THE COST OF CAPITAL

LEARNING GOALS

LG1 Understand the key assumptions that underlie cost of capital, the basic concept of cost of capital, and the specific sources of capital that it includes.

LG2 Determine the cost of long-term debt and the cost of preferred stock.

LG3 Calculate the cost of common stock equity and convert it into the cost of retained earnings and the cost of new issues of common stock.

LG4 Calculate the weighted average cost of capital (WACC) and discuss the alternative weighting schemes.

LG5 Describe the procedures used to determine break points and the weighted marginal cost of capital (WMCC).

LG6 Explain how the weighted marginal cost of capital (WMCC) can be used with the investment opportunities schedule (IOS) to make the firm's financing/investment decisions.

Across the Disciplines WHY THIS CHAPTER MATTERS TO YOU

Accounting: You need to understand the various sources of capital and how their costs are calculated in order to provide data used in determining the firm's overall cost of capital.

Information systems: You need to understand the various sources of capital and how their costs are calculated in order to develop systems that will estimate the costs of those sources of capital, as well as the overall cost of capital.

Management: You need to understand the cost of capital in order to assess the acceptability and relative rankings of proposed long-term investments.

Marketing: You need to understand what the firm's cost of capital is because proposed projects will face rejection if their promised returns are less than the firm's cost of capital.

Operations: You need to understand the cost of capital in order to assess the economic viability of investments in plant and equipment needed to improve or expand the firm's capacity.

NEXTEL

ANSWERING THE CALL
FOR FUNDS

Nextel, the fifth largest mobile-phone company in the United States, offers its customers
unique technology that combines a variety of wireless services on one handset. Despite its
dominance in the business market and its high revenue growth, through early 2002 the company
was still in a net-loss position. Its continued march toward profitability requires large capital
expenditures; in 2000 alone, it spent $3.5 billion to keep up with technological advances and add
new features. To fund its growth, Nextel raised well over $20 billion in new debt and equity financ-
ing from 1996 to 2000.

Searching for new sources of capital and finding the most appropriate sources for different
purposes can keep costs of capital in line. Nextel aggressively raises capital whenever it sees an
opportunity, so that money will always be available for expansion. The firm combines different
financing instruments to create a healthy balance between debt and equity. The type of financing
is tied to market conditions. When the high-yield debt markets tightened in 1998 as a conse-
quence of the international financial situation, the private markets proved to be a better, more
reasonably priced choice. The company also issued convertible bonds and preferred stock when
market conditions were right. In 2000 Nextel was able to tap strong equity markets to issue $2.8
billion of common equity, which helped it to stay within existing debt provisions. This turned out to
be a good move; the market for telecommunications and other technology stocks collapsed soon
after.

Choosing cost-effective financing instruments so that Nextel can work toward a balanced
capital structure is no easy task in today's volatile capital markets. If the equity markets are
closed, the company may have no choice but to issue debt, regardless of cost, in order to secure
adequate funding for its capital projects.

In this chapter we'll demonstrate how to calculate the cost of specific sources of capital
and how to combine them to arrive at a *weighted cost of capital* that firms can use to evaluate
investment opportunities.

LG1 11.1 An Overview of the Cost of Capital

cost of capital
The rate of return that a firm must earn on the projects in which it invests to maintain its market value and attract funds.

The **cost of capital** is the rate of return that a firm must earn on the projects in which it invests to maintain the market value of its stock. It can also be thought of as the rate of return required by the market suppliers of capital to attract their funds to the firm. If risk is held constant, projects with a rate of return above the cost of capital will increase the value of the firm, and projects with a rate of return below the cost of capital will decrease the value of the firm.

The cost of capital is an extremely important financial concept. It acts as a major link between the firm's long-term investment decisions (discussed in Part 3) and the wealth of the owners as determined by investors in the marketplace. It is in effect the "magic number" that is used to decide whether a proposed corporate investment will increase or decrease the firm's stock price. Clearly, only those investments that are expected to increase stock price ($NPV > \$0$, or $IRR > $ cost of capital) would be recommended. Because of its key role in financial decision making, the importance of the cost of capital cannot be overemphasized.

Some Key Assumptions

The cost of capital is a dynamic concept affected by a variety of economic and firm-specific factors. To isolate the basic structure of the cost of capital, we make some key assumptions relative to risk and taxes:

business risk
The risk to the firm of being unable to cover operating costs.

financial risk
The risk to the firm of being unable to cover required financial obligations (interest, lease payments, preferred stock dividends).

Hint Because of the positive relationship between risk and return, a firm's financing cost (cost of capital) will change if the acceptance of a project changes the firm's business or financial risk. The cost of capital can therefore be more easily measured by assuming that new projects do not change these risks.

1. **Business risk**—the risk to the firm of being unable to cover operating costs—*is assumed to be unchanged*. This assumption means that the firm's acceptance of a given project does not affect its ability to meet operating costs.
2. **Financial risk**—the risk to the firm of being unable to cover required financial obligations (interest, lease payments, preferred stock dividends)—*is assumed to be unchanged*. This assumption means that projects are financed in such a way that the firm's ability to meet required financing costs is unchanged.
3. After-tax costs are considered relevant. In other words, *the cost of capital is measured on an after-tax basis*. This assumption is consistent with the framework used to make capital budgeting decisions.

The Basic Concept

target capital structure
The desired optimal mix of debt and equity financing that most firms attempt to maintain.

The cost of capital is estimated at a given point in time. It reflects the expected average future cost of funds over the long run. Although firms typically raise money in lumps, the cost of capital should reflect the interrelatedness of financing activities. For example, if a firm raises funds with debt (borrowing) today, it is likely that some form of equity, such as common stock, will have to be used the next time it needs funds. Most firms attempt to maintain a desired optimal mix of debt and equity financing. This mix is commonly called a **target capital structure**—a topic that will be addressed in Chapter 12. Here, it is sufficient to

say that although firms raise money in lumps, they tend toward some desired *mix of financing.*

To capture the interrelatedness of financing assuming the presence of a target capital structure, we need to look at the *overall cost of capital* rather than the cost of the specific source of funds used to finance a given expenditure.

EXAMPLE ▼   A firm is *currently* faced with an investment opportunity. Assume the following:

Best project available today

$$Cost = \$100,000$$
$$Life = 20 \text{ years}$$
$$IRR = 7\%$$

Cost of least-cost financing source available

$$Debt = 6\%$$

Because it can earn 7% on the investment of funds costing only 6%, the firm undertakes the opportunity. Imagine that *1 week later* a new investment opportunity is available:

Best project available 1 week later

$$Cost = \$100,000$$
$$Life = 20 \text{ years}$$
$$IRR = 12\%$$

Cost of least-cost financing source available

$$Equity = 14\%$$

In this instance, the firm rejects the opportunity, because the 14% financing cost is greater than the 12% expected return.

Were the firm's actions in the best interests of its owners? No; it accepted a project yielding a 7% return and rejected one with a 12% return. Clearly, there should be a better way, and there is: The firm can use a combined cost, which over the long run will yield better decisions. By weighting the cost of each source of financing by its *target proportion* in the firm's capital structure, the firm can obtain a *weighted average cost* that reflects the interrelationship of financing decisions. Assuming that a 50–50 mix of debt and equity is targeted, the weighted average cost here would be 10% [(0.50 × 6% debt) + (0.50 × 14% equity)]. With this cost, the first opportunity would have been rejected (7% IRR < 10% weighted average cost), and the second would have been accepted (12% IRR > 10% weighted average cost). Such an outcome would clearly be more desirable. ▲

The Cost of Specific Sources of Capital

This chapter focuses on finding the costs of specific sources of capital and combining them to determine the weighted average cost of capital. Our concern is only with the *long-term* sources of funds available to a business firm, because these sources supply the permanent financing. Long-term financing supports the

firm's fixed-asset investments.[1] We assume throughout the chapter that such investments are selected by using appropriate capital budgeting techniques.

There are four basic sources of long-term funds for the business firm: long-term debt, preferred stock, common stock, and retained earnings. The right-hand side of a balance sheet can be used to illustrate these sources:

Balance Sheet		
	Current liabilities	
	Long-term debt	Sources of long-term funds

Assets	Stockholders' equity
	    Preferred stock
	    Common stock equity
	        Common stock
	        Retained earnings	

Although not every firm will use all of these methods of financing, each firm is expected to have funds from some of these sources in its capital structure.

The *specific cost* of each source of financing is the *after-tax* cost of obtaining the financing *today,* not the historically based cost reflected by the existing financing on the firm's books. Techniques for determining the specific cost of each source of long-term funds are presented on the following pages. Although these techniques tend to develop precisely calculated values, the resulting values are at best *rough approximations* because of the numerous assumptions and forecasts that underlie them. Although we round calculated costs to the nearest 0.1 percent throughout this chapter, it is not unusual for practicing financial managers to use costs rounded to the nearest 1 percent because these values are merely estimates.

R e v i e w   Q u e s t i o n s

11–1 What is the *cost of capital?* What role does it play in long-term investment decisions?

11–2 Why do we assume that *business risk* and *financial risk* are unchanged when evaluating the cost of capital? Discuss the implications of these assumptions on the acceptance and financing of new projects.

11–3 Why is the cost of capital measured on an *after-tax basis?* Why is use of a weighted average cost of capital rather than the cost of the specific source of funds recommended?

11–4 You have just been told, "Because we are going to finance this project with debt, its required rate of return must exceed the cost of debt." Do you agree or disagree? Explain.

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1. The role of both long-term and short-term financing in supporting both fixed- and current-asset investments is addressed in Chapter 14. Suffice it to say that long-term funds are at minimum used to finance fixed assets.

11.2 **The Cost of Long-Term Debt**

cost of long-term debt, k_i
The after-tax cost today of raising long-term funds through borrowing.

The **cost of long-term debt, k_i,** is the after-tax cost today of raising long-term funds through borrowing. For convenience, we typically assume that the funds are raised through the sale of bonds. In addition, as we did in Chapter 6, we assume that the bonds pay *annual* (rather than *semiannual*) interest.

Net Proceeds

net proceeds
Funds actually received from the sale of a security.

flotation costs
The total costs of issuing and selling a security.

Most corporate long-term debts are incurred through the sale of bonds. The **net proceeds** from the sale of a bond, or any security, are the funds that are actually received from the sale. **Flotation costs**—the total costs of issuing and selling a security—reduce the net proceeds from the sale. These costs apply to all public offerings of securities—debt, preferred stock, and common stock. They include two components: (1) *underwriting costs*—compensation earned by investment bankers for selling the security, and (2) *administrative costs*—issuer expenses such as legal, accounting, printing, and other expenses.

EXAMPLE ▼

Duchess Corporation, a major hardware manufacturer, is contemplating selling $10 million worth of 20-year, 9% coupon (stated *annual* interest rate) bonds, each with a par value of $1,000. Because similar-risk bonds earn returns greater than 9%, the firm must sell the bonds for $980 to compensate for the lower coupon interest rate. The flotation costs are 2% of the par value of the bond ($0.02 \times \$1,000$), or $20. The net proceeds to the firm from the sale of each bond are therefore $960 ($980 − $20).

Before-Tax Cost of Debt

The before-tax cost of debt, k_d, for a bond can be obtained in any of three ways: quotation, calculation, or approximation.

Using Cost Quotations

Hint From the issuer's perspective, the IRR on a bond's cash flows is its *cost to maturity;* from the investor's perspective, the IRR on a bond's cash flows is its *yield to maturity* (*YTM*), as explained in Chapter 6. These two measures are conceptually similarly, although their point of view is different.

When the net proceeds from sale of a bond equal its par value, the before-tax cost just equals the coupon interest rate. For example, a bond with a 10 percent coupon interest rate that nets proceeds equal to the bond's $1,000 par value would have a before-tax cost, k_d, of 10 percent.

A second quotation that is sometimes used is the *yield to maturity* (*YTM*) on a similar-risk bond[2] (see Chapter 6). For example, if a similar-risk bond has a YTM of 9.7 percent, this value can be used as the before-tax cost of debt, k_d.

Calculating the Cost

This approach finds the before-tax cost of debt by calculating the *internal rate of return* (*IRR*) on the bond cash flows. From the issuer's point of view, this value is the *cost to maturity* of the cash flows associated with the debt. The cost to

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2. Generally, the yield to maturity of bonds with a similar "rating" is used. Bond ratings, which are published by independent agencies, were discussed in Chapter 6.

FOCUS ON e-FINANCE   Sold to the Lowest Bidder

In August 2000, **Dow Chemical** became the first industrial corporation to price and distribute bonds online. **WR Hambrecht + Co.**, a pioneer in online equity IPOs, conducted the 2-hour Dutch auction at its OpenBook auction Web site. In a Dutch auction (long used to price and sell Treasury bonds), investors place bids to buy a particular amount of a security at a specific price within a spread set by the issuer before the auction. The underwriter accepts the lowest price at which there is enough demand to sell all the bonds offered (the clearing price). Investors who bid that price or higher get their requested allocations at the clearing price.

Dow's open bond auction of $300 million in 5-year bonds was well received, attracting a broader investor base that could reduce volatility in the secondary market.

The interest rate on the issue was similar to what Dow would have paid using the traditional syndication process, but the underwriting fee was over 50 percent lower. "To me, it's a no-brainer," said Dow treasurer Geoffery Merszei.

In the future, market watchers expect Internet auctions to lower issuance costs for debt capital through more efficient pricing that reflects market demand. All bidders have equal access to securities, and investors can see a real-time, fully visible demand curve for a bond issue as it unfolds, resulting in improved distribution and enhanced liquidity.

Despite Dow's success, few corporations have followed it online. **Ford Motor Credit** issued $750 million of 3-year notes in March 2001. In February 2001, government-sponsored residential mortgage agency **Freddie Mac**

announced that it would use Open-Book for eight auctions. So far, most major investment bankers have resisted endorsing a method that would undercut their more lucrative traditional underwriting business. However, both proponents and opponents of online Dutch auctions of corporate debt believe that this method works best for large, standard-issue bonds from investment-grade issuers.

Sources: Adapted from Shella Calamba, "Wall St. Ignores Online Bond Deals at Its Peril," *Dow Jones Newswires* (August 18, 2000), downloaded from *www.wrhambrecht.com/inst/openbook/media.html;* Emily S. Plishner, "E-bonds: Will They Fly?" *CFO* (March 1, 2001); and "WR Hambrecht + Co's Core Technology to Support the First Dutch Auction of Freddie Mac Two- and Three-Year Reference Notes," press release from WR Hambrecht + Co. (February 8, 2001), downloaded from *www.wrhambrecht.com/inst/openbook/media.html.*

maturity can be calculated by using either a trial-and-error technique[3] or a financial calculator. It represents the annual before-tax percentage cost of the debt.

EXAMPLE ▼   In the preceding example, the net proceeds of a $1,000, 9% coupon interest rate, 20-year bond were found to be $960. The calculation of the annual cost is quite simple. The cash flow pattern is exactly the opposite of a conventional pattern; it consists of an initial inflow (the net proceeds) followed by a series of annual outlays (the interest payments). In the final year, when the debt is retired, an outlay representing the repayment of the principal also occurs. The cash flows associated with Duchess Corporation's bond issue are as follows:

End of year(s)	Cash flow
0	$ 960
1–20	−$ 90
20	−$1,000

3. The trial-and-error technique is presented at the book's Web site, *www.aw.com/gitman*.

Input	Function
20	N
960	PV
−90	PMT
−1000	FV
	CPT
	I

Solution
9.452

The initial $960 inflow is followed by annual interest outflows of $90 (9% coupon interest rate $\times$ $1,000 par value) over the 20-year life of the bond. In year 20, an outflow of $1,000 (the repayment of the principal) occurs. We can determine the cost of debt by finding the IRR, which is the discount rate that equates the present value of the outflows to the initial inflow.

Calculator Use   [*Note:* Most calculators require either the present (net proceeds) or the future (annual interest payments and repayment of principal) values to be input as negative numbers when we calculate cost to maturity. That approach is used here.] Using the calculator and the inputs shown at the left, you should find the before-tax cost (cost to maturity) to be 9.452%.

Approximating the Cost

The before-tax cost of debt, k_d, for a bond with a $1,000 par value can be approximated by using the following equation:

$$k_d = \frac{I + \dfrac{\$1,000 - N_d}{n}}{\dfrac{N_d + \$1,000}{2}} \tag{11.1}$$

where

I = annual interest in dollars
N_d = net proceeds from the sale of debt (bond)
n = number of years to the bond's maturity

EXAMPLE ▼ Substituting the appropriate values from the Duchess Corporation example into the approximation formula given in Equation 11.1, we get

$$k_d = \frac{I + \dfrac{\$1,000 - \$960}{20}}{\dfrac{\$960 + \$1,000}{2}} = \frac{\$90 + 2}{\$980}$$

$$= \frac{\$92}{\$980} = \underline{\underline{9.4\%}}$$

This approximate before-tax cost of debt is close to the 9.452% value calculated precisely in the preceding example.

After-Tax Cost of Debt

However, as indicated earlier, the *specific cost* of financing must be stated on an after-tax basis. Because interest on debt is tax deductible, it reduces the firm's taxable income. The after-tax cost of debt, k_i, can be found by multiplying the before-tax cost, k_d, by 1 minus the tax rate, T, as stated in the following equation:

$$k_i = k_d \times (1 - T) \tag{11.2}$$

EXAMPLE ▼

Duchess Corporation has a 40% tax rate. Using the 9.4% before-tax debt cost calculated above, and applying Equation 11.2, we find an after-tax cost of debt of 5.6% [9.4% × (1 − 0.40)]. Typically, the explicit cost of long-term debt is less than the explicit cost of any of the alternative forms of long-term financing, primarily because of the tax deductibility of interest. ▲

Review Questions

11–5 What are the *net proceeds* from the sale of a bond? What are *flotation costs* and how do they affect a bond's net proceeds?

11–6 What three methods can be used to find the before-tax cost of debt?

11–7 How is the before-tax cost of debt converted into the after-tax cost?

11.3 The Cost of Preferred Stock

Preferred stock represents a special type of ownership interest in the firm. It gives preferred stockholders the right to receive their *stated* dividends before any earnings can be distributed to common stockholders. Because preferred stock is a form of ownership, the proceeds from its sale are expected to be held for an infinite period of time. The key characteristics of preferred stock were described in Chapter 7. However, the one aspect of preferred stock that requires review is dividends.

Preferred Stock Dividends

Most preferred stock dividends are stated as a *dollar amount:* "x dollars per year." When dividends are stated this way, the stock is often referred to as "x-dollar preferred stock." Thus a "$4 preferred stock" is expected to pay preferred stockholders $4 in dividends each year on each share of preferred stock owned.

Sometimes preferred stock dividends are stated as an *annual percentage rate.* This rate represents the percentage of the stock's par value, or face value, that equals the annual dividend. For instance, an 8 percent preferred stock with a $50 par value would be expected to pay an annual dividend of $4 a share (0.08 × $50 par = $4). Before the cost of preferred stock is calculated, any dividends stated as percentages should be converted to annual dollar dividends.

Calculating the Cost of Preferred Stock

cost of preferred stock, k_p
The ratio of the preferred stock dividend to the firm's net proceeds from the sale of preferred stock; calculated by dividing the annual dividend, D_p, by the net proceeds from the sale of the preferred stock, N_p.

The **cost of preferred stock, k_p,** is the ratio of the preferred stock dividend to the firm's net proceeds from the sale of the preferred stock. The net proceeds represents the amount of money to be received minus any flotation costs. Equation 11.3 gives the cost of preferred stock, k_p, in terms of the annual dollar dividend, D_p, and the net proceeds from the sale of the stock, N_p:

$$k_p = \frac{D_p}{N_p} \qquad (11.3)$$

Because preferred stock dividends are paid out of the firm's *after-tax* cash flows, a tax adjustment is not required.

EXAMPLE ▼

Duchess Corporation is contemplating issuance of a 10% preferred stock that is expected to sell for its $87-per-share par value.[4] The cost of issuing and selling the stock is expected to be $5 per share. The first step in finding the cost of the stock is to calculate the dollar amount of the annual preferred dividend, which is $8.70 (0.10 × $87). The net proceeds per share from the proposed sale of stock equals the sale price minus the flotation costs ($87 − $5 = $82). Substituting the annual dividend, D_p, of $8.70 and the net proceeds, N_p, of $82 into Equation 11.3 gives the cost of preferred stock, 10.6% ($8.70 ÷ $82).

▲

The cost of Duchess's preferred stock (10.6%) is much greater than the cost of its long-term debt (5.6%). This difference exists primarily because the cost of long-term debt (the interest) is tax deductible.

Review Question

11–8   How would you calculate the cost of preferred stock?

LG3 ## 11.4 The Cost of Common Stock

The *cost of common stock* is the return required on the stock by investors in the marketplace. There are two forms of common stock financing: (1) retained earnings and (2) new issues of common stock. As a first step in finding each of these costs, we must estimate the cost of common stock equity.

cost of common stock equity, k_s
The rate at which investors discount the expected dividends of the firm to determine its share value.

constant-growth valuation (Gordon) model
Assumes that the value of a share of stock equals the present value of all future dividends (assumed to grow at a constant rate) that it is expected to provide over an infinite time horizon.

Finding the Cost of Common Stock Equity

The **cost of common stock equity, k_s,** is the rate at which investors discount the expected dividends of the firm to determine its share value. Two techniques are used to measure the cost of common stock equity.[5] One relies on the constant-growth valuation model, the other on the capital asset pricing model (CAPM).

Using the Constant-Growth Valuation (Gordon) Model

In Chapter 7 we found the value of a share of stock to be equal to the present value of all future dividends, which in one model were assumed to grow at a constant annual rate over an infinite time horizon. This is the **constant-growth valuation**

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4. For simplicity, the preferred stock in this example is assumed to be sold for its par value. In practice, particularly for subsequent issues of already outstanding preferred stock, it is typically sold at a price that differs from its par value.

5. Other, more subjective techniques are available for estimating the cost of common stock equity. One popular technique is the *bond yield plus a premium;* it estimates the cost of common stock equity by adding a premium, typically between 3% and 5%, to the firm's current cost of long-term debt. Another, even more subjective technique uses the firm's *expected return on equity (ROE)* as a measure of its cost of common stock equity. Here we focus only on the more theoretically based techniques.

model, also known as the **Gordon model.** The key expression derived for this model was presented as Equation 7.5 and is restated here:

$$P_0 = \frac{D_1}{k_s - g} \tag{11.4}$$

where

P_0 = value of common stock
D_1 = per-share dividend *expected* at the end of year 1
k_s = required return on common stock
g = constant rate of growth in dividends

Solving Equation 11.4 for k_s results in the following expression for the *cost of common stock equity:*

$$k_s = \frac{D_1}{P_0} + g \tag{11.5}$$

Equation 11.5 indicates that the cost of common stock equity can be found by dividing the dividend expected at the end of year 1 by the current price of the stock and adding the expected growth rate. Because common stock dividends are paid from *after-tax* income, no tax adjustment is required.

EXAMPLE ▼   Duchess Corporation wishes to determine its cost of common stock equity, k_s. The market price, P_0, of its common stock is $50 per share. The firm expects to pay a dividend, D_1, of $4 at the end of the coming year, 2004. The dividends paid on the outstanding stock over the past 6 years (1998–2003) were as follows:

Year	Dividend
2003	$3.80
2002	3.62
2001	3.47
2000	3.33
1999	3.12
1998	2.97

Using the table for the present value interest factors, *PVIF* (Table A–2), or a financial calculator in conjunction with the technique described for finding growth rates in Chapter 4, we can calculate the annual growth rate of dividends, *g*. It turns out to be approximately 5% (more precisely, it is 5.05%). Substituting $D_1 = \$4$, $P_0 = \$50$, and $g = 5\%$ into Equation 11.5 yields the cost of common stock equity:

$$k_s = \frac{\$4}{\$50} + 0.05 = 0.08 + 0.05 = 0.130, \text{ or } \underline{13.0}\%$$

The 13.0% cost of common stock equity represents the return required by *existing* shareholders on their investment. If the actual return is less than that, shareholders are likely to begin selling their stock.   ▲

Using the Capital Asset Pricing Model (CAPM)

capital asset pricing model (CAPM)
Describes the relationship between the required return, k_s, and the nondiversifiable risk of the firm as measured by the beta coefficient, b.

Recall from Chapter 5 that the **capital asset pricing model (CAPM)** describes the relationship between the required return, k_s, and the nondiversifiable risk of the firm as measured by the beta coefficient, b. The basic CAPM is

$$k_s = R_F + [b \times (k_m - R_F)] \tag{11.6}$$

where

R_F = risk-free rate of return
k_m = market return; return on the market portfolio of assets

Using CAPM indicates that the cost of common stock equity is the return required by investors as compensation for the firm's nondiversifiable risk, measured by beta.

EXAMPLE ▼

Duchess Corporation now wishes to calculate its cost of common stock equity, k_s, by using the capital asset pricing model. The firm's investment advisers and its own analyses indicate that the risk-free rate, R_F, equals 7%; the firm's beta, b, equals 1.5; and the market return, k_m, equals 11%. Substituting these values into Equation 11.6, the company estimates the cost of common stock equity, k_s, to be

$$k_s = 7.0\% + [1.5 \times (11.0\% - 7.0\%)] = 7.0\% + 6.0\% = \underline{13.0}\%$$

The 13.0% cost of common stock equity represents the required return of investors in Duchess Corporation common stock. It is the same as that found by using the constant-growth valuation model.

▲

Comparing the Constant-Growth and CAPM Techniques

The CAPM technique differs from the constant-growth valuation model in that it directly considers the firm's risk, as reflected by beta, in determining the *required* return or cost of common stock equity. The constant-growth model does not look at risk; it uses the market price, P_0, as a reflection of the *expected* risk–return preference of investors in the marketplace. The constant-growth valuation and CAPM techniques for finding k_s are theoretically equivalent. But it is difficult to demonstrate that equivalency because of measurement problems associated with growth, beta, the risk-free rate (what maturity of government security to use), and the market return. The use of the constant-growth valuation model is often preferred because the data required are more readily available.

Another difference is that when the constant-growth valuation model is used to find the cost of common stock equity, it can easily be adjusted for flotation costs to find the cost of new common stock; the CAPM does not provide a simple adjustment mechanism. The difficulty in adjusting the cost of common stock equity calculated by using CAPM occurs because in its common form the model does not include the market price, P_0, a variable needed to make such an adjustment. Although CAPM has a stronger theoretical foundation, the computational appeal of the traditional constant-growth valuation model justifies its use throughout this text to measure common stock costs.

The Cost of Retained Earnings

cost of retained earnings, k_r
The same as the cost of an equivalent fully subscribed issue of additional common stock, which is equal to the cost of common stock equity, k_s.

Hint Using retained earnings as a major source of financing for capital expenditures does not give away control of the firm and does not dilute present earnings per share, as would occur if new common stock were issued. However, the firm must effectively manage retained earnings, in order to produce profits that increase future retained earnings.

As you know, dividends are paid out of a firm's earnings. Their payment, made in cash to common stockholders, reduces the firm's retained earnings. Let's say a firm needs common stock equity financing of a certain amount; it has two choices relative to retained earnings: It can issue additional common stock in that amount and still pay dividends to stockholders out of retained earnings. Or it can increase common stock equity by retaining the earnings (not paying the cash dividends) in the needed amount. In a strict accounting sense, the retention of earnings increases common stock equity in the same way that the sale of additional shares of common stock does. Thus the **cost of retained earnings, k_r,** to the firm is the same as the cost of an *equivalent fully subscribed issue of additional common stock*. Stockholders find the firm's retention of earnings acceptable only if they expect that it will earn at least their required return on the reinvested funds.

Viewing retained earnings as a fully subscribed issue of additional common stock, we can set the firm's cost of retained earnings, k_r, equal to the cost of common stock equity as given by Equations 11.5 and 11.6.[6]

$$k_r = k_s \qquad\qquad (11.7)$$

It is not necessary to adjust the cost of retained earnings for flotation costs, because by retaining earnings, the firm "raises" equity capital without incurring these costs.

EXAMPLE ▼

The cost of retained earnings for Duchess Corporation was actually calculated in the preceding examples: It is equal to the cost of common stock equity. Thus k_r equals 13.0%. As we will show in the next section, the cost of retained earnings is always lower than the cost of a new issue of common stock, because it entails no flotation costs.

The Cost of New Issues of Common Stock

cost of a new issue of common stock, k_n
The cost of common stock, net of underpricing and associated flotation costs.

underpriced
Stock sold at a price below its current market price, P_0.

Our purpose in finding the firm's overall cost of capital is to determine the after-tax cost of *new* funds required for financing projects. The **cost of a new issue of common stock, k_n,** is determined by calculating the cost of common stock, net of underpricing and associated flotation costs. Normally, for a new issue to sell, it has to be **underpriced**—sold at a price below its current market price, P_0.

Firms underprice new issues for a variety of reasons. First, when the market is in equilibrium (that is, the demand for shares equals the supply of shares), additional demand for shares can be achieved only at a lower price. Second, when additional shares are issued, each share's percent of ownership in the firm is diluted, thereby justifying a lower share value. Finally, many investors view the issuance of additional shares as a signal that management is using common stock equity financing because it believes that the shares are currently overpriced. Recognizing this information, they will buy shares only at a price below the current market price. Clearly, these and other factors necessitate underpricing of new

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6. Technically, if a stockholder received dividends and wished to invest them in additional shares of the firm's stock, he or she would first have to pay personal taxes on the dividends and then pay brokerage fees before acquiring additional shares. By using pt as the average stockholder's personal tax rate and bf as the average brokerage fees stated as a percentage, we can specify the cost of retained earnings, k_r, as $k_r = k_s \times (1 - pt) \times (1 - bf)$. Because of the difficulty in estimating pt and bf, only the simpler definition of k_r given in Equation 11.7 is used here.

offerings of common stock. Flotation costs paid for issuing and selling the new issue will further reduce proceeds.

We can use the constant-growth valuation model expression for the cost of existing common stock, k_s, as a starting point. If we let N_n represent the net proceeds from the sale of new common stock after subtracting underpricing and flotation costs, the cost of the new issue, k_n, can be expressed as follows:[7]

$$k_n = \frac{D_1}{N_n} + g \tag{11.8}$$

The net proceeds from sale of new common stock, N_n, will be less than the current market price, P_0. Therefore, the cost of new issues, k_n, will always be greater than the cost of existing issues, k_s, which is equal to the cost of retained earnings, k_r. *The cost of new common stock is normally greater than any other long-term financing cost.* Because common stock dividends are paid from after-tax cash flows, no tax adjustment is required.

EXAMPLE ▼ In the constant-growth valuation example, we found Duchess Corporation's cost of common stock equity, k_s, to be 13%, using the following values: an expected dividend, D_1, of $4; a current market price, P_0, of $50; and an expected growth rate of dividends, g, of 5%.

To determine its cost of *new* common stock, k_n, Duchess Corporation has estimated that on the average, new shares can be sold for $47. The $3-per-share underpricing is due to the competitive nature of the market. A second cost associated with a new issue is flotation costs of $2.50 per share that would be paid to issue and sell the new shares. The total underpricing and flotation costs per share are therefore expected to be $5.50.

Subtracting the $5.50 per share underpricing and flotation cost from the current $50 share price results in expected net proceeds of $44.50 per share ($50.00 − $5.50). Substituting $D_1 = \$4$, $N_n = \$44.50$, and $g = 5\%$ into Equation 11.8 results in a cost of new common stock, k_n, as follows:

$$k_n = \frac{\$4.00}{\$44.50} + 0.05 = 0.09 + 0.05 = 0.140, \text{ or } \underline{\underline{14.0\%}}$$

Duchess Corporation's cost of new common stock is therefore 14.0%. This is the ▲ value to be used in subsequent calculations of the firm's overall cost of capital.

Review Questions

11–9 What premise about share value underlies the constant-growth valuation (Gordon) model that is used to measure the cost of common stock equity, k_s?

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7. An alternative, but computationally less straightforward, form of this equation is

$$k_n = \frac{D_1}{P_0 \times (1 - f)} + g \tag{11.8a}$$

where f represents the *percentage* reduction in current market price expected as a result of underpricing and flotation costs. Simply stated, N_n in Equation 11.8 is equivalent to $P_0 \times (1 - f)$ in Equation 11.8a. For convenience, Equation 11.8 is used to define the cost of a new issue of common stock, k_n.

11–10 Why is the cost of financing a project with retained earnings less than the cost of financing it with a new issue of common stock?

LG4 11.5 The Weighted Average Cost of Capital

weighted average cost of capital (WACC), k_a
Reflects the expected average future cost of funds over the long run; found by weighting the cost of each specific type of capital by its proportion in the firm's capital structure.

Now that we have calculated the cost of specific sources of financing, we can determine the overall cost of capital. As noted earlier, the **weighted average cost of capital (WACC)**, k_a, reflects the expected average future cost of funds over the long run. It is found by weighting the cost of each specific type of capital by its proportion in the firm's capital structure.

Calculating the Weighted Average Cost of Capital (WACC)

Calculating the weighted average cost of capital (WACC) is straightforward: Multiply the specific cost of each form of financing by its proportion in the firm's capital structure and sum the weighted values. As an equation, the weighted average cost of capital, k_a, can be specified as follows:

$$k_a = (w_i \times k_i) + (w_p \times k_p) + (w_s \times k_{r \text{ or } n}) \tag{11.9}$$

where

w_i = proportion of long-term debt in capital structure
w_p = proportion of preferred stock in capital structure
w_s = proportion of common stock equity in capital structure

$w_i + w_p + w_s = 1.0$

Three important points should be noted in Equation 11.9:

1. For computational convenience, it is best to convert the weights into decimal form and leave the specific costs in percentage terms.
2. *The sum of the weights must equal 1.0.* Simply stated, all capital structure components must be accounted for.
3. The firm's common stock equity weight, w_s, is multiplied by either the cost of retained earnings, k_r, or the cost of new common stock, k_n. Which cost is used depends on whether the firm's common stock equity will be financed using retained earnings, k_r, or new common stock, k_n.

EXAMPLE ▼ In earlier examples, we found the costs of the various types of capital for Duchess Corporation to be as follows:

$$\text{Cost of debt, } k_i = 5.6\%$$
$$\text{Cost of preferred stock, } k_p = 10.6\%$$
$$\text{Cost of retained earnings, } k_r = 13.0\%$$
$$\text{Cost of new common stock, } k_n = 14.0\%$$

TABLE 11.1	Calculation of the Weighted Average Cost of Capital for Duchess Corporation		
Source of capital	Weight (1)	Cost (2)	Weighted cost [(1) × (2)] (3)
Long-term debt	0.40	5.6%	2.2%
Preferred stock	0.10	10.6	1.1
Common stock equity	0.50	13.0	6.5
Totals	1.00		9.8%
	Weighted average cost of capital = 9.8%		

The company uses the following weights in calculating its weighted average cost of capital:

Source of capital	Weight
Long-term debt	40%
Preferred stock	10
Common stock equity	50
Total	100%

Because the firm expects to have a sizable amount of retained earnings available ($300,000), it plans to use its cost of retained earnings, k_r, as the cost of common stock equity. Duchess Corporation's weighted average cost of capital is calculated in Table 11.1. The resulting weighted average cost of capital for Duchess is 9.8%. Assuming an unchanged risk level, the firm should accept all projects that will earn a return greater than 9.8%.

Weighting Schemes

Weights can be calculated on the basis of either *book value* or *market value* and using either *historical* or *target* proportions.

book value weights
Weights that use accounting values to measure the proportion of each type of capital in the firm's financial structure.

market value weights
Weights that use market values to measure the proportion of each type of capital in the firm's financial structure.

Book Value Versus Market Value

Book value weights use accounting values to measure the proportion of each type of capital in the firm's financial structure. **Market value weights** measure the proportion of each type of capital at its market value. Market value weights are appealing, because the market values of securities closely approximate the actual dollars to be received from their sale. Moreover, because the costs of the various types of capital are calculated by using prevailing market prices, it seems reasonable to use market value weights. In addition, the long-term investment cash

flows to which the cost of capital is applied are estimated in terms of current as well as future market values. *Market value weights are clearly preferred over book value weights.*

Historical Versus Target

historical weights
Either book or market value weights based on *actual* capital structure proportions.

Historical weights can be either book or market value weights based on *actual* capital structure proportions. For example, past or current book value proportions would constitute a form of historical weighting, as would past or current market value proportions. Such a weighting scheme would therefore be based on real—rather than desired—proportions.

target weights
Either book or market value weights based on *desired* capital structure proportions.

   Target weights, which can also be based on either book or market values, reflect the firm's *desired* capital structure proportions. Firms using target weights establish such proportions on the basis of the "optimal" capital structure they wish to achieve. (The development of these proportions and the optimal structure are discussed in detail in Chapter 12.)

   When one considers the somewhat approximate nature of the calculation of weighted average cost of capital, the choice of weights may not be critical. However, from a strictly theoretical point of view, the *preferred weighting scheme is target market value proportions,* and these are assumed throughout this chapter.

Review Questions

11–11 What is the *weighted average cost of capital (WACC),* and how is it calculated?

11–12 Describe the logic underlying the use of *target capital structure weights,* and compare and contrast this approach with the use of *historical weights.* What is the preferred weighting scheme?

LG5 LG6   11.6 The Marginal Cost and Investment Decisions

The firm's weighted average cost of capital is a key input to the investment decision-making process. As demonstrated earlier in the chapter, the firm should make only those investments for which the expected return is greater than the weighted average cost of capital. Of course, at any given time, the firm's financing costs and investment returns will be affected by the volume of financing and investment undertaken. The *weighted marginal cost of capital* and the *investment opportunities schedule* are mechanisms whereby financing and investment decisions can be made simultaneously.

The Weighted Marginal Cost of Capital (WMCC)

The weighted average cost of capital may vary over time, depending on the volume of financing that the firm plans to raise. *As the volume of financing increases, the costs of the various types of financing will increase, raising the firm's weighted*

weighted marginal cost of capital (WMCC)
The firm's weighted average cost of capital (WACC) associated with its *next dollar* of total new financing.

average cost of capital. Therefore, it is useful to calculate the **weighted marginal cost of capital (WMCC),** which is simply the firm's weighted average cost of capital (WACC) associated with its *next dollar* of total new financing. This marginal cost is relevant to current decisions.

The costs of the financing components (debt, preferred stock, and common stock) rise as larger amounts are raised. Suppliers of funds require greater returns in the form of interest, dividends, or growth as compensation for the increased risk introduced by larger volumes of *new* financing. The WMCC is therefore an increasing function of the level of total new financing.

Another factor that causes the weighted average cost of capital to increase is the use of common stock equity financing. New financing provided by common stock equity will be taken from available retained earnings until this supply is exhausted and then will be obtained through new common stock financing. Because retained earnings are a less expensive form of common stock equity financing than the sale of new common stock, the weighted average cost of capital will rise with the addition of new common stock.

Finding Break Points

break point
The level of *total* new financing at which the cost of one of the financing components rises, thereby causing an upward shift in the *weighted marginal cost of capital (WMCC).*

To calculate the WMCC, we must calculate **break points,** which reflect the level of *total* new financing at which the cost of one of the financing components rises. The following general equation can be used to find break points:

$$BP_j = \frac{AF_j}{w_j} \qquad (11.10)$$

where

BP_j = break point for financing source j
AF_j = amount of funds available from financing source j at a given cost
w_j = capital structure weight (stated in decimal form) for financing source j

EXAMPLE ▼   When Duchess Corporation exhausts its $300,000 of available retained earnings (at $k_r = 13.0\%$), it must use the more expensive new common stock financing (at $k_n = 14.0\%$) to meet its common stock equity needs. In addition, the firm expects that it can borrow only $400,000 of debt at the 5.6% cost; additional debt will have an after-tax cost (k_i) of 8.4%. Two break points therefore exist: (1) when the $300,000 of retained earnings costing 13.0% is exhausted, and (2) when the $400,000 of long-term debt costing 5.6% is exhausted.

The break points can be found by substituting these values and the corresponding capital structure weights given earlier into Equation 11.10. We get the dollar amounts of *total* new financing at which the costs of the given financing sources rise:

$$BP_{\text{common equity}} = \frac{\$300,000}{0.50} = \$600,000$$

$$BP_{\text{long-term debt}} = \frac{\$400,000}{0.40} = \$1,000,000$$

Calculating the WMCC

Once the break points have been determined, the next step is to calculate the weighted average cost of capital over the range of total new financing between break points. First, we find the WACC for a level of total new financing between zero and the first break point. Next, we find the WACC for a level of total new financing between the first and second break points, and so on. By definition, for each of the ranges of total new financing between break points, certain component capital costs (such as debt or common equity) will increase. This will cause the weighted average cost of capital to increase to a higher level than that over the preceding range.

Together, these data can be used to prepare a **weighted marginal cost of capital (WMCC) schedule.** This is a graph that relates the firm's weighted average cost of capital to the level of total new financing.

EXAMPLE ▼ Table 11.2 summarizes the calculation of the WACC for Duchess Corporation over the three ranges of total new financing created by the two break points—$600,000 and $1,000,000. Comparing the costs in column 3 of the table for each of the three ranges, we can see that the costs in the first range ($0 to $600,000) are those calculated in earlier examples and used in Table 11.1. The second range ($600,000 to $1,000,000) reflects the increase in the common stock equity cost to 14.0%. In the final range, the increase in the long-term debt cost to 8.4% is introduced.

The weighted average costs of capital (WACC) for the three ranges are summarized in the table shown at the bottom of Figure 11.1. These data describe the

TABLE 11.2	**Weighted Average Cost of Capital for Ranges of Total New Financing for Duchess Corporation**			
Range of total new financing	**Source of capital (1)**	**Weight (2)**	**Cost (3)**	**Weighted cost [(2) × (3)] (4)**
$0 to $600,000	Debt	.40	5.6%	2.2%
	Preferred	.10	10.6	1.1
	Common	.50	13.0	6.5
			Weighted average cost of capital	9.8%
$600,000 to $1,000,000	Debt	.40	5.6%	2.2%
	Preferred	.10	10.6	1.1
	Common	.50	14.0	7.0
			Weighted average cost of capital	10.3%
$1,000,000 and above	Debt	.40	8.4%	3.4%
	Preferred	.10	10.6	1.1
	Common	.50	14.0	7.0
			Weighted average cost of capital	11.5%

WMCC Schedule
Weighted marginal cost of
capital (WMCC) schedule for
Duchess Corporation
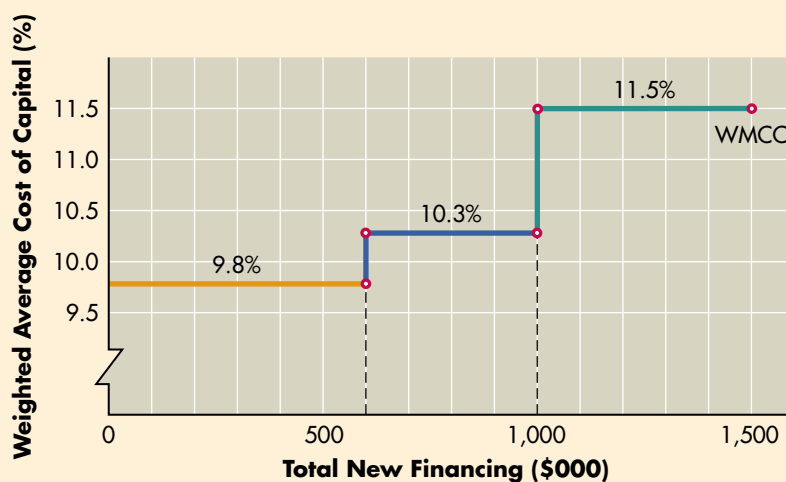
Range of total new financing	WACC
$0 to $600,000	9.8%
$600,000 to $1,000,000	10.3
$1,000,000 and above	11.5

weighted marginal cost of capital (WMCC), which increases as levels of total new financing increase. Figure 11.1 presents the WMCC schedule. Again, it is clear that the WMCC is an increasing function of the amount of total new financing raised.

The Investment Opportunities Schedule (IOS)

At any given time, a firm has certain investment opportunities available to it. These opportunities differ with respect to the size of investment, risk, and return.[8] The firm's **investment opportunities schedule (IOS)** is a ranking of investment possibilities from best (highest return) to worst (lowest return). Generally, the first project selected will have the highest return, the next project the second highest, and so on. The return on investments will *decrease* as the firm accepts additional projects.

investment opportunities schedule (IOS)
A ranking of investment possibilities from best (highest return) to worst (lowest return).

EXAMPLE ▼ Column 1 of Table 11.3 shows Duchess Corporation's current investment opportunities schedule (IOS) listing the investment possibilities from best (highest return) to worst (lowest return). Column 2 of the table shows the initial investment required by each project. Column 3 shows the cumulative total invested

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8. Because the calculated weighted average cost of capital does not apply to risk-changing investments, we assume that all opportunities have equal risk similar to the firm's risk.

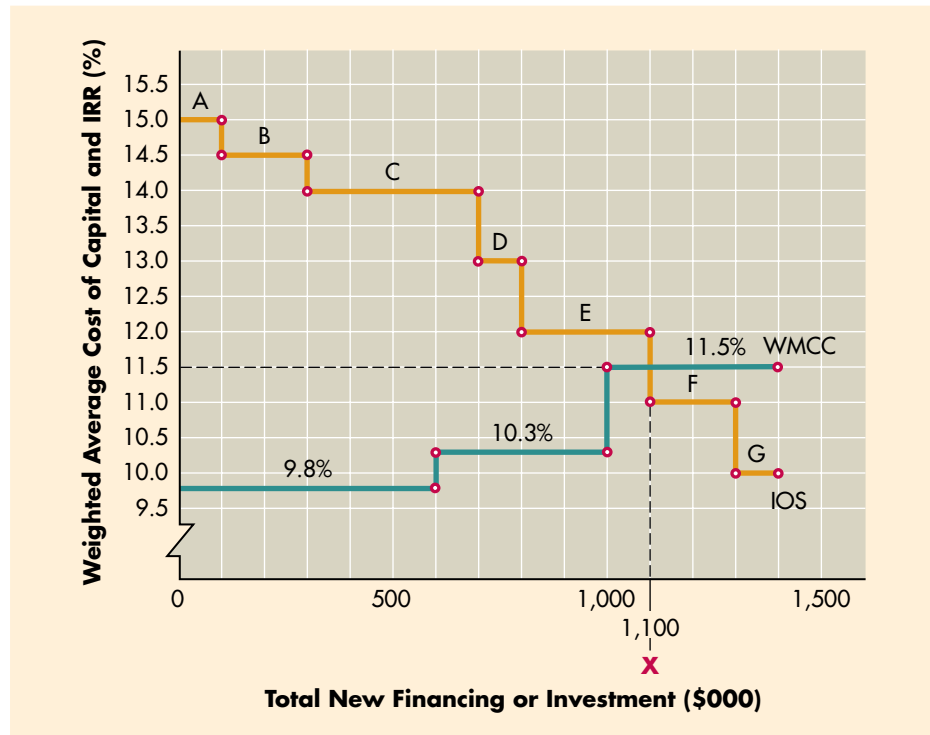| TABLE 11.3	Investment Opportunities Schedule (IOS) for Duchess Corporation		
Investment opportunity	Internal rate of return (IRR) (1)	Initial investment (2)	Cumulative investment[a] (3)
A	15.0%	$100,000	$ 100,000
B	14.5	200,000	300,000
C	14.0	400,000	700,000
D	13.0	100,000	800,000
E	12.0	300,000	1,100,000
F	11.0	200,000	1,300,000
G	10.0	100,000	1,400,000

[a]The cumulative investment represents the total amount invested in projects with higher returns plus the investment required for the corresponding investment opportunity.

FIGURE 11.2

IOS and WMCC Schedules

Using the IOS and WMCC to select projects for Duchess Corporation

funds necessary to finance all projects better than and including the corresponding investment opportunity. Plotting the project returns against the cumulative investment (column 1 against column 3) results in the firm's investment opportunities schedule (IOS). A graph of the IOS for Duchess Corporation is given in Figure 11.2.

FOCUS ON **PRACTICE**   Theory or Practice?

Do major U.S. corporations practice what your professors teach? A recent survey of the cost of capital techniques at Fortune 1000 firms showed that financial managers today pay more attention to the cost of capital and its role in capital budgeting and valuation of the firm than they did 15 years ago. A contributing factor is the growing popularity of performance evaluation models that use cost of capital in their formulas, such as economic value added (EVA®, discussed in Chapter 9).

The survey, which updated a study conducted in 1982, revealed that companies are becoming more sophisticated in their knowledge and use of financial techniques. Here are the key findings from the 111 respondents, of whom 41 percent were manufacturers, 46 percent suppliers of services, and 13 percent distributors.

• Most firms calculate the cost of capital using long-term debt and equity, although some exclude capital leases and preferred stock.

• Over 90 percent use a weighted average cost of capital (WACC); about half base the calculation on target weights, another 35 percent on current market value weights.

• The current capital structure of most respondents is consistent with their target capital structure. The average capital structure at the time of the survey was 34 percent debt, 5 percent preferred stock, and 61 percent common stock.

• Firms use more than one method to calculate cost of equity; most employ the investors' required return, calculated using CAPM.

• Over 60 percent of firms differentiate project risk on an individual project basis and adjust the discount rate rather than cash flows.

• About half of the respondents recalculate their cost of capital when environmental conditions (shifts in long-term rates) warrant; another 27 percent recompute it annually.

• Most firms use one cost of capital regardless of the total amount of financing they require. Nearly all use the cost of capital for all new-project decisions; over three-quarters use it to estimate the firm's value.

Source: Lawrence J. Gitman and Pieter A. Vandenberg, "Cost of Capital Techniques Used by Major U.S. Firms: 1997 vs. 1980," *Financial Practice and Education* (Fall/Winter 2000), pp. 53–68.

Using the WMCC and IOS to Make Financing/Investment Decisions

As long as a project's internal rate of return is greater than the weighted marginal cost of new financing, the firm should accept the project.[9] The return will decrease with the acceptance of more projects, and the weighted marginal cost of capital will increase because greater amounts of financing will be required. The decision rule therefore would be: *Accept projects up to the point at which the marginal return on an investment equals its weighted marginal cost of capital.* Beyond that point, its investment return will be less than its capital cost.[10]

This approach is consistent with the maximization of net present value (NPV) for conventional projects for two reasons: (1) The NPV is positive as long as the IRR exceeds the weighted average cost of capital, k_a. (2) The larger the difference between the IRR and k_a, the larger the resulting NPV. Therefore, the acceptance of projects beginning with those that have the greatest positive difference between

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9. Although net present value could be used to make these decisions, the internal rate of return is used here because of the ease of comparison it offers.

10. So as not to confuse the discussion presented here, the fact that using the IRR for selecting projects may not yield optimal decisions is ignored. The problems associated with the use of IRR in capital rationing were discussed in greater detail in Chapter 10.

IRR and k_a, down to the point at which IRR just equals k_a, should result in the maximum total NPV for all independent projects accepted. Such an outcome is completely consistent with the firm's goal of maximizing owner wealth.

EXAMPLE ▼ Figure 11.2 shows Duchess Corporation's WMCC schedule and IOS on the same set of axes. By raising $1,100,000 of new financing and investing these funds in projects A, B, C, D, and E, the firm should maximize the wealth of its owners, because these projects result in the maximum total net present value. Note that the 12.0% return on the last dollar invested (in project E) *exceeds* its 11.5% weighted average cost. Investment in project F is not feasible, because its 11.0% return is *less than* the 11.5% cost of funds available for investment.

The firm's optimal capital budget of $1,100,000 is marked with an **X** in Figure 11.2. At that point, the IRR equals the weighted average cost of capital, and the firm's size as well as its shareholder value will be optimized. In a sense, the size of the firm is determined by the market—the availability of and returns on investment opportunities, and the availability and cost of financing.

In practice, most firms operate under *capital rationing*. That is, management imposes constraints that keep the capital expenditure budget below optimal (where IRR $= k_a$). Because of this, a gap frequently exists between the theoretically optimal capital budget and the firm's actual level of financing/investment.

> ### Review Questions
>
> **11–13** What is the *weighted marginal cost of capital (WMCC)?* What does the *WMCC schedule* represent? Why does this schedule increase?
> **11–14** What is the *investment opportunities schedule (IOS)?* Is it typically depicted as an increasing or a decreasing function? Why?
> **11–15** How can the WMCC schedule and the IOS be used to find the level of financing/investment that maximizes owner wealth? Why do many firms finance/invest at a level below this optimum?

SUMMARY

FOCUS ON VALUE

The cost of capital is an extremely important rate of return used by the firm in the long-term decision process, particularly in capital budgeting decisions. It is the expected average future cost to the firm of funds over the long run. Because the cost of capital is the pivotal rate of return used in the investment decision process, its accuracy can significantly affect the quality of these decisions.

Even with good estimates of project cash flows, the application of NPV and IRR decision techniques, and adequate consideration of project risk, a poorly estimated cost of capital can result in the destruction of shareholder value. Underestimation of the cost of capital

can result in the mistaken acceptance of poor projects, whereas overestimation can cause good projects to be rejected. In either situation, the firm's action could be detrimental to the firm's value. By applying the techniques presented in this chapter to estimate the firm's cost of capital, the financial manager will improve the likelihood that the firm's long-term decisions are consistent with the firm's overall goal of **maximizing stock price (owner wealth).**

REVIEW OF LEARNING GOALS

LG1 **Understand the key assumptions that underlie cost of capital, the basic concept of cost of capital, and the specific sources of capital that it includes.** The cost of capital is the rate of return that a firm must earn on its investments to maintain its market value and attract needed funds. It is affected by business and financial risks, which are assumed to be unchanged. To capture the interrelatedness of financing, a weighted average cost of capital should be used to find the expected average future cost of funds over the long run. The specific costs of the basic sources of capital (long-term debt, preferred stock, retained earnings, and common stock) can be calculated individually.

LG2 **Determine the cost of long-term debt and the cost of preferred stock.** The cost of long-term debt is the after-tax cost today of raising long-term funds through borrowing. Cost quotations, calculation (using either a trial-and-error technique or a financial calculator), or an approximation can be used to find the before-tax cost of debt, which must then be tax-adjusted. The cost of preferred stock is the ratio of the preferred stock dividend to the firm's net proceeds from the sale of preferred stock. The key formulas for the before- and after-tax cost of debt and the cost of preferred stock are given in Table 11.4.

LG3 **Calculate the cost of common stock equity and convert it into the cost of retained earnings and the cost of new issues of common stock.** The cost of common stock equity can be calculated by using the constant-growth valuation (Gordon) model or the CAPM. The cost of retained earnings is equal to the cost of common stock equity. An adjustment in the cost of common stock equity to reflect underpricing and flotation costs is necessary to find the cost of new issues of common stock. The key formulas for the cost of common stock equity, the cost of re-

tained earnings, and the cost of new issues of common stock are given in Table 11.4.

LG4 **Calculate the weighted average cost of capital (WACC) and discuss the alternative weighting schemes.** The firm's WACC reflects the expected average future cost of funds over the long run. It can be determined by combining the costs of specific types of capital after weighting each of them by its proportion using historical book or market value weights, or target book or market value weights. The theoretically preferred approach uses target weights based on market values. The key formula for WACC is given in Table 11.4.

LG5 **Describe the procedures used to determine break points and the weighted marginal cost of capital (WMCC).** As the volume of total new financing increases, the costs of the various types of financing will increase, raising the firm's WACC. The WMCC is the firm's WACC associated with its next dollar of total new financing. Break points represent the level of total new financing at which the cost of one of the financing components rises, causing an upward shift in the WMCC. The general formula for break points is given in Table 11.4. The WMCC schedule relates the WACC to each level of total new financing.

LG6 **Explain how the weighted marginal cost of capital (WMCC) can be used with the investment opportunities schedule (IOS) to make the firm's financing/investment decisions.** The IOS presents a ranking of currently available investments from best (highest return) to worst (lowest return). It is used in combination with the WMCC to find the level of financing/investment that maximizes owner wealth. The firm accepts projects up to the point at which the marginal return on its investment equals its weighted marginal cost of capital.

TABLE 11.4	Summary of Key Definitions and Formulas for Cost of Capital

Definitions of variables

AF_j = amount of funds available from financing source j at a given cost

b = beta coefficient or measure of nondiversifiable risk

BP_j = break point for financing source j

D_1 = per share dividend *expected* at the end of year 1

D_p = annual preferred stock dividend (in dollars)

g = constant rate of growth in dividends

I = annual interest in dollars

k_a = weighted average cost of capital

k_d = before-tax cost of debt

k_i = after-tax cost of debt

k_m = required return on the market portfolio

k_n = cost of a new issue of common stock

k_p = cost of preferred stock

k_r = cost of retained earnings

k_s = required return on common stock

n = number of years to the bond's maturity

N_d = net proceeds from the sale of debt (bond)

N_n = net proceeds from the sale of new common stock

N_p = net proceeds from the sale of preferred stock

P_0 = value of common stock

R_F = risk-free rate of return

T = firm's tax rate

w_i = proportion of long-term debt in capital structure

w_j = capital structure proportion (historical or target, stated in decimal form) for financing source j

w_p = proportion of preferred stock in capital structure

w_s = proportion of common stock equity in capital structure

Cost of capital formulas

Before-tax cost of debt (approximation):

$$k_d = \frac{I + \dfrac{\$1,000 - N_d}{n}}{\dfrac{N_d + \$1,000}{2}}$$ [Eq. 11.1]

After-tax cost of debt: $k_i = k_d \times (1 - T)$ [Eq. 11.2]

Cost of preferred stock: $k_p = \dfrac{D_p}{N_p}$ [Eq. 11.3]

Cost of common stock equity:

Using constant-growth valuation model: $k_s = \dfrac{D_1}{P_0} + g$ [Eq. 11.5]

Using CAPM: $k_s = R_F + [b \times (k_m - R_F)]$ [Eq. 11.6]

Cost of retained earnings: $k_r = k_s$ [Eq. 11.7]

Cost of new issues of common stock: $k_n = \dfrac{D_1}{N_n} + g$ [Eq. 11.8]

Weighted average cost of capital (WACC):

$$k_a = (w_i \times k_i) + (w_p \times k_p) + (w_s \times k_{r \text{ or } n})$$ [Eq. 11.9]

Break point: $BP_j = \dfrac{AF_j}{w_j}$ [Eq. 11.10]

SELF-TEST PROBLEM (Solution in Appendix B)

LG2 LG3 LG4   ST 11–1 **Specific costs, WACC, WMCC, and IOS**   Humble Manufacturing is interested
LG5 LG6   in measuring its overall cost of capital. The firm is in the 40% tax bracket. Cur-
                   rent investigation has gathered the following data:

Debt   The firm can raise an unlimited amount of debt by selling $1,000-par-
value, 10% coupon interest rate, 10-year bonds on which *annual interest* pay-
ments will be made. To sell the issue, an average discount of $30 per bond must
be given. The firm must also pay flotation costs of $20 per bond.

Preferred stock   The firm can sell 11% (annual dividend) preferred stock at its
$100-per-share par value. The cost of issuing and selling the preferred stock is
expected to be $4 per share. An unlimited amount of preferred stock can be sold
under these terms.

Common stock   The firm's common stock is currently selling for $80 per share.
The firm expects to pay cash dividends of $6 per share next year. The firm's div-
idends have been growing at an annual rate of 6%, and this rate is expected to
continue in the future. The stock will have to be underpriced by $4 per share,
and flotation costs are expected to amount to $4 per share. The firm can sell an
unlimited amount of new common stock under these terms.

Retained earnings   The firm expects to have $225,000 of retained earnings
available in the coming year. Once these retained earnings are exhausted, the
firm will use new common stock as the form of common stock equity
financing.

a. Calculate the specific cost of each source of financing. (Round to the nearest
0.1%.)
b. The firm uses the weights shown in the following table, which are based on
target capital structure proportions, to calculate its weighted average cost of
capital. (Round to the nearest 0.1%.)

Source of capital	Weight
Long-term debt	40%
Preferred stock	15
Common stock equity	45
Total	100%

(1) Calculate the single break point associated with the firm's financial situa-
tion. *(Hint:* This point results from the exhaustion of the firm's retained
earnings.)
(2) Calculate the weighted average cost of capital associated with total new
financing below the break point calculated in part (1).
(3) Calculate the weighted average cost of capital associated with total new
financing above the break point calculated in part (1).

c. Using the results of part **b** along with the information shown in the following table on the available investment opportunities, draw the firm's weighted marginal cost of capital (WMCC) schedule and investment opportunities schedule (IOS) on the same set of axes (total new financing or investment on the x axis and weighted average cost of capital and IRR on the y axis).

Investment opportunity	Internal rate of return (IRR)	Initial investment
A	11.2%	$100,000
B	9.7	500,000
C	12.9	150,000
D	16.5	200,000
E	11.8	450,000
F	10.1	600,000
G	10.5	300,000

d. Which, if any, of the available investments do you recommend that the firm accept? Explain your answer. How much total new financing is required?

PROBLEMS

LG1   **11–1   Concept of cost of capital**   Wren Manufacturing is in the process of analyzing its investment decision-making procedures. The two projects evaluated by the firm during the past month were projects 263 and 264. The basic variables surrounding each project analysis, using the IRR decision technique, and the resulting decision actions are summarized in the following table.

Basic variables	Project 263	Project 264
Cost	$64,000	$58,000
Life	15 years	15 years
IRR	8%	15%
Least-cost financing		
Source	Debt	Equity
Cost (after-tax)	7%	16%
Decision		
Action	Accept	Reject
Reason	8% IRR > 7% cost	15% IRR < 16% cost

a. Evaluate the firm's decision-making procedures, and explain why the acceptance of project 263 and rejection of project 264 may not be in the owners' best interest.
b. If the firm maintains a capital structure containing 40% debt and 60% equity, find its weighted average cost using the data in the table.

c. Had the firm used the weighted average cost calculated in part **b,** what actions would have been indicated relative to projects 263 and 264?

d. Compare and contrast the firm's actions with your findings in part **c.** Which decision method seems more appropriate? Explain why.

LG2 **11–2** **Cost of debt using both methods** Currently, Warren Industries can sell 15-year, $1,000-par-value bonds paying *annual interest* at a 12% coupon rate. As a result of current interest rates, the bonds can be sold for $1,010 each; flotation costs of $30 per bond will be incurred in this process. The firm is in the 40% tax bracket.

a. Find the net proceeds from sale of the bond, N_d.

b. Show the cash flows from the firm's point of view over the maturity of the bond.

c. Use the *IRR approach* to calculate the before-tax and after-tax costs of debt.

d. Use the *approximation formula* to estimate the before-tax and after-tax costs of debt.

e. Compare and contrast the costs of debt calculated in parts **c** and **d.** Which approach do you prefer? Why?

LG2 **11–3** **Cost of debt using the approximation formula** For each of the following $1,000-par-value bonds, assuming *annual interest* payment and a 40% tax rate, calculate the *after-tax* cost to maturity using the *approximation formula*.

| Bond	Life	Underwriting fee	Discount (−) or premium (+)	Coupon interest rate
A	20 years	$25	−$20	9%
B	16	40	+ 10	10
C	15	30	− 15	12
D	25	15	Par	9
E	22	20	− 60	11

LG2 **11–4** **The cost of debt using the approximation formula** Gronseth Drywall Systems, Inc., is in discussions with its investment bankers regarding the issuance of new bonds. The investment banker has informed the firm that different maturities will carry different coupon rates and sell at different prices. The firm must choose among several alternatives. In each case, the bonds will have a $1,000 par value and flotation costs will be $30 per bond. The company is taxed at 40%. Calculate the after-tax cost of financing with each of the following alternatives.

Alternative	Coupon rate	Time to maturity	Premium or discount
A	9%	16 years	$250
B	7	5	50
C	6	7	par
D	5	10	− 75

**LG2** **11–5** **Cost of preferred stock**   Taylor Systems has just issued preferred stock. The stock has a 12% annual dividend and a $100 par value and was sold at $97.50 per share. In addition, flotation costs of $2.50 per share must be paid.
   a. Calculate the cost of the preferred stock.
   b. If the firm sells the preferred stock with a 10% annual dividend and nets $90.00 after flotation costs, what is its cost?
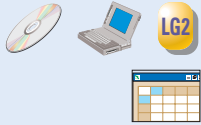
LG2 **11–6** **Cost of preferred stock**   Determine the cost for each of the following preferred stocks.

Preferred stock	Par value	Sale price	Flotation cost	Annual dividend
A	$100	$101	$9.00	11%
B	40	38	$3.50	8%
C	35	37	$4.00	$5.00
D	30	26	5% of par	$3.00
E	20	20	$2.50	9%
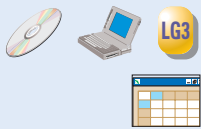
LG3 **11–7** **Cost of common stock equity—CAPM**   J&M Corporation common stock has a beta, b, of 1.2. The risk-free rate is 6%, and the market return is 11%.
   a. Determine the risk premium on J&M common stock.
   b. Determine the required return that J&M common stock should provide.
   c. Determine J&M's cost of common stock equity using the CAPM.

LG3 **11–8** **Cost of common stock equity**   Ross Textiles wishes to measure its cost of common stock equity. The firm's stock is currently selling for $57.50. The firm expects to pay a $3.40 dividend at the end of the year (2004). The dividends for the past 5 years are shown in the following table.

Year	Dividend
2003	$3.10
2002	2.92
2001	2.60
2000	2.30
1999	2.12

After underpricing and flotation costs, the firm expects to net $52 per share on a new issue.
   a. Determine the growth rate of dividends.
   b. Determine the net proceeds, N_n, that the firm actually receives.

c. Using the constant-growth valuation model, determine the cost of retained earnings, k_r.
d. Using the constant-growth valuation model, determine the cost of new common stock, k_n.

LG3 **11–9** **Retained earnings versus new common stock**   Using the data for each firm shown in the following table, calculate the cost of retained earnings and the cost of new common stock using the constant-growth valuation model.

Firm	Current market price per share	Dividend growth rate	Projected dividend per share next year	Underpricing per share	Flotation cost per share
A	$50.00	8%	$2.25	$2.00	$1.00
B	20.00	4	1.00	0.50	1.50
C	42.50	6	2.00	1.00	2.00
D	19.00	2	2.10	1.30	1.70

LG2 **LG4** **11–10** **The effect of tax rate on WACC**   Equity Lighting Corp. wishes to explore the effect on its cost of capital of the rate at which the company pays taxes. The firm wishes to maintain a capital structure of 30% debt, 10% preferred stock, and 60% common stock. The cost of financing with retained earnings is 14%, the cost of preferred stock financing is 9%, and the before-tax cost of debt financing is 11%. Calculate the weighted average cost of capital (WACC) given the tax rate assumptions in parts **a** to **c.**
a. Tax rate = 40%
b. Tax rate = 35%
c. Tax rate = 25%
d. Describe the relationship between changes in the rate of taxation and the weighted average cost of capital.

LG4 **11–11** **WACC—Book weights**   Ridge Tool has on its books the amounts and specific (after-tax) costs shown in the following table for each source of capital.

Source of capital	Book value	Specific cost
Long-term debt	$700,000	5.3%
Preferred stock	50,000	12.0
Common stock equity	650,000	16.0

    a. Calculate the firm's weighted average cost of capital using book value weights.

    b. Explain how the firm can use this cost in the investment decision-making process.

11–12 WACC—Book weights and market weights   Webster Company has compiled the information shown in the following table.

Source of capital	Book value	Market value	After-tax cost
Long-term debt	$4,000,000	$3,840,000	6.0%
Preferred stock	40,000	60,000	13.0
Common stock equity	1,060,000	3,000,000	17.0
Totals	$5,100,000	$6,900,000	

    a. Calculate the weighted average cost of capital using book value weights.

    b. Calculate the weighted average cost of capital using market value weights.

    c. Compare the answers obtained in parts a and b. Explain the differences.

11–13 WACC and target weights   After careful analysis, Dexter Brothers has determined that its optimal capital structure is composed of the sources and target market value weights shown in the following table.

Source of capital	Target market value weight
Long-term debt	30%
Preferred stock	15
Common stock equity	55
Total	100%

The cost of debt is estimated to be 7.2%; the cost of preferred stock is estimated to be 13.5%; the cost of retained earnings is estimated to be 16.0%; and the cost of new common stock is estimated to be 18.0%. All of these are after-tax rates. The company's debt represents 25%, the preferred stock represents 10%, and the common stock equity represents 65% of total capital on the basis of the market values of the three components. The company expects to have a significant amount of retained earnings available and does not expect to sell any new common stock.

    a. Calculate the weighted average cost of capital on the basis of historical market value weights.

b. Calculate the weighted average cost of capital on the basis of target market value weights.

LG4 **LG5**

11–14 **Cost of capital and break point**   Edna Recording Studios, Inc., reported earnings available to common stock of $4,200,000 last year. From that, the company paid a dividend of $1.26 on each of its 1,000,000 common shares outstanding. The capital structure of the company includes 40% debt, 10% preferred stock, and 50% common stock. It is taxed at a rate of 40%.

a. If the market price of common stock is $40 and dividends are expected to grow at a rate of 6% a year for the foreseeable future, what is the company's cost of financing with retained earnings?

b. If flotation costs on new shares of common stock amount to $1.00 per share, what is the company's cost of new common stock financing?

c. The company can issue $2.00 dividend preferred stock for a market price of $25.00 per share. Flotation costs would amount to $3.00 per share. What is the cost of preferred stock financing?

d. The company can issue $1,000 par, 10% coupon, 5-year bonds that can be sold for $1,200 each. Flotation costs would amount to $25.00 per bond. Use the estimation formula to figure the approximate cost of new debt financing.

e. What is the maximum investment that Edna Recording can make in new projects before it must issue new common stock?

f. What is the WACC for projects with a cost at or below the amount calculated in part **e?**

g. What is the WMCC for projects with a cost above the amount calculated in part **e** (assuming that debt across all ranges remains at the percentage cost calculated in part **d**)?

LG2 **LG3** **LG4** **LG5**

11–15 **Calculation of specific costs, WACC, and WMCC**   Dillon Labs has asked its financial manager to measure the cost of each specific type of capital as well as the weighted average cost of capital. The weighted average cost is to be measured by using the following weights: 40% long-term debt, 10% preferred stock, and 50% common stock equity (retained earnings, new common stock, or both). The firm's tax rate is 40%.

Debt   The firm can sell for $980 a 10-year, $1,000-par-value bond paying *annual interest* at a 10% coupon rate. A flotation cost of 3% of the par value is required in addition to the discount of $20 per bond.

Preferred stock   Eight percent (annual dividend) preferred stock having a par value of $100 can be sold for $65. An additional fee of $2 per share must be paid to the underwriters.

Common stock   The firm's common stock is currently selling for $50 per share. The dividend expected to be paid at the end of the coming year (2004) is $4. Its dividend payments, which have been approximately 60% of earnings per share in each of the past 5 years, were as shown in the following table.

Year	Dividend
2003	$3.75
2002	3.50
2001	3.30
2000	3.15
1999	2.85

It is expected that in order to sell, new common stock must be underpriced $5 per share, and the firm must also pay $3 per share in flotation costs. Dividend payments are expected to continue at 60% of earnings.

a. Calculate the specific cost of each source of financing. (Assume that $k_r = k_s$.)
b. If earnings available to common shareholders are expected to be $7 million, what is the break point associated with the exhaustion of retained earnings?
c. Determine the weighted average cost of capital between zero and the break point calculated in part **b**.
d. Determine the weighted average cost of capital just beyond the break point calculated in part **b**.

LG2 LG3 LG4 LG5   **11–16   Calculation of specific costs, WACC, and WMCC**   Lang Enterprises is interested in measuring its overall cost of capital. Current investigation has gathered the following data. The firm is in the 40% tax bracket.

Debt   The firm can raise an unlimited amount of debt by selling $1,000-par-value, 8% coupon interest rate, 20-year bonds on which *annual interest* payments will be made. To sell the issue, an average discount of $30 per bond would have to be given. The firm also must pay flotation costs of $30 per bond.

Preferred stock   The firm can sell 8% preferred stock at its $95-per-share par value. The cost of issuing and selling the preferred stock is expected to be $5 per share. An unlimited amount of preferred stock can be sold under these terms.

Common stock   The firm's common stock is currently selling for $90 per share. The firm expects to pay cash dividends of $7 per share next year. The firm's dividends have been growing at an annual rate of 6%, and this is expected to continue into the future. The stock must be underpriced by $7 per share, and flotation costs are expected to amount to $5 per share. The firm can sell an unlimited amount of new common stock under these terms.

Retained earnings   When measuring this cost, the firm does not concern itself with the tax bracket or brokerage fees of owners. It expects to have available $100,000 of retained earnings in the coming year; once these retained earnings are exhausted, the firm will use new common stock as the form of common stock equity financing.

a. Calculate the specific cost of each source of financing. (Round answers to the nearest 0.1%.)

Source of capital	Weight
Long-term debt	30%
Preferred stock	20
Common stock equity	50
Total	100%

b. The firm's capital structure weights used in calculating its weighted average cost of capital are shown in the table above. (Round answer to the nearest 0.1%.)
   (1) Calculate the single break point associated with the firm's financial situation. (*Hint:* This point results from exhaustion of the firm's retained earnings.)
   (2) Calculate the weighted average cost of capital associated with total new financing below the break point calculated in part (1).
   (3) Calculate the weighted average cost of capital associated with total new financing above the break point calculated in part (1).

LG4 LG5 LG6 11–17 Integrative—WACC, WMCC, and IOS   Cartwell Products has compiled the data shown in the following table for the current costs of its three basic sources of capital—long-term debt, preferred stock, and common stock equity—for various ranges of new financing.

Source of capital	Range of new financing	After-tax cost
Long-term debt	$0 to $320,000	6%
	$320,000 and above	8
Preferred stock	$0 and above	17%
Common stock equity	$0 to $200,000	20%
	$200,000 and above	24

The company's capital structure weights used in calculating its weighted average cost of capital are shown in the following table.

Source of capital	Weight
Long-term debt	40%
Preferred stock	20
Common stock equity	40
Total	100%

a. Determine the break points and ranges of *total* new financing associated with each source of capital.
b. Using the data developed in part **a,** determine the break points (levels of *total* new financing) at which the firm's weighted average cost of capital will change.
c. Calculate the weighted average cost of capital for each range of total new financing found in part **b.** (*Hint:* There are three ranges.)
d. Using the results of part **c,** along with the following information on the available investment opportunities, draw the firm's weighted marginal cost of capital (WMCC) schedule and investment opportunities schedule (IOS) on the same set of axes (total new financing or investment on the x axis and weighted average cost of capital and IRR on the y axis).

Investment opportunity	Internal rate of return (IRR)	Initial investment
A	19%	$200,000
B	15	300,000
C	22	100,000
D	14	600,000
E	23	200,000
F	13	100,000
G	21	300,000
H	17	100,000
I	16	400,000

e. Which, if any, of the available investments do you recommend that the firm accept? Explain your answer.

LG4 LG5 LG6 **11–18** **Integrative—WACC, WMCC, and IOC** Grainger Corp., a supplier of fitness equipment, is trying to decide whether to undertake any or all of the proposed projects in its investment opportunities schedule (IOS). The firm's cost-of-capital schedule and investment opportunities schedules follow.

Cost-of-Capital Schedule			
Range of new financing	Source	Weight	After-tax cost
0–$600,000	Debt	.50	6.3%
	Preferred stock	.10	12.5
	Common stock	.40	15.3
$600,000–$1,000,000	Debt	.50	6.3%
	Preferred stock	.10	12.5
	Common stock	.40	16.4
$1,000,000 and above	Debt	.50	7.8%
	Preferred stock	.10	12.5
	Common stock	.40	16.4

Investment Opportunities Schedule

Investment opportunity	Internal rate of return	Cost
Project H	14.5%	$200,000
Project G	13.0	700,000
Project K	12.8	500,000
Project M	11.4	600,000

a. Complete the cost-of-capital schedule by calculating the WACC and the WMCC schedule for the various ranges of new financing.
b. Identify those projects that you recommend that Grainger Corp. undertake in the next year.
c. Illustrate your recommendations by drawing a graph of Grainger's weighted average costs and investment opportunities similar to Figure 11.2.
d. Explain why certain projects are recommended and other(s) are not.

CHAPTER 11 CASE **Making Star Products'
Financing/Investment Decision**

Star Products Company is a growing manufacturer of automobile accessories whose stock is actively traded on the over-the-counter exchange. During 2003, the Dallas-based company experienced sharp increases in both sales and earnings. Because of this recent growth, Melissa Jen, the company's treasurer, wants to make sure that available funds are being used to their fullest. Management policy is to maintain the current capital structure proportions of 30% long-term debt, 10% preferred stock, and 60% common stock equity for at least the next 3 years. The firm is in the 40% tax bracket.

Star's division and product managers have presented several competing investment opportunities to Ms. Jen. However, because funds are limited, choices of which projects to accept must be made. The investment opportunities schedule (IOS) is shown in the following table.

**Investment Opportunities Schedule (IOS)
for Star Products Company**

Investment opportunity	Internal rate of return (IRR)	Initial investment
A	15%	$400,000
B	22	200,000
C	25	700,000
D	23	400,000
E	17	500,000
F	19	600,000
G	14	500,000

To estimate the firm's weighted average cost of capital (WACC), Ms. Jen contacted a leading investment banking firm, which provided the financing cost data shown in the following table.

Financing Cost Data
Star Products Company

Long-term debt: The firm can raise $450,000 of additional debt by selling 15-year, $1,000-par-value, 9% coupon interest rate bonds that pay *annual interest*. It expects to net $960 per bond after flotation costs. Any debt in excess of $450,000 will have a before-tax cost, k_d, of 13%.

Preferred stock: Preferred stock, regardless of the amount sold, can be issued with a $70 par value and a 14% annual dividend rate and will net $65 per share after flotation costs.

Common stock equity: The firm expects dividends and earnings per share to be $0.96 and $3.20, respectively, in 2004 and to continue to grow at a constant rate of 11% per year. The firm's stock currently sells for $12 per share. Star expects to have $1,500,000 of retained earnings available in the coming year. Once the retained earnings have been exhausted, the firm can raise additional funds by selling new common stock, netting $9 per share after underpricing and flotation costs.

Required

a. Calculate the cost of each source of financing, as specified:
   (1) Long-term debt, first $450,000.
   (2) Long-term debt, greater than $450,000.
   (3) Preferred stock, all amounts.
   (4) Common stock equity, first $1,500,000.
   (5) Common stock equity, greater than $1,500,000.
b. Find the break points associated with each source of capital, and use them to specify each of the ranges of total new financing over which the firm's weighted average cost of capital (WACC) remains constant.
c. Calculate the weighted average cost of capital (WACC) over each of the ranges of total new financing specified in part **b.**
d. Using your findings in part **c** along with the investment opportunities schedule (IOS), draw the firm's weighted marginal cost of capital (WMCC) and IOS on the same set of axes (total new financing or investment on the *x* axis and weighted average cost of capital and IRR on the *y* axis).
e. Which, if any, of the available investments would you recommend that the firm accept? Explain your answer.

WEB EXERCISE

Go to the St. Louis Federal Reserve Bank Web site *www.stls.frb.org*. Click on **Economic Research**; click on **Fred**; click on **Monthly Interest Rates**; and then click on **Bank Prime Loan Rate Changes—Historic Dates of Changes and Rates—1929.**

1. What was the prime interest rate in 1934?
2. What is the highest the prime interest rate has been? When was that?

3. What has been the highest prime interest rate since you were born?

4. What is the present prime interest rate?

5. Over the past 10 years, what was the lowest prime interest rate? What has been the highest prime interest rate over the past 10 years?

Now go to Barra's Web site *www.barra.com* and click on **Research + Indexes** and then on **S&P/Barra U.S. Equity Indexes**.

6. What was the average annual 10-year return on large-cap stocks, as measured by growth in the S&P 500 (annualized 10-year return)? How does this compare to your answers in question 5?

Remember to check the book's Web site at

www.aw.com/gitman

for additional resources, including additional Web exercises.