiplies good results into great results, but it also multiplies bad results into terrible results. This means when business conditions change, performance measured by ROE or EPS makes wider swings for more leveraged organizations than for those with relatively less debt. The *incremental* variation in results is what we've called *financial risk*.

We can illustrate the idea with Arizona Balloon Corporation using Tables 14.1 and 14.2. The first table represents relatively good times, while the second reflects harder times and lower earnings. Within each table there's a no-leverage situation in the first column and a high-leverage case in the third column.

To see the effect of financial leverage on risk, we'll compare the changes in ROE in the first and third columns, respectively, between the two tables. The analysis is shown in Table 14.3. Focus on the first three lines of Table 14.3. The column on the left shows that the change in ROE from good times to bad times is just 7.2% when there's no leverage. On the other hand, the column on the right shows that change to be 36.0% when there's a high degree of leverage.

Table 14.3

**Financial
Leverage
and Risk**



	ROE	
	Column 1 No Debt	Column 3 80% Debt
Good times (Table 14.1)	12.0%	36.0%
Bad times (Table 14.2)	4.8	0.0
Difference	7.2%	36.0%
Incremental difference in ROE due to financial leverage	= 36.0% - 7.2% = 28.8%	

Because there's no financial leverage in column 1 of Tables 14.1 and 14.2, the difference in those ROEs represents the variability of the basic business's results. In other words, that change is due to *business risk*.⁴

The difference in the column 3 ROEs represents the *sum* of the variabilities arising from operations and from financing. The incremental variability, the difference between the two differences, is a result of *financial risk*. This difference is shown on the fourth line of Table 14.3.

In ABC's case, business risk accounts for a swing of 7.2% in ROE. The financial risk associated with 80% leverage, however, accounts for a swing of $(36.0\% - 7.2\% =) 28.8\%$ in ROE. In other words, at 80% debt financial risk is $(28.8\%/7.2\% =)$ four times as large as business risk. The result makes sense, because 80% debt represents a high degree of leverage.

To check your understanding, show that the financial risk associated with 50% debt (column 2) is equal to business risk.

A good way to think of these ideas is to say that leverage magnifies changes in operating income (EBIT) into larger changes in ROE and EPS. Further, the more leverage there is, the larger is the magnification.

Financial risk is the **increased variability** in financial results that comes from **additional leverage**.

PUTTING THE IDEAS TOGETHER—THE EFFECT ON STOCK PRICE

Our study of the Arizona Balloon Corporation has demonstrated two important effects of leverage.

1. During periods of reasonably good performance, leverage enhances results in terms of ROE and EPS.
2. Leverage adds variability to financial performance when operating results change. This means performance is riskier with more leverage.

Both phenomena become more pronounced as the level of leverage increases.

These effects drive stock prices in opposite directions. The first, enhanced performance under *likely* conditions, makes the expected return on a stock investment higher. That makes the stock more desirable to investors, which causes them to bid up its price.

In ABC's case, for example, suppose everyone expects prosperity consistent with Table 14.1 next year, believing the chances of a recession are very remote. Then ABC's expected EPS with no leverage is \$1.20 from the first column. That expectation can be increased to \$1.80 by moving to the leverage position in column 2. If no one is too worried about poor economic conditions, the higher expected performance is just accepted at its face value.

The second effect makes a stock investment riskier, and we know from the principle of risk aversion (Chapter 9, page 382) that investors don't like that. Hence, the second effect tends to drive investors away, lowering the price.

The key question is which effect dominates and when?

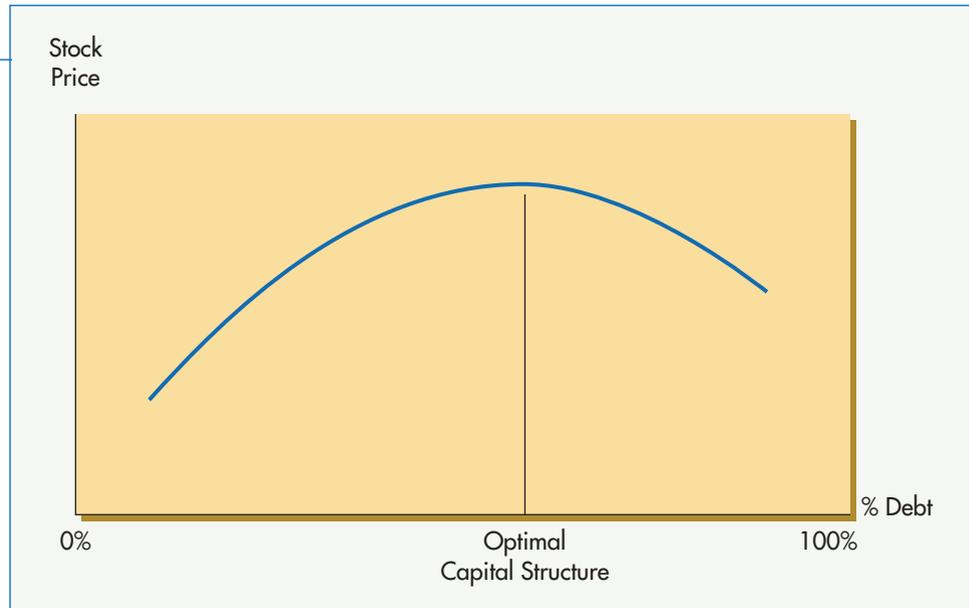
Real Investor Behavior and the Optimal Capital Structure

It turns out that at low to moderate levels of debt, investors value the positive effects of leverage a great deal and virtually ignore concerns about increased risk. This is especially true if the economic outlook is good. Hence, increases in leverage tend to raise stock prices when leverage is low or moderate.

Leverage **enhances performance** while it **adds risk**, pushing stock prices in **opposite directions**.

When **leverage is low**, a little **more** has a **positive effect** on investors, but at **high** debt levels **concerns about risk dominate**, and the **effect of more is negative**.

4. We generally measure business risk at EBIT, but when there's no financial leverage the result is the same at ROE.

Figure 14.2**The Effect of Leverage on Stock Price**

As leverage increases, its effect goes from **positive to negative**, which results in an **optimum capital structure**.

As leverage increases, however, concerns about risk and poor performance begin to overwhelm the benefits of enhanced return in people's minds. Thus, at higher levels, further increases in leverage have a negative effect on stock price.

In other words, as leverage increases from nothing to very high levels (all other things held constant), stock price increases, reaches a maximum, and then decreases. The idea is shown graphically in Figure 14.2. The maximum point on the graph is conceptually important. It corresponds to the *optimal capital structure*. By definition this is the capital structure (percent debt, level of leverage) that maximizes stock price.

Finding the Optimum—A Practical Problem

No one doubts that the response pattern of stock price to leverage is generally as pictured in Figure 14.2 or that there is indeed some optimal level of debt that produces a maximum price. The problem is that no one has a way to determine exactly where the maximum is for a particular company at a particular time.

The appropriate level of leverage tends to vary with the nature of a company's business as well as with the economic climate. A firm whose basic business is relatively volatile would be expected to use less leverage than a company in a stable business. That's because a high level of business risk compounded by a high level of leverage produces an extremely risky company.

With respect to economic climate, investors are more sensitive to risk when the outlook is poor than when it's good. The optimal level of leverage therefore should be lower in bad times because investors are repelled by increasing risk sooner.

Unfortunately, these ideas aren't particularly quantifiable, so we aren't able to locate the optimum along the horizontal axis of Figure 14.2 with any accuracy.

That doesn't mean capital structure thinking is useless. However, it is more of a general guide than a precise set of instructions for managing a company. The accepted wisdom is more or less as follows.



REAL APPLICATIONS

AOL Time Warner (Time Warner Inc.): The Perils of Leverage

In 2000, America Online (AOL), the famous Internet provider, and Time Warner, a media giant with interests in publishing and the film industry, merged in what was billed as a marriage of “old media” and “new media.” Unfortunately, the “media marriage” initially produced little but red ink. Within months of the ceremony, America Online’s business went into a steep slump, and the stock of the combined company, AOL Time Warner (since renamed Time Warner Inc.) plummeted, wiping out more than \$100 billion in market value. To make matters worse, Time Warner’s print publishing business suffered a significant decline in advertising revenue after the September 11th terrorist attack on the World Trade Center.

But a big part of the reason the combined company suffered as badly in the stock market as it did may have been due to excessive leverage. The combined company reported long-term debt as of September 30, 2002, of \$28.2 billion, up from \$22.8 billion at the end of 2001. At first glance, that doesn’t seem excessive relative to the company’s reported assets of \$161 billion at the end of 2002’s third quarter. Indeed, few analysts would argue that debt of about $(\$28/\$161=)$ 17% of assets is too much.

But a closer look at the balance sheet may have led investors to a different conclusion. The problem is likely to have been that more than half of the assets reported represented intangibles, which are arguably of little value in the future. Over half of the total assets figure, about \$82 billion, was goodwill, an intangible representing the excess of purchase prices paid to acquire companies in the past over the fair market value of the assets actually brought on board. Other intangibles accounted for approximately \$45 billion more of the balance sheet’s asserted value. If cautious investors refused to value these assets in their thinking, they were left with only about \$34 billion in “hard” assets like cash, receivables, equipment, and property. Under those assumptions, the \$28 billion in debt represents 82% of assets, a very big number in most industries, implying AOL Time Warner was a highly leveraged and therefore very risky company.

In early 2003, the firm took most of the goodwill off of its balance sheet, reporting a \$99 billion loss on the transaction. The move was mandated by new accounting rules and made the company’s debt load more obvious.

The company’s CEO, Richard Parsons, vowed to pay down debt and turn the business around. In a conference with Wall Street analysts he characterized 2003 as a “reset” year from which AOL Time Warner would re-emerge with new “momentum.” Observers felt that was doable because the firm’s underlying businesses were profitable.

Progress toward that goal has been significant but slow. As of 2005 the company had succeeded in reducing its debt obligations by more than 20%, but continued to carry a hefty \$20 billion in long-term debt, that’s still a very big number.

Source: WSJ.com, “AOL Posts a \$98.7 Billion Loss on New Goodwill Write-Down,” January 30, 2003; and AOL Web site, 3rd quarter 2002 10-Q, Thomson One Financials, June 2000.

from the **CFO**

1. A firm with good profit prospects and little or no debt is probably missing an opportunity by not using borrowed money if interest rates are reasonable.
2. For most businesses, the optimal capital structure is somewhere between 30% and 50% debt.
3. Debt levels above 60% create excessive risk and should be avoided.

As a practical matter, the optimum capital structure **cannot be precisely located.**

A firm's **target capital structure** is management's estimate of the optimal capital structure.

Keep in mind that these are rough guidelines with lots of exceptions, and not hard rules.

The Target Capital Structure

We referred to a *target capital structure* during our discussion of the cost of capital in Chapter 13. We said the target structure is one that management prefers over any other and attempts to maintain as it raises money. We're now in a position to better appreciate that idea.

The target capital structure is just an approximation of the optimal capital structure. It is management's best guess at a level of leverage that maximizes the firm's stock price.

You may recall that in Chapter 13 we weren't concerned about stating target and actual capital structures with a great deal of precision. The reason should be apparent now. We can't find the optimal structure with a high degree of accuracy, so it doesn't make much sense to get too detailed about a guess at it.

The Effect of Leverage When Stocks Aren't Trading at Book Value

There's an important detail that shouldn't be missed in what we've been doing. We've presented illustrations of changes in leverage in which equity is replaced by debt. They have all involved changes in the number of shares of stock outstanding that are proportionate to the changes in equity.

That proportionality is ensured by assuming the stock can be purchased for retirement at a market price equal to its book value. When that isn't the case, things can be somewhat more complex. The relationship between ROE and EPS can be shown to be

$$\text{EPS} = \text{ROE} \times (\text{book value per share})$$

When stock is purchased for retirement at book value, the book value per share of the remaining shares stays the same. And the transaction has essentially the same effect on EPS that it does on ROE. However, when stock is purchased for retirement at a price different from its book value, the book value of the remaining shares changes. Therefore, a transaction can have different effects on ROE and EPS. Our results generally hold for ROE, but may not for EPS.

This phenomenon adds to the general imprecision of the ideas with which we've been working. The important point is the general direction in which leverage drives stock price, not the exact amount of the effect.

THE DEGREE OF FINANCIAL LEVERAGE (DFL)—A MEASUREMENT

Financial leverage magnifies changes in EBIT into larger changes in ROE and EPS. It is of interest to know just how large that magnification is at any particular level of leverage.

For example, suppose a firm anticipates a 20% drop in EBIT. If the company has no debt, ROE and EPS will also drop by 20%. But what drop should be expected if the firm's capital is 30% or 40% debt? Clearly the question is important if management is interested in the effect that changes in ROE and EPS may have on investors.

It's possible to answer the question by using a concept called the *degree of financial leverage*, abbreviated *DFL*. The DFL lets us quantify the effectiveness of leverage by relating *relative* changes in EPS and EBIT at any level of leverage.⁵

The idea is expressed as follows

$$(14.2) \quad \text{DFL} = \frac{\% \Delta \text{EPS}}{\% \Delta \text{EBIT}}$$

where $\% \Delta \text{EPS}$ and $\% \Delta \text{EBIT}$ mean the relative changes in EPS and EBIT, respectively.

The best way to visualize the meaning of the DFL is to rewrite equation 14.2 by multiplying through by $\% \Delta \text{EBIT}$.

$$(14.2a) \quad \% \Delta \text{EPS} = \text{DFL} \times \% \Delta \text{EBIT}$$

This expression says that relative changes in EBIT are multiplied by the DFL to arrive at relative changes in EPS. For example, if a firm's DFL is 1.5 and EBIT changes by 20%, EPS will change by $(1.5 \times 20\%) = 30\%$.

If financial statements are available, the DFL can be calculated by assuming a small change in EBIT, working through to the resulting change in EPS, and substituting the relative changes into equation 14.2. However, that approach is rather tedious. An easier method is available by using the following formula.

$$(14.3) \quad \text{DFL} = \frac{\text{EBIT}}{\text{EBIT} - I}$$

where I is interest.

The derivation of equation 14.3 is a little involved, so we'll just accept the result.

The **DFL** relates relative changes in **EBIT** to relative changes in **EPS**.

Example 14.2 Selected income statement and capital information for the Moberly Manufacturing Company follow (\$000).

		Capital	
Revenue	\$5,580	Debt	\$1,000
Cost/expense	<u>4,200</u>	Equity	<u>7,000</u>
EBIT	\$1,380	Total	\$8,000

Currently 700,000 shares of common stock are outstanding. The firm pays 15% interest on its debt and anticipates that it can borrow as much as it reasonably needs at that rate. The income tax rate is 40%.

Moberly is interested in boosting the price of its stock. To do that, management is considering restructuring capital to 50% debt in the hope that the increased EPS will have a positive

5. A relative change is a percentage change. For example, a 5% change in the number 20 is a change of 1 unit, because 1 is 5% of 20. An increase to 21 is a positive 5% change. A decrease to 19 is a negative 5% change.

In general, a relative change in a number is the change divided by the number itself, expressed as a percentage. If we represent the change in the number N by ΔN , the relative change in N is expressed as

$$\% \Delta N = \frac{\Delta N}{N} \times 100$$

If N is 20 and ΔN is 1, we have

$$\% \Delta N = \frac{1}{20} \times 100 = 5\%$$

effect on price. However, the economic outlook is shaky, and the company's CFO thinks there's a good chance that a deterioration in business conditions will reduce EBIT next year. At the moment Moberly's stock sells for its book value of \$10 per share.

Estimate the effect of the proposed restructuring on EPS. Then use the degree of financial leverage to assess the increase in risk that will come along with it.

SOLUTION: First we'll calculate the proposed capital structure and display it alongside the current structure. Because equity can be traded at its book value, the restructuring is a straightforward exchange of equity for debt with a proportionate reduction in the number of shares outstanding.

	Current	Proposed
Capital		
Debt	\$1,000	\$4,000
Equity	<u>7,000</u>	<u>4,000</u>
Total	\$8,000	\$8,000
Shares outstanding	700,000	400,000

Next calculate projected EAT and EPS at the current level of business for both capital structures.

	Current	Proposed
EBIT	\$1,380	\$1,380
Interest (15% of debt)	<u>150</u>	<u>600</u>
EBT	\$1,230	\$ 780
Tax (@ 40%)	<u>492</u>	<u>312</u>
EAT	\$ 738	\$ 468
EPS	\$1.054	\$1.170

It's easy to see that if business conditions remain unchanged, the proposed structure will yield a higher EPS.

Next use equation 14.3 to calculate the DFL under each structure.

$$DFL_{\text{cur}} = \frac{\text{EBIT}}{\text{EBIT} - I} = \frac{\$1,380}{\$1,380 - \$150} = 1.12$$

$$DFL_{\text{prop}} = \frac{\text{EBIT}}{\text{EBIT} - I} = \frac{\$1,380}{\$1,380 - \$600} = 1.77$$

Now we can see why the CFO is concerned. EPS will be much more volatile under the proposed structure than it is currently. To illustrate, suppose business deteriorates and EBIT declines by 30%; that's not unusual. We can use equation 14.2a to see what will happen under both the current and proposed structures.

Under the current structure, EPS will decline by a percentage calculated as follows.

$$\begin{aligned} \% \Delta \text{EPS}_{\text{cur}} &= DFL_{\text{cur}} \times \% \Delta \text{EBIT} \\ &= 1.12 \times 30\% = 33.6\% \end{aligned}$$

But under the proposed structure the percentage decline will be

$$\begin{aligned} \% \Delta \text{EPS}_{\text{prop}} &= DFL_{\text{prop}} \times \% \Delta \text{EBIT} \\ &= 1.77 \times 30\% = 53.1\% \end{aligned}$$

Now apply these percentage declines to the projected EPSs to see what they'll become under both structures if the business deterioration does occur.

$$\text{Current: } \$1.054(1 - .336) = \$.70$$

$$\text{Proposed: } \$1.170(1 - .531) = \$.55$$

The implication is that if the proposed capital structure is adopted *and* a substantial downturn occurs, the resulting EPS will be lower than the EPS under the old structure. Clearly, adopting the proposal adds substantial risk.

The impact of the proposed restructuring on stock prices is arguable. We can't say with certainty whether or not the positive effect of the EPS increase will overcome the negative effect of increased risk. It all depends on the current perceptions of investors.

The uncertainty can be expressed in terms of the graph in Figure 14.2 (page 560). The question revolves around just where Moberly currently is on the graph and whether the restructuring will carry it past the peak. We can't say for sure. However, using the DFL to analyze the risk increase gives management a much better feel for the trade-offs involved than it would get if only the EPS impact were considered.

It's unfortunate that the DFL concept isn't used a great deal in practice. In the Moberly problem, many analysts would have stopped after calculating the two EPSs under good conditions. They'd have understood that risk was increased, but wouldn't have tried to quantify the increase for the benefit of the decision maker. We're certain our current readers will rectify that situation in a few years.

EBIT–EPS ANALYSIS

We've learned that financial leverage can enhance results at normal levels of operating profit, but makes those results more volatile at the same time. If that knowledge is to do any good, managers need to be able to use it to make intelligent choices about the amount of leverage their companies should employ given a set of expectations about future business.

This means managers need a way of quantifying and analyzing the trade-off between results and risk implied by moving from one level of leverage to another. EBIT–EPS analysis provides a graphic portrayal of the trade-off that makes the choice relatively straightforward.

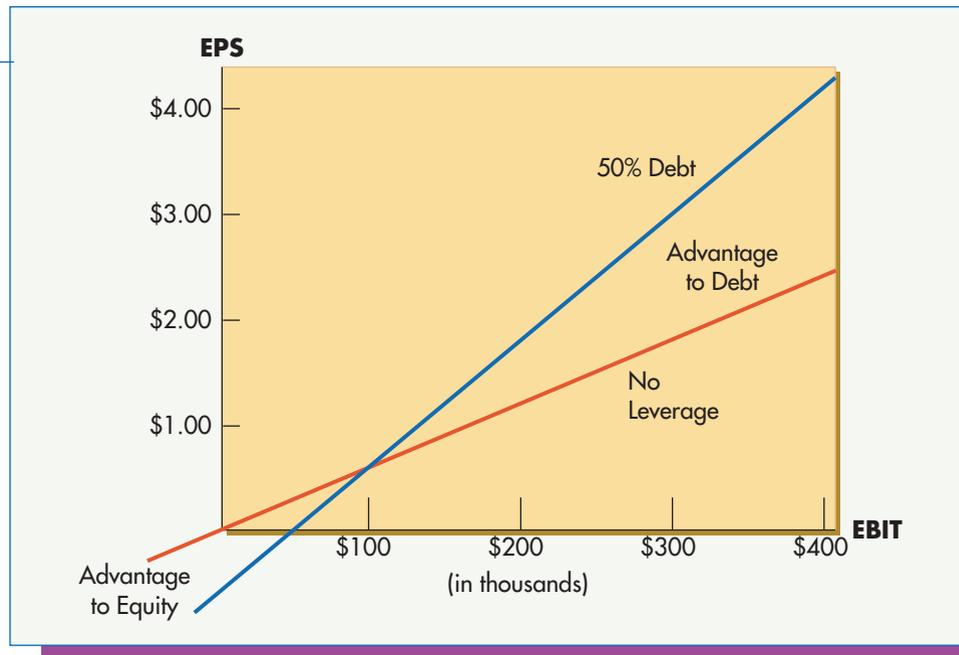
To illustrate, let's go back to the Arizona Balloon Corporation and assume management expects the relatively good year reflected in Table 14.1 (page 553). To keep the illustration simple, we'll assume the choice is between the leverage scenarios of columns 1 and 2 only, although any other combination of debt and equity could be analyzed.

The EBIT–EPS technique involves graphing EPS as a function of EBIT for each leverage level as shown in Figure 14.3. We'll begin with the all equity case in column 1. The table gives us an EPS of \$1.20 at an EBIT of \$200,000. That's a point on the EBIT–EPS graph for zero leverage. EPS is a linear function of EBIT, so we need only one other point to draw the graph. We'll choose EBIT of \$400,000 and calculate EPS.

EBIT	\$400,000
Interest (10%)	—
EBT	\$400,000
Tax (40%)	160,000
EAT	\$240,000
Number of shares	100,000
EPS	\$ 2.40

Figure 14.3

**EBIT–EPS
Analysis for
Arizona Balloon
Corporation from
Table 14.1,
Columns 1 and 2**



These points determine the line labeled “No Leverage” in Figure 14.3.

For the 50% debt scenario, column 2 of Table 14.1 shows an EPS of \$1.80 at an EBIT of \$200,000. A calculation like the one we’ve just done (using \$50,000 in interest and 500,000 shares of stock) gives a second point at which EPS is \$4.20 when EBIT is \$400,000. These points determine the line labeled “50% Debt” in the diagram.

The two lines represent EPS at various levels of operating profit under their respective assumptions about leverage. Notice that they cross one another, making different choices of leverage superior on either side of the intersection. We prefer the higher EPS of the upper line anywhere other than at the intersection, where we’re indifferent between the two choices.

It’s important to be able to find the indifference point. In general the formula of an EPS–EBIT line is the financial computation of EPS from EBIT stated in algebraic form.

$$\text{EPS} = \frac{(\text{EBIT} - I)(1 - T)}{\text{number of shares}}$$

where: I = interest

T = tax rate

Compare the equation to the steps in the partial income statement above. In the numerator, $(\text{EBIT} - I)$ is earnings before tax (EBT), which is adjusted to earnings after tax by multiplying by $(1 - T)$. That divided by the number of shares outstanding is EPS.

We can find the indifference point by equating the EPS for the no-leverage line with that for the 50% leverage line.

$$\frac{\text{No Leverage}}{(\text{EBIT} - \$0)(1 - .4)} = \frac{50\% \text{ Debt}}{(\text{EBIT} - \$50,000)(1 - .4)}$$

$$\frac{\quad}{100,000} = \frac{\quad}{50,000}$$

EBIT–EPS analysis portrays the results of **leverage** and helps to decide **how much** to use.

Solving yields

$$\text{EBIT}_{\text{indif}} = \$100,000$$

In other words, the lines cross, and our preference for leverage changes when EBIT passes through \$100,000.

Notice how useful the diagram is. It tells management that if EBIT is expected to stay above \$100,000, the firm is better off with the higher leverage option. It also gives an indication of how much better off the firm will be for any level of EBIT.

The risk that comes with leverage is reflected by what happens to EPS in the 50% debt case if operating profits fall below \$100,000. In that range, ABC will be on the upper line without leverage, but on the lower line with 50% debt.

The analysis doesn't make the leverage decision for ABC's management. But combined with an idea of the likely variability of EBIT, it gives them all they need to make an informed choice. If EBIT is unlikely to fall much below \$100,000, higher leverage is appropriate. On the other hand, if big swings are common, little or no leverage may be the wiser decision.

from the **CFO**

OPERATING LEVERAGE

We mentioned operating leverage briefly in the beginning of the chapter. The concept deals with cost rather than capital, but the functions and effects are similar to those of financial leverage. Operating leverage also has the ability to *combine* with financial leverage to produce alarmingly volatile results. For this reason we need to be familiar with the workings of operating leverage even though it's not exactly a capital structure issue. We'll begin our study with some background.

TERMINOLOGY AND DEFINITIONS

The term “operations” refers to a firm's business activities exclusive of long-term financing. In terms of the income statement, those activities involve the items from sales down to operating income (EBIT).

Risk in Operations—Business Risk

A firm's EBIT varies over time for a variety of reasons including ups and downs in sales, changes in cost conditions, and the effectiveness of management. Recall that we've already defined variation in EBIT as *business risk* (page 551).

It's important to realize that every business has some variation in its operating results, but some have more than others. The amount depends to a great extent on the nature of the business. Some industries have stable conditions of demand and cost, while in others things go up and down like roller coasters. Generally, most of the variation in EBIT comes about as a result of changes in the level of sales.

Fixed and Variable Costs and Cost Structure

A business's costs can be separated into two categories, *fixed* and *variable*. A fixed cost doesn't change when the level of sales changes, but a variable cost does.

Fixed costs are things like rent, depreciation, utilities, and management salaries. Variable costs include direct labor, direct materials, and other items that go up and down with volume, like sales commissions. Costs that don't fit neatly into either category can usually be separated into fixed and variable components for purposes of analysis. Ultimately, all costs and expenses can be segregated, at least roughly, into fixed and variable categories. Fixed cost is also called *overhead*.

Variation in EBIT is defined as **business risk**.

Cost structure is the mix of **fixed and variable** costs in a firm's operations.

Operating leverage increases as the proportion of **fixed cost** increases.

http://

For more on break-even analysis go to <http://www.dinkytown.net/java/BreakEven.html>

Breakeven analysis shows the mix of **fixed and variable** cost and the volume required for **zero profit/loss**.

A firm's *cost structure* is the mix of fixed and variable costs used in its operating processes. The idea is analogous to the concept of capital structure describing the mix of debt and equity within capital.

Operating Leverage Defined

Given the similar concepts of cost structure and capital structure, operating leverage is defined with respect to cost just as financial leverage is defined with respect to capital. *Operating leverage* refers to the amount of *fixed* cost in the cost structure. Thus, if a firm's costs are largely fixed, it has a great deal of operating leverage.

A good way to get a feel for cost structure and operating leverage is to imagine a factory that can be run in one of two ways, either with (1) a lot of people and a few machines or with (2) a lot of machines and a few people. We tend to describe the first organization as labor intensive or utilizing manual processes and the second as capital intensive or automated.

People represent variable cost because they can be let go when sales and production decline. Machines, on the other hand, represent fixed cost because they can't be laid off during a downturn. Hence, the automated plant (2) has more operating leverage than the labor intensive plant (1).

BREAKEVEN ANALYSIS

Breakeven analysis is widely used to determine the level of activity a firm must achieve to stay in business in the long run. The technique explicitly lays out the effect of sales volume on a firm's use of fixed and variable costs. In doing that it provides an excellent insight into the nature and effect of operating leverage. We'll develop the breakeven model and then use it to illustrate operating leverage.

Overview of Breakeven

The term "breakeven" means zero profit or loss, generally measured at EBIT (operating income). At breakeven, income (revenue) exactly equals outgo (costs and expenses) and the firm just survives. Breakeven analysis is a way of looking at operations to determine the volume, in either units or dollars, a company must sell to achieve this zero-profit, zero-loss situation.

In what follows we'll use the term "cost" broadly to include items generally referred to as expense. Both costs and expenses can be fixed or variable.

BREAKEVEN DIAGRAMS

Fixed and variable costs are represented graphically in the first two panels of Figure 14.4. Cost is plotted along the vertical axis and unit sales (Q for quantity) along the horizontal

Figure 14.4

Fixed, Variable, and Total Cost

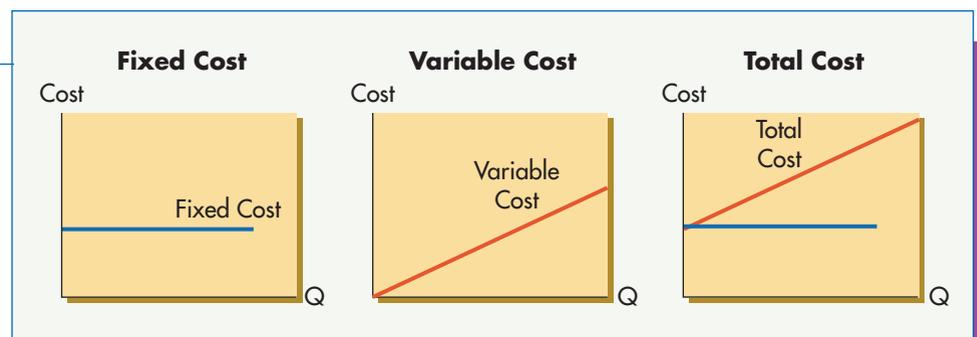
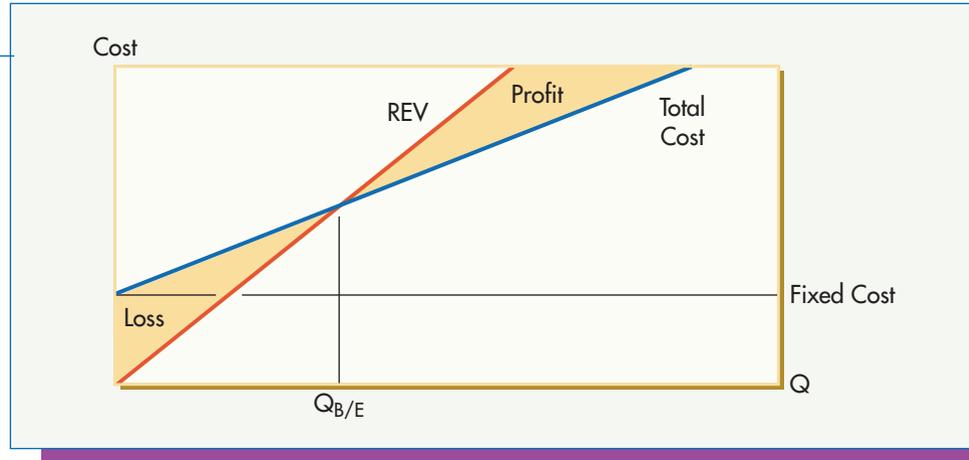


Figure 14.5

The Breakeven Diagram



axis. Fixed cost is constant as sales increase, while variable cost increases proportionately with sales.

The two diagrams are generally combined by plotting variable cost on top of fixed cost. The result is shown in the third panel where the diagonal line represents total cost, the sum of fixed and variable costs.

The *breakeven diagram* is depicted in Figure 14.5. It's formed by overlaying a line representing revenue on the total cost diagram. At any level of sales, revenue is just PQ , price times quantity. A revenue line is shown in Figure 14.5 starting from the origin and extending upward to the right.

Breakeven is the level of sales at which revenue equals cost. On the diagram it's the point where the total cost line and the revenue line intersect. The breakeven volume is directly below that point on the horizontal axis, indicated by $Q_{B/E}$ on the diagram.

At any sales volume, the firm's profit or loss is the difference between revenue and total cost. This can be measured by the difference in the heights of those lines above the axis. The shaded area between the two lines to the right of their intersection represents profitable operations and the shaded area to the left represents losses.

The Contribution Margin

Every time a unit is sold, one unit's worth of variable cost is incurred. The amount by which price exceeds that unit variable cost is called the **contribution** made by the sale. Expressed as an equation,

$$(14.4) \quad C_t = P - V$$

where: C_t is the contribution,
 P is price, and
 V is variable cost per unit.

The term implies a *contribution* to profit and fixed cost. Notice that the unit contribution is the same anywhere on the breakeven diagram—that is, at any level of sales.

Breakeven is at the intersection of revenue and total cost.

Every sale makes a **contribution** of the difference between price and variable cost.

Contribution can be expressed as a percentage of revenue by dividing by the price, P . It's then called the *contribution margin*, which we'll write as C_M . Dividing equation 14.4 by P , we have

$$(14.5) \quad C_M = \frac{P - V}{P}$$

Example 14.3 Suppose a company can make a unit of product for \$7 in variable labor and materials, and sell it for \$10. What are the contribution and contribution margin?

SOLUTION: The contribution comes directly from equation 14.4.

$$\begin{aligned} C_t &= P - V \\ &= \$10 - \$7 \\ &= \$3 \end{aligned}$$

The contribution margin comes from equation 14.5.

$$C_M = \frac{P - V}{P} = \frac{\$3}{\$10} = .3 = 30\%$$

Calculating the Breakeven Sales Level

EBIT is revenue minus cost, which can be expressed in terms of price and quantity as

$$(14.6) \quad \text{EBIT} = PQ - VQ - F_c$$

where: P = price per unit,
 V = variable cost per unit,
 Q = quantity sold, and
 F_c = total fixed cost.

Notice in this equation that P and V are multiplied by Q to represent revenue (PQ) and total variable cost (VQ), but fixed cost is represented by a single variable, F_c . EBIT is revenue minus both cost components, variable and fixed.

Breakeven occurs where revenue (PQ) equals total cost ($VQ + F_c$); hence, $\text{EBIT} = 0$. To find that point, rewrite equation 14.6 with $\text{EBIT} = 0$.

$$0 = PQ - VQ - F_c$$

Then factor out Q , rearrange terms, and solve for the breakeven value of Q , which we've called $Q_{B/E}$.

$$Q(P - V) - F_c = 0$$

$$(14.7) \quad Q_{B/E} = \frac{F_c}{P - V}$$

Notice that the breakeven volume is found by dividing fixed cost by $(P - V)$, which is the contribution per unit sold. In words, the breakeven calculation tells how many units have to be sold to *contribute* enough money to cover (pay for) fixed costs.

Breakeven volume is **fixed cost divided by contribution**.

The breakeven point stated in terms of dollar sales rather than units is equation 14.7 multiplied by price, P . If we call $S_{B/E}$ the breakeven dollar sales level, we have

$$(14.8) \quad S_{B/E} = \frac{P(F_c)}{P - V}$$

Dividing the numerator and denominator of equation 14.8 by P and substituting from equation 14.5 gives a useful expression.

$$(14.9) \quad S_{B/E} = \frac{F_c}{(P - V)/P} = \frac{F_c}{C_M}$$

Equation 14.9 says that the breakeven sales level is just fixed cost, F_c , divided by the *contribution margin*, C_M (stated in decimal form).

Example 14.4 What is the breakeven sales level in units and dollars for the company in Example 14.3 if the firm has fixed costs of \$1,800 per month?

SOLUTION: For the breakeven point in units, write equation 14.7 and substitute.

$$Q_{B/E} = \frac{F_c}{P - V} = \frac{\$1,800}{\$3} = 600 \text{ units}$$

Because as each unit sells for \$10, the breakeven sales level in dollar terms, from equation 14.8, is just

$$\$10 \times 600 = \$6,000$$

Alternatively, the last result is available from equation 14.9 by dividing fixed cost by the contribution margin expressed in decimal form.

$$S_{B/E} = \frac{F_c}{(P - V)/P} = \frac{F_c}{C_M} = \frac{\$1,800}{.3} = \$6,000$$

This calculation essentially tells us how many dollars, each of which contributes 30 cents to profit and fixed cost, it takes to make \$1,800.

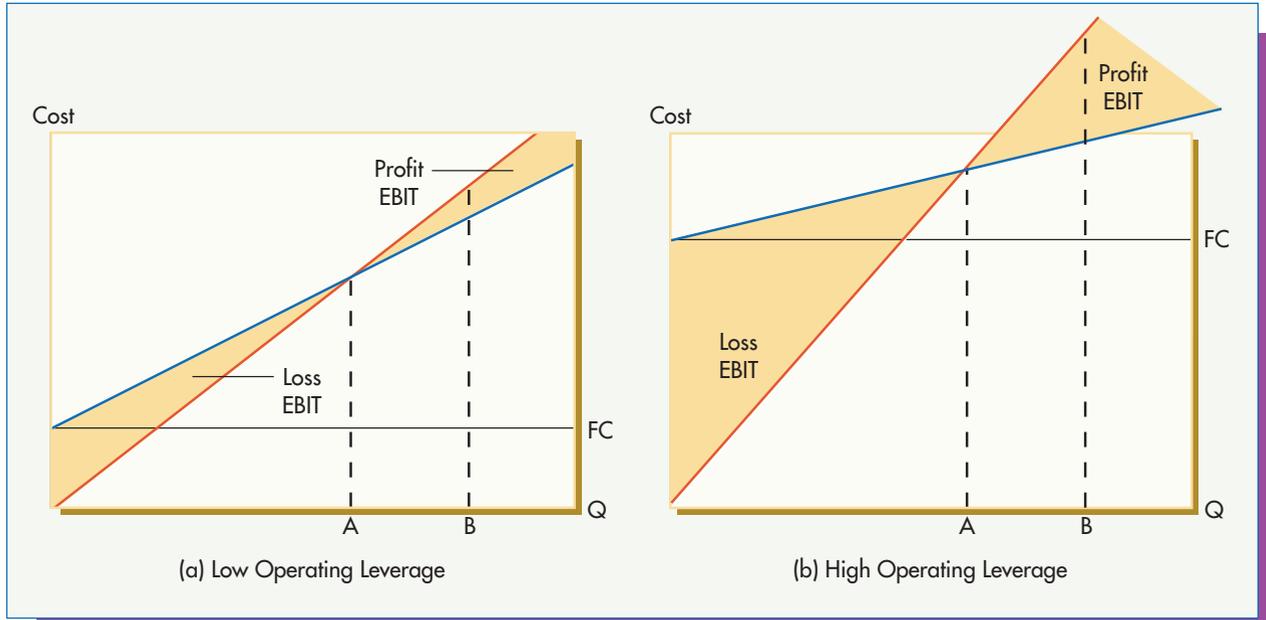
Notice that breakeven volumes in either units or dollars are stated per period of time. In Example 14.4 the period is a month because fixed costs were given on a monthly basis.

THE EFFECT OF OPERATING LEVERAGE

Breakeven analysis gives us an excellent approach to understanding exactly how operating leverage works. We'll begin by examining the breakeven diagrams for two firms that use different amounts of operating leverage. This is equivalent to saying that they differ with respect to their cost structures, one having relatively more fixed cost than the other. The diagrams are shown in Figure 14.6.

For convenience we'll assume both firms have the same breakeven volume shown at sales level A in the diagrams. Recall that the diagrams reflect profit or loss in terms of EBIT in the shaded areas on either side of the breakeven points. As output expands, profit grows as we move further to the right of breakeven. On the other hand, if volume falls below the breakeven level, losses grow as we move further to the left.

Figure 14.6 Breakeven Diagrams at High and Low Operating Leverage



As volume moves away from breakeven, profit or loss **increases faster** with more **operating leverage**.

Variation in EBIT (business risk) is **larger** with more **operating leverage**.

The Risk Effect

Notice the relative speed with which profit or loss grows as we move away from volume level A in the two diagrams. The high operating leverage firm on the right expands profits much faster than the low leverage firm on the left. However, it also expands losses much faster if output falls below the breakeven at A.

This is the essence of operating leverage. Any movement away from point A produces some change in EBIT in the low leverage company. The same movement away from A will produce a larger change in EBIT in the higher leverage firm. In other words, the increased leverage magnifies the change in EBIT that results from a given change in sales volume.

Thus, operating leverage can be said to increase the variation in EBIT as a result of variations in sales. Because variation in EBIT is defined as business risk, it follows that *increased operating leverage increases business risk*.

The effect can be appreciated from the geometry of the diagrams. The high leverage firm has a smaller variable cost, which makes its total cost line flatter than that of the low leverage firm. That means it diverges from the revenue line faster.

Stated another way, the high leverage firm gets a larger contribution from each sale, so it accumulates profits or losses faster as it moves away from the breakeven. Of course, this is true for movement between any two sales levels along the horizontal axis. The trade-off is that the high leverage firm has more fixed cost to cover before it makes a profit than the low leverage firm.

The Effect on Expected EBIT

More operating leverage implies higher operating profit at any output above the breakeven. To see this consider point B in both diagrams of Figure 14.6. The geometry

of the diagrams shows that at the same distance above the breakeven output, the higher fixed cost firm will always make more EBIT.

In general, the higher the fixed cost, the higher profit is at a given point above breakeven. Imagine the F_c line sliding upward in the diagram of Figure 14.6b with the breakeven point staying the same. That would flatten the total cost line and widen the profit triangle.

Hence, if a firm is relatively sure of its output level, it's better off to trade variable costs for fixed. In other words, increasing operating leverage multiplies operating income (EBIT) at output levels that are likely to be high.

What we've said assumes a higher fixed cost is accompanied by a proportionately lower variable cost so the breakeven point stays more or less the same. If that doesn't happen, higher fixed cost doesn't necessarily mean anything.

Example 14.5 Suppose the low leverage firm in Figure 14.6a has fixed costs of \$1,000 per period, sells its product for \$10, and has variable costs of \$8 per unit. Further suppose that the high leverage firm in Figure 14.6b has fixed costs of \$1,500 and also sells product for \$10 a unit.

The diagram shows the breakeven volumes for the two firms to be the same. What variable cost per unit must the high leverage firm have if it is to achieve the same breakeven point as the low leverage firm? State the trade-off at the breakeven point. Which structure is preferred if there's a choice?

SOLUTION: Compute the breakeven volume for the low leverage firm (a) by writing equation 14.7.

$$Q_{B/E-a} = \frac{F_c}{P - V} = \frac{\$1,000}{\$10 - \$8} = 500 \text{ units}$$

This will also be $Q_{B/E-b}$, the breakeven volume for the high leverage firm.

Now write equation 14.7 for the high leverage firm, showing the variable cost per unit as an unknown, V_b . Then substitute the given price and fixed cost and the calculated breakeven volume.

$$Q_{B/E-b} = \frac{F_c}{P - V_b}$$

$$500 \text{ units} = \frac{\$1,500}{\$10 - V_b}$$

Solving for V_b yields

$$V_b = \$7$$

And

$$C_t = \$10 - \$7 = \$3$$

Summarizing, we have the following.

	Low Leverage	High Leverage
Contribution	\$ 2	\$ 3
Fixed cost	\$1,000	\$1,500

Thus, at the breakeven, a \$1 differential in contributions makes up for a \$500 difference in fixed cost.

For an expected level of sales somewhat above the breakeven, the preferable structure depends on volatility. If expectations are for relatively stable business, the high fixed cost model gives better operating results. However, if sales are likely to vary a lot, especially below the breakeven point, the low fixed cost structure might be better in the long run.

THE DEGREE OF OPERATING LEVERAGE (DOL)—A MEASUREMENT

Operating leverage amplifies changes in sales volume into larger changes in EBIT. It can be quantified and measured with an idea called the *degree of operating leverage*, abbreviated DOL. The concept is similar to the DFL we discussed earlier.

The DOL is the ratio of the relative change in EBIT to a relative change in sales. We can write this as

$$(14.10) \quad \text{DOL} = \frac{\% \Delta \text{EBIT}}{\% \Delta Q}$$

We'll forgo the derivation here, but it can be shown that the DOL can be expressed as follows.

$$(14.11) \quad \text{DOL} = \frac{Q(P - V)}{Q(P - V) - F_c}$$

where the variables have the meanings we've been using.

The **DOL** relates relative **changes in volume (Q)** to relative **changes in EBIT**.

Example 14.6 The Albergetti Corp. sells its products at an average price of \$10. Variable costs are \$7 per unit and fixed costs are \$600 per month. Evaluate the degree of operating leverage when sales are 5% and then 50% above the breakeven level.

SOLUTION: First compute the breakeven volume using equation 14.7.

$$Q_{B/E} = \frac{F_c}{P - V} = \frac{\$600}{\$10 - \$7} = 200 \text{ units}$$

Breakeven plus 5% and 50% implies sales of 210 and 300 units, respectively. Use equation 14.11 to calculate the DOL at 210 units per month and at 300 units. At 210 units, we have

$$\begin{aligned} \text{DOL}_{Q=210} &= \frac{Q(P - V)}{Q(P - V) - F_c} \\ &= \frac{210(\$10 - \$7)}{210(\$10 - 7) - \$600} \\ &= 21 \end{aligned}$$

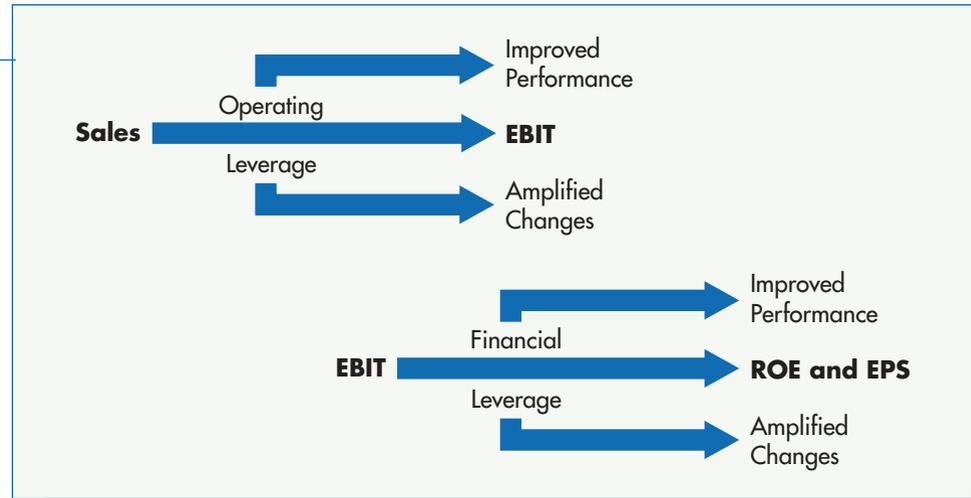
At 300 units, we have

$$\begin{aligned} \text{DOL}_{Q=300} &= \frac{300(\$10 - \$7)}{300(\$10 - \$7) - \$600} \\ &= 3 \end{aligned}$$

Notice that the DOL *decreases* as the output level increases above the breakeven. As a brief exercise, show that the DOL is infinite (not defined) in equation 14.11 at the breakeven point.

Figure 14.7

The Similar Functions of Operating and Financial Leverage



COMPARING OPERATING AND FINANCIAL LEVERAGE

Operating leverage connects sales with EBIT in much the same way that financial leverage connects EBIT with ROE and EPS.

Recall that financial leverage can improve performance in ROE and EPS, and that it amplifies changes in EBIT into larger relative changes in those ratios. Similarly, operating leverage can enhance EBIT at a given sales level, and expands variations in sales into larger relative variations in EBIT. The idea is illustrated in Figure 14.7.

Another similarity has to do with the nature of operating and financial costs. Financial leverage involves substituting debt for equity in the firm's capital structure, while operating leverage involves substituting fixed cost for variable cost in its cost structure.

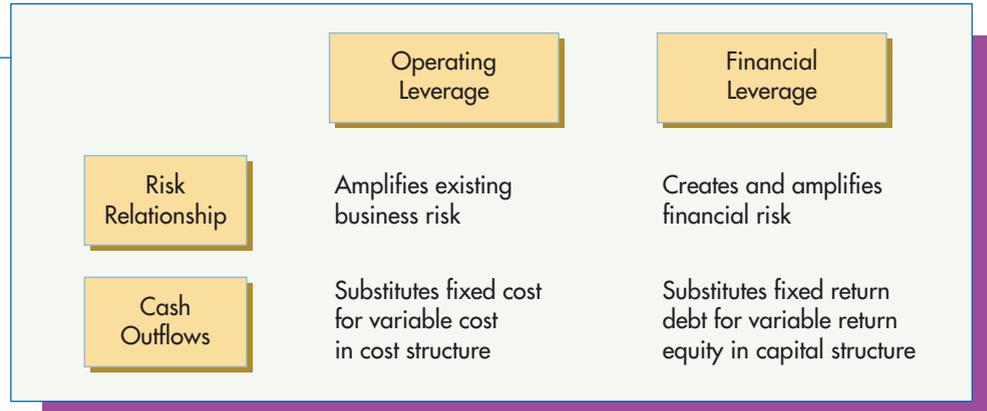
Notice, however, that debt is a *fixed* cost method of financing in that it pays a fixed amount of interest to investors regardless of how well the company does. Equity, on the other hand, is a *variable* cost form of financing, because the dividends paid to stockholders can be varied or eliminated if the firm isn't doing well. Hence, both forms of leverage involve substituting fixed cash outflows for variable cash outflows.

Finally, there's a similarity but not an exact match between the two kinds of leverage with respect to the two kinds of risk we've defined. Financial risk is the additional variation in ROE and EPS caused by financial leverage, while business risk is variation in EBIT that's enhanced by operating leverage. Both kinds of leverage make their respective risks larger as the levels of leverage increase. However, financial leverage is the sole cause of financial risk, while some business risk would exist even if there were no operating leverage. These last ideas are summarized in Figure 14.8.

Two final points of comparison are worth noting. First, virtually all productive processes involve the use of some equipment that generates fixed cost. Therefore, all firms have some operating leverage. On the other hand, many firms use no debt and therefore have no financial leverage.

Second, financial leverage is more controllable than operating leverage. Technology dictates the minimum and maximum amounts of machinery needed to make most products, so management's choice of an operating leverage level is relatively limited. On the other hand, management can generally choose the amount of debt a firm uses within very broad limits.

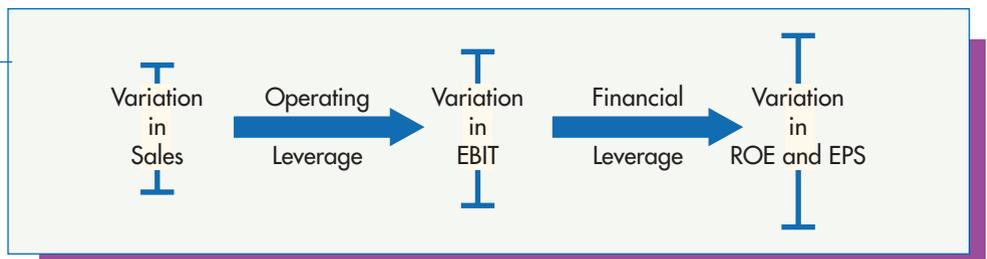
Financial and operating leverage are similar in that **both can enhance results while increasing variation.**

Figure 14.8**Risk and Cost Relationships between Operating and Financial Leverage****THE COMPOUNDING EFFECT OF OPERATING AND FINANCIAL LEVERAGE**

The effects of **financial and operating** leverage **compound** one another.

An important result of the existence of two kinds of leverage is that they compound one another. Changes in sales are amplified by operating leverage into larger relative changes in EBIT, which in turn are amplified into still larger relative changes in ROE and EPS by financial leverage. The net effect is quite large because the combined effect of the two kinds of leverage is *multiplicative* rather than additive.

This means that fairly modest changes in the level of sales can lead to dramatic swings in ROE and EPS in companies that use both operating and financial leverage. The idea is illustrated in Figure 14.9.

Figure 14.9**The Compounding Effect of Operating and Financial Leverage**

The **DTL** reflects the combined effect of both kinds of leverage.

The compound effect of operating and financial leverage can be measured by a concept called the *degree of total leverage*, abbreviated DTL. The DTL is simply the product of DOL and DFL.

(14.12)

$$\text{DTL} = \text{DOL} \times \text{DFL}$$

Example 14.7

The Allegheny Company is considering replacing a manual production process with a machine. The money to buy the machine will be borrowed. The replacement of people with a machine will alter the firm's cost structure in favor of fixed cost, while the loan will move the capital

structure in the direction of more debt. The firm's leverage positions at expected output levels with and without the project are summarized as follows.

	DOL	DFL
Current	2.0	1.5
Proposed	3.5	2.5

The economic outlook is uncertain and some managers fear a decline in sales of as much as 10% in the coming year. Evaluate the effect of the proposed project on risk in financial performance.

SOLUTION: Currently, the degree of total leverage is

$$\begin{aligned} \text{DTL} &= \text{DOL} \times \text{DFL} \\ &= 2(1.5) \\ &= 3 \end{aligned}$$

This means that a 10% decline in sales could result in a 30% decline in EPS. Stated another way, the relative volatility of EPS is three times that of sales.

Under the proposed conditions, the DTL would be much larger.

$$\begin{aligned} \text{DTL} &= \text{DOL} \times \text{DFL} \\ &= 3.5(2.5) \\ &= 8.75 \end{aligned}$$

Here, EPS is almost nine times as volatile as sales, and a 10% drop in volume could produce as much as an 88% decrease in EPS. In other words, EPS could be virtually wiped out. That's likely to affect stock prices a great deal more than a 30% decline.

The conclusion is that the proposal has a great deal more inherent risk than one might think at first glance.⁶

CAPITAL STRUCTURE THEORY

During the last 50 years, financial scholars have devoted a great deal of thinking to capital structure. They've essentially been addressing the same question we posed at the beginning of this chapter: Does capital structure affect stock price and the market value of the firm, and if so, is there an optimal structure that maximizes either or both?

The scholarly approach is more mathematical than the work we've been doing, but the results are essentially the same. Structure does affect price and value, and there is an optimum, but there's no way to find it with any precision.

6. Both of the degree of leverage concepts are a little tricky. The volatility implied by both ratios increases with the addition of debt or fixed cost, but it's even more sensitive to the proximity of breakeven points.

Examine equation 14.3 for the DFL and equation 14.11 for the DOL. Notice that both denominators are zero at breakeven points. In the case of the DOL, the denominator is EBIT, which is zero at the breakeven we've been talking about in this section. For the DFL, the denominator is EBT, which is zero when interest equals operating income.

In the neighborhood of those points, the denominators are very small so the fractions are very large. Hence, we get large *relative* changes in EPS or EBIT, but those changes may not be very large in absolute terms because we're operating at EPS or EBIT levels near zero.

Capital structure theory is one of the more important elements of modern financial thought, and has yielded some valuable insights into real-world problems. Hence, it's important that professionals be familiar with the theoretical approach and understand the nature of the results. Fortunately, we can do that without mastering a great deal of mathematics.

BACKGROUND—THE VALUE OF THE FIRM

Theory approaches capital structure by focusing on the market value of the firm and its cost of capital. The assumption is that if market value can be increased by manipulating capital structure, an increase in stock price must follow.

We'll need to become familiar with the terminology and principles used before getting into the theory itself.

Notation

First let's define the notation (symbols) we'll be using. The market value of the firm is the total market value of all of its debt and equity securities represented as follows.

V_d = market value of the firm's debt

V_e = market value of the firm's stock (equity)

V_f = market value of the firm in total

Hence,

$$(14.13) \quad V_f = V_d + V_e$$



PRACTICAL FINANCE

Leverage and Business Strategy

Business strategy involves understanding the factors that define industrial competition. An important issue in strategy is predicting how companies will react to troubled times or competitive challenges. Leverage plays a big part in those predictions.

The more heavily a firm is leveraged, either financially or operationally, the more quickly it loses money when volume decreases. The effect is compounded when both forms of leverage are present. This means leveraged companies react aggressively when something threatens their volume. They cut prices, increase advertising, and offer special promotions at the drop of a hat to keep volume up. That tends to make the industries in which they operate chaotic and less attractive for everyone. Japanese firms provide a great example of the phenomenon. They're known for their competitiveness, some of which can be traced to exceptional leverage.

Business credit is relatively easy in Japan, and companies tend to carry two or three times the debt of American firms. In other words, they're highly leveraged financially. Firms are also focused on low unit cost, which they achieve with large automated plants. That implies high fixed cost and commensurately high operating leverage.

Beyond these factors, Japanese culture acts to increase leverage. Employment is a lifetime proposition there, and firms just don't lay off employees when business decreases. Hence, labor, the traditional variable cost, is essentially fixed. That increases operating leverage still further.

Taken together, these things imply an extraordinarily high degree of total leverage in Japanese companies. Strategically, they seem to behave accordingly.

Investors' returns on the firm's securities will be

$$k_d = \text{return on an investment in debt (bonds)}$$

and $k_e = \text{return on an investment in equity (stock)}$.

In our study of the cost of capital (Chapter 13), we said that the firm's costs of debt and equity were the investors' returns adjusted for flotation costs and taxes. Theory operates in an abstract world. It assumes away flotation costs and begins by assuming there are no taxes. Therefore, the costs of debt and equity are exactly k_d and k_e , respectively. The cost of capital is then a weighted average of these, which we'll write as

$$k_a = \text{average cost of capital}$$

Value Is Based on Cash Flow Which Comes from Income

The value of any security is the present value of the cash flows that come from owning it, and all cash flows paid to investors come from earnings. Hence, earnings ultimately determine value.

We'll focus on operating income (EBIT), which is by definition the earnings stream available to either debt or equity investors. To avoid some notational confusion later, we'll refer to operating income as OI rather than EBIT in this section.

Assume OI is completely divided between interest and dividend payments, so we can write

$$(14.14) \quad \text{OI} = \text{I} + \text{D}$$

where: $\text{I} = \text{total annual interest payment to bondholders and}$

$\text{D} = \text{total annual dividend payment to stockholders}$.

Debt is assumed to be perpetual. Whenever principal is paid off, a new amount of equal size is immediately borrowed; hence, I is constant year after year. Because no income is retained, the company doesn't grow, and OI remains constant as well. Then equation 14.14 implies that dividend payments are also constant. In other words, each stream of annual payments, I and D, is a *perpetuity*.

The values of the firm's debt and equity are then the present values of these perpetuities, (see page 253) and we can write

$$(14.15) \quad V_d = \frac{\text{I}}{k_d}$$

and

$$(14.16) \quad V_e = \frac{\text{D}}{k_e}$$

where k_d and k_e are the costs of debt and equity. Using equation 14.13, we can also write

$$(14.17) \quad V_f = \frac{\text{I}}{k_d} = \frac{\text{D}}{k_e}$$

The nature of the weighted average return is such that the following expression is essentially equivalent to equation 14.17.

$$(14.18) \quad V_f = \frac{\text{OI}}{k_a}$$

Theory begins by assuming a world **without taxes or transaction costs**, so investors' returns are exactly component capital costs.

Dividend and interest payments are both **perpetuities**, and the firm's market value is the sum of their present values.

Returns drive value in an inverse relationship.

In words, these equations say that the value of the firm is determined by the costs of its debt and equity, and that we can look at them together through the average cost of capital, k_a . Keep in mind that lower rates mean higher values.

This is an important way of looking at things. It means we can think of returns as driving value. For example, if something causes investors to require a higher return on an investment in a company's stock, equation 14.16 says that will drive the value of the firm's equity down. If the return on debt remains the same, the cost of capital, k_a , will also rise and overall value will drop.

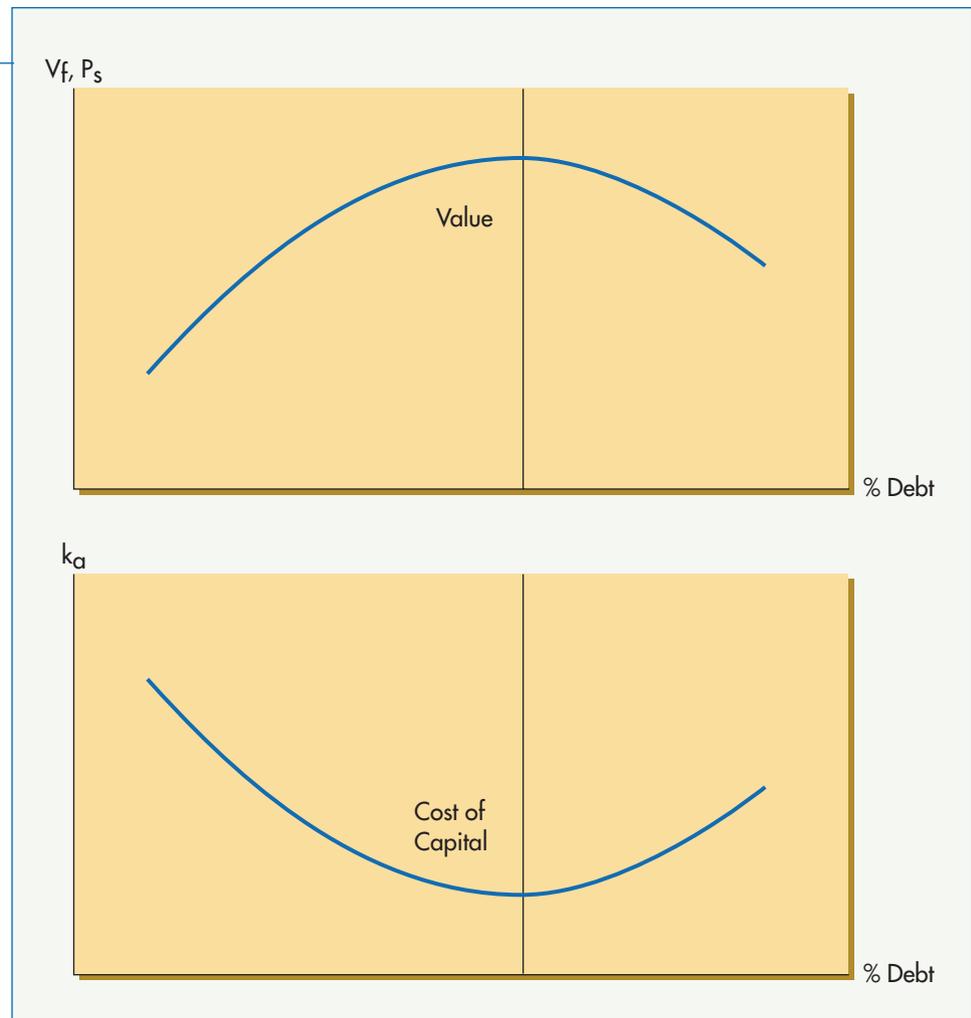
Graphic Portrayals

The foregoing means we can look at value by tracking the behavior of the three returns, k_d , k_e , and k_a , as capital structure changes. We're particularly concerned with the behavior of k_a , the average cost of capital, because of its relation to overall value.

Earlier we talked about stock price and value increasing to a maximum as leverage increases. Equation 14.18 tells us that this is equivalent to k_a decreasing to a minimum and then increasing as debt increases. The idea is illustrated in Figure 14.10, where value and stock price, V_f and P_s , achieve a maximum, while k_a reaches a minimum at the same capital structure.

Figure 14.10

Variation in Value and Average Return with Capital Structure



In what follows, we'll find it useful to include k_e and k_d in the bottom graph of portrayals like Figure 14.10 to analyze how changes in the two component costs of capital influence the average cost.

THE EARLY THEORY BY MODIGLIANI AND MILLER

The theoretical ball got rolling in 1958 when two well-known scholars named Franco Modigliani and Merton Miller published a paper on the effect of capital structure on value.⁷ Modigliani and Miller are cited often, and it has become common to refer to them as MM.

Restrictive Assumptions in the Original Model

MM's work was a sophisticated mathematical model of the financial world. It included a number of restrictions on the behavior of firms and individuals that made it less than realistic. Nevertheless, it provided important insights into the effects of capital structure on value. Later work relaxed some of the restrictions and led to the state of the theory as it is today.

For our purposes the most important restrictions were the following.

1. There are no income taxes.
2. Securities trade in perfectly efficient capital markets in which there are no transaction costs.
3. Investors and companies can borrow as much as they want at the same rate. That is,
 - a. Rates don't go up as one borrows more money, and
 - b. The rate is the same for investors and companies.

The second assumption contains an important subtlety. Among other things, it says that there are no costs associated with bankruptcy. This idea sounds like a contradiction to many students and needs to be explained.

A bankrupt company goes through two processes. First it loses value because of deteriorating business conditions; then it goes into bankruptcy proceedings, which involve either a restructuring of debt or a liquidation of assets.

The assumption of zero bankruptcy cost implies that no legal or administrative fees are incurred in restructuring or liquidating, and if liquidation is required, assets are sold for a value close to what they were worth to the company.

In other words, bankruptcy costs are fees and losses on the sale of used assets. The term does not refer to the loss in value that put the business into a bankruptcy situation in the first place.

The Assumptions and Reality

Clearly, the assumptions of the original MM model were unrealistic. First and most obvious, there are income taxes.

Second, the legal and administrative expenses of bankruptcy are quite large, and assets sold under duress usually bring only a fraction of their original value. In fact, these costs often eat up most of what's left in a bankrupt company.

Third, individuals usually pay higher interest rates than firms pay, and anyone's rates generally go up as more money is borrowed.

MM initially assumed there were **no costs to bankruptcy**.

7. See Franco Modigliani and Merton H. Miller, "The Cost of Capital, Corporation Finance, and the Theory of Investment," *American Economic Review* 48 (June 1958): 261–297.

In spite of these problems, the MM model made an insightful contribution to thinking on the subject of capital structure and provided a starting point for a great deal more effort.

The Result

MM showed that under the restrictive assumptions we've discussed and several others, the firm's total value is unaffected by capital structure. The result is called the **independence hypothesis**, because it shows value to be independent of structure. It can be described in terms of a firm's cost of debt and equity and its average cost of capital. The ideas are illustrated in Figure 14.11.

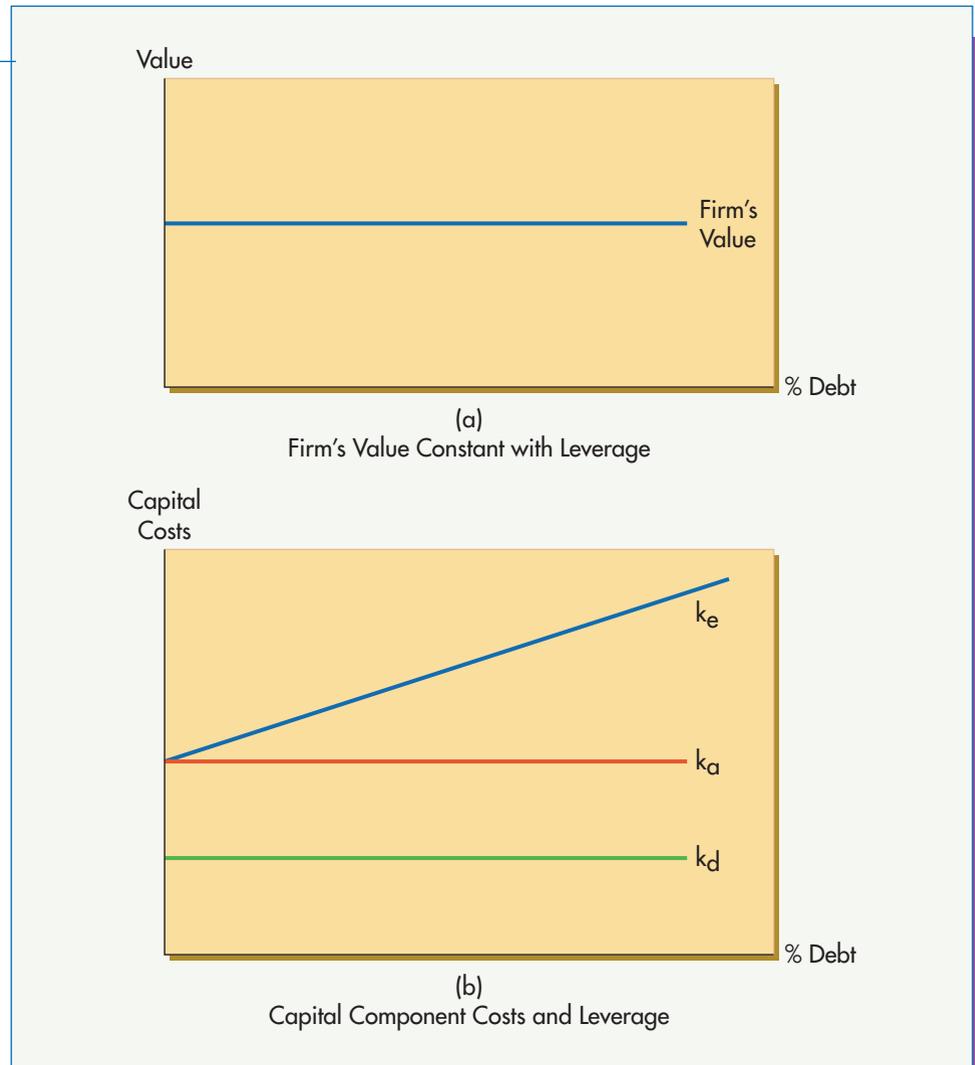
The top graph is straightforward. The firm's value is constant with increasing leverage as we move from left to right on the graph. Stock price can also be shown to be unchanging. The bottom graph requires more explanation.

Notice that along the vertical axis, at zero debt, we have only equity capital, so $k_e = k_a$. Also notice that k_d is lower than k_e , reflecting the fact that an investment in debt is somewhat safer than an investment in the same company's equity. The

Under MM's initial set of restrictions, **value is independent** of capital structure.

Figure 14.11

The Independence Hypothesis



assumption that the firm can borrow at a constant rate is reflected by displaying k_d as a horizontal line for all percentages of debt.

Now consider what happens as the firm replaces equity with debt and moves to the right in the graph. Because the debt is lower in cost, you'd expect the average cost of capital, k_a , to fall as more debt is added to the financing mix. It doesn't, however, because k_e rises as the debt load increases, compensating in the average for the lower cost debt.

Some increase in k_e will always come about when debt is added, because additional debt increases the financial risk on equity holders. As risk increases, equity holders demand higher rates of return. But a constant k_a and the associated constant value implies that k_e increases *exactly* enough to offset the benefit of the increasing amount of lower cost debt being used.

MM's Result Supports the Operating Income View

MM's result wasn't exactly new. Many people already held what can be called an operating income view that's largely the same.

This position maintains that because the firm's value is the present value of its expected operating income stream, a rational market will implicitly hold the total value of that stream constant no matter how the capital is divided between debt and equity. In a sense, this view says that you can't make something out of nothing. The firm's investment value is whatever it is on the basis of income, and that's that. You can't magically create more value by fooling around with the mix.

However, until MM came along, no one had a very good explanation of how this would happen in the marketplace. That is, no one could satisfactorily explain a *process* that would hold investment value constant as leverage is added or subtracted.

The Arbitrage Concept

MM proposed that a process of *arbitrage*⁸ driven by equity investors seeking to *maximize their returns* would hold the value of a firm constant through changes in leverage. The argument is quite complex, but essentially says that if the value of a firm were to go up due to adding leverage, shareholders could get a better return by selling its shares, borrowing some money on their own, and investing in a similar but unleveraged company (the arbitrage is between the leveraged and unleveraged companies). MM's assumption of uniform interest rates comes into play as investors borrow money on their own.

The selloff would drive the price of the leveraged firm down, while the buying would put upward pressure on the price of the unleveraged firm, driving the two values together. The entire process then holds the value of any firm constant as leverage is increased.

(Don't try to figure out why this should work from what we've said here. We haven't gone into enough detail to do that. It's enough that you get a rough appreciation of the conceptual approach.)

MM were said to have provided *behavioral support* for the operating income argument. In other words, they showed how the behavior of investors in financial markets might hold the total value of a firm constant through changes in capital structure. Keep in mind, however, that to do this they had to assume the absence of taxes, no transaction costs for investing (like commissions), and that everyone could borrow as much as they wanted at the same rate.

As **cheaper debt** is added, the **cost of equity increases** because of increased risk such that the weighted average **cost of capital remains constant**.

MM propose that **arbitrage** between leveraged and unleveraged firms will hold **value constant** as debt increases.

8. Arbitrage means making a profit by buying and selling the same thing at the same time in two different markets. For example, suppose you noticed that a stock was selling for \$45 in New York and \$50 in Boston. You could make a profit by placing a buy order in New York and a sell order in Boston at the same time, and delivering the share in Boston that you bought in New York.

The MM result implies that leverage affects value because of **market imperfections**.

Interpreting the Result

It's important to understand what this early result implies about the real world. It doesn't say that a firm's value and its stock price are unaffected by leverage. We know that isn't true. What it does imply is that the *reason* leverage affects value stems from *market imperfections*, like taxes and transaction costs, and not from the basic interaction of investors and companies. That's an important insight into why things are the way they are.

RELAXING THE ASSUMPTIONS—MORE INSIGHTS

Things really got interesting when the assumptions that excluded taxes and bankruptcy costs were relaxed. Before we get into the effect of those changes we need to understand an important point about the workings of the tax system.

Financing and the U.S. Tax System

The tax system favors debt over equity financing because interest payments are deductible to the paying company but dividends are not. We'll illustrate with the two companies depicted in Table 14.4. Assume they're identical except that one is financed entirely with equity and the other is 50% debt financed. Also assume both pay out all after-tax earnings in dividends, the interest rate is 10%, and the tax rate is 40%.

Table 14.4

The Tax System Favors Debt Financing

	All Equity	50% Debt 50% Equity
Capital		
Debt	\$ 0	\$ 500
Equity	<u>1,000</u>	<u>500</u>
Total capital	\$1,000	\$1,000
EBIT	\$ 100	\$ 100
Interest (10% of debt)		<u>50</u>
EBT	\$ 100	\$ 50
Tax (40% of EBT)	<u>40</u>	<u>20</u>
Net income (EAT)	\$ 60	\$ 30
Dividend	<u>60</u>	<u>30</u>
Net retained	\$ 0	\$ 0
Payments to Investors		
Interest	\$ 0	\$ 50
Dividends	<u>60</u>	<u>30</u>
Total	\$ 60	\$ 80

The tax system **favors debt financing** because **interest is tax deductible**, while dividends are not.

Both companies pay all available earnings to the investors who furnish capital. In the case of the equity-financed company, that means all EAT goes to stockholders. However, the other firm pays interest to bondholders and EAT to stockholders.

The important point is shown at the bottom of the table. *Total* payments to investors are *higher* for the leveraged company. The difference comes from the fact that the leveraged firm can deduct interest from taxable income and therefore *pays less tax*.

Including Corporate Taxes in the MM Theory

In the presence of taxes, operating income (OI) has to be split between investors and the government. Because value is ultimately based on income received by investors, this lowers the firm's value from what it would be if there were no taxes. However, the amount of the value reduction depends on the firm's use of leverage, because that affects how much tax the government collects.

Let's focus on how much the government gets. The amount depends on the tax rate and the distribution of funds between debt and equity investors.

In the absence of debt, all of OI is taxable. If the tax rate is T , the government gets

$$(a) \quad T(OI)$$

However, interest is tax deductible, so if there's debt and an amount of interest, I , the government gets only

$$(b) \quad T(OI - I) = T(OI) - TI$$

The difference in what the government gets with and without debt is the difference between a and b, which is TI . Thus, when a firm uses debt financing, the government's take is reduced by TI every year.

Stated conversely, debt results in a yearly perpetuity of TI dollars to be divided among investors that wouldn't be available if debt weren't used. The amount TI is called the *tax shield* associated with debt financing.

The impact of the tax shield on value is simply the present value of the perpetuity TI capitalized at discount rate k_d .

$$(14.19) \quad \text{PV of tax shield} = \frac{TI}{k_d}$$

This can be written more conveniently by recognizing that interest is just debt times the interest rate.

$$(14.20) \quad I = Bk_d$$

where B = debt. (We use the letter B because debt is in the form of bonds.)

Substituting into equation 14.19 yields

$$(14.21) \quad \text{PV of tax shield} = \frac{TI}{k_d} = \frac{TBk_d}{k_d} = TB$$

TB is also referred to as the *benefit of debt*. In words, equation 14.21 says that *having debt in the capital structure increases a firm's value by the magnitude of that debt times the tax rate*.

For example, suppose an all-equity firm that has a tax rate of 40% and a market value of \$2 million restructures by trading \$1 million in stock for the same amount in bonds. The implication of the theory with taxes is that the firm's market value will increase by

$$.4 \times \$1M = \$400,000$$

to \$2.4 million.

Further, the *increment in value will all accrue to the stockholders* because the value of the bonds is fixed by the terms of the bond contract and current interest rates.

In the MM model with taxes, **interest** provides a **tax shield** that reduces government's share of the firm's earnings.

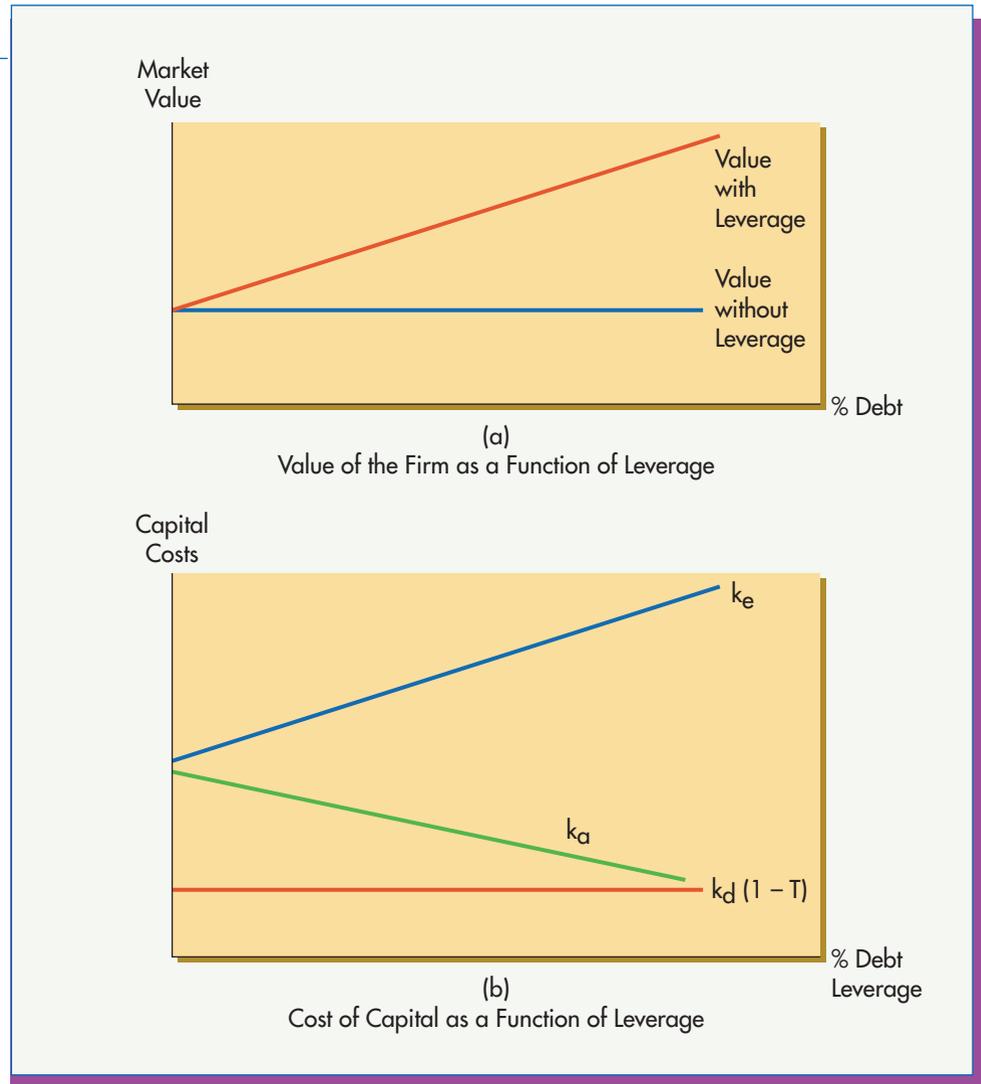
Value is increased by the **PV** of the **tax shield**. The **benefit of debt** is the **tax rate** times the **debt** amount.

The benefit of debt accrues **entirely to stockholders** because bond returns are fixed.

This is a very significant conclusion. It says that a firm can increase its value and the wealth of shareholders at a constant rate by trading equity for debt until it is financed virtually 100% with debt (we say virtually because there has to be some equity). The result is represented in Figure 14.12.

Figure 14.12

MM Theory with Taxes



In the MM model with taxes, **value increases** steadily as **leverage is added**.

The top graph shows the market value of the firm increasing from its all-equity value as the addition of debt increases the present value of the tax shield along with leverage. The lower graph shows the behavior of the component and weighted average costs of capital. Notice that with the inclusion of taxes the cost of debt is $k_D(1 - T)$ rather than just k_D .

In this representation, the average cost of capital falls with the inclusion of more low-cost debt. The cost of equity increases at the same time, but not fast enough to overcome the effect of the low-cost debt.

Bankruptcy costs eventually make investors **raise required rates**, which **lowers value**.

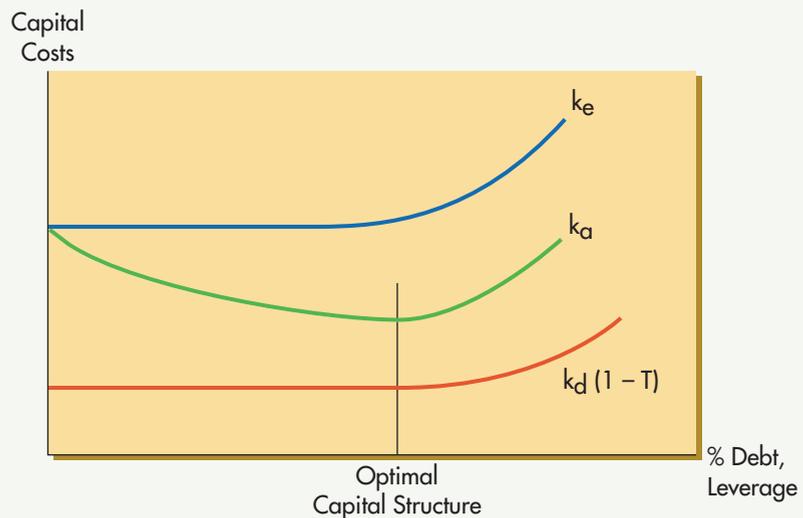
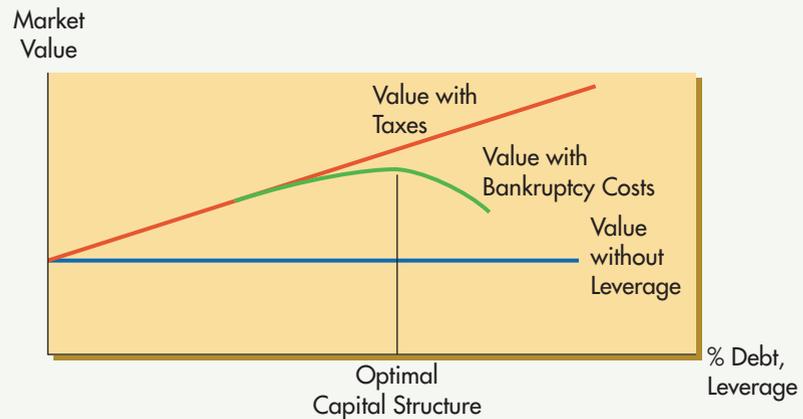
Including Bankruptcy Costs in the MM Theory

The probability of business failure increases as a firm takes on more debt. As explained earlier, bankruptcy costs are *additional* losses that accrue primarily to stockholders when companies fail. As leverage increases past some point, investors become conscious enough of bankruptcy costs to begin raising their required rates of return. In other words, investors begin to worry that *they* will incur losses due to bankruptcy cost if the firm fails. This happens first to equity investors and later to bondholders. As investor required rates go up, so do the firm's capital costs.

The effect is shown in Figure 14.13b. As we move to the right, critical points are passed after which k_e and then k_a begin to climb. It's important to notice that the average cost of capital, k_a , does not begin to increase as soon as k_e starts upward.

Figure 14.13

MM Theory with Taxes and Bankruptcy Costs



That's because it is still being driven downward by the mix change coming from the replacement of high-cost equity with low-cost debt. The minimum value of k_a is reached only after k_e has gone up quite a bit, perhaps reinforced by an increase in k_d .

Now consider the top diagram that shows the firm's value. According to equations 14.15 through 14.18, increasing required returns have a depressing effect on value as we continue to the right after one or both of the returns begin to rise. However, the growing tax shield continues to add value at the same time.

At first the rate effect isn't strong enough to overcome the tax effect and the net result of more leverage is still an increase in value. Before long, however, the growing specter of failure overwhelms the tax effect, and value begins to decline with additional leverage. The peak in value coincides with the minimum in k_a .

Summarizing the Results

In short, the MM model with taxes and bankruptcy costs says that additional leverage increases the value of a firm when total leverage is relatively low. However, a maximum is eventually reached, after which further increases reduce value. Unfortunately, the theory does not provide a method for finding the maximum.

Notice that this result is essentially the same as the one we developed by using an intuitive approach early in the chapter. A little leverage helps, a lot hurts, and it's hard to find the perfect amount.

However, the reasons for the conclusion are different. The MM model attributes the benefit of leverage solely to taxes, while the intuitive approach relies on the impact of improved performance on investors' attitudes and perceptions. Both attribute leverage's negative effects to risk.

AN INSIGHT INTO MERGERS AND ACQUISITIONS

Corporate mergers happen in a number of ways that we'll study in some detail in Chapter 17. For now we just need to understand that in many mergers one company simply buys the stock of another company called the *target*.

To obtain control quickly, the buying company has to purchase most of the shares of the target over a short period of time. That means it can't just buy them in the stock market at the going price, because at any particular time most stockholders aren't interested in selling at that price.

To overcome this difficulty, the acquiring firm offers to buy the target's stock at a *premium* over its current market price. The offer is made to all of the target's stockholders at once and may be extended directly or through the firm's management.

This process means that a corporate buyer usually pays a great deal more for a target company than the pre-merger market value of its stock. Paying twice that value isn't unheard of.

This raises an interesting question. How can any sane acquiring company rationalize paying as much as 50% or 100% over market value for a target company? Are the financial high rollers who do such deals crazy, or do they know something others don't?

One rationale for high acquisition premiums involves capital structure theory and the method of financing the purchase. Target companies are frequently thought to be undervalued because they aren't using much debt. In other words, their capital structures are near the left sides of the graphs in Figure 14.13. The implication is that a restructuring which adds debt might substantially increase their value.

The **MM model** with taxes and bankruptcy costs concludes that an **optimal capital structure exists**.

Acquiring firms often raise the money to purchase a target's stock by borrowing. The resulting merged business ends up with a new owner and a great deal more debt than it had before. This seems like a sucker deal for the new owner. *But* if the increase in market value due to adding debt (and moving to the right in Figure 14.13) is greater than the total premium paid for the stock, everyone can come out a winner, the buyers as well as the old owners.

In other words, the increase in leverage brought about by a merger can *theoretically* produce a value increment that is available to be divided between the new and old owners. If the increment is big enough, and the new owners negotiate wisely enough, they can get rich! On the other hand, if they misjudge the effect of the leverage increase, they can go broke.

The argument certainly has validity, but it tends to be somewhat overblown. Indeed, many acquisitions involve premiums that seem far beyond anything that could be achieved through a leverage-based value increment.

Borrowing to pay a **premium** in an **acquisition** may be theoretically **justified** if value is increasing with leverage.

QUESTIONS

1. The user of leverage might be thought of as taking advantage of the provider. Between stockholders and bondholders, who is the user, and who is the provider? Give a word explanation or illustration that might support this view. What does the used party get in return?
2. The central issue underlying the study of leverage is whether or not it influences stock price and whether there's an optimal structure. But the whole idea seems kind of fuzzy and uncertain. Why are people so interested? (*Hint*: Think of management's goals and of the world of mergers.)
3. Relate business and financial risk as defined in this chapter to the risks described in Chapter 9.
4. Why are ROE and EPS such important measures of performance to investors?
5. Both business risk and financial risk would exist with or without either type of leverage. Leverage just makes them more significant. Are those statements true or false? Explain.
6. Briefly explain the pros and cons of financial leverage. In other words, what are its benefits, and what are the costs that come along with those benefits?
7. Explain in words the ROCE test for the advisability of adding leverage. That is, what is the test really telling us? When will it indicate a company is doing the wrong thing?
8. The risk added by financing is small and insignificant in relation to the inherent risk in most businesses. Is that statement true or false? Discuss.
9. Describe generally how leverage affects stock prices. What forces are at work, driven by what effects?
10. Explain the difference between a fixed and a variable cost. How do these concepts change as the time horizon lengthens? In other words, are the same things fixed over a five-year planning period that are fixed in a typical one-year period? What about a 10-year period? What's the relevant period when we're talking about operating leverage?

11. Why do labor-intensive processes involve less operating leverage than automated processes? What fixed costs are associated with automation? Why can't those costs be eliminated by just selling the machinery?
12. Explain the idea of breakeven analysis in a brief paragraph.
13. Describe the concept of the breakeven point in words by using the concept of contribution and fixed costs. (Short answer.)
14. Summarize the effect of operating leverage on EBIT.
15. The Braithwaite Tool Co. is considering a major modernization and automation of its plant using borrowed funds. Fully discuss a serious financial negative that could result from the project.
16. Explain the idea of bankruptcy costs. Why are they important to investors? When do investors start to worry about them?
17. Briefly describe the result of MM's original restrictive model. Why was it important in spite of its serious restrictions?
18. Briefly summarize the operating income argument that was supported by the original MM result.
19. Outline the arbitrage process proposed by MM that supports the operating income argument. What is the arbitrage between?
20. Explain in words how the tax system favors debt financing.
21. In a short paragraph, describe the result of adding taxes to the MM model.
22. In another short paragraph, describe the effect of adding bankruptcy costs to the MM model with taxes.
23. Compare the implications of the MM model with taxes and bankruptcy costs to the things we discovered by studying the Arizona Balloon Corporation.

BUSINESS ANALYSIS

1. The Armageddon Corp. is in big trouble. Sales are down and profits are off. On top of that, the firm's credit rating has been reduced, so it's facing very high interest rates on anything it borrows in the future. Current long-term borrowing represents 60% of capital but at fixed interest rates, so it won't be affected.

The firm's major stockholder, the Apocalypse Group, has scheduled a conference with management to discuss the company's problems. Everyone is very nervous about this conference, and the executive team is meeting to decide what to tell Apocalypse.

Charlie Gladhand, the director of marketing, came into the meeting wearing a wide grin. He explained that he'd read an article about leverage that contained the solution to the company's problem. The article told of several successful firms that had, to the delight of their owners, become more successful by borrowing money. Charlie suggests that Armageddon dazzle the Apocalypse Group by borrowing heavily in the next few days before the conference.

Critique Charlie's idea.

2. You're interested in investing in the Peters Company, which has shown a remarkable increase in EPS during the last three years. Investigating, you find that the company's debt to equity ratio has increased dramatically over the same period and is now four to one. How does this information affect your feelings about Peters as an investment?
3. You're the CFO of Axelrod Trucking, a privately held firm whose owner, Joe Axelrod, is interested in selling the company and retiring. He therefore wants to pump up its value by any means possible. Joe read an article about leverage in a business magazine the other day, and has sent you a memo directing that you restructure the firm's capital to the "optimum" in order to maximize the company's value. Prepare a brief response to Joe's memo.
4. The Revere Company currently has good earnings and a capital structure that's 20% debt. Its EPS is in the upper quarter of firms in its industry. Top management's compensation is in large part based on the year-end price of the company's stock. It's now October and the president, Harry Upscale, is looking for ways to pump that price before December 31. Harry invests in stocks himself and pays a great deal of attention to EPS when buying and selling. He also understands that leverage can magnify EPS. However, he knows little more than that about finance. Harry has strongly suggested to the treasurer that Revere restructure its capital to 65% debt to enhance EPS and increase stock price.

You're an analyst in the firm's treasury department. The treasurer has asked you to prepare an analysis of Harry's proposal to help him talk the boss out of the idea. You've calculated the company's current DFL at 2.2, and projected that it would be 5.8 at the proposed leverage level. Draft a memo from the treasurer to Harry tactfully explaining why his idea may not work and might actually have a result opposite to what he wants to achieve.
5. The Appleridge Company is a large manufacturer of capital goods. (The demand for capital goods typically swings up and down a great deal between good and bad economic times.) Business has been good lately and is expected to remain so in the foreseeable future. The firm is currently relatively labor intensive in its processes. The chief engineer, Mike Quickwrench, has suggested a major project to modernize and automate the plant. At the output level planned for next year, the project will reduce total cost by 10%. Mike has presented the idea to the management team in a totally positive light. The other executives are caught up in Mike's enthusiasm and are ready to proceed. You're Appleridge's CFO, and feel that all sides of an issue should be discussed before it is approved. What concerns do you have? How would you present them in a way that keeps you from appearing to be overly negative?
6. The Wycombe Company is doing well and is interested in diversifying, so it has been looking around for an acquisition target. The Albe Company has been found with the help of an investment banker. Albe is quite profitable and is about half the size of Wycombe. This size relationship is reflected in their market values. Both firms are financed entirely by equity. The investment banker has advised that it will be necessary to pay a premium of about 30% over market price to acquire Albe. Wycombe's president is having a hard time with this news and has asked you for advice. Construct and explain an approach to the acquisition that might make the premium easier to rationalize. Would it affect your argument if neither Albe nor Wycombe were particularly profitable? If so, how?

PROBLEMS

1. The Connecticut Computer Company has the following selected financial results.

	10% Debt	40% Debt	75% Debt
Debt	\$ 10,000		
Equity	90,000		
Total capital	\$100,000		
Shares (@ \$5)	18,000		
EBIT	\$ 18,000		
Interest (15%)	1,500		
EBT	\$ 16,500		
Tax (40%)	6,600		
EAT	\$ 9,900		
ROE			
EPS			

The company is considering a capital restructuring to increase leverage from its present level of 10% of capital.

- a. Calculate Connecticut's ROE and EPS under its current capital structure.
 - b. Restate the financial statement line items shown, the number of shares outstanding, ROE, and EPS if Connecticut borrows money and uses it to retire stock until its capital structure is 40% debt assuming EBIT remains unchanged and the stock continues to sell at its book value. (Develop the second column of the chart shown.)
 - c. Recalculate the same figures assuming Connecticut continues to restructure until its capital structure is 75% debt. (Develop the third column of the chart.)
 - d. How is increasing leverage affecting financial performance? What overall effect might the changes have on the market price of Connecticut's stock? Why? (Words only. *Hint*: Consider the move from 10% to 40% and that from 40% to 75% separately.)
2. Reconsider the Connecticut Computer Company of the previous problem assuming the firm has experienced some difficulties and its EBIT has fallen to \$8,000.
 - a. Reconstruct the three-column chart assuming Connecticut's EBIT remains at \$8,000.
 - b. Interpret the result in terms of stock price and the advisability of restructuring capital under these conditions.
 - c. Could these results have been predicted more easily? Use the ROCE concept to come to the same conclusion.
 3. Assume Connecticut Computer Company of the last two problems is earning an EBIT of \$15,000. Once again, calculate the chart showing the implication of adding more leverage. Verbally rationalize the result.
 4. Watson Waterbed Works Inc. has an EBIT of \$2.75 million, can borrow at 15% interest, and pays combined state and federal income taxes of 40%. It currently has no debt and is capitalized by equity of \$12 million. The firm has 1.5 million shares of common stock outstanding that trade at book value.

- a. Calculate Watson's EAT, ROE, and EPS currently and at capital structures that have 20%, 40%, 60%, and 80% debt.
 - b. Compare the EPS at the different leverage levels, and the amount of change between levels as leverage increases. What happens to the effect of more debt as leverage increases from a little to a lot?
5. The Canterbury Coach Corporation has EBIT of \$3.62 million and total capital of \$20 million, which is 15% debt. The 425,000 shares of stock outstanding sell at book value. The firm pays 12% interest on its debt and is subject to a combined state and federal tax rate of 40%. Canterbury is contemplating a capital restructuring to either 30%, 45%, 60%, or 75% debt.
- a. At the current level of profitability, will more debt enhance results? Why?
 - b. Calculate the EAT, ROE, EPS, and the DFL at the current and proposed structures, and display your results in a systematic table.
 - c. In a short paragraph referring to your table, discuss the trade-off between performance and increased risk (reflected in the DFL) as leverage increases. Do some levels seem to make more sense than others? What business characteristics would make the higher leverage levels less of a problem?
6. The Tanenbaum Tea Company wants to show the stock market an EPS of \$3 per share, but doesn't expect to be able to improve profitability over what is reflected in the financial plan for next year. The plan is partially reproduced below.

Tanenbaum Tea Company
Financial Projection 20x1
(\$000)

EBIT	\$18,750	Debt	\$ 13,000
Interest (@ 12%)	1,560	Equity	97,000
EBT	\$ 17,190	Capital	\$110,000
Tax (@ 40%)	6,876		
EAT	\$10,314	Number of shares =	3,700,000

Tanenbaum's stock sells at book value. Will trading equity for debt help the firm achieve its EPS goal, and if so, what debt level will produce the desired EPS?

7. Balfour Corp. has the following operating results and capital structure (\$000).

Revenue	\$6,000	Debt	\$ 1,200
Cost/expense	4,500	Equity	8,800
EBIT	\$1,500	Total	\$10,000

The firm is contemplating a capital restructuring to 60% debt. Its stock is currently selling for book value at \$25 per share. The interest rate is 9% and combined state and federal taxes are 42%.

- a. Calculate EPS under the current and proposed capital structures.
- b. Calculate the DFL under both structures.
- c. Use the DFLs to forecast the resulting EPS under each structure if operating profit falls off by 5%, 10%, or 25%.

- d. Comment on the desirability of the proposed structure versus the current one as a function of the volatility of the business.
- e. Is stock price likely to be increased by a change to the proposed capital structure? Discuss briefly.

8. Algebraically derive:

$$\text{EPS} = \text{ROE} \times (\text{book value per share})$$

(Hint: Write the definitions of ROE, EPS, and book value, and then start substituting.)

9. You're a financial analyst at Pinkerton Interactive Graphic Systems (PIGS), a successful entrant in a new and rapidly growing field. As in most new fields, however, rapid growth is anything but ensured, and PIGS's future performance is uncertain.

The firm expects to earn operating profits of \$4 million next year, up from \$1 million last year. To support this enormous growth the firm plans to raise \$15 million in new capital. It already has capital of \$5 million that is 40% debt.

PIGS can raise the new money in any proportion of debt and equity management chooses. The CFO is considering three possibilities: all equity, \$8 million debt and \$7 million equity, and all debt.

Interest on the current debt as well as on new borrowing is expected to be 10%, and the company pays state and federal income taxes at a combined rate of 40%. Equity will be raised by selling stock at the current market price of \$10, which is equal to its book value.

The CFO has asked you to prepare an analysis to aid management in making the debt/equity decision. You are also to provide a recommendation of your own.

- a. Prepare an EBIT–EPS analysis of the situation showing a line for the capital structure that results from each of the three options. (Calculate EPS under each new capital structure at EBIT levels of \$1 million, \$2 million, and \$4 million. Then graph EBIT versus EPS for each option. Refer to Figure 14.3. Show last year's EPS on the graph.)
 - b. Discuss the effect the options might have on stock price.
 - c. Make a subjective recommendation under each of the following assumptions about the \$4 million operating profit forecast. Support your position with words and references to your EBIT–EPS analysis.
 - 1. The \$4 million operating profit projection is a best-case scenario. Anything from (\$2) million to \$4 million has an equal probability of occurring.
 - 2. The \$4 million is a fair estimate with about a 60% probability. However, performance better than \$4 million is unlikely. Results could range anywhere from zero to \$4 million.
 - 3. The \$4 million is an easy target. There's an even chance of anything between \$4 million and \$8 million.
10. Cranberry Wood Products Inc. spends an average of \$9.50 in labor and \$12.40 in materials on every unit it sells. Sales commissions and shipping amount to another \$3.10. All other costs are fixed and add up to \$140,000 per month. The average unit sells for \$32.00.
- a. What are Cranberry's contribution and contribution margin?
 - b. What is the firm's breakeven point in units?

- c. Calculate the dollar breakeven point in two ways.
 - d. Sketch the breakeven diagram.
 - e. Calculate the DOL when sales are 20%, 30%, and 40% above breakeven.
11. Refer to the Cranberry company of the previous problem:
- a. Suppose automated equipment is added that increases fixed costs by \$20,000 per month. How much will total variable cost have to decrease to keep the breakeven point the same?
 - b. Calculate the DOL at the same output levels used in part (e) of the previous problem.
 - c. Comment on the differences in DOL with and without the additional equipment.

Problems 12–15 refer to Burl Wood Products (BWP), a manufacturer of high-quality furniture.

12. BWP projects sales of 100,000 units next year at an average price of \$50 per unit. Variable costs are estimated at 40% of revenue, and fixed costs will be \$2.4 million. BWP has \$1 million in bonds outstanding on which it pays 8%, and its marginal tax rate is 40%. There are 100,000 shares of stock outstanding which trade at their book value of \$30. Compute BWP's contribution, contribution margin, EAT, DOL, and EPS.
13. BWP intends to purchase a machine which will result in a major improvement in product quality along with a small increase in manufacturing efficiency. The machine will cost \$1 million which will be borrowed at 9%. The quality improvement is expected to have a significant impact on BWP's competitive position. Indeed, management expects sales to increase by 5% in spite of a planned 10% price increase. The efficiency improvement combined with the price increase will result in variable costs of 36% of revenue. Fixed cost, however, will rise by 19%.
- a. Compute BWP's, new contribution, contribution margin, EAT, DOL, and EPS if it purchases the new machine.
 - b. If all of BWP's projections come to pass, how will stock price be influenced? What factors should be considered in estimating a stock price change?
14. Calculate BWP's DFL and DTL before and after the acquisition of the new machine.
15. Use the information from the previous two problems. Calculate BWP's breakeven point in units and dollars, with and without the purchase of the new machine.
16. The Spitfire Model Airplane Company has the following modified income statement (\$000) at 100,000 units of production.

Revenue	\$10,000
Variable cost	6,500
Fixed cost	<u>2,200</u>
EBIT	\$ 1,300
Interest (@ 10%)	<u>500</u>
EBT	\$ 800
Tax (@ 40%)	<u>320</u>
EAT	\$ 480
Number of shares	20,000

- a. What are Spitfire's contribution margin and dollar breakeven point?
 - b. Calculate Spitfire's current DFL, DOL, and DTL.
 - c. Calculate the current EPS and estimate what it would become if sales declined by 25%. Use the DTL first and then recalculate the modified income statement. (Assume a negative EBT generates a negative tax.)
17. The Singleton Metal Stamping Company is planning to buy a new computer-controlled stamping machine for \$10 million. The purchase will be financed entirely with borrowed money, which will change Singleton's capital structure substantially. It will also change operations by adding \$1.5 million in fixed cost and eliminating \$2 million in variable cost at the current level of sales. The firm's current financial position is reflected in the following statement (\$000).

Revenue	\$18,000		
Variable cost	10,000	Debt	\$ 5,000
Fixed cost	<u>5,000</u>	Equity	<u>15,000</u>
EBIT	\$ 3,000	Total	\$ 20,000
Interest (@10%)	<u>500</u>		
EBT	\$ 2,500	Number of shares	750,000
Tax (@ 40%)	<u>1,000</u>	EPS	\$ 2.00
EAT	\$ 1,500		

- a. Restate the financial statements with the new machine, and calculate the dollar breakeven points with and without it.
 - b. Calculate the DFL with and without the new machine.
 - c. Calculate the DOL with and without the new machine. (*Hint: You don't need Q to use equation 14.11, because PQ is revenue and VQ is total variable cost.*)
 - d. Calculate the DTL with and without the new machine.
 - e. Comment on the variability of EPS with sales and the source of that variability.
 - f. Is it a good idea to buy the new machine if sales are expected to remain near current levels? Give two reasons why or why not. What has to be anticipated for the project to make sense?
18. Schoen Industries pays interest of \$3 million each year on bonds with an average coupon rate of 7.5%. The firm has 4.5 million shares of stock outstanding and pays out 100% of earnings in dividends. Earnings per share (EPS) is \$3.50. Schoen's cost of equity is 12%. Calculate the firm's total value (the value of its debt plus that of its equity) under the assumptions of Modigliani and Miller's simplest model (i.e., that there are no taxes and no transactions costs in financial markets).
19. Assume Schoen Industries of the last problem is subject to income tax at a rate of 40%.
- a. Recalculate the value of the firm assuming there is no tax shield associated with debt and compare it to the value calculated in the last problem. That is, assume interest is subtracted in calculating earnings, but is not deductible in calculating taxes. How much value has theoretically been lost to investors as a result of taxes? Which investors suffer the loss, stockholders or bondholders?
 - b. What is the value of the *tax shield* associated with the firm's debt. What is the *benefit of debt*? Calculate the theoretical value of the firm including the benefit

- of debt and compare it with the value calculated in the last problem. Who gets the incremental value resulting from the tax shield?
- c. Under what conditions, assuming bankruptcy costs are introduced, are investors likely to receive the full benefit of debt calculated in part b? Words only.

INTERNET PROBLEM

20. Go to <http://www.Morningstar.com>. Click on quotes in the upper left corner of the page without putting anything in the window. Use the blue search box in the middle of the page to find information about companies. Put in a name or ticker-tape symbol and click search. When the firm comes up, click financial statements on the left and then the tab for 10-year balance sheets. Calculate the firm's debt as a percentage of total capital (debt + equity) as a measure of leverage. Compare the ratios for a few companies you're familiar with. Explore different kinds of companies such as manufacturers, service providers, and financial services firms. Write a brief summary of your findings.

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21. In this exercise, we will calculate the capital structures of several firms and examine the stability of those structures.
- Enter Thomson ONE for each of the seven companies we have been working with; Sherwin Williams (SHW), General Motors (GM), Harley-Davidson (HOG), Starbucks (SBUX), Microsoft (MSFT), General Mills (GIS), and Yahoo (YHOO), and locate the five-year balance sheet history. Scroll down to the liabilities and equities section and write down the firm's capital components over the last five years. Then compute the capital structure as of the end of each year.
- Are the structures relatively stable over time?
 - Might stability reflect a target capital structure or could there be other reasons for it?
 - Which of the firms *might* be applying the ideas presented in this chapter about managing stock price with leverage? Which companies don't seem to be paying much attention to that idea?
 - Our firms are from different industries but some may have similar capital structures. What characteristic do those firms share that could explain the similarity. (*Hint*: Why do certain companies have little or no debt?)
 - Do any of the firms seem to have too much debt?
 - How could a debt-heavy capital structure come about despite management's efforts to maintain a more conservative structure?

22. Now compare each firm's structure with those of its peers. For each firm enter the Thomson ONE peer analysis module, locate the balance sheet, and scroll down to the liabilities and equity section. Record the firm's capital components and calculate its capital structure.

Once you have the subject company's figures, make the same calculation for the peer mean balance sheet, which represents an average of the firms in the company's peer set. Comment on the company's capital structure relative to the average structure in its industry.

Now identify the individual peers. Select one or two firms you recognize, make the same calculation, and compare the resulting capital structure with that of the subject firm. Is there a significant difference? If so, can you hypothesize why?