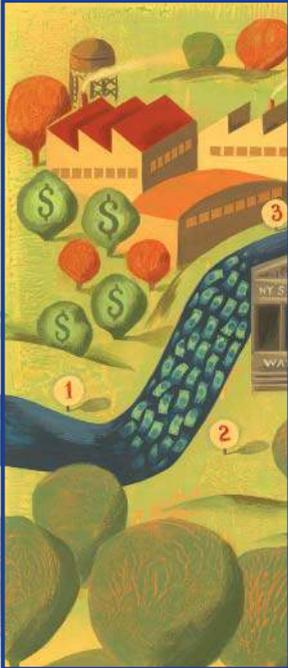


CHAPTER OUTLINE


The Purpose of the Cost of Capital
Cost of Capital Concepts

- Capital Components
- Capital Structure
- Returns on Investments and the Costs of Capital Components
- The Weighted Average Calculation—the WACC
- Capital Structure and Cost—Book versus Market Value

Calculating the WACC

- Developing Market-Value–Based Capital Structures

- Calculating Component Costs of Capital
- Putting the Weights and Costs Together

The Marginal Cost of Capital (MCC)

- The Break in MCC When Retained Earnings Run Out
- The MCC Schedule

**The Cost of Capital—A Comprehensive Example
A Potential Mistake—Handling Separately Funded Projects**

We introduced the cost of capital briefly in Chapter 10, because we needed some appreciation of the concept to grasp the rationale behind capital budgeting. In this chapter we'll explore the idea in more detail and learn how to calculate a firm's cost of capital.

THE PURPOSE OF THE COST OF CAPITAL

A company's cost of capital is the average rate it pays for the use of its capital funds. That rate provides a benchmark against which to measure investment opportunities in the context of capital budgeting.

The idea is very straightforward. No one should invest in any project that will return less than the cost of invested funds. Because a firm's cost of capital is the best estimate of the cost of any money it invests, it should never take on a project that doesn't return at least that rate.

This is equivalent to saying that to be accepted, a project must either have an IRR that exceeds the cost of capital or an NPV that is positive when computed at that rate. These ideas were developed in Chapter 10 where we used the symbol k to represent the cost of capital. Review pages 423–424 if necessary.

It's quite important to the effective management of a company that its cost of capital be estimated accurately. Otherwise the firm is likely to make incorrect investment decisions that can jeopardize its profitability and long-run survival.

The cost of capital concept is similar to an idea we've already studied: an individual investor's required return for a particular stock. In Chapter 9 (page 372), we said that an investor wouldn't buy a stock unless its expected return was higher than his or her required return for that company. Further, we said that people base required returns on risk.

The **cost of capital** is the **average rate paid** for the **use of capital funds**. It is used **primarily** in **capital budgeting**.

A company's cost of capital can be thought of as its required return for all capital budgeting projects that have risk levels approximately equal to its own risk. A project's expected return is its IRR. Hence, a firm won't invest in a project unless its IRR (expected return) exceeds that firm's cost of capital (required return).

COST OF CAPITAL CONCEPTS

“Capital” refers to money acquired for use over long periods of time. The funds are generally used for getting businesses started, acquiring long-lived assets, and otherwise doing the kinds of projects we studied in Chapters 10 through 12 under the topic of capital budgeting. On a firm's financial statements, capital appears on the lower right side of the balance sheet.

CAPITAL COMPONENTS

The **components** of a firm's capital are **debt, common equity**, and **preferred stock**.

Capital can be divided into **components** according to the way the money was raised. The two basic classifications are debt and common equity. Debt is borrowed money raised through loans or the sale of bonds. Common equity indicates an ownership interest, and comes from the sale of common stock or from retaining earnings.

A third kind of capital comes from the sale of preferred stock. Preferred can be thought of as a cross between debt and equity, because it has some of the characteristics of each. Legally it's a kind of equity, but for many financial purposes it behaves more like debt. Because of this hybrid nature, preferred is sometimes combined with one of the other components for purposes of analysis.

However, preferred stock offers investors a return which is generally different from that of either debt or common equity. Therefore, in the context of the cost of capital, it's handled separately as a third component.

In the rest of this chapter we'll refer to common equity simply as equity and preferred equity as preferred stock or just preferred.

CAPITAL STRUCTURE

Capital structure is the **mix** of the three **capital components**.

The mix of capital components in use by a company at a point in time is known as its **capital structure**. We generally describe capital structure in percentage terms referring to the relative sizes of the components. For example, a firm that has the following capital components can be described as 30% debt, 10% preferred stock, and 60% equity.

Debt	\$ 30,000,000	30%
Preferred stock	10,000,000	10
Equity	<u>60,000,000</u>	<u>60</u>
Total capital	\$100,000,000	100%

The Target Capital Structure

A firm's **target capital structure** is a mix of components that management **considers optimal** and strives to maintain.

A great deal of importance is sometimes placed on operating with the “right” capital structure. However, the determination of what's right is the subject of some debate. We'll address this issue in Chapter 14. In the meantime, we'll assume that the management of a firm may have a particular mix of capital components that it considers more desirable than any other. We'll call that mix the firm's **target capital structure**, and assume that management strives to maintain it as money is raised.



PRACTICAL FINANCE

The Cost of Capital—Intuitively

Suppose an entrepreneur plans to open a business that will earn 12% on invested money. If he has no money of his own, but can borrow at 15%, does it make sense to start the business?

Clearly it doesn't. The enterprise is certain to lose money, because it will pay more for funds than it will earn using them. The business makes sense only if the entrepreneur can borrow at a rate below 12%.

This is the idea behind the cost of capital. We shouldn't pay more for a resource than it earns. In this simple case, the cost of capital is just the rate at which borrowed funds are available. In reality firms have more than one kind of capital and each has a different cost. The cost of capital is a single rate that represents an average of those costs.

Where a target capital structure has been designated, we'll see that it can be used in place of the actual capital structure for certain calculations.

Raising Money in the Proportions of the Capital Structure

As a practical matter, an exact capital structure can't be maintained continuously, because money tends to be acquired in finite amounts by issuing securities of one kind or another, one at a time.

For example, suppose a firm had the capital structure just illustrated and that mix was also its target. Further suppose the company needed to raise an additional \$1 million. To do that it would generally issue and sell \$1 million of either debt, preferred stock, or common stock. Trying to sell some of each security in the proportion of 30–10–60 wouldn't be practical.

Issuing one security for the additional money would throw the proportions in the capital structure off target. Then the next time it raised capital, the company could try to move back toward the target mix.

In spite of this practical difficulty, cost of capital calculations are generally based on the assumption that money is raised in the exact proportions of some capital structure. In this case we would assume the firm raised its \$1 million by selling \$300,000 in new bonds and \$100,000 in new preferred stock, along with \$600,000 of equity. The equity would come from a combination of retained earnings and the sale of new common stock. The assumption isn't very realistic, but the distortion it produces is generally small.

RETURNS ON INVESTMENTS AND THE COSTS OF CAPITAL COMPONENTS

Investors provide capital to companies by purchasing their securities. The investors' returns are paid out by the companies, so those returns are costs to the firms in which the investments are made. This is a fundamental point. The return received by an investor on a particular type of security (debt, preferred, or equity) and the cost to the company of the funds raised through that security are opposite sides of the same coin.

Cost of capital **calculations** assume that capital is **raised in the exact proportions** of some capital structure.

The **return earned** by investors on the security underlying a capital component is its **unadjusted cost**.

For a particular company, investments in the securities underlying the three capital components tend to offer returns of different magnitudes, because each type of security has different risk characteristics. Thus, each capital component has a distinct cost that's related to the return earned by the investors who provide that component. And because the returns are different, so are the costs.

Generally the return on an equity investment is higher than the return on debt or preferred because the risk is higher. Hence, the firm's cost of equity capital is higher than its cost of debt or preferred stock. The return/cost of debt tends to be the lowest of the three, because debt is the least risky investment. The cost of preferred is usually between the cost of debt and that of equity.

Although the cost paid out by the company is the investor's return, there are some adjustments that keep the *effective* cost and return from being exactly the same. Hence, we say that cost and return are related rather than equal. We'll describe the adjustments later.

For now the important point is that there are separate component costs of capital for debt, preferred stock, and equity. And each component cost is related to the return earned by investors owning the security underlying that component.

THE WEIGHTED AVERAGE CALCULATION—THE WACC

Calculating the cost of capital is conceptually quite simple. Firms raise capital from several sources, each of which has its own cost. A firm's overall cost of capital is just the average of the costs of its separate sources weighted by the proportion of each source used. The separate sources are the capital components we've been talking about, and the proportions are the percentages of each component in the firm's capital structure.

The procedure has led to the term *weighted average cost of capital*, abbreviated **WACC**. The expression has exactly the same meaning as the simpler "cost of capital" we've been using until now. It's customary to use the expression WACC in discussions of the subject, because it avoids confusion with the cost of capital for an individual component.

Computing the WACC—An Example

To compute a WACC, we need two things: the mix of the capital components in use and the cost of each component. We'll get into how we arrive at each shortly, but first let's preview what we'll do once we have them. An example is the easiest way to understand the procedure.

Because component securities have **different risks**, they offer **different returns** and have **different costs**. **Equity** is **highest**, **debt** is **lowest**, and preferred is between.

The **WACC** is a **weighted average** of component costs where the weights reflect the amount of each component used.

Example 13.1 Calculate the WACC for the Zodiac Company given the following information about its capital structure.

Capital Component	Value	Cost
Debt	\$ 60,000	9%
Preferred stock	50,000	11
Common stock	90,000	14
	<u>\$200,000</u>	

SOLUTION: First we compute the capital structure weights on the basis of the dollar values given. This involves adding up the dollar amounts and stating each as a percentage of the total. That calculation results in the first two numerical columns below. The weight of the debt component, for example, is

$$\frac{\$60,000}{\$200,000} = .30 = 30\%$$

Notice that the weights have to add up to 1.00 or 100%, and that they are the decimal equivalents of the percentages in the firm's capital structure.

Next multiply the cost of each component by its weight and sum the results as shown. The result is the WACC.

Capital Component	Value	Weight		Cost		
Debt	\$ 60,000	.30	×	9%	=	2.70%
Preferred stock	50,000	.25	×	11	=	2.75
Common stock	90,000	.45	×	14	=	6.30
	<u>\$200,000</u>	<u>1.00</u>		WACC	=	<u>11.75%</u>

CAPITAL STRUCTURE AND COST—BOOK VERSUS MARKET VALUE

A major source of confusion about the WACC stems from the fact that both capital structure and component costs can be viewed in terms of either the book or market value of the underlying capital. We'll talk about structure first and then about component costs.

Capital Structure—Book versus Market

The book values of a firm's capital accounts reflect the prices at which the securities that raised its capital were originally sold, and are embodied in the capital section of its balance sheet. Market values reflect the current market prices of those same securities. The firm's capital structure can be based on either. We'll illustrate the difference with a case in which there's only debt and equity capital (no preferred stock).

Assume the Diplomat Corporation, a new firm, raises \$100,000 in equity by selling 10,000 shares of common stock at \$10 each. It also borrows \$100,000 by selling 100 bonds at a par value of \$1,000. Immediately after those transactions, Diplomat has the capital structure shown in Table 13.1, which reflects both book and market values.

Now imagine that Diplomat's stock price increases to \$12, while interest rates climb and drive the price of its bonds down to \$850. These market adjustments do

The **value of capital** can be stated based on the **book or market prices** of the underlying securities.

Table 13.1

The Diplomat Corporation's Initial Capital Structure—Book and Market Equal

Equity	10,000 shares × \$ 10 = \$100,000	50.0%
Debt	100 bonds × 1,000 = 100,000	50.0
	<u>Total \$200,000</u>	<u>100.0%</u>

Table 13.2 The Diplomat Corporation's Market-Value–Based Capital Structure

Equity	10,000 shares × \$	12 = \$120,000	58.5%
Debt	100 bonds ×	850 = <u>85,000</u>	<u>41.5</u>
		Total \$205,000	100.0%

not change the capital entries on the company's books. Therefore, the book-value–based structure remains as shown in Table 13.1.

However, the market-value–based structure does change significantly. The result is shown in Table 13.2.

Capital structures based on book and market values are generally different because the market values of securities change all the time, and those changes are not reflected on company books. Our question is which basis for structure is appropriate for calculating the WACC?

Component Returns/Costs—Book versus Market

Investors' returns and the related component costs of capital can also be thought of in either book or market terms. We'll illustrate with a bond.

Suppose a firm sells a 10% coupon rate bond at its face value. Initially an investor buying the bond earns a 10% return, and the company pays the same 10% interest on the borrowed money. Suppose the market interest rate later falls to 8%.

After the market rate change, two returns can be associated with the bond. The original investor is still receiving 10% on his or her investment, and the company is still paying 10% on the original amount borrowed. However, a new investor buying the bond will have to pay a higher price and will therefore earn a return of only 8%. Hence, either an 8% market rate or a 10% book rate can be associated with the debt.

Once again, our question is which should be reflected in the component cost of debt in the WACC calculation.

The Appropriate Perspective for the WACC Calculation

Which view—book or market—is more appropriate for calculating the WACC? To answer that question we have to understand exactly what the use of each implies in the context of capital budgeting.

Book values relate to capital the company already has. It was raised in the past to support past projects. Using those values to calculate the WACC results in a figure that reflects the composite cost of existing capital that's already committed.

Market values relate to the current state of capital markets. Using market values to calculate the WACC gives a figure that reflects an average of what capital would cost if it were raised today.

We use the WACC in techniques like IRR and NPV to evaluate newly proposed projects. Old capital isn't available to fund these undertakings because it has already been spent. Hence, firms generally have to fund projects with new capital they have yet to raise. It therefore makes sense to evaluate those new projects against the likely cost of the new capital that will support them.

That means it's appropriate that the WACC reflect current market conditions, because those conditions are the best estimate of what capital will cost during the coming period. Hence, we should use market values throughout the WACC calculation.

Book values reflect the cost of capital **already spent**. **Market values** estimate the cost of capital to be raised in the **near future**.

Market values are appropriate because new projects are generally funded with **newly raised money**.

The Customary Approach

The customary approach is to assume that in the future, the firm will either maintain its present capital structure based on market prices or will strive to achieve some target structure also based on market prices. Either of these structures is combined with market-based component costs of capital to develop the WACC.

People are generally less concerned with the precision of the capital structure in the calculation than with the accuracy of the component costs of capital. In practice, it turns out that calculating the present structure at market prices is somewhat tedious. Further, the market-based structure is constantly changing. A reasonable target structure is often used for simplicity as much as for any other reason. The error implied is generally very small.

CALCULATING THE WACC



Calculating a real WACC involves three distinct steps. First we develop a market-value-based capital structure. Then we *adjust* the market returns on the securities underlying the capital components to reflect the company's true component costs of capital. Finally, we put these together to calculate a WACC.

DEVELOPING MARKET-VALUE-BASED CAPITAL STRUCTURES

Developing a capital structure involves stating the dollar amounts of the capital components in use by the firm, adding them up, and then restating each as a percentage of the total. A book value structure is easy to calculate because the book values of debt, preferred stock, and equity are readily available on the balance sheet.

Developing a market-value-based structure is more difficult. It requires that we compute the current market value of all the securities underlying each category of balance sheet capital, and then develop a structure from those values. The best way to understand the procedure is through an example.

Example 13.2

The Wachusett Corporation has the following capital situation.

Debt: Two thousand bonds were issued five years ago at a coupon rate of 12%. They had 30-year terms and \$1,000 face values. They are now selling to yield 10%.

Preferred stock: Four thousand shares of preferred are outstanding, each of which pays an annual dividend of \$7.50. They originally sold to yield 15% of their \$50 face value. They're now selling to yield 13%.

Equity: Wachusett has 200,000 shares of common stock outstanding, currently selling at \$15 per share.

Develop Wachusett's market-value-based capital structure.

SOLUTION: The market value of each capital component is the market price of the underlying security multiplied by the number of those securities outstanding. We can use the valuation concepts from Chapters 7 and 8 to arrive at prices for the bonds and preferred stock. The price of the common stock is given.

Debt: The price of Wachusett's bonds is calculated by using the bond formula developed in Chapter 7, equation 7.4. In this case, $k = 5\%$, $n = 50$, $PMT = \$60$, and $F = \$1,000$. (See page 276.)

A **market-value**—based capital structure uses the **current** prices of the firm's outstanding securities.

$$\begin{aligned} P_b &= \text{PMT}[\text{PVFA}_{k,n}] + \text{FV}[\text{PVF}_{k,n}] \\ &= \$60[\text{PVFA}_{5,50}] + \$1,000[\text{PVF}_{5,50}] \\ &= \$60(18.2559) + \$1,000(.0872) \\ &= \$1,182.55 \end{aligned}$$

Because there are 2,000 bonds outstanding, the market value of the debt is

$$\$1,182.55 \times 2,000 = \$2,365,100$$

Preferred stock: The preferred shares pay a \$7.50 dividend and currently yield 13%. Each preferred share is valued as follows (see Chapter 8, equation 8.13, page 346).

$$P_p = \frac{D_p}{k} = \frac{\$7.50}{.13} = \$57.69$$

Because there are 4,000 preferred shares outstanding, their total market value is

$$\$57.69 \times 4,000 = \$230,760$$

Common equity: The market value of Wachusett's common stock is just the market price times the number of shares outstanding.

$$\$15.00 \times 200,000 = \$3,000,000$$

Market-value-based weights: Next we summarize and compute the capital component weights based on market values.

Debt	\$2,365,100	42.3%
Preferred	230,760	4.1
Equity	<u>3,000,000</u>	<u>53.6</u>
	\$5,595,860	100.0%

http://

Go to the *Business Owner's Toolkit* at <http://www.toolkit.cch.com>.

To learn more about how to select the appropriate discount rate, click on *Managing Your Business Finances*, and then *Major Purchases and Projects*

CALCULATING COMPONENT COSTS OF CAPITAL

In this section we'll look into procedures for calculating the component costs of capital for debt, preferred stock, and equity. In each case, we'll start by considering the market return currently received by *new* investors on the securities underlying the component. Then we'll make certain adjustments to those returns that are necessary to reflect practical reality. We'll describe the adjustments before getting into the individual component costs.

Adjustments—The Effect of Financial Markets and Taxes

Although the returns received by investors and the costs paid out by companies are the same money, the amounts *effectively* paid and received can be different because of taxes and certain transaction costs associated with doing business in financial markets.

Taxes

The tax effect applies only to debt, and stems from the fact that interest payments are tax deductible to the paying firm. That effectively makes debt cheaper than it would be if interest weren't deductible.

The returns paid to new investors are **adjusted** to arrive at **effective** costs to the company.

For example, if the firm's marginal tax rate is 40%,¹ the payment of \$1 in interest reduces taxable income by \$1, and the firm pays \$.40 less tax even though the investor gets the full dollar of interest. By way of contrast, \$1 paid as a dividend is not deductible and results in no tax savings.

The dollar cost of paying an amount of interest, I , is

$$I(1 - T)$$

where T is the tax rate. The same rule applies when interest is expressed as a rate of return. If the firm pays interest at a rate k_d , the effective after-tax cost of paying that rate is

$$k_d(1 - T)$$

For example, if the interest rate is 10% and the tax rate is 40%, the cost of debt adjusted for taxes would be

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

Recall that the return paid to investors on debt is the lowest of the three capital components because debt is the least risky investment. The tax effect reduces the cost of debt even further in relation to the cost of the other components, making it a real bargain.

Flotation Costs

Flotation costs are administrative fees and expenses incurred in the process of issuing and selling (floating) securities. You can think of flotation cost as a commission paid to firms in the investment banking industry for services performed in raising capital.

If flotation costs are f percent of the proceeds of a security issue that raises an amount P paid by investors, the amount received by the issuing company is

$$P - fP = P(1 - f)$$

where f is in decimal form in the equation. Clearly, flotation costs lower the amount of money a firm receives when it sells securities. They have the effect of making the cost of the issue higher than the return received by investors. In general we can write

$$\frac{\text{component}}{\text{cost of capital}} = \frac{\text{investor's return}}{(1 - f)} = \frac{k}{(1 - f)}$$

In words, the component cost of capital is higher than the investor's return by the ratio of $1/(1 - f)$.²

For example, if the return on a particular security is 10% and flotation costs are 20%, the component cost of capital is

$$\frac{\text{component}}{\text{cost of capital}} = \frac{k}{(1 - f)} = \frac{10\%}{(1 - .20)} = 12.5\%$$

The Cost of Debt

To calculate the component cost of debt based on market returns, we take the return received by investors currently purchasing the firm's bonds and adjust it for the effects

The **tax deductibility of interest** makes debt an even **cheaper** source of capital than it is due to low risk.

Flotation costs lower the amount received when a security is issued, **increasing the cost** of the capital raised.

1. The marginal federal income tax rate for most firms is 35%. However, most companies are also subject to state income taxes, so 40% is a reasonable approximation of an average total rate.

2. This relationship is strictly true only when the investment is expected to generate an infinite stream of cash flows. If the stream is finite, as in a bond investment, it is an approximation.

of taxes. Most debt isn't initially sold to the general public, but is *privately placed* with large investors. Therefore, flotation costs are minimal, and we needn't adjust for them.

The market return on business debt is generally well known for the firm's own securities or for issues of similar risk. We'll call that return k_d . Then the cost of debt is

$$(13.1) \quad \text{cost of debt} = k_d(1 - T)$$

where $(1 - T)$ adjusts for the fact that interest is tax deductible to the paying firm.

The **cost of debt** is the investor's return adjusted for the **tax deductibility of interest** payments.

Example 13.3 Blackstone Inc. has 12% coupon rate bonds outstanding that yield 8% to investors buying them now. Blackstone's marginal tax rate including federal and state taxes is 37%. What is Blackstone's cost of debt?

SOLUTION: First notice that k_d is the current market yield of 8%, not the coupon rate. To calculate the cost of debt we simply write equation 13.1 and substitute from the information given.

$$\begin{aligned} \text{cost of debt} &= k_d(1 - T) \\ &= .08(1 - .37) \\ &= 5.04\% \end{aligned}$$

The Cost of Preferred Stock

Preferred stock provides an investor with a constant dividend as long as the share remains outstanding. Recall from our work in Chapters 6 and 8 that such an arrangement is known as a *perpetuity*.

The price of a preferred share is the present value of the perpetuity of the dividend stream, and is given by the expression

$$(13.2) \quad P_p = \frac{D_p}{k_p}$$

where P_p is the current price of a share, D_p is the preferred dividend, and k_p is the return on the investment in preferred stock. (See Chapter 6, page 253 and Chapter 8, page 346.)

Solving equation 13.2 for the investor's return yields

$$(13.3) \quad k_p = \frac{D_p}{P_p}$$

Preferred dividends are not tax deductible to the issuing firm, so no tax adjustment needs to be made. However, flotation costs must be incorporated by multiplying equation 13.3 by $1/(1 - f)$. Rewriting, we have

$$(13.4) \quad \text{cost of preferred stock} = \frac{D_p}{(1 - f)P_p} = \frac{k_p}{(1 - f)}$$

The **cost of preferred stock** is the investor's return adjusted for **flotation costs**.

Example 13.4 The preferred stock of the Francis Corporation was issued several years ago with each share paying 6% of a \$100 par value. Flotation costs on new preferred are expected to average 11% of the funds raised.

- What is Francis's cost of preferred capital if the interest rate on similar preferred stock is 9% today?
- Calculate Francis's cost of preferred if the stock is selling at \$75 per share today.

SOLUTION: Notice that parts (a) and (b) of this problem pose the same question with slightly different given information. In part (a) we have the market return directly, and in part (b) we have the information needed to calculate it.

- Write equation 13.4 using only the last term on the right, and adjust the market return for flotation costs directly.

$$\begin{array}{l} \text{cost of} \\ \text{preferred} \\ \text{stock} \end{array} = \frac{k_p}{(1 - f)} = \frac{9\%}{1 - .11} = 10.1\%$$

- In this case, instead of having the yield, we're told that the stock is currently selling for \$75. We also know it pays an annual dividend of 6% of \$100 or \$6. Write equation 13.4 using the middle term and substitute.

$$\begin{array}{l} \text{cost of} \\ \text{preferred} \\ \text{stock} \end{array} = \frac{D_p}{(1 - f)P_p} = \frac{\$6}{(1 - .11)\$75} = 9.0\%$$

The **cost of equity** is imprecise because of the **uncertainty** of future cash flows.

New equity comes from **two sources**, stock sales and retained earnings, which have **different costs**.

The Cost of Common Equity

The market return available on an equity investment isn't as easy to come up with as the market return on debt or preferred stock. Those securities give an investor known streams of future payments in return for the prices paid, so calculating the return is easy. The anticipated return on a stock investment, on the other hand, depends on *estimates* of future dividends and prices, which are much less certain than interest payments and preferred dividends.

As a result of this uncertainty, the market return on an equity investment has to be estimated. To do that we can use some of the ideas we've developed in earlier chapters. We'll look at three approaches involving the CAPM, the Gordon model, and risk premiums.

Another complication arises from the fact that equity comes from two sources, retained earnings and the sale of new stock. These have to be treated separately because they turn out to have different costs. We'll look at each in turn, beginning with retained earnings.

The Cost of Retained Earnings

It's tempting to think of retained earnings as free to the company, because they come from its own internal operations. However, all earnings belong to the firm's stockholders whether they're paid out as dividends or retained. To the extent that management retains earnings, they reinvest shareholders' money in the company for them.

In other words, retained earnings represents money stockholders could have spent if it had been paid out in dividends. Therefore, those stockholders deserve a return on the funds just as though the money had been paid out and reinvested through the

purchase of new shares. By this logic, the market return on new shares is the appropriate starting point for estimating the cost of retained earnings.

No Adjustments between Return and Cost for Retained Earnings

It's important to notice that retained earnings are the only *internally generated* capital source. They aren't raised through financial markets, so they don't incur flotation costs. They're also not tax deductible. Hence, no adjustments are necessary to convert return to cost.

The CAPM Approach—The Required Rate of Return

We studied the capital asset pricing model (CAPM) in Chapter 9. The model is a theory purporting to explain how investors set required rates of return for particular stocks. Recall that the required rate is the return that just induces investors to purchase a stock, and is generally assumed to be a function of the stock's risk. The expected rate of return, on the other hand, is the return investors expect in the future given the knowledge currently available about a particular stock.

Under normal market conditions stock prices are more or less *in equilibrium*, meaning that expected and required rates of return are about equal. Hence, the market return on a particular stock can be approximated by estimating either the required return or the expected return. The CAPM allows us to estimate the required return; we'll look at estimating with the expected return in the next section.

The CAPM's expression for the required rate of return is the security market line (SML). It was presented in Chapter 9 as equation 9.4. We'll relabel the expression and repeat it here for convenience.

$$(13.5) \quad k_X = k_{RF} + (k_M - k_{RF})b_X$$

where: k_X is the required return on stock X
 k_{RF} is the risk-free rate, usually taken to be the current return on three-month treasury bills
 k_M is the return on the market or on an "average" stock, usually estimated through a market index like the S&P 500
 b_X is stock X's beta coefficient, the measure of company X's market risk

Equation 13.5 provides a direct estimate of the current market return available to investors on the equity of company X. It is therefore also a direct estimate of the cost of equity acquired through retained earnings, because no tax or market adjustments are necessary.

Example 13.5 The return on the Strand Corporation's stock is relatively volatile as reflected by the company's beta of 1.8. The return on the S&P 500 is currently 12% and is expected to remain at that level. Treasury bills are yielding 6.5%. Estimate Strand's cost of retained earnings.

SOLUTION: Write equation 13.5 and substitute directly, using the return on the S&P 500 as k_M and the treasury bill yield as k_{RF} .

$$\begin{aligned} \text{cost of RE} &= k_X = k_{RF} + (k_M - k_{RF})b_X \\ &= 6.5\% + (12\% - 6.5\%)1.8 \\ &= 16.4\% \end{aligned}$$

The cost of retained earnings is equal to the unadjusted return earned by new buyers of the firm's stock.

The Dividend Growth Approach—The Expected Rate of Return

In Chapter 8 we developed an expression for pricing a stock that is expected to grow at a constant rate into the indefinite future. The model is alternatively called the *dividend growth model* or the *Gordon model* after the scholar who developed it. The expression was presented as equation 8.10. We'll relabel and repeat it here with one minor change in notation. We'll replace k in the denominator with k_e to emphasize the idea that the rate is the expected return on an investment in the stock.

$$(13.6) \quad P_0 = \frac{D_0(1 + g)}{k_e - g}$$

where: P_0 is the current price of the stock
 D_0 is the most recent annual dividend paid by the company
 k_e is the expected return on an investment in the stock
 g is the anticipated, constant growth rate of the company and its dividend stream

Solving equation 13.6 for k_e gives a direct estimate of the cost of equity capital obtained through retained earnings. The result is equation 13.7.³

$$(13.7) \quad \text{cost of RE} = k_e = \frac{D_0(1 + g)}{P_0} + g$$

Example 13.6 Periwinkle Inc. paid a dividend of \$1.65 last year and its stock is currently selling for \$33.60 a share. The company is expected to grow at 7.5% indefinitely. Estimate the firm's cost of retained earnings.

SOLUTION: Write equation 13.7 and substitute for Periwinkle's expected return and the cost of RE.

$$\begin{aligned} \text{cost of RE} = k_e &= \frac{D_0(1 + g)}{P_0} + g \\ &= \frac{\$1.65(1.075)}{\$33.60} + .075 \\ &= .053 + .075 = 12.8\% \end{aligned}$$

The **cost of retained earnings** can be estimated using the **CAPM**, the **dividend growth (Gordon) model**, or a **risk premium**.

The Risk Premium Approach

Since beginning our study of interest in Chapter 5, we've recognized that any return can be thought of as the sum of a base rate and premiums for bearing risk.

Investment risk and the associated risk premiums vary among companies, but they also vary between the kinds of securities offered by a single company. Debt is the safest investment, while equity has considerably more risk.

The relationship between the risk of debt and the risk of equity is relatively constant among companies. In other words, the *increment* in risk between debt and equity is about the same for high-risk and low-risk firms. That increment tends to command an additional risk premium of between 3% and 5%.

3. Recall that in the Gordon model the next dividend is $D_1 = D_0(1 + g)$. Hence, equations 13.6 and 13.7 can also be written with D_1 in the numerators of the fractions.

As a result, it's feasible to estimate the return on a firm's equity by adding three to five percentage points to the market return on its debt, which is generally easy to get. We can formalize the relationship as

$$(13.8) \quad k_e = k_d + rp_e$$

where k_d and k_e are the respective market returns on debt and equity, and rp_e is the additional risk premium on equity. The cost of retained earnings is then equal to this estimate of k_e .

Example 13.7 The Carter Company's long-term bonds are currently yielding 12%. Estimate Carter's cost of retained earnings.

SOLUTION: Simply write equation 13.8 and substitute, using 4% for the incremental risk premium.

$$\begin{aligned} \text{cost of RE} = k_e &= k_d + rp_e \\ &= 12\% + 4\% \\ &= 16\% \end{aligned}$$

The Cost of New Common Stock

So far, we've been talking about equity capital from retained earnings. Firms often need to raise more equity capital than is available from earnings, and do so by selling new common stock.

Equity from new stock is just like equity from retained earnings, with the exception that raising it involves incurring flotation costs. Therefore, the expressions we've used so far to estimate the cost of equity have to be adjusted to reflect those costs. This is easiest to do in equation 13.7, the dividend growth model, because the price of the stock appears explicitly in that expression. The adjustment simply involves substituting $(1 - f)P_0$ for P_0 , where f represents the fraction of the price going to flotation cost. The result is as follows.

$$(13.9) \quad \text{cost of new equity} = k_e = \frac{D_0(1 + g)}{(1 - f)P_0} + g$$

The cost of **new common stock** includes an adjustment for **flotation** costs.

Example 13.8 Suppose Periwinkle Inc. of Example 13.6 had to raise capital beyond that available from retained earnings. What would be its cost of equity from new stock if flotation costs were 12% of money raised?

SOLUTION: Write equation 13.9 and substitute from Example 13.6, including a 12% flotation cost.

$$\begin{aligned} \text{cost of new equity} = k_e &= \frac{D_0(1 + g)}{(1 - f)P_0} + g \\ &= \frac{\$1.65(1.075)}{(.88)\$33.60} + .075 \\ &= .06 + .075 = 13.5\% \end{aligned}$$

PUTTING THE WEIGHTS AND COSTS TOGETHER

Once we've calculated a market-value-based capital structure and a series of component costs based on market returns, the weighted average calculation for the WACC is a simple matter. The procedure is identical to the one we illustrated in Example 13.1 using the appropriate weights and costs. We'll forgo presenting the same computation here.

A comprehensive example presented after the next section includes the weighted average calculation in its proper sequence.

The **MCC** is a graph of the **WACC** showing **abrupt increases** as larger amounts of capital are raised in a planning period.

THE MARGINAL COST OF CAPITAL (MCC)

A firm's WACC is not independent of the amount of capital raised. In fact, it tends to increase abruptly from time to time as funding requirements are increased. Changes in the WACC are reflected in the **marginal cost of capital (MCC) schedule**, which is a graph showing how the WACC changes as a firm raises more capital during a planning period, usually a year. Glance ahead to Figure 13.1 on page 530 to see the idea expressed graphically.

The WACC/MCC terminology is a little confusing. The MCC schedule is a graph showing the values the WACC goes through as larger amounts of money are raised. We could just as easily call it a graph of the WACC. The term "marginal cost of capital" (MCC) itself means the cost of the next dollar of capital to be raised.

Notice that the WACC starts out at one level and jumps to a higher level as the total amount of capital raised passes a certain point. If still more capital were to be raised, the MCC would have more step-function jumps like the one shown. The first jump or break is of particular interest.

THE BREAK IN MCC WHEN RETAINED EARNINGS RUN OUT

The first increase in the MCC usually occurs when the firm runs out of retained earnings and starts raising external equity by selling stock. The WACC increases at that point because the cost of equity increases. We can see this phenomenon clearly by comparing two of the examples in the last section.

Examples 13.6 and 13.8 both involve the cost of equity for Periwinkle Inc. In the first example we calculated the cost of retained earnings, and in the second we dealt with the cost of equity from new stock. Notice that the 13.5% cost of new equity is higher than the 12.8% cost of retained earnings. The difference is due to the flotation costs associated with selling the new shares.

We generally assume firms use all the money available from retained earnings before selling new stock, so the cost of equity capital increases abruptly as the firm moves into externally raised money. But if the cost of equity increases at some point, the WACC must also increase at the same point because equity is an element in the weighted average calculation. A numerical illustration will make these ideas clear.

We'll assume the information shown in Table 13.3 about the Brighton Company, and develop its MCC schedule. We'll calculate the WACC, first using the cost of retained earnings and then using the cost of new equity. These are the WACCs before and after the retained earnings breakpoint. The two computations are shown in Table 13.4. Notice that the only difference between them is the cost of equity.

Table 13.4 shows that Brighton's WACC will increase by 1.2% as the firm uses up retained earnings and moves into new equity.

The MCC **breaks** when **retained earnings are exhausted**, and the cost of equity increases due to **flotation costs**.

Table 13.3

The Brighton Company's Capital Structure, Component Costs, and Requirements

	Capital Structure	Component Cost
Debt	40%	8%
Equity	60%	From RE 10% From new stock 12%
Expected retained earnings		\$ 3 million
Total capital requirement		10 million

Table 13.4

The Brighton Company's WACC Calculations

	Capital Structure Weights	Capital Component Cost
With equity from RE		
Debt	.4 ×	8% = 3.2%
Equity	.6 ×	10 = <u>6.0</u>
		WACC = 9.2%
With equity from new stock		
Debt	.4 ×	8% = 3.2%
Equity	.6 ×	12 = <u>7.2</u>
		WACC = 10.4%

Locating the Break

The next question involves locating the break in terms of total funding. In other words, how much capital will have been raised when the WACC increases?

This turns out to be a simple matter. Recall that we assumed capital will be raised in the proportions of some capital structure. In this case the structure is 60% equity, so every dollar raised will be 60% equity. We also expect to have \$3 million of retained earnings to use up before turning to new stock. Hence, our question is equivalent to asking for the total funding level when 60% of that total is \$3 million. In other words, \$3 million is 60% of what number?

The calculation answering that question is division by .6. Brighton will have raised a total of

$$\$3 \text{ million} / .60 = \$5 \text{ million}$$

when it runs out of retained earnings. Therefore, the WACC *breaks* at \$5 million.

This is an important calculation. The first breakpoint of the WACC/MCC is always found by dividing the amount of retained earnings available by the fractional proportion of equity in the capital structure.

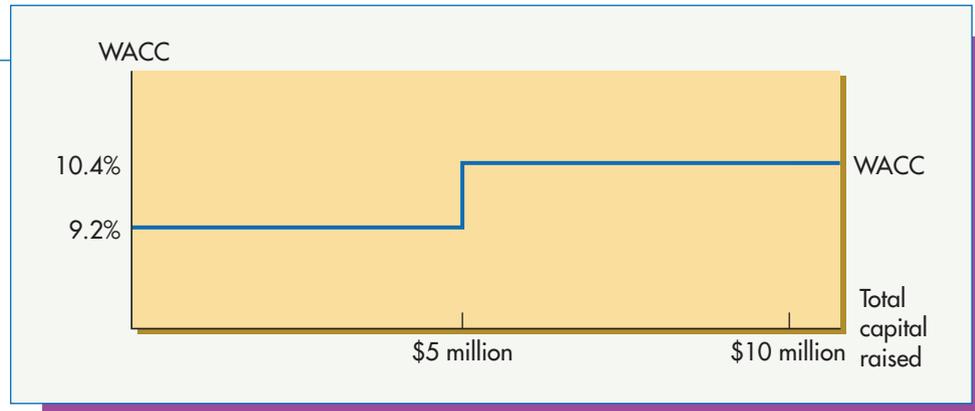
THE MCC SCHEDULE

Brighton's results are shown graphically in Figure 13.1. The graph shows the WACC at various funding levels. As we said earlier, the overall portrayal is referred to as the marginal cost of capital (MCC) schedule. Notice how the schedule makes a definitive

Find the **MCC break** by dividing **available RE** by the **proportion of equity** in the capital structure.

Figure 13.1

The Brighton Company's Marginal Cost of Capital (MCC) Schedule



break at the point where retained earnings are exhausted. Also notice that the break occurs at the level of total capital that has been raised when retained earnings run out (\$5 million), not at the level of available retained earnings, \$3 million in this case.

Other Breaks in the MCC Schedule

For most companies, the WACC is reasonably constant, aside from the break into external equity, as long as moderate levels of capital are raised. However, low-cost funds cannot be raised at or near the initial WACC without limit. The internal workings of capital markets tend to put restrictions on the amount of new money available to companies in any time period.

For example, suppose Brighton attempted to raise \$20 million instead of \$10 million. Perceiving such a large capital program as risky, investors would be likely to demand higher returns for further investments in both debt and equity. That means Brighton would have to pay higher interest rates to borrow more and accept a lower price to sell additional stock. Effectively, the MCC would have more upward steps to the right on the graph between \$10 million and \$20 million.⁴

Combining the MCC and the IOS

A firm's available capital budgeting projects can be sorted into descending order of IRR and displayed on the same set of axes as the MCC. The idea is shown in Figure 13.2 for the Brighton Company. Each block represents a project. The heights and widths of the blocks are, respectively, the projects' IRRs and the amounts of capital they require. The pattern traced by the upper rightward boundary of the projects is known as the **investment opportunity schedule (IOS)**. The horizontal segments of the IOS are the IRRs of the respective projects.

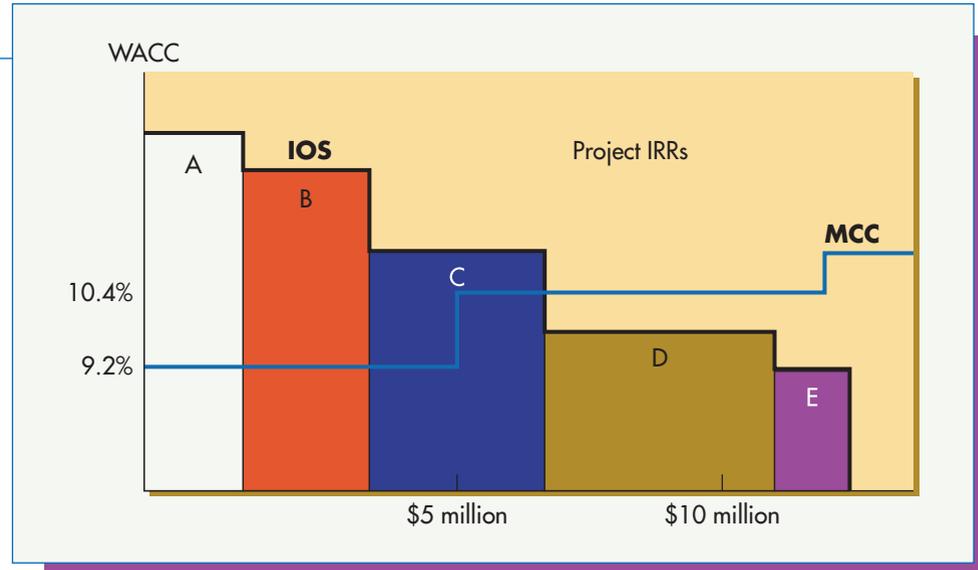
This portrayal makes clear which projects should be undertaken and which should not. Brighton should accept projects as long as the IOS (IRR) is above the MCC. Figure 13.2 shows that projects A, B, and C should be undertaken, but projects D and E should not. Notice that the first break in the MCC makes projects D and E unacceptable. If the WACC continued at 9.2% indefinitely, both of these projects would

The **investment opportunity schedule (IOS)** is a plot of the IRRs of available projects arranged in descending order.

4. Occasionally the cost of debt or preferred increases *before* the shift from retained earnings to outside equity. Then that point isn't the *first* break in the MCC as we've described.

Figure 13.2

Marginal Cost of Capital (MCC) Schedule and Investment Opportunity Schedule (IOS)



The **MCC and IOS plotted together** show which projects should be undertaken.

The firm's **WACC** for the planning period is at the **intersection** of the **MCC** and the **IOS**.

have IRRs equal to or above the cost of capital. Because the MCC breaks as new equity has to come from the sale of stock, they don't.

Interpreting the MCC

The portrayal in Figure 13.2 seems to imply that Brighton should evaluate the first \$5 million of capital projects with a WACC of 9.2% and projects using the next \$5 million with a WACC of 10.4%. However, this approach is cumbersome in that it requires keeping track of more than one WACC. The same effect is achieved by taking a marginal approach and defining the WACC as the rate at which the IOS and the MCC intersect, 10.4% in the illustration.

This is an important point. A firm's WACC for a planning period (usually a year) is determined by the availability of financial resources *and* the pattern of investment opportunities projected during that period.

THE COST OF CAPITAL—A COMPREHENSIVE EXAMPLE

In this section we'll work through a comprehensive example of the calculations necessary to develop a firm's WACC and the MCC curve. We'll also comment on practice as we go along.

Example 13.9

Baxter Metalworks Inc. has the following elements of capital.

Debt: Baxter issued \$1,000, 30-year bonds 10 years ago at a coupon rate of 9%. Five thousand bonds were sold at par. Similar bonds are now selling to yield 12%.

Preferred stock: Twenty thousand shares of 10% preferred stock were sold five years ago at their \$100 par value. Similar securities now yield 13%.

Equity: The company was originally financed with the sale of 1 million shares of common stock at \$10 a share. Accumulated retained earnings are currently \$3 million. The stock is now selling at \$12.50.

Target capital structure: We won't get into the reasoning behind the idea that one mix of capital components might be better than another until Chapter 14. For now, assume that Baxter has chosen the following target capital structure.

Debt	20%
Preferred stock	10
Equity	70

This means management attempts to keep the market values of the capital components reasonably close to these proportions over time as money is raised.

Other information:

- Baxter's marginal income tax rate including federal and state rates is 40%.
- Flotation costs average 10% in the sale of common and preferred stock.
- Short-term treasury bills currently yield 7%.
- An average stock currently yields 13.5%.
- Baxter's beta is 1.4.
- The firm is expected to grow at 6.5% indefinitely.
- The annual dividend paid last year was \$1.10 per share.
- Next year's business plan includes earnings of \$2 million, of which \$1.4 million will be retained.

Calculate Baxter's capital structure, capital component weights, and its WACC before and after the retained earnings break. Sketch the firm's MCC.

SOLUTION: We'll solve this problem and illustrate some important points along the way with the following steps.

1. Book values and weights (for reference only).
2. Market values and weights.
3. Compare target, book, and market weights, and comment on practice.
4. Capital component costs.
5. Computation of WACCs.
6. Sketch MCC.

1. Book Values and Weights of Baxter's Capital Components

First we'll recreate the capital section of Baxter's balance sheet.

Debt (5,000 bonds @ \$1,000)	\$ 5,000,000
Preferred stock (20,000 shares @ \$100)	2,000,000
Equity	
Common stock (1 million shares @ \$10)	\$10,000,000
Retained earnings	3,000,000
Total capital	<u>13,000,000</u> \$20,000,000

Now calculate the book weights by stating debt, preferred equity, and common equity as percentages of total capital. This calculation is made for reference only, because we don't use book values to calculate WACC.

Debt	\$ 5,000,000	25%
Preferred	2,000,000	10
Equity	13,000,000	65
	<u>\$20,000,000</u>	<u>100%</u>

2. Market Values and Weights

To calculate capital component weights based on market values, we have to find the current market value of the securities underlying each component.

Debt: The market value of Baxter's debt is based on the current price of its outstanding bonds. That price is different from face value, because the market interest rate is no longer equal to the bond's coupon rate. The calculation is made using the bond formula developed in Chapter 7, equation 7.4. In this case $k = 6\%$, $n = 40$, $PMT = \$45$, and $FV = \$1,000$. Review pages 276–278 if this procedure is unfamiliar to you.

$$\begin{aligned} P_b &= PMT[PVFA_{k,n}] + FV[PVF_{k,n}] \\ &= \$45[PVFA_{6,40}] + \$1,000[PVF_{6,40}] \\ &= \$45(15.0463) + \$1,000(.0972) \\ &= \$774.28 \end{aligned}$$

Because 5,000 bonds are outstanding, the market value of the debt is

$$\$774.28 \times 5,000 = \$3,871,400$$

Preferred stock: The preferred shares were issued to yield 10% at a \$100 par value. Therefore, the preferred dividend is \$10. The market yield is now 13%, so each preferred share is valued as follows (see Chapter 8, equation 8.13, page 346).

$$P_p = \frac{D_p}{k} = \frac{\$10}{.13} = \$76.92$$

For the 20,000 preferred shares outstanding, their total market value is

$$\$76.92 \times 20,000 = \$1,538,400$$

Common equity: The market value of Baxter's common stock is easy to calculate. The shares are selling at \$12.50 and there are 1 million outstanding, so their value is

$$\$12.50 \times 1,000,000 = \$12,500,000$$

Market-value-based weights: Next we summarize and compute the capital component weights based on market values.

Debt	\$ 3,871,400	21.6%
Preferred	1,538,400	8.6
Equity	<u>12,500,000</u>	<u>69.8</u>
	\$17,909,800	100.0%

As you can see, calculating market value weights is somewhat tedious. This is especially true if a number of different classifications of stocks and bonds are all outstanding at the same time.

3. Book, Market, and Target Capital Structures

At this point it's appropriate to stop and compare the alternative capital structures we've talked about. These are the target structure and structures based on book and market values. The results are summarized as follows.

	Book	Market	Target
Debt	25%	21.6%	20%
Preferred stock	10	8.6	10
Common equity	<u>65</u>	<u>69.8</u>	<u>70</u>
	100%	100.0%	100%

Notice that in this example, the weights aren't very different from one another. Of course, that's not always the case, but it does happen quite a bit. It's especially true that the market-value-based weights and the target structure are quite similar.

In the rest of this example we'll use the market value weights, noticing that they're very close to the target structure.

4. Capital Component Costs

Next we'll calculate the cost of each capital component using the rules developed earlier.

Debt: The cost of debt is given by equation 13.1. It's equal to the return being received by debt investors adjusted for taxes.

$$\begin{aligned}\text{cost of debt} &= k_d(1 - T) \\ &= .12(1 - .40) \\ &= 7.2\%\end{aligned}$$

Preferred stock: Equation 13.4 gives us the cost of preferred either through consideration of the preferred dividend relative to its market price or by directly adjusting the market yield for flotation costs. Because we're given a market yield of 13% in this case, we'll do the latter.

$$\text{cost of preferred stock} = \frac{k_p}{(1 - f)} = \frac{13\%}{1 - .10} = 14.4\%$$

Equity: We'll deal with the cost of equity in two steps. First we'll estimate the cost of retained earnings, and then the cost of new stock.

Retained earnings: We'll approach the cost of retained earnings in the three ways we've considered, and then reconcile the results.

CAPM: Equation 13.5 gives the return required on Baxter's stock by a typical investor in terms of the risk-free rate, the market return, and Baxter's beta.

$$\begin{aligned}\text{cost of RE} = k_B &= k_{RF} + (k_M - k_{RF})b_B \\ &= 7.0\% + (13.5\% - 7.0\%)1.4 \\ &= 16.1\%\end{aligned}$$

Dividend growth: Equation 13.7 gives the expected return on Baxter's stock given its current price, recent dividend history, and anticipated growth rate.

$$\begin{aligned}\text{cost of RE} = k_e &= \frac{D_0(1 + g)}{P_0} + g \\ &= \frac{\$1.10(1.065)}{\$12.50} + .065 \\ &= .094 + .065 \\ &= 15.9\%\end{aligned}$$

Risk premium: The risk premium approach adds a premium of 3% to 5% to the return on a firm's debt to allow for the extra risk involved in an equity investment. Using equation 13.8 and a middle value of 4% for the additional premium, we have

$$\begin{aligned}\text{cost of RE} = k_e &= k_d + rp_e \\ &= 12\% + 4\% \\ &= 16\%\end{aligned}$$

Some **judgment** is required in **reconciling** the results of the different approaches to the **cost of equity**.

Reconciliation: In this case the three approaches give similar results, which are summarized as follows.

CAPM	16.1%
Dividend growth	15.9
Risk premium	16.0

Hence, using 16.0% for the cost of retained earnings seems reasonable. When the estimates vary considerably, some judgment is required to select an appropriate rate.

New stock: The return on equity raised through the sale of new stock is estimated using the dividend growth model adjusted for flotation costs. Equation 13.9 yields

$$\begin{aligned}
 \text{cost of new equity} = k_e &= \frac{D_0(1 + g)}{(1 - f)P_0} + g \\
 &= \frac{\$1.10(1.065)}{(.90)\$12.50} + .065 \\
 &= .104 + .065 \\
 &= 16.9\%
 \end{aligned}$$

Notice that the cost of new stock is .9% higher than the cost of retained earnings.

A note on accuracy: As we've said before, it's important to realize that return/cost calculations with respect to equity are not as accurate as our tenth of a percent figures seem to imply. An estimate that's good to about half of a percent is generally the best we can hope for.

5. Computation of the WACCs

Deriving the WACC is now a straightforward weighted average calculation. We'll use weights based on market values. The calculation has to be done twice because of the two different costs of equity for retained earnings and new stock. The results will be the WACCs before and after the retained earnings breakpoint.

The computation is laid out in the following table. The entries in the weight column are the decimal equivalents of the percentages of each component in the capital structure based on market values. Treat the pre-break and after-break pairs of columns separately. Multiply the cost of each component by the number in the weight column to get the factor column. Then add the factors for the WACC. We use results rounded to the nearest tenth of a percent in applications.

Capital Component	Weight	Pre-Break		After-Break	
		Cost	Factor	Cost	Factor
Debt	.216	7.2%	1.56	7.2%	1.56
Preferred stock	.086	14.4	1.24	14.4	1.24
Equity	.698	16.0	<u>11.17</u>	16.9	<u>11.80</u>
			WACC = 13.97%	WACC = 14.60%	
			Use rounded values: 14.0%	14.6%	

6. The MCC

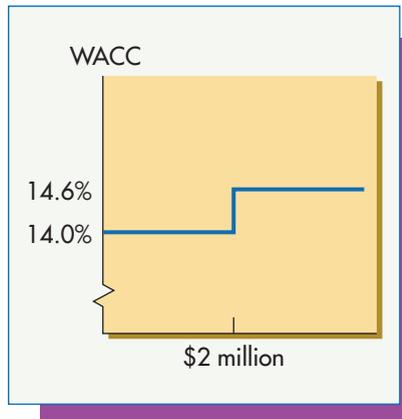
The MCC schedule shows the WACC before and after the retained earnings breakpoint. To plot it we have to know how much capital will have been raised when the break occurs.

Baxter expects to generate \$1.4 million in retained earnings next year, and every dollar raised is assumed to be 69.8% equity—either retained earnings or new stock. To locate the breakpoint we have to answer the following question: \$1.4 million is 69.8% of what total capital amount? To get the answer, simply divide \$1.4 million by .698, the fractional component of equity in the capital structure.

The calculation is

$$\$1,400,000 / .698 = \$2,005,731$$

For practical purposes we'll round this result and assume the retained earnings breakpoint is \$2 million. The plot of Baxter's MCC can then be drawn as follows.



At some point to the right, the MCC would step upward again as Baxter approaches the limits of its money-raising capability, and the various capital components become more expensive. However, we can't predict exactly where those steps will be the way we can forecast the breakpoint due to running out of retained earnings.

A POTENTIAL MISTAKE—HANDLING SEPARATELY FUNDED PROJECTS

Sometimes a project is proposed that is to be funded entirely by a single source of capital. This situation can create some confusion about the application of the WACC in practice.

For example, a firm might float a bond issue and use the proceeds entirely to fund just one project. It's logical to ask whether the cost of capital used to evaluate the project should be the cost of the bond issue and not the firm's WACC. Because debt tends to be the cheapest form of capital, such an approach would make the project more likely to be accepted.

Although it seems that a close matching of a source of funds with its use would be appropriate whenever possible, it's a mistake in capital budgeting which has to be conducted within the context of the firm's overall capital-raising capability. Firms cannot continue to raise low-cost debt indefinitely without from time to time raising higher cost equity. In other words, firms have a limited debt capacity that can be used up until a further infusion of equity is made.



PRACTICAL FINANCE

Revisiting EVA[®]

Recall that at the end of our study of ratio analysis in Chapter 3 (pages 94–95) we introduced two new performance measurement concepts, market value added (MVA) and economic value added (EVA[®]). We're now in a better position to appreciate EVA.

EVA is important because of a shortcoming in the concept of net income, the traditional measure of financial performance. Net income begins with revenue and subtracts costs and expenses *including interest* to arrive at the so-called “bottom line.” Hence, the traditional income statement charges operations with the cost of debt, but *ignores the cost of equity and preferred stock*. That means net income implicitly treats equity and preferred as free resources which, of course, they aren't. EVA corrects that problem by charging for the use of all capital instead of just debt. The charge is calculated by multiplying total capital by the *cost of capital* as developed in this chapter. The EVA calculation is expressed as follows where equity includes preferred stock.

$$\text{EVA} = \text{EBIT} (1 - T) - (\text{debt} + \text{equity}) (\text{cost of capital } \%)$$

EBIT (1 – T) is operating income *after tax*, which is then reduced by the charge for all capital used.

EVA is a very important concept in management today. It's worth your while to review the broad implications of the idea now that you have a better understanding of the cost of capital.

Source: <http://sternstewart.com>

All projects should be evaluated against the **WACC including those with dedicated funding.**

Let's consider an illustration in which the firm is borrowing exclusively to fund a project to see what can happen if we base the accept/reject decision on the cost of debt alone. For simplicity we'll assume the firm has no preferred stock. Imagine that its cost of debt and cost of equity are 8% and 12%, respectively, and that the capital structure is half debt and half equity so the WACC is 10%. Suppose the project proposed has an IRR of 9%, is evaluated against the 8% cost of debt, and is therefore accepted. Notice that it would have been rejected if evaluated against the WACC of 10%.

Now suppose that sometime later another project comes along with an IRR of 11%, and the firm tries to borrow to fund it. However, lenders say the company's debt capacity is exhausted and refuse to advance funds.

Suppose equity money is available to fund the project, but its cost is 12%. Using the same rationale of measuring a project against the cost of the specific capital component funding it, the firm evaluates the second project against the 12% cost of equity and rejects it.

Notice what has happened. The company has accepted a project with an IRR of 9% and rejected one with an IRR of 11%. This obvious error is a result of trying to match funding sources and uses within the constraint of one firm's capital-raising capability. Had the firm evaluated both projects at the WACC of 10%, the correct accept/reject decisions would have been made. The implication is clearly that *all* projects (which are risk consistent with the firm's operations) should be evaluated at the WACC.

QUESTIONS

1. Compare the cost of capital concept with the idea of the required return on a stock investment made by an individual. Relate both ideas to the risk of the investment. How would a very risky investment/project be handled in the capital budgeting/cost of capital context?
2. Define the idea of capital structure and capital components. Why is capital structure important to the cost of capital concept? In many capital structure discussions, preferred stock is lumped in with either debt or common equity. With respect to the cost of capital, however, it's treated separately. Why?
3. You are a new financial analyst working for a company that's more than 100 years old. The CFO has asked you and a young member of the accounting staff to work together in reviewing the firm's capital structure for the purpose of recalculating its cost of capital. As you both leave the CFO's office, your accounting colleague says this job is really going to be easy because he already has the information. In preparing the latest annual report, he worked on the capital section of the balance sheet and has the values of debt, preferred stock, and equity at his fingertips. He says the two of you can summarize these into a report in five minutes and then go out for a beer. How do you react and why? Is the fact that the firm is quite old relevant? Why?
4. The investor's return and the company's cost are opposite sides of the same coin—almost, but not quite. Explain.
5. There's an issue of historical versus market value with respect to both the cost of capital components and the amounts of those components used in developing weights. We're willing to accept an approximation for the weights, but not for the cost/returns. Why?
6. A number of investment projects are under consideration at your company. You've calculated the cost of capital based on market values and rates, and analyzed the projects using IRR and NPV. Several projects are marginally acceptable. While watching the news last night, you learned that most economists predict a rise in interest rates over the next year. Should you modify your analysis in light of this information? Why?
7. Establishing the cost of equity is the most arbitrary and difficult part of developing a firm's cost of capital. Outline the reasons behind this problem and the approaches available to make the best of it.
8. Retained earnings are generated by the firm's internal operations and are immediately reinvested to earn more money for the company and its shareholders. Therefore, such funds have zero cost to the company. Is this statement true or false? Explain.
9. Define the marginal cost of capital (MCC) and explain in words why it predictably undergoes a step-function increase (breaks) as more capital is raised during a budget period.
10. After the break in the MCC caused by using up retained earnings, the schedule can be expected to remain flat indefinitely. Is that statement right or wrong? If wrong, explain what can be expected to happen to the MCC and why.
11. Why is it appropriate to define the WACC as the highest step on the MCC under the IOS? Is anything lost by using this definition?

BUSINESS ANALYSIS

1. You're the newly hired CFO of a small construction company. The privately held firm is capitalized with \$2 million in owner's equity and \$3 million in variable rate bank loans. The construction business is quite risky, so returns of 20% to 25% are normally demanded on equity investments. The bank is currently charging 14% on the firm's loans, but interest rates are expected to rise in the near future. Your boss, the owner, started his career as a carpenter and has an excellent grasp of day-to-day operations. However, he knows little about finance. Business has been good lately, and several expansion projects are under consideration. A cash flow projection has been made for each. You're satisfied that these estimates are reasonable.

The owner has called you in and confessed to being confused about the projects. He instinctively feels that some are financially marginal and may not be beneficial to the company, but he doesn't know how to demonstrate this or how to choose among the projects that are financially viable.

Assuming the owner understands the concept of return on investment, write a brief memo explaining the ideas of IRR and cost of capital and how they can solve his problem. Don't get into the detailed mechanics of the calculations, but do use the figures given above to make a rough estimate of the company's cost of capital and use the result in your memo.

2. You're the CFO of a small company that is considering a new venture. The president and several other members of management are very excited about the idea for reasons related to engineering and marketing rather than profitability. You've analyzed the proposal using capital budgeting techniques and found that it fails both IRR and NPV tests with a cost of capital based on market returns. The problem is that interest rates have risen steeply in the last year, so the cost of capital seems unusually high.

You've presented your results to the management team, who are very disappointed. In fact, they'd like to find a way to discredit your analysis so they can justify going ahead with the project. You've explained your analysis and everything seems well understood except for one point. The group insists that the use of returns currently available to investors as a basis for the cost of capital components doesn't make sense. The vice president of marketing put his objection as follows. "Two years ago we borrowed \$1 million at 10%. We haven't paid it back, and we're still making interest payments of \$100,000 every year. Clearly, our cost of debt is 10% and not the 14% you want to use. If you'd use our 'real' cost of debt, as well as of equity and preferred stock, the project would easily qualify financially." How do you respond?

(The appropriate response is relatively short. It's worth noting that this kind of thing happens all the time in corporations. Marketing and engineering people often get carried away with "neat" projects that don't make sense financially. The CFO has to watch the bottom line and it's not unusual to be seen as a wet blanket who wants to spoil the others' fun!)

3. The engineering department at Digitech Inc. wants to buy a new state-of-the-art computer. The proposed machine is faster than the one now being used, but whether the extra speed is worth the expense is questionable given the nature of the firm's applications. The chief engineer (who has an MBA and a reasonable understanding of financial principles) has put together an enormously detailed capital budgeting proposal for the acquisition of the new machine, which concludes

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that it's a great deal. You're a financial analyst for the firm and have been assigned to review the engineering proposal. Your review has highlighted two problems. First, the cost savings projected as a result of using the new machine seem rather optimistic. Second, the analysis uses an unrealistically low cost of capital.

With respect to the second point, the engineering proposal contains the following exhibit documenting the development of the cost of capital used.

Digitech's capital structure is 60% debt and 40% equity
 The computer manufacturer is offering financing at
 8% as a sales incentive
 $\text{Cost of capital} = 8\% \times .6 = 4.8\%$
 $\text{After tax} = 4.8\% \times (1 - T) = 4.8\% \times .6 = 2.9\%$

You've checked the market and found that Digitech's bonds are currently selling to yield 14%, and the stock is returning about 20%.

How would you proceed? That is, explain the chief engineer's error(s) and indicate the correct calculations.

- Whitefish Inc. operates a fleet of 15 fishing boats in the North Atlantic Ocean. Fishing has been good in the last few years as has the market for product, so the firm can sell all the fish it can catch. Charlie Bass, the vice president for operations, has worked up a capital budgeting proposal for the acquisition of new boats. Each boat is viewed as an individual project identical to the others, and shows an IRR of 22%. The firm's cost of capital has been correctly calculated at 14% before the retained earnings break and 15% after that point. Charlie argues that the capital budgeting figures show that the firm should acquire as many new boats as it possibly can, financing them with whatever means it finds available. You are Whitefish's CFO. Support or criticize Charlie's position. How should the appropriate number of new boats be determined? Does acquiring a large number of new boats present any problems or risks that aren't immediately apparent from the financial figures?

PROBLEMS

- Blazingame Inc.'s capital components have the following market values.

Debt	\$35,180,000
Preferred stock	17,500,000
Common equity	48,350,000

Calculate the firm's capital structure and show the weights that would be used for a weighted average cost of capital (WACC) computation.

- The Aztec Corporation has the following capital components and costs. Calculate Aztec's WACC.

Component	Value	Cost
Debt	\$23,625	12.0%
Preferred stock	4,350	13.5
Common equity	52,275	19.2

3. Willerton Industries Inc. has the following balances in its capital accounts as of 12/31/X3:

Long-term debt	\$65,000,000
Preferred stock	15,000,000
Common stock	40,000,000
Paid in excess	15,000,000
Retained earnings	37,500,000

Calculate Willerton's capital structure based on book values.

4. Referring to Willerton Industries of the previous problem, the company's long-term debt is comprised of 20-year \$1,000 face value bonds issued 7 years ago at an 8% coupon rate. The bonds are now selling to yield 6%. Willerton's preferred is from a single issue of \$100 par value, 9% preferred stock that is now selling to yield 8%. Willerton has 4 million shares of common stock outstanding at a current market price of \$31. Calculate Willerton's market-value-based capital structure.
5. Again referring to Willerton of the two previous problems, assume the firm's cost of retained earnings is 11% and its marginal tax rate is 40%. Calculate its WACC using its book-value-based capital structure ignoring flotation costs. Make the same calculation using the market-value-based capital structure. How significant is the difference?
6. A relatively young firm has capital components valued at book and market and market component costs as follows. No new securities have been issued since the firm was originally capitalized.

Component	Value		Cost
	Market	Book	
Debt	\$42,830	\$40,000	8.5%
Preferred stock	10,650	10,000	10.6
Common equity	65,740	32,000	25.3

- a. Calculate the firm's capital structures and WACCs based on both book and market values, and compare the two.
- b. What appears to have happened to interest rates since the company was started?
- c. Does the firm seem to be successful? Why?
- d. What should be the implication of using a WACC based on book as opposed to market values? In other words, what kind of mistakes might management make by using the book values?
7. Five years ago Hemingway Inc. issued 6,000 30-year bonds with par values of \$1,000 at a coupon rate of 8%. The bonds are now selling to yield 5%. The company also has 15,000 shares of preferred stock outstanding that pay a dividend of

- \$6.50 per share. These are currently selling to yield 10%. Its common stock is selling at \$21, and 200,000 shares are outstanding. Calculate Hemingway's market-value-based capital structure.
8. The Wall Company has 142,500 shares of common stock outstanding that are currently selling at \$28.63. It has 4,530 bonds outstanding that won't mature for 20 years. They were issued at a par value of \$1,000 paying a coupon rate of 6%. Comparable bonds now yield 9%. Wall's \$100 par value preferred stock was issued at 8% and is now yielding 11%; 7,500 shares are outstanding. Develop Wall's market-value-based capital structure.
 9. The market price of Albertson Ltd.'s common stock is \$5.50 and 100,000 shares are outstanding. The firm's books show common equity accounts totaling \$400,000. There are 5,000 preferred shares outstanding that originally sold for their par value of \$50, pay an annual dividend of \$3, and are currently selling to yield an 8% return. Also, 200 bonds are outstanding that were issued 5 years ago at their \$1,000 face values for 30-year terms, pay a coupon rate of 7%, and are currently selling to yield 10%. Develop Albertson's capital structure based on both book and market values.
 10. Asbury Corp. issued 30-year bonds 11 years ago with a coupon rate of 9.5%. Those bonds are now selling to yield 7%. The firm also issued some 20-year bonds 2 years ago with an 8% coupon rate. The two bond issues are rated equally by Standard and Poors and Moody's. Asbury's marginal tax rate is 38%.
 - a. What is Asbury's after-tax cost of debt?
 - b. What is the current selling price of the 20-year bonds?
 11. The Dentite Corporation's bonds are currently selling to yield new buyers a 12% return on their investment. Dentite's marginal tax rate including both federal and state taxes is 38%. What is the firm's after-tax cost of debt?
 12. Harris Inc.'s preferred stock was issued five years ago to yield 9%. Investors buying those shares on the secondary market today are getting a 14% return. Harris generally pays flotation costs of 12% on new securities issues. What is Harris's cost of preferred financing?
 13. Fuller, Inc., issued \$100, 8% preferred stock five years ago. It is currently selling for \$84.50. Assuming Fuller has to pay flotation costs of 10%, what is Fuller's cost of preferred stock?
 14. New buyers of Simmonds Inc. stock expect a return of about 22%. The firm pays flotation costs of 9% when it issues new securities. What is Simmonds' cost of equity
 - a. from retained earnings?
 - b. from new stock?
 15. Kleig Inc.'s bonds are selling to yield 9%. The firm plans to sell new bonds to the general public and will therefore incur flotation costs of 6%. The company's marginal tax rate is 42%.
 - a. What is Kleig's cost of debt with respect to the new bonds? (*Hint*: Adjust the cost of debt formula to include flotation costs.)
 - b. Suppose Kleig also borrows directly from a bank at 12%.
 1. What is its cost of debt with respect to such bank loans? (*Hint*: Would bank loans be subject to flotation costs?)

2. If total borrowing is 60% through bonds and 40% from the bank, what is Kleig's overall cost of debt? (*Hint: Think weighted average.*)
16. A few years ago, Hendersen Corp. issued preferred stock paying 8% of its par value of \$50. The issue is currently selling for \$38. Preferred stock flotation costs are 15% of the proceeds of the sale. What is Hendersen's cost of preferred stock?
17. The Pepperpot Company's stock is selling for \$52. Its last dividend was \$4.50, and the firm is expected to grow at 7% indefinitely. Flotation costs associated with the sale of common stock are 10% of the proceeds raised. Estimate Pepperpot's cost of equity from retained earnings and from the sale of new stock.
18. The Longlife Insurance Company has a beta of .8. The average stock currently returns 15% and short-term treasury bills are offering 6%. Estimate Longlife's cost of retained earnings.
19. The Longlife Insurance Company of the preceding problem has several bonds outstanding that are currently selling to yield 9%. What does this imply about the cost of the firm's equity?
20. Hammell Industries has been using 10% as its cost of retained earnings for a number of years. Management has decided to revisit this decision based on recent changes in financial markets. An average stock is currently earning 8%, treasury bills yield 3.5%, and shares of Hammell's stock are selling for \$29.44. The firm just paid a dividend of \$1.50, and anticipates growing at 5% for the foreseeable future. Hammell's CFO recently asked an investment banker about issuing bonds and was told the market was demanding a 6.5% coupon rate on similar issues. Hammell stock has a beta of 1.4. Recommend a cost of retained earnings for Hammell.
21. Suppose Hammell of the previous problem needs to issue new stock to raise additional equity capital. What is its cost of new equity if flotation costs are 12%?
22. Whitley Motors Inc. has the following capital.
- Debt:* The firm issued 900 25-year bonds five years ago which were sold at a par value of \$1,000. The bonds carry a coupon rate of 7%, but are currently selling to yield new buyers 10%.
- Preferred stock:* 3,500 shares of 8% preferred were sold 12 years ago at a par value of \$50. They're now priced to yield 11%.
- Equity:* The firm got started with the sale of 10,000 shares of common stock at \$100 per share. Since that time earnings of \$800,000 have been retained. The stock is now selling for \$89. Whitley's business plan for next year projects net income of \$300,000, half of which will be retained.
- The firm's marginal tax rate is 38% including federal and state obligations. It pays flotation costs of 8% on all new stock issues. Whitley is expected to grow at a rate of 3.5% indefinitely and recently paid an annual dividend of \$4.
- Develop Whitley's WACC before and after the retained earnings break and indicate how much capital will have been raised when the break occurs.
23. The Longenes Company uses a target capital structure when calculating the cost of capital. The target structure and current component costs based on market conditions follow.

Component	Mix	Cost*
Debt	25%	8%
Preferred stock	10	12
Common equity	65	20

*The costs of debt and preferred stock are already adjusted for taxes and/or flotation costs. The cost of equity is unadjusted.

The firm expects to earn \$20 million next year and plans to invest \$18 million in new capital projects. It generally pays dividends equal to 60% of earnings. Flotation costs are 10% for common and preferred stock.

- What is Longenes's initial WACC?
 - Where is the retained earnings breakpoint in the MCC? (Round to the nearest \$.1 million.)
 - What is the new WACC after the break? (Adjust the entire cost of equity for flotation costs.)
 - Longenes can borrow up to \$4 million at a net cost of 8% as shown. After that the net cost of debt rises to 12%. What is the new WACC after the increase in the cost of debt?
 - Where is the second break in the MCC? That is, how much total capital has been raised when the second increase in WACC occurs?
 - Sketch Longenes's MCC.
24. (Integrative Problem) Taunton Construction Inc.'s capital situation is described as follows.

Debt: The firm issued 10,000 25-year bonds 10 years ago at their par value of \$1,000. The bonds carry a coupon rate of 14% and are now selling to yield 10%.

Preferred stock: Thirty thousand shares of preferred stock were sold six years ago at a par value of \$50. The shares pay a dividend of \$6 per year. Similar preferred issues are now yielding 9%.

Equity: Taunton was initially financed by selling 2 million shares of common stock at \$12. Accumulated retained earnings are now \$5 million. The stock is currently selling at \$13.25.

Taunton's *target capital structure* is as follows.

Debt	30%
Preferred stock	5
Common equity	<u>65</u>
	100%

Other information:

- Taunton's marginal tax rate (state and federal) is 40%.
- Flotation costs average 12% for common and preferred stock.
- Short-term treasury bills currently yield 7.5%.
- The market is returning 12.5%.
- Taunton's beta is 1.2.
- The firm is expected to grow at 6% indefinitely.
- The last annual dividend paid was \$1.00 per share.

- Taunton expects to earn \$5 million next year.
- The firm can borrow an additional \$2 million at rates similar to the market return on its old debt. Beyond that, lenders are expected to demand returns in the neighborhood of 14%.
- Taunton has the following capital budgeting projects under consideration in the coming year. These represent its investment opportunity schedule (IOS).

Project	IRR	Capital Required	Cumulative Capital Required
A	15%	\$3 million	\$ 3 million
B	14	2 million	5 million
C	13	2 million	7 million
D	12	2 million	9 million
E	11	2 million	11 million

- Calculate the firm's capital structure based on book and market values, and compare with the target capital structure. Is the target structure a reasonable approximation of the market-value-based structure? Is the book structure very far off?
- Calculate the cost of debt based on the market return on the company's existing bonds.
- Calculate the cost of preferred stock based on the market return on the company's existing preferred stock.
- Calculate the cost of retained earnings using three approaches: CAPM, dividend growth, and risk premium. Reconcile the results into a single estimate.
- Estimate the cost of equity raised through the sale of new stock using the dividend growth approach.
- Calculate the WACC by using equity from retained earnings based on your component cost estimates and the target capital structure.
- Where is the first breakpoint in the MCC (the point where retained earnings run out)? Calculate to the nearest \$.1 million.
- Calculate the WACC after the first breakpoint.
- Where is the second breakpoint in the MCC (the point at which the cost of debt increases)? Why does this second break exist? Calculate to the nearest \$.1 million.
- Calculate the WACC after the second break.
- Plot Taunton's MCC.
- Plot Taunton's IOS on the same axes as the MCC. Which projects should be accepted, and which should be rejected? Do any of those rejected have IRRs above the initial WACC? If so, explain in words why they're being rejected.
- What is *the* WACC for the planning period?
- Suppose project E is self-funding in that it comes with a source of its own debt financing. A loan is offered through an equipment manufacturer at 9%. The cost of the loan is

$$9\% \times (1 - T) = 5.4\%$$

Should project E be accepted under such conditions?

25. Newrock Manufacturing Inc. has the following target capital structure

Debt	25%
Preferred	20
Equity	55

Investment bankers have advised the CFO that the company could raise up to \$5 million in new debt financing by issuing bonds at a 6.0% coupon rate; beyond that amount, new debt would require a 7.0% coupon. Newrock's 8.5% preferred stock, issued at a par value of \$100, currently sells for \$112.50. There are 3 million shares of common stock outstanding on which the firm paid an annual dividend of \$2.00 recently. The stock currently trades at \$36.00 per share. Next year's net income is projected at \$14 million and management expects 6% growth in the foreseeable future. Flotation costs are 6% on debt and 11% on common and preferred stock. The marginal tax rate is 40%.

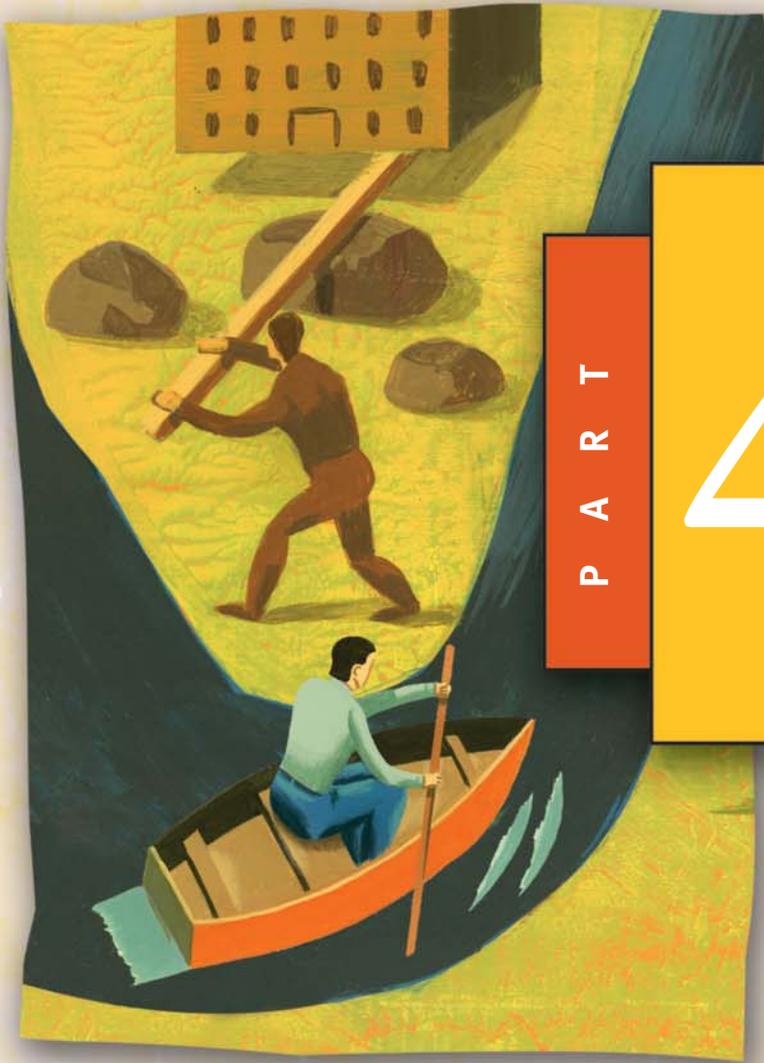
- Calculate the WACC using the target capital structure and the cost of retained earnings for the equity component.
- Plot Newrock's MCC identifying the levels of funding at which the first two breaks occur, and calculate the WACCs after each break.
- Newrock has identified the following capital projects for next year:

Project	Investment	IRR
A	\$4.0 million	11.0%
B	3.6 million	10.5
C	8.6 million	13.2
D	2.0 million	8.7
E	5.5 million	9.5
F	5.0 million	7.2
G	4.1 million	10.5
H	6.4 million	8.0

Projects A and B are mutually exclusive, as are Projects C and H. Plot the IOS and the MCC and determine the ideal size of next year's capital program.

INTERNET PROBLEM

- Visit Ibbotson's Cost of Capital Center Web site at <http://www.ibbotson.com> (click on "Knowledge Center," then "Published Research," and select "Cost of Capital" to review a recent research paper). Select one of the articles listed and prepare a one-page summary highlighting the most important points.



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Chapter 15 Dividends