COST OF CAPITAL

Eastman Chemical is a leading international chemical company and maker of plastics such as that used in soft drink containers. It was created on December 31, 1993, when its former parent company, Eastman Kodak, split off the division as a separate company. Soon thereafter, Eastman Chemical adopted a new motivational program for its employees. Everyone who works for the company, from hourly workers up to the CEO, gets a bonus that depends on the amount by which Eastman's return on capital for the year exceeds its cost of capital. With this approach, Eastman joined the many firms that tie compensation packages to how good a job the firm does in providing an adequate return for its investors. In this chapter, we learn how to compute a firm's cost of capital and find out what it means to the firm and its investors.

Visit us at www.mhhe.com/rwj

DIGITAL STUDY TOOLS
- Self-Study Software
- Multiple-Choice Quizzes
- Flashcards for Testing and Key Terms

Suppose you have just become the president of a large company, and the first decision you face is whether to go ahead with a plan to renovate the company's warehouse distribution system. The plan will cost the company $50 million, and it is expected to save $12 million per year after taxes over the next six years.

This is a familiar problem in capital budgeting. To address it, you would determine the relevant cash flows, discount them, and, if the net present value is positive, take on the project; if the NPV is negative, you would scrap it. So far, so good; but what should you use as the discount rate?

From our discussion of risk and return, you know that the correct discount rate depends on the riskiness of the project to renovate the warehouse distribution system. In particular, the new project will have a positive NPV only if its return exceeds what the financial markets offer on investments of similar risk. We called this minimum required return the *cost of capital* associated with the project.[1]

Thus, to make the right decision as president, you must examine what the capital markets have to offer and use this information to arrive at an estimate of the project's cost of capital. Our primary purpose in this chapter is to describe how to go about doing this. There are a variety of approaches to this task, and a number of conceptual and practical issues arise.

One of the most important concepts we develop is that of the *weighted average cost of capital* (WACC). This is the cost of capital for the firm as a whole, and it can be interpreted as the required return on the overall firm. In discussing the WACC, we will recognize the fact that a firm will normally raise capital in a variety of forms and that these different forms of capital may have different costs associated with them.

---

[1]The term *cost of money* is also used.

We also recognize in this chapter that taxes are an important consideration in determining the required return on an investment: We are always interested in valuing the aftertax cash flows from a project. We will therefore discuss how to incorporate taxes explicitly into our estimates of the cost of capital.

15.1 The Cost of Capital: Some Preliminaries

In Chapter 13, we developed the security market line, or SML, and used it to explore the relationship between the expected return on a security and its systematic risk. We concentrated on how the risky returns from buying securities looked from the viewpoint of, for example, a shareholder in the firm. This helped us understand more about the alternatives available to an investor in the capital markets.

In this chapter, we turn things around a bit and look more closely at the other side of the problem, which is how these returns and securities look from the viewpoint of the companies that issue them. The important fact to note is that the return an investor in a security receives is the cost of that security to the company that issued it.

REQUIRED RETURN VERSUS COST OF CAPITAL

When we say that the required return on an investment is, say, 10 percent, we usually mean that the investment will have a positive NPV only if its return exceeds 10 percent. Another way of interpreting the required return is to observe that the firm must earn 10 percent on the investment just to compensate its investors for the use of the capital needed to finance the project. This is why we could also say that 10 percent is the cost of capital associated with the investment.

To illustrate the point further, imagine that we are evaluating a risk-free project. In this case, how to determine the required return is obvious: We look at the capital markets and observe the current rate offered by risk-free investments, and we use this rate to discount the project's cash flows. Thus, the cost of capital for a risk-free investment is the risk-free rate.

If a project is risky, then, assuming that all the other information is unchanged, the required return is obviously higher. In other words, the cost of capital for this project, if it is risky, is greater than the risk-free rate, and the appropriate discount rate would exceed the risk-free rate.

We will henceforth use the terms *required return, appropriate discount rate*, and *cost of capital* more or less interchangeably because, as the discussion in this section suggests, they all mean essentially the same thing. The key fact to grasp is that the cost of capital associated with an investment depends on the risk of that investment. This is one of the most important lessons in corporate finance, so it bears repeating:

> **The cost of capital depends primarily on the use of the funds, not the source.**

It is a common error to forget this crucial point and fall into the trap of thinking that the cost of capital for an investment depends primarily on how and where the capital is raised.

FINANCIAL POLICY AND COST OF CAPITAL

We know that the particular mixture of debt and equity a firm chooses to employ—its capital structure—is a managerial variable. In this chapter, we will take the firm's financial policy as given. In particular, we will assume that the firm has a fixed debt–equity ratio that

it maintains. This ratio reflects the firm's *target* capital structure. How a firm might choose that ratio is the subject of our next chapter.

From the preceding discussion, we know that a firm's overall cost of capital will reflect the required return on the firm's assets as a whole. Given that a firm uses both debt and equity capital, this overall cost of capital will be a mixture of the returns needed to compensate its creditors and those needed to compensate its stockholders. In other words, a firm's cost of capital will reflect both its cost of debt capital and its cost of equity capital. We discuss these costs separately in the sections that follow.

Concept Questions

15.1a What is the primary determinant of the cost of capital for an investment?

15.1b What is the relationship between the required return on an investment and the cost of capital associated with that investment?

The Cost of Equity

15.2

We begin with the most difficult question on the subject of cost of capital: What is the firm's overall **cost of equity**? The reason this is a difficult question is that there is no way of directly observing the return that the firm's equity investors require on their investment. Instead, we must somehow estimate it. This section discusses two approaches to determining the cost of equity: the dividend growth model approach and the security market line (SML) approach.

cost of equity
The return that equity investors require on their investment in the firm.

THE DIVIDEND GROWTH MODEL APPROACH

The easiest way to estimate the cost of equity capital is to use the dividend growth model we developed in Chapter 8. Recall that, under the assumption that the firm's dividend will grow at a constant rate g, the price per share of the stock, P_0, can be written as:

$$P_0 = \frac{D_0 \times (1 + g)}{R_E - g} = \frac{D_1}{R_E - g}$$

where D_0 is the dividend just paid and D_1 is the next period's projected dividend. Notice that we have used the symbol R_E (the E stands for equity) for the required return on the stock.

As we discussed in Chapter 8, we can rearrange this to solve for R_E as follows:

$$R_E = D_1/P_0 + g \qquad\qquad [15.1]$$

Because R_E is the return that the shareholders require on the stock, it can be interpreted as the firm's cost of equity capital.

Implementing the Approach   To estimate R_E using the dividend growth model approach, we obviously need three pieces of information: P_0, D_0, and g.[2] Of these, for a publicly traded, dividend-paying company, the first two can be observed directly, so they are easily obtained. Only the third component, the expected growth rate for dividends, must be estimated.

---

[2]Notice that if we have D_0 and g, we can simply calculate D_1 by multiplying D_0 by $(1 + g)$.

To illustrate how we estimate R_E, suppose Greater States Public Service, a large public utility, paid a dividend of $4 per share last year. The stock currently sells for $60 per share. You estimate that the dividend will grow steadily at a rate of 6 percent per year into the indefinite future. What is the cost of equity capital for Greater States?

Using the dividend growth model, we can calculate that the expected dividend for the coming year, D_1, is:

$$D_1 = D_0 \times (1 + g)$$
$$= \$4 \times 1.06$$
$$= \$4.24$$

Given this, the cost of equity, R_E, is:

$$R_E = D_1/P_0 + g$$
$$= \$4.24/60 + .06$$
$$= 13.07\%$$

The cost of equity is thus 13.07 percent.

Estimating g   To use the dividend growth model, we must come up with an estimate for g, the growth rate. There are essentially two ways of doing this: (1) Use historical growth rates, or (2) use analysts' forecasts of future growth rates. Analysts' forecasts are available from a variety of sources. Naturally, different sources will have different estimates, so one approach might be to obtain multiple estimates and then average them.

Alternatively, we might observe dividends for the previous, say, five years, calculate the year-to-year growth rates, and average them. For example, suppose we observe the following for some company:

Year	Dividend
2003	$1.10
2004	1.20
2005	1.35
2006	1.40
2007	1.55

We can calculate the percentage change in the dividend for each year as follows:

Year	Dividend	Dollar Change	Percentage Change
2003	$1.10	—	—
2004	1.20	$.10	9.09%
2005	1.35	.15	12.50
2006	1.40	.05	3.70
2007	1.55	.15	10.71

Notice that we calculated the change in the dividend on a year-to-year basis and then expressed the change as a percentage. Thus, in 2004 for example, the dividend rose from $1.10 to $1.20, an increase of $.10. This represents a $.10/1.10 = 9.09% increase.

If we average the four growth rates, the result is $(9.09 + 12.50 + 3.70 + 10.71)/4 = 9\%$, so we could use this as an estimate for the expected growth rate, g. Notice that this 9 percent growth rate we have calculated is a simple, or arithmetic average. Going back to Chapter 12, we also could calculate a geometric growth rate. Here, the dividend grows from $1.10 to $1.55 over a four-year period. What's the compound, or geometric growth rate? See if you

don't agree that it's 8.95 percent; you can view this as a simple time value of money problem where $1.10 is the present value and $1.55 is the future value.

As usual, the geometric average (8.95 percent) is lower than the arithmetic average (9.09 percent), but the difference here is not likely to be of any practical significance. In general, if the dividend has grown at a relatively steady rate, as we assume when we use this approach, then it can't make much difference which way we calculate the average dividend growth rate.

Advantages and Disadvantages of the Approach   The primary advantage of the dividend growth model approach is its simplicity. It is both easy to understand and easy to use. There are a number of associated practical problems and disadvantages.

First and foremost, the dividend growth model is obviously applicable only to companies that pay dividends. This means that the approach is useless in many cases. Furthermore, even for companies that pay dividends, the key underlying assumption is that the dividend grows at a constant rate. As our previous example illustrates, this will never be *exactly* the case. More generally, the model is really applicable only to cases in which reasonably steady growth is likely to occur.

A second problem is that the estimated cost of equity is very sensitive to the estimated growth rate. For a given stock price, an upward revision of g by just one percentage point, for example, increases the estimated cost of equity by at least a full percentage point. Because D_1 will probably be revised upward as well, the increase will actually be somewhat larger than that.

Finally, this approach really does not explicitly consider risk. Unlike the SML approach (which we consider next), there is no direct adjustment for the riskiness of the investment. For example, there is no allowance for the degree of certainty or uncertainty surrounding the estimated growth rate for dividends. As a result, it is difficult to say whether or not the estimated return is commensurate with the level of risk.[3]

THE SML APPROACH

In Chapter 13, we discussed the security market line, or SML. Our primary conclusion was that the required or expected return on a risky investment depends on three things:

1. The risk-free rate, R_f.
2. The market risk premium, $E(R_M) - R_f$.
3. The systematic risk of the asset relative to average, which we called its beta coefficient, β.

Using the SML, we can write the expected return on the company's equity, $E(R_E)$, as:

$$E(R_E) = R_f + \beta_E \times [E(R_M) - R_f]$$

where β_E is the estimated beta. To make the SML approach consistent with the dividend growth model, we will drop the Es denoting expectations and henceforth write the required return from the SML, R_E, as:

$$R_E = R_f + \beta_E \times (R_M - R_f) \tag{15.2}$$

---

[3]There is an implicit adjustment for risk because the current stock price is used. All other things being equal, the higher the risk, the lower is the stock price. Further, the lower the stock price, the greater is the cost of equity, again assuming all the other information is the same.

Implementing the Approach   To use the SML approach, we need a risk-free rate, R_f, an estimate of the market risk premium, $R_M - R_f$, and an estimate of the relevant beta, β_E. In Chapter 12 (Table 12.3), we saw that one estimate of the market risk premium (based on large common stocks) is 8.5 percent. U.S. Treasury bills are paying about 4.9 percent as this chapter is being written, so we will use this as our risk-free rate. Beta coefficients for publicly traded companies are widely available.[4]

To illustrate, in Chapter 13, we saw that eBay had an estimated beta of 1.35 (Table 13.8). We could thus estimate eBay's cost of equity as:

$$R_{eBay} = R_f + \beta_{eBay} \times (R_M - R_f)$$
$$= 4.9\% + 1.35 \times 8.5\%$$
$$= 16.38\%$$

Thus, using the SML approach, we calculate that eBay's cost of equity is about 16.38 percent.

Betas and T-bill rates can both be found at www.bloomberg.com.

Advantages and Disadvantages of the Approach   The SML approach has two primary advantages. First, it explicitly adjusts for risk. Second, it is applicable to companies other than just those with steady dividend growth. Thus, it may be useful in a wider variety of circumstances.

There are drawbacks, of course. The SML approach requires that two things be estimated: the market risk premium and the beta coefficient. To the extent that our estimates are poor, the resulting cost of equity will be inaccurate. For example, our estimate of the market risk premium, 8.5 percent, is based on 80 years of returns on a particular portfolio of stocks. Using different time periods or different stocks could result in very different estimates.

Finally, as with the dividend growth model, we essentially rely on the past to predict the future when we use the SML approach. Economic conditions can change quickly; so as always, the past may not be a good guide to the future. In the best of all worlds, both approaches (the dividend growth model and the SML) are applicable and the two result in similar answers. If this happens, we might have some confidence in our estimates. We might also wish to compare the results to those for other similar companies as a reality check.

EXAMPLE 15.1	**The Cost of Equity**

Suppose stock in Alpha Air Freight has a beta of 1.2. The market risk premium is 8 percent, and the risk-free rate is 6 percent. Alpha's last dividend was $2 per share, and the dividend is expected to grow at 8 percent indefinitely. The stock currently sells for $30. What is Alpha's cost of equity capital?

We can start off by using the SML. Doing this, we find that the expected return on the common stock of Alpha Air Freight is:

$$R_E = R_f + \beta_E \times (R_M - R_f)$$
$$= 6\% + 1.2 \times 8\%$$
$$= 15.6\%$$

(continued)

---

[4]We can also estimate beta coefficients directly by using historical data. For a discussion of how to do this, see Chapters 9, 10, and 12 in S.A. Ross, R.W. Westerfield, and J.J. Jaffe, *Corporate Finance*, 8th ed. (New York: McGraw-Hill, 2008).

This suggests that 15.6 percent is Alpha's cost of equity. We next use the dividend growth model. The projected dividend is $D_0 \times (1 + g) = \$2 \times 1.08 = \$2.16$, so the expected return using this approach is:

$$R_E = D_1/P_0 + g$$
$$= \$2.16/30 + .08$$
$$= 15.2\%$$

Our two estimates are reasonably close, so we might just average them to find that Alpha's cost of equity is approximately 15.4 percent.

Concept Questions

15.2a What do we mean when we say that a corporation's cost of equity capital is 16 percent?

15.2b What are two approaches to estimating the cost of equity capital?

The Costs of Debt and Preferred Stock

15.3

In addition to ordinary equity, firms use debt and, to a lesser extent, preferred stock to finance their investments. As we discuss next, determining the costs of capital associated with these sources of financing is much easier than determining the cost of equity.

THE COST OF DEBT

The **cost of debt** is the return the firm's creditors demand on new borrowing. In principle, we could determine the beta for the firm's debt and then use the SML to estimate the required return on debt just as we estimated the required return on equity. This isn't really necessary, however.

cost of debt
The return that lenders require on the firm's debt.

Unlike a firm's cost of equity, its cost of debt can normally be observed either directly or indirectly: The cost of debt is simply the interest rate the firm must pay on new borrowing, and we can observe interest rates in the financial markets. For example, if the firm already has bonds outstanding, then the yield to maturity on those bonds is the market-required rate on the firm's debt.

Alternatively, if we know that the firm's bonds are rated, say, AA, then we can simply find the interest rate on newly issued AA-rated bonds. Either way, there is no need to estimate a beta for the debt because we can directly observe the rate we want to know.

There is one thing to be careful about, though. The coupon rate on the firm's outstanding debt is irrelevant here. That rate just tells us roughly what the firm's cost of debt was back when the bonds were issued, not what the cost of debt is today.[5] This is why we have to look at the yield on the debt in today's marketplace. For consistency with our other notation, we will use the symbol R_D for the cost of debt.

---

[5]The firm's cost of debt based on its historic borrowing is sometimes called the *embedded debt cost.*

EXAMPLE 15.2	The Cost of Debt

Suppose the General Tool Company issued a 30-year, 7 percent bond 8 years ago. The bond is currently selling for 96 percent of its face value, or $960. What is General Tool's cost of debt?

Going back to Chapter 7, we need to calculate the yield to maturity on this bond. Because the bond is selling at a discount, the yield is apparently greater than 7 percent, but not much greater because the discount is fairly small. You can check to see that the yield to maturity is about 7.37 percent, assuming annual coupons. General Tool's cost of debt, R_D, is thus 7.37 percent.

THE COST OF PREFERRED STOCK

Determining the *cost of preferred stock* is quite straightforward. As we discussed in Chapters 6 and 8, preferred stock has a fixed dividend paid every period forever, so a share of preferred stock is essentially a perpetuity. The cost of preferred stock, R_P, is thus:

$$R_P = D/P_0 \qquad\qquad\qquad [15.3]$$

where D is the fixed dividend and P_0 is the current price per share of the preferred stock. Notice that the cost of preferred stock is simply equal to the dividend yield on the preferred stock. Alternatively, because preferred stocks are rated in much the same way as bonds, the cost of preferred stock can be estimated by observing the required returns on other, similarly rated shares of preferred stock.

EXAMPLE 15.3	Alabama Power Co.'s Cost of Preferred Stock

On May 14, 2006, Alabama Power Co. had two issues of ordinary preferred stock that traded on the NYSE. One issue paid $1.30 annually per share and sold for $22.05 per share. The other paid $1.46 per share annually and sold for $24.45 per share. What is Alabama Power's cost of preferred stock?

Using the first issue, we calculate that the cost of preferred stock is:

$R_P = D/P_0$

$\quad = \$1.30/22.05$

$\quad = 5.9\%$

Using the second issue, we calculate that the cost is:

$R_P = D/P_0$

$\quad = \$1.46/24.45$

$\quad = 6\%$

So, Alabama Power's cost of preferred stock appears to be about 6 percent.

Concept Questions

15.3a Why is the coupon rate a bad estimate of a firm's cost of debt?

15.3b How can the cost of debt be calculated?

15.3c How can the cost of preferred stock be calculated?

The Weighted Average Cost of Capital

Now that we have the costs associated with the main sources of capital the firm employs, we need to worry about the specific mix. As we mentioned earlier, we will take this mix, which is the firm's capital structure, as given for now. Also, we will focus mostly on debt and ordinary equity in this discussion.

In Chapter 3, we mentioned that financial analysts frequently focus on a firm's total capitalization, which is the sum of its long-term debt and equity. This is particularly true in determining cost of capital; short-term liabilities are often ignored in the process. We will not explicitly distinguish between total value and total capitalization in the following discussion; the general approach is applicable with either.

THE CAPITAL STRUCTURE WEIGHTS

We will use the symbol E (for equity) to stand for the *market* value of the firm's equity. We calculate this by taking the number of shares outstanding and multiplying it by the price per share. Similarly, we will use the symbol D (for debt) to stand for the *market* value of the firm's debt. For long-term debt, we calculate this by multiplying the market price of a single bond by the number of bonds outstanding.

If there are multiple bond issues (as there normally would be), we repeat this calculation of D for each and then add up the results. If there is debt that is not publicly traded (because it is held by a life insurance company, for example), we must observe the yield on similar publicly traded debt and then estimate the market value of the privately held debt using this yield as the discount rate. For short-term debt, the book (accounting) values and market values should be somewhat similar, so we might use the book values as estimates of the market values.

Finally, we will use the symbol V (for value) to stand for the combined market value of the debt and equity:

$$V = E + D \qquad\qquad [15.4]$$

If we divide both sides by V, we can calculate the percentages of the total capital represented by the debt and equity:

$$100\% = E/V + D/V \qquad\qquad [15.5]$$

These percentages can be interpreted just like portfolio weights, and they are often called the *capital structure weights*.

For example, if the total market value of a company's stock were calculated as $200 million and the total market value of the company's debt were calculated as $50 million, then the combined value would be $250 million. Of this total, $E/V = \$200$ million/250 million = 80%, so 80 percent of the firm's financing would be equity and the remaining 20 percent would be debt.

We emphasize here that the correct way to proceed is to use the *market* values of the debt and equity. Under certain circumstances, such as when calculating figures for a privately owned company, it may not be possible to get reliable estimates of these quantities. In this case, we might go ahead and use the accounting values for debt and equity. Although this would probably be better than nothing, we would have to take the answer with a grain of salt.

TAXES AND THE WEIGHTED AVERAGE COST OF CAPITAL

There is one final issue we need to discuss. Recall that we are always concerned with aftertax cash flows. If we are determining the discount rate appropriate to those cash flows, then the discount rate also needs to be expressed on an aftertax basis.

As we discussed previously in various places in this book (and as we will discuss later), the interest paid by a corporation is deductible for tax purposes. Payments to stockholders, such as dividends, are not. What this means, effectively, is that the government pays some of the interest. Thus, in determining an aftertax discount rate, we need to distinguish between the pretax and the aftertax cost of debt.

To illustrate, suppose a firm borrows $1 million at 9 percent interest. The corporate tax rate is 34 percent. What is the aftertax interest rate on this loan? The total interest bill will be $90,000 per year. This amount is tax deductible, however, so the $90,000 interest reduces the firm's tax bill by .34 × $90,000 = $30,600. The aftertax interest bill is thus $90,000 − 30,600 = $59,400. The aftertax interest rate is thus $59,400/1 million = 5.94%.

Notice that, in general, the aftertax interest rate is simply equal to the pretax rate multiplied by 1 minus the tax rate. [If we use the symbol T_C to stand for the corporate tax rate, then the aftertax rate can be written as $R_D \times (1 - T_C)$.] For example, using the numbers from the preceding paragraph, we find that the aftertax interest rate is 9% × (1 − .34) = 5.94%.

Bringing together the various topics we have discussed in this chapter, we now have the capital structure weights along with the cost of equity and the aftertax cost of debt. To calculate the firm's overall cost of capital, we multiply the capital structure weights by the associated costs and add them up. The total is the **weighted average cost of capital (WACC)**:

$$\text{WACC} = (E/V) \times R_E + (D/V) \times R_D \times (1 - T_C) \qquad [15.6]$$

To get a feel for actual, industry-level WACCs, visit www.ibbotson.com.

weighted average cost of capital (WACC)
The weighted average of the cost of equity and the aftertax cost of debt.

This WACC has a straightforward interpretation. It is the overall return the firm must earn on its existing assets to maintain the value of its stock. It is also the required return on any investments by the firm that have essentially the same risks as existing operations. So, if we were evaluating the cash flows from a proposed expansion of our existing operations, this is the discount rate we would use.

If a firm uses preferred stock in its capital structure, then our expression for the WACC needs a simple extension. If we define P/V as the percentage of the firm's financing that comes from preferred stock, then the WACC is simply:

$$\text{WACC} = (E/V) \times R_E + (P/V) \times R_P + (D/V) \times R_D \times (1 - T_C) \qquad [15.7]$$

where R_P is the cost of preferred stock.

| **EXAMPLE 15.4** | **Calculating the WACC** |

The B.B. Lean Co. has 1.4 million shares of stock outstanding. The stock currently sells for $20 per share. The firm's debt is publicly traded and was recently quoted at 93 percent of face value. It has a total face value of $5 million, and it is currently priced to yield 11 percent. The risk-free rate is 8 percent, and the market risk premium is 7 percent. You've estimated that Lean has a beta of .74. If the corporate tax rate is 34 percent, what is the WACC of Lean Co.?

We can first determine the cost of equity and the cost of debt. Using the SML, we find that the cost of equity is 8% + .74 × 7% = 13.18%. The total value of the equity is

(continued)

1.4 million × $20 = $28 million. The pretax cost of debt is the current yield to maturity on the outstanding debt, 11 percent. The debt sells for 93 percent of its face value, so its current market value is .93 × $5 million = $4.65 million. The total market value of the equity and debt together is $28 million + 4.65 million = $32.65 million.

From here, we can calculate the WACC easily enough. The percentage of equity used by Lean to finance its operations is $28 million/$32.65 million = 85.76%. Because the weights have to add up to 1, the percentage of debt is 1 − .8576 = 14.24%. The WACC is thus:

$$\begin{aligned} \text{WACC} &= (E/V) \times R_E + (D/V) \times R_D \times (1 - T_C) \\ &= .8576 \times 13.18\% + .1424 \times 11\% \times (1 - .34) \\ &= 12.34\% \end{aligned}$$

B.B. Lean thus has an overall weighted average cost of capital of 12.34 percent.

CALCULATING THE WACC FOR EASTMAN CHEMICAL

In this section, we illustrate how to calculate the WACC for Eastman Chemical, the company we discussed at the beginning of the chapter. Our goal is to take you through, on a step-by-step basis, the process of finding and using the information needed using online sources. As you will see, there is a fair amount of detail involved, but the necessary information is, for the most part, readily available.

Eastman's Cost of Equity   Our first stop is the key statistics screen for Eastman available at finance.yahoo.com (ticker: EMN). As of mid-2006, here's what it looked like:

EASTMAN CHEM CO (NYSE:EMN) Delayed quote data

Last Trade:	**51.34**	Day's Range:	50.89 - 51.56
Trade Time:	4:02PM ET	52wk Range:	44.10 - 58.81
Change:	↑ 0.21 (0.41%)	Volume:	591,400
Prev Close:	51.13	Avg Vol (3m):	863,338
Open:	51.06	Market Cap:	4.20B
Bid:	N/A	P/E (ttm):	8.44
Ask:	N/A	EPS (ttm):	6.09
1y Target Est:	54.17	Div & Yield:	1.76 (3.30%)

According to this screen, Eastman has 81.8 million shares of stock outstanding. The book value per share is $21.028, but the stock sells for $51.34. Total equity is therefore about $1.72 billion on a book value basis, but it is closer to $4.20 billion on a market value basis.

FINANCIAL HIGHLIGHTS	
Fiscal Year	
Fiscal Year Ends:	31-Dec
Most Recent Quarter (mrq):	31-Mar-06
Profitability	
Profit Margin (ttm):	7.04%
Operating Margin (ttm):	10.25%
Management Effectiveness	
Return on Assets (ttm):	9.54%
Return on Equity (ttm):	32.66%
Income Statement	
Revenue (ttm):	7.10B
Revenue Per Share (ttm):	87.438
Qtrly Revenue Growth (yoy):	2.30%
Gross Profit (ttm):	1.40B
EBITDA (ttm):	1.20B
Net Income Avl to Common (ttm):	500.00M
Diluted EPS (ttm):	6.09
Qtrly Earnings Growth (yoy):	-35.20%
Balance Sheet	
Total Cash (mrq):	485.00M
Total Cash Per Share (mrq):	5.929
Total Debt (mrq):	1.67B
Total Debt/Equity (mrq):	0.971
Current Ratio (mrq):	1.935
Book Value Per Share (mrq):	21.028
Cash Flow Statement	
Operating Cash Flow (ttm):	703.00M
Levered Free Cash Flow (ttm):	-57.38M

TRADING INFORMATION	
Stock Price History	
Beta:	1.11
52-Week Change[3]:	-11.02%
S&P500 52-Week Change[3]:	1.64%
52-Week High (17-Jun-05)[3]:	58.81
52-Week Low (21-Sep-05)[3]:	44.10
50-Day Moving Average[3]:	55.29
200-Day Moving Average[3]:	52.44
Share Statistics	
Average Volume (3 month)[3]:	863,338
Average Volume (10 day)[3]:	1,159,760
Shares Outstanding:	81.80M
Float:	81.54M
% Held by Insiders[4]:	6.74%
% Held by Institutions[4]:	82.60%
Shares Short (as of 10-May-06)[3]:	2.66M
Short Ratio (as of 10-May-06)[3]:	3.3
Short % of Float (as of 10-May-06)[3]:	3.30%
Shares Short (prior month)[3]:	2.87M
Dividends & Splits	
Forward Annual Dividend Rate[5]:	1.76
Forward Annual Dividend Yield[5]:	3.30%
Trailing Annual Dividend Rate[3]:	1.76
Trailing Annual Dividend Yield[3]:	3.40%
5 Year Average Dividend Yield[5]:	4.00%
Payout Ratio[5]:	29%
Dividend Date[3]:	03-Jul-06
Ex-Dividend Date[5]:	13-Jun-06
Last Split Factor (new per old)[2]:	N/A
Last Split Date[3]:	N/A

To estimate Eastman's cost of equity, we will assume a market risk premium of 8.5 percent, similar to what we calculated in Chapter 12. Eastman's beta on Yahoo! is 1.11, which is only slightly higher than the beta of the average stock. To check this number, we went to www.hoovers.com and www.msnbc.com. The beta estimates we found there were 0.90 and 0.94. These estimates of beta are lower than the estimate from Yahoo!, so we will use an average of the three estimates, which is 0.983. According to the bond section of finance.yahoo.com, T-bills were paying about 4.86 percent. Using the CAPM to estimate the cost of equity, we find:

$$R_E = 0.0486 + 0.983(0.085) = 0.1322 \text{ or } 13.22\%$$

Eastman has paid dividends for only a few years, so calculating the growth rate for the dividend discount model is problematic. However, under the analysts' estimates link at

finance.yahoo.com, we found the following:

Growth Est	EMN	Industry	Sector	S&P 500
Current Qtr.	-11.3%	3.6%	18.1%	11.7%
Next Qtr.	-13.7%	15.7%	51.1%	13.2%
This Year	-15.5%	12.3%	27.0%	13.8%
Next Year	-4.4%	7.6%	8.3%	10.7%
Past 5 Years (per annum)	36.5%	N/A	N/A	N/A
Next 5 Years (per annum)	7.0%	9.35%	11.67%	10.74%
Price/Earnings (avg. for comparison categories)	10.2	13.07	12.20	14.14
PEG Ratio (avg. for comparison categories)	1.46	1.40	1.05	1.32

Analysts estimate the growth in earnings per share for the company will be 7 percent for the next five years. For now, we will use this growth rate in the dividend discount model to estimate the cost of equity; the link between earnings growth and dividends is discussed in a later chapter. The estimated cost of equity using the dividend discount model is:

$$R_E = \left[\frac{\$1.76\,(1 + .07)}{\$51.34}\right] + .07 = .1069 \text{ or } 10.69\%$$

Notice that the estimates for the cost of equity are different. This is often the case. Remember that each method of estimating the cost of equity relies on different assumptions, so different estimates of the cost of equity should not surprise us. If the estimates are different, there are two simple solutions. First, we could ignore one of the estimates. We would look at each estimate to see if one of them seemed too high or too low to be reasonable. Second, we could average the two estimates. Averaging the two estimates for Eastman's cost of equity gives us a cost of equity of 11.94 percent. This seems like a reasonable number, so we will use it in calculating the cost of capital in this example.

Eastman's Cost of Debt   Eastman has six relatively long-term bond issues that account for essentially all of its long-term debt. To calculate the cost of debt, we will have to combine these six issues. What we will do is compute a weighted average. We went to www.nasdbondinfo.com to find quotes on the bonds. We should note here that finding the yield to maturity for all of a company's outstanding bond issues on a single day is unusual. If you remember our previous discussion of bonds, the bond market is not as liquid as the stock market; on many days, individual bond issues may not trade. To find the book value of the bonds, we went to www.sec.gov and found the 10Q report dated March 31, 2006, and filed with the SEC on May 3, 2006. The basic information is as follows:[6]

---

[6]You might be wondering why the yield on the 7.625 percent issue maturing in 2024 is lower than that on the other two long-term issues with similar maturities. The reason is that this issue has a put feature (discussed in Chapter 7) that the other two issues do not. Such features are desirable from the buyer's standpoint, so this issue has a higher price and thus a lower yield.

Coupon Rate	Maturity	Book Value (Face value, in Millions)	Price (% of Par)	Yield to Maturity
3.25%	2008	$ 72	94.15	5.85
7.00	2012	138	105.52	5.87
6.30	2018	179	99.15	6.40
7.25	2024	497	102.10	7.04
7.625	2024	200	106.31	7.00
7.60	2027	298	106.12	7.03

To calculate the weighted average cost of debt, we take the percentage of the total debt represented by each issue and multiply by the yield on the issue. We then add to get the overall weighted average debt cost. We use both book values and market values here for comparison. The results of the calculations are as follows:

Coupon Rate	Book Value (Face value, in Millions)	Percentage of Total	Market Value (in Millions)	Percentage of Total	Yield to Maturity	Book Values	Market Values
3.25%	$ 72	0.05	$ 67.79	0.05	5.85%	0.30%	0.28%
7.00	138	0.10	145.61	0.10	5.87	0.59	0.60
6.30	179	0.13	177.47	0.12	6.40	0.83	0.80
7.60	497	0.36	507.44	0.36	7.04	2.53	2.50
7.625	200	0.14	212.62	0.15	7.00	1.01	1.04
7.60	298	0.22	316.25	0.22	7.03	1.51	1.56
Total	$1,384	1.00	$1,427.18	1.00		6.77%	6.78%

As these calculations show, Eastman's cost of debt is 6.77 percent on a book value basis and 6.78 percent on a market value basis. Thus, for Eastman, whether market values or book values are used makes no difference. The reason is simply that the market values and book values are similar. This will often be the case and explains why companies frequently use book values for debt in WACC calculations. Also, Eastman has no preferred stock, so we don't need to consider its cost.

Eastman's WACC   We now have the various pieces necessary to calculate Eastman's WACC. First, we need to calculate the capital structure weights. On a book value basis, Eastman's equity and debt are worth $1.720 billion and $1.384 billion, respectively. The total value is $3.104 billion, so the equity and debt percentages are $1.720 billion/3.104 billion = .55 and $1.384 billion/3.104 billion = .45. Assuming a tax rate of 35 percent, Eastman's WACC is:

$$\text{WACC} = .55 \times 11.94\% + .45 \times 6.77\% \times (1 - .35)$$
$$= 8.55\%$$

Thus, using book value capital structure weights, we get about 8.55 percent for Eastman's WACC.

If we use market value weights, however, the WACC will be higher. To see why, notice that on a market value basis, Eastman's equity and debt are worth $4.200 billion and $1.427 billion, respectively. The capital structure weights are therefore $4.200 billion/5.627 billion = .75 and $1.427 billion/5.627 billion = .25, so the equity percentage is much higher. With these weights, Eastman's WACC is:

$$\text{WACC} = .75 \times 11.94\% + .25 \times 6.78\% \times (1 - .35)$$
$$= 10\%$$

Thus, using market value weights, we get about 10 percent for Eastman's WACC, which is about 1.5 percent higher than the 8.55 percent WACC we got using book value weights.

As this example illustrates, using book values can lead to trouble, particularly if equity book values are used. Going back to Chapter 3, recall that we discussed the market-to-book ratio (the ratio of market value per share to book value per share). This ratio is usually substantially bigger than 1. For Eastman, for example, verify that it's about 2.4; so book values significantly overstate the percentage of Eastman's financing that comes from debt. In addition, if we were computing a WACC for a company that did not have publicly traded stock, we would try to come up with a suitable market-to-book ratio by looking at publicly traded companies, and we would then use this ratio to adjust the book value of the company under consideration. As we have seen, failure to do so can lead to significant underestimation of the WACC.

Our nearby *Work the Web* box explains more about the WACC and related topics.

WORK THE WEB

So how does our estimate of the WACC for Eastman Chemical compare to others? One place to find estimates for WACC is www.valuepro.net. We went there and found the following information for Eastman:

Online Valuation for EMN - 6 / 14 / 2006

Intrinsic Stock Value 173.98 [Recalculate] [Value Another Stock]

Excess Return Period (yrs)	10	Depreciation Rate (% of Rev)	4.31
Revenues ($mil)	7100.0	Investment Rate (% of Rev)	4.86
Growth Rate (%)	12	Working Capital (% of Rev)	10.09
Net Oper. Profit Margin (%)	9.75	Short-Term Assets ($mil)	1929.0
Tax Rate (%)	29.506	Short-Term Liab. ($mil)	1112
Stock Price ($)	52.7600	Equity Risk Premium (%)	3
Shares Outstanding (mil)	81.7	Company Beta	1.1025
10-Yr Treasury Yield (%)	5	Value Debt Out. ($mil)	1587
Bond Spread Treasury (%)	1.5	Value Pref. Stock Out. ($mil)	0
Preferred Stock Yield (%)	7.5	Company WACC (%)	7.31

As you can see, ValuePro estimates the WACC (Cost of Capital) for Eastman as 7.31 percent, which is lower than our estimate of 10 percent. You can see why the estimates for WACC are different: Different inputs were used in the computations. For example, ValuePro uses an equity risk premium of only 3 percent. Calculating WACC requires the estimation of various inputs, and you must use your best judgment in these estimates.

SOLVING THE WAREHOUSE PROBLEM AND SIMILAR CAPITAL BUDGETING PROBLEMS

Now we can use the WACC to solve the warehouse problem we posed at the beginning of the chapter. However, before we rush to discount the cash flows at the WACC to estimate NPV, we need to make sure we are doing the right thing.

Going back to first principles, we need to find an alternative in the financial markets that is comparable to the warehouse renovation. To be comparable, an alternative must be of the same level of risk as the warehouse project. Projects that have the same risk are said to be in the same risk class.

The WACC for a firm reflects the risk and the target capital structure of the firm's existing assets as a whole. As a result, strictly speaking, the firm's WACC is the appropriate discount rate only if the proposed investment is a replica of the firm's existing operating activities.

In broader terms, whether or not we can use the firm's WACC to value the warehouse project depends on whether the warehouse project is in the same risk class as the firm. We will assume that this project is an integral part of the overall business of the firm. In such cases, it is natural to think that the cost savings will be as risky as the general cash flows of the firm, and the project will thus be in the same risk class as the overall firm. More generally, projects like the warehouse renovation that are intimately related to the firm's existing operations are often viewed as being in the same risk class as the overall firm.

We can now see what the president should do. Suppose the firm has a target debt–equity ratio of $1/3$. From Chapter 3, we know that a debt–equity ratio of $D/E = 1/3$ implies that E/V is .75 and D/V is .25. The cost of debt is 10 percent, and the cost of equity is 20 percent. Assuming a 34 percent tax rate, the WACC will be:

$$
\begin{aligned}
\text{WACC} &= (E/V) \times R_E + (D/V) \times R_D \times (1 - T_C) \\
&= .75 \times 20\% + .25 \times 10\% \times (1 - .34) \\
&= 16.65\%
\end{aligned}
$$

Recall that the warehouse project had a cost of $50 million and expected aftertax cash flows (the cost savings) of $12 million per year for six years. The NPV (in millions) is thus:

$$
\text{NPV} = -\$50 + \frac{12}{(1 + \text{WACC})^1} + \cdots + \frac{12}{(1 + \text{WACC})^6}
$$

Because the cash flows are in the form of an ordinary annuity, we can calculate this NPV using 16.65 percent (the WACC) as the discount rate as follows:

$$
\begin{aligned}
\text{NPV} &= -\$50 + 12 \times \frac{1 - [1/(1 + .1665)^6]}{.1665} \\
&= -\$50 + 12 \times 3.6222 \\
&= -\$6.53
\end{aligned}
$$

Should the firm take on the warehouse renovation? The project has a negative NPV using the firm's WACC. This means that the financial markets offer superior projects in the same risk class (namely, the firm itself). The answer is clear: The project should be rejected. For future reference, our discussion of the WACC is summarized in Table 15.1.

I.   The Cost of Equity, R_E

   A. Dividend growth model approach (from Chapter 8):

$$R_E = D_1/P_0 + g$$

   where D_1 is the expected dividend in one period, g is the dividend growth rate, and P_0 is the current stock price.

   B. SML approach (from Chapter 13):

$$R_E = R_f + \beta_E \times (R_M - R_f)$$

   where R_f is the risk-free rate, R_M is the expected return on the overall market, and β_E is the systematic risk of the equity.

II. The Cost of Debt, R_D

   A. For a firm with publicly held debt, the cost of debt can be measured as the yield to maturity on the outstanding debt. The coupon rate is irrelevant. Yield to maturity is covered in Chapter 7.

   B. If the firm has no publicly traded debt, then the cost of debt can be measured as the yield to maturity on similarly rated bonds (bond ratings are discussed in Chapter 7).

III. The Weighted Average Cost of Capital, WACC

   A. The firm's WACC is the overall required return on the firm as a whole. It is the appropriate discount rate to use for cash flows similar in risk to those of the overall firm.

   B. The WACC is calculated as:

$$\text{WACC} = (E/V) \times R_E + (D/V) \times R_D \times (1 - T_C)$$

   where T_C is the corporate tax rate, E is the *market* value of the firm's equity, D is the *market* value of the firm's debt, and $V = E + D$. Note that E/V is the percentage of the firm's financing (in market value terms) that is equity, and D/V is the percentage that is debt.

Using the WACC	**EXAMPLE 15.5**

A firm is considering a project that will result in initial aftertax cash savings of $5 million at the end of the first year. These savings will grow at the rate of 5 percent per year. The firm has a debt–equity ratio of .5, a cost of equity of 29.2 percent, and a cost of debt of 10 percent. The cost-saving proposal is closely related to the firm's core business, so it is viewed as having the same risk as the overall firm. Should the firm take on the project?

   Assuming a 34 percent tax rate, the firm should take on this project if it costs less than $30 million. To see this, first note that the PV is:

$$PV = \frac{\$5 \text{ million}}{\text{WACC} - .05}$$

This is an example of a growing perpetuity as discussed in Chapter 6. The WACC is:

$$
\begin{aligned}
\text{WACC} &= (E/V) \times R_E + (D/V) \times R_D \times (1 - T_C) \\
&= 2/3 \times 29.2\% + 1/3 \times 10\% \times (1 - .34) \\
&= 21.67\%
\end{aligned}
$$

The PV is thus:

$$PV = \frac{\$5 \text{ million}}{.2167 - .05} = \$30 \text{ million}$$

The NPV will be positive only if the cost is less than $30 million.

Bennett Stewart on EVA

A firm's weighted average cost of capital has important applications other than the discount rate in capital project evaluations. For instance, it is a key ingredient to measure a firm's true economic profit, or what I like to call EVA, standing for economic value added. Accounting rules dictate that the interest expense a company incurs on its debt financing be deducted from its reported profit, but those same rules ironically forbid deducting a charge for the shareholders' funds a firm uses. In economic terms, equity capital is in fact a very costly financing source, because shareholders bear the risk of being paid last, after all other stakeholders and investors are paid first. But according to accountants, shareholders equity is free.

This egregious oversight has dire practical consequences. For one thing, it means that the profit figure accountants certify to be correct is inherently at odds with the net present value decision rule. For instance, it is a simple matter for management to inflate its reported earnings and earnings-per-share in ways that actually harm the shareholders by investing capital in projects that earn less than the overall cost of capital but more than the aftertax cost of borrowing money, which amounts to a trivial hurdle in most cases, a couple percentage points at most. In effect, EPS requires management to vault a mere three foot hurdle when to satisfy shareholders managers must jump a ten foot hurdle that includes the cost of equity. A prime example of the way accounting profit leads smart managers to do dumb things was Enron, where former top executives Ken Lay and Jeff Skilling boldly declared in the firm's 2000 annual report that they were "laser-focused on earnings per share," and so they were. Bonuses were funded out of book profit, and project developers were paid for signing up new deals and not generating a decent return on investment. Consequently, Enron's EPS was on the rise while its true economic profit—its EVA—measured after deducting the full cost of capital, was plummeting in the years leading up to the firm's demise—the result of massive misallocations of capital to ill-advised energy and new economy projects. The point is, EVA measures economic profit, the profit that actually discounts to net present value, and the maximization of which is every company's most important financial goal; yet for all its popularity EPS is just an accounting contrivance that is wholly unrelated to the maximization of shareholder wealth or sending the right decision signals to management.

Starting in the early 1990s firms around the world—ranging from Coca-Cola, to Briggs & Stratton, Herman Miller, and Eli Lilly in America, Siemens in Germany, Tata Consulting and the Godrej Group out of India, Brahma Beer in Brazil, and many, many more—began to turn to EVA as a new and better way to measure performance and set goals, make decisions and determine bonuses, and to communicate with investors and to teach business and finance basics to managers and employees. Properly tailored and implemented, EVA is a natural way to bring the cost of capital to life, and to turn everyone in a company into a capital conscientious, owner-entrepreneur.

Bennett Stewart is a co-founder of Stern Stewart & Co. and also the CEO of EVA Dimensions, a firm providing EVA data, valuation modeling, and hedge fund management. Stewart pioneered the practical development of EVA as chronicled in his book, *The Quest for Value*.

PERFORMANCE EVALUATION: ANOTHER USE OF THE WACC

Visit www.sternstewart.com for more about EVA.

Looking back at the Eastman Chemical example we used to open the chapter, we see another use of the WACC: its use for performance evaluation. Probably the best-known approach in this area is the economic value added (EVA) method developed by Stern Stewart and Co. Companies such as AT&T, Coca-Cola, Quaker Oats, and Briggs and Stratton are among the firms that have been using EVA as a means of evaluating corporate performance. Similar approaches include market value added (MVA) and shareholder value added (SVA).

Although the details differ, the basic idea behind EVA and similar strategies is straightforward. Suppose we have $100 million in capital (debt and equity) tied up in our firm, and our overall WACC is 12 percent. If we multiply these together, we get $12 million. Referring back to Chapter 2, if our cash flow from assets is less than this, we are, on an overall basis, destroying value; if cash flow from assets exceeds $12 million, we are creating value.

In practice, evaluation strategies such as these suffer to a certain extent from problems with implementation. For example, it appears that Eastman Chemical and others make

496

extensive use of book values for debt and equity in computing cost of capital. Even so, by focusing on value creation, WACC-based evaluation procedures force employees and management to pay attention to the real bottom line: increasing share prices.

> **Concept Questions**
>
> **15.4a** How is the WACC calculated?
>
> **15.4b** Why do we multiply the cost of debt by $(1 - T_C)$ when we compute the WACC?
>
> **15.4c** Under what conditions is it correct to use the WACC to determine NPV?

Divisional and Project Costs of Capital

15.5

As we have seen, using the WACC as the discount rate for future cash flows is appropriate only when the proposed investment is similar to the firm's existing activities. This is not as restrictive as it sounds. If we are in the pizza business, for example, and we are thinking of opening a new location, then the WACC is the discount rate to use. The same is true of a retailer thinking of a new store, a manufacturer thinking of expanding production, or a consumer products company thinking of expanding its markets.

Nonetheless, despite the usefulness of the WACC as a benchmark, there will clearly be situations in which the cash flows under consideration have risks distinctly different from those of the overall firm. We consider how to cope with this problem next.

THE SML AND THE WACC

When we are evaluating investments with risks that are substantially different from those of the overall firm, use of the WACC will potentially lead to poor decisions. Figure 15.1 illustrates why.

In Figure 15.1, we have plotted an SML corresponding to a risk-free rate of 7 percent and a market risk premium of 8 percent. To keep things simple, we consider an all-equity company with a beta of 1. As we have indicated, the WACC and the cost of equity are exactly equal to 15 percent for this company because there is no debt.

Suppose our firm uses its WACC to evaluate all investments. This means that any investment with a return of greater than 15 percent will be accepted and any investment with a return of less than 15 percent will be rejected. We know from our study of risk and return, however, that a desirable investment is one that plots above the SML. As Figure 15.1 illustrates, using the WACC for all types of projects can result in the firm's incorrectly accepting relatively risky projects and incorrectly rejecting relatively safe ones.

For example, consider point A. This project has a beta of $\beta_A = .60$, as compared to the firm's beta of 1.0. It has an expected return of 14 percent. Is this a desirable investment? The answer is yes because its required return is only:

$$\text{Required return} = R_f + \beta_A \times (R_M - R_f)$$
$$= 7\% + .60 \times 8\%$$
$$= 11.8\%$$

However, if we use the WACC as a cutoff, then this project will be rejected because its return is less than 15 percent. This example illustrates that a firm that uses its WACC as a cutoff will tend to reject profitable projects with risks less than those of the overall firm.

FIGURE 15.1

The Security Market
Line (SML) and the
Weighted Average Cost
of Capital (WACC)

If a firm uses its WACC to make accept–reject decisions for all types of projects, it will have a tendency toward incorrectly accepting risky projects and incorrectly rejecting less risky projects.
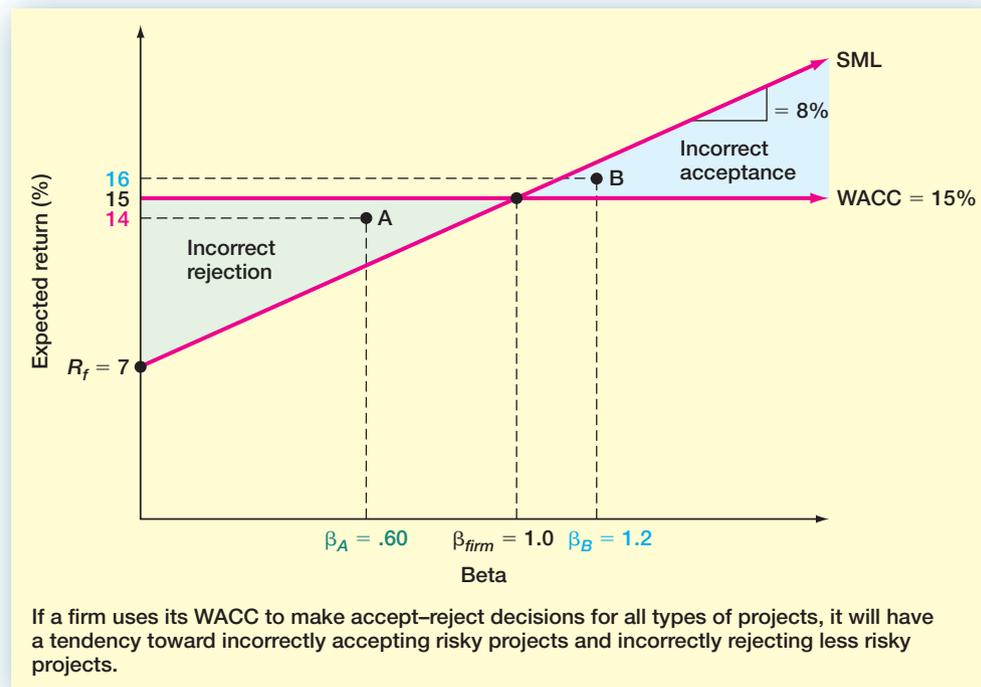
At the other extreme, consider point B. This project has a beta of $\beta_B = 1.2$. It offers a 16 percent return, which exceeds the firm's cost of capital. This is not a good investment, however, because, given its level of systematic risk, its return is inadequate. Nonetheless, if we use the WACC to evaluate it, it will appear to be attractive. So the second error that will arise if we use the WACC as a cutoff is that we will tend to make unprofitable investments with risks greater than those of the overall firm. As a consequence, through time, a firm that uses its WACC to evaluate all projects will have a tendency to both accept unprofitable investments and become increasingly risky.

DIVISIONAL COST OF CAPITAL

The same type of problem with the WACC can arise in a corporation with more than one line of business. Imagine, for example, a corporation that has two divisions: a regulated telephone company and an electronics manufacturing operation. The first of these (the phone operation) has relatively low risk; the second has relatively high risk.

In this case, the firm's overall cost of capital is really a mixture of two different costs of capital, one for each division. If the two divisions were competing for resources, and the firm used a single WACC as a cutoff, which division would tend to be awarded greater funds for investment?

The answer is that the riskier division would tend to have greater returns (ignoring the greater risk), so it would tend to be the "winner." The less glamorous operation might have great profit potential that would end up being ignored. Large corporations in the United States are aware of this problem, and many work to develop separate divisional costs of capital.

THE PURE PLAY APPROACH

We've seen that using the firm's WACC inappropriately can lead to problems. How can we come up with the appropriate discount rates in such circumstances? Because we cannot observe the returns on these investments, there generally is no direct way of coming up

with a beta, for example. Instead, what we must do is examine other investments outside the firm that are in the same risk class as the one we are considering, and use the market-required return on these investments as the discount rate. In other words, we will try to determine what the cost of capital is for such investments by trying to locate some similar investments in the marketplace.

For example, going back to our telephone division, suppose we wanted to come up with a discount rate to use for that division. What we could do is identify several other phone companies that have publicly traded securities. We might find that a typical phone company has a beta of .80, AA-rated debt, and a capital structure that is about 50 percent debt and 50 percent equity. Using this information, we could develop a WACC for a typical phone company and use this as our discount rate.

Alternatively, if we were thinking of entering a new line of business, we would try to develop the appropriate cost of capital by looking at the market-required returns on companies already in that business. In the language of Wall Street, a company that focuses on a single line of business is called a *pure play*. For example, if you wanted to bet on the price of crude oil by purchasing common stocks, you would try to identify companies that dealt exclusively with this product because they would be the most affected by changes in the price of crude oil. Such companies would be called "pure plays on the price of crude oil."

What we try to do here is to find companies that focus as exclusively as possible on the type of project in which we are interested. Our approach, therefore, is called the **pure play approach** to estimating the required return on an investment. To illustrate, suppose McDonald's decides to enter the personal computer and network server business with a line of machines called McPuters. The risks involved are quite different from those in the fast-food business. As a result, McDonald's would need to look at companies already in the personal computer business to compute a cost of capital for the new division. Two obvious pure play candidates would be Dell and Gateway, which are predominantly in this line of business. IBM, on the other hand, would not be as good a choice because its primary focus is elsewhere, and it has many different product lines.

pure play approach
The use of a WACC that is unique to a particular project, based on companies in similar lines of business.

In Chapter 3, we discussed the subject of identifying similar companies for comparison purposes. The same problems we described there come up here. The most obvious one is that we may not be able to find any suitable companies. In this case, how to objectively determine a discount rate becomes a difficult question. Even so, the important thing is to be aware of the issue so that we at least reduce the possibility of the kinds of mistakes that can arise when the WACC is used as a cutoff on all investments.

THE SUBJECTIVE APPROACH

Because of the difficulties that exist in objectively establishing discount rates for individual projects, firms often adopt an approach that involves making subjective adjustments to the overall WACC. To illustrate, suppose a firm has an overall WACC of 14 percent. It places all proposed projects into four categories as follows:

Category	Examples	Adjustment Factor	Discount Rate
High risk	New products	+6%	20%
Moderate risk	Cost savings, expansion of existing lines	+0	14
Low risk	Replacement of existing equipment	−4	10
Mandatory	Pollution control equipment	n/a	n/a

n/a = Not applicable.

FIGURE 15.2   The Security Market Line (SML) and the Subjective Approach

With the subjective approach, the firm places projects into one of several risk classes. The discount rate used to value the project is then determined by adding (for high risk) or subtracting (for low risk) an adjustment factor to or from the firm's WACC. This results in fewer incorrect decisions than if the firm simply used the WACC to make the decisions.
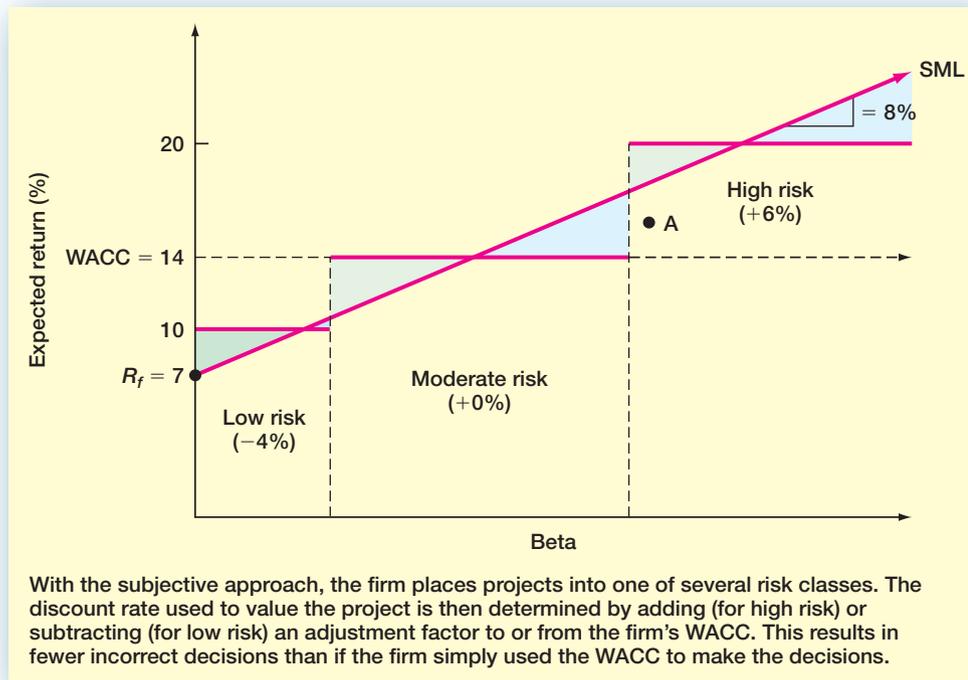
The effect of this crude partitioning is to assume that all projects either fall into one of three risk classes or else are mandatory. In the last case, the cost of capital is irrelevant because the project must be taken. With the subjective approach, the firm's WACC may change through time as economic conditions change. As this happens, the discount rates for the different types of projects will also change.

Within each risk class, some projects will presumably have more risk than others, and the danger of making incorrect decisions still exists. Figure 15.2 illustrates this point. Comparing Figures 15.1 and 15.2, we see that similar problems exist; but the magnitude of the potential error is less with the subjective approach. For example, the project labeled A would be accepted if the WACC were used, but it is rejected once it is classified as a high-risk investment. What this illustrates is that some risk adjustment, even if it is subjective, is probably better than no risk adjustment.

It would be better, in principle, to objectively determine the required return for each project separately. However, as a practical matter, it may not be possible to go much beyond subjective adjustments because either the necessary information is unavailable or the cost and effort required are simply not worthwhile.

Concept Questions

15.5a What are the likely consequences if a firm uses its WACC to evaluate all proposed investments?

15.5b What is the pure play approach to determining the appropriate discount rate? When might it be used?

Flotation Costs and the Weighted Average Cost of Capital

15.6

So far, we have not included issue, or flotation, costs in our discussion of the weighted average cost of capital. If a company accepts a new project, it may be required to issue, or float, new bonds and stocks. This means that the firm will incur some costs, which we call *flotation costs*. The nature and magnitude of flotation costs are discussed in some detail in Chapter 16.

Sometimes it is suggested that the firm's WACC should be adjusted upward to reflect flotation costs. This is really not the best approach because, once again, the required return on an investment depends on the risk of the investment, not the source of the funds. This is not to say that flotation costs should be ignored. Because these costs arise as a consequence of the decision to undertake a project, they are relevant cash flows. We therefore briefly discuss how to include them in project analysis.

THE BASIC APPROACH

We start with a simple case. The Spatt Company, an all-equity firm, has a cost of equity of 20 percent. Because this firm is 100 percent equity, its WACC and its cost of equity are the same. Spatt is contemplating a large-scale $100 million expansion of its existing operations. The expansion would be funded by selling new stock.

Based on conversations with its investment banker, Spatt believes its flotation costs will run 10 percent of the amount issued. This means that Spatt's proceeds from the equity sale will be only 90 percent of the amount sold. When flotation costs are considered, what is the cost of the expansion?

As we discuss in more detail in Chapter 16, Spatt needs to sell enough equity to raise $100 million *after* covering the flotation costs. In other words:

$100 million = (1 − .10) × Amount raised

Amount raised = $100 million/.90 = $111.11 million

Spatt's flotation costs are thus $11.11 million, and the true cost of the expansion is $111.11 million once we include flotation costs.

Things are only slightly more complicated if the firm uses both debt and equity. For example, suppose Spatt's target capital structure is 60 percent equity, 40 percent debt. The flotation costs associated with equity are still 10 percent, but the flotation costs for debt are less—say 5 percent.

Earlier, when we had different capital costs for debt and equity, we calculated a weighted average cost of capital using the target capital structure weights. Here we will do much the same thing. We can calculate a weighted average flotation cost, f_A, by multiplying the equity flotation cost, f_E, by the percentage of equity (E/V) and the debt flotation cost, f_D, by the percentage of debt (D/V) and then adding the two together:

$$f_A = (E/V) \times f_E + (D/V) \times f_D \qquad \qquad \text{[15.8]}$$
$$= 60\% \times .10 + 40\% \times .05$$
$$= 8\%$$

The weighted average flotation cost is thus 8 percent. What this tells us is that for every dollar in outside financing needed for new projects, the firm must actually raise $1/(1 − .08) = $1.087. In our example, the project cost is $100 million when we ignore flotation costs. If we include them, then the true cost is $100 million/$(1 − f_A)$ = $100 million/.92 = $108.7 million.

In taking issue costs into account, the firm must be careful not to use the wrong weights. The firm should use the target weights, even if it can finance the entire cost of the project with either debt or equity. The fact that a firm can finance a specific project with debt or equity is not directly relevant. If a firm has a target debt–equity ratio of 1, for example, but chooses to finance a particular project with all debt, it will have to raise additional equity later on to maintain its target debt–equity ratio. To take this into account, the firm should always use the target weights in calculating the flotation cost.

EXAMPLE 15.6	Calculating the Weighted Average Flotation Cost

The Weinstein Corporation has a target capital structure that is 80 percent equity, 20 percent debt. The flotation costs for equity issues are 20 percent of the amount raised; the flotation costs for debt issues are 6 percent. If Weinstein needs $65 million for a new manufacturing facility, what is the true cost once flotation costs are considered?

We first calculate the weighted average flotation cost, f_A:

$$f_A = (E/V) \times f_E + (D/V) \times f_D$$
$$= 80\% \times .20 + 20\% \times .06$$
$$= 17.2\%$$

The weighted average flotation cost is thus 17.2 percent. The project cost is $65 million when we ignore flotation costs. If we include them, then the true cost is $65 million/$(1 − f_A)$ = $65 million/.828 = $78.5 million, again illustrating that flotation costs can be a considerable expense.

FLOTATION COSTS AND NPV

To illustrate how flotation costs can be included in an NPV analysis, suppose the Tripleday Printing Company is currently at its target debt–equity ratio of 100 percent. It is considering building a new $500,000 printing plant in Kansas. This new plant is expected to generate aftertax cash flows of $73,150 per year forever. The tax rate is 34 percent. There are two financing options:

1. A $500,000 new issue of common stock: The issuance costs of the new common stock would be about 10 percent of the amount raised. The required return on the company's new equity is 20 percent.
2. A $500,000 issue of 30-year bonds: The issuance costs of the new debt would be 2 percent of the proceeds. The company can raise new debt at 10 percent.

What is the NPV of the new printing plant?

To begin, because printing is the company's main line of business, we will use the company's weighted average cost of capital to value the new printing plant:

$$\text{WACC} = (E/V) \times R_E + (D/V) \times R_D \times (1 − T_C)$$
$$= .50 \times 20\% + .50 \times 10\% \times (1 − .34)$$
$$= 13.3\%$$

Because the cash flows are $73,150 per year forever, the PV of the cash flows at 13.3 percent per year is:

$$\text{PV} = \frac{\$73,150}{.133} = \$550,000$$

If we ignore flotation costs, the NPV is:

$$\text{NPV} = \$550{,}000 - 500{,}000 = \$50{,}000$$

With no flotation costs, the project generates an NPV that is greater than zero, so it should be accepted.

What about financing arrangements and issue costs? Because new financing must be raised, the flotation costs are relevant. From the information given, we know that the flotation costs are 2 percent for debt and 10 percent for equity. Because Tripleday uses equal amounts of debt and equity, the weighted average flotation cost, f_A, is:

$$f_A = (E/V) \times f_E + (D/V) \times f_D = .50 \times 10\% + .50 \times 2\%$$
$$= 6\%$$

503

Remember, the fact that Tripleday can finance the project with all debt or all equity is irrelevant. Because Tripleday needs $500,000 to fund the new plant, the true cost, once we include flotation costs, is $500,000/$(1 - f_A)$ = $500,000/.94 = $531,915. Because the PV of the cash flows is $550,000, the plant has an NPV of $550,000 − 531,915 = $18,085, so it is still a good investment. However, its value is less than we initially might have thought.

INTERNAL EQUITY AND FLOTATION COSTS

Our discussion of flotation costs to this point implicitly assumes that firms always have to raise the capital needed for new investments. In reality, most firms rarely sell equity at all. Instead, their internally generated cash flow is sufficient to cover the equity portion of their capital spending. Only the debt portion must be raised externally.

The use of internal equity doesn't change our approach. However, we now assign a value of zero to the flotation cost of equity because there is no such cost. In our Tripleday example, the weighted average flotation cost would therefore be:

$$f_A = (E/V) \times f_E + (D/V) \times f_D$$
$$= .50 \times 0\% + .50 \times 2\%$$
$$= 1\%$$

Notice that whether equity is generated internally or externally makes a big difference because external equity has a relatively high flotation cost.

Concept Questions

15.6a What are flotation costs?

15.6b How are flotation costs included in an NPV analysis?

15.7 Summary and Conclusions

This chapter has discussed cost of capital. The most important concept is the weighted average cost of capital, or WACC, which we interpreted as the required rate of return on the overall firm. It is also the discount rate appropriate for cash flows that are similar in risk to those of the overall firm. We described how the WACC can be calculated, and we illustrated how it can be used in certain types of analyses.

We also pointed out situations in which it is inappropriate to use the WACC as the discount rate. To handle such cases, we described some alternative approaches to developing discount rates, such as the pure play approach. We also discussed how the flotation costs associated with raising new capital can be included in an NPV analysis.

CHAPTER REVIEW AND SELF-TEST PROBLEMS

15.1 Calculating the Cost of Equity Suppose stock in Watta Corporation has a beta of .80. The market risk premium is 6 percent, and the risk-free rate is 6 percent. Watta's last dividend was $1.20 per share, and the dividend is expected to grow at 8 percent indefinitely. The stock currently sells for $45 per share. What is Watta's cost of equity capital?

15.2 Calculating the WACC In addition to the information given in the previous problem, suppose Watta has a target debt–equity ratio of 50 percent. Its cost of debt is 9 percent before taxes. If the tax rate is 35 percent, what is the WACC?

15.3 Flotation Costs Suppose in the previous problem Watta is seeking $30 million for a new project. The necessary funds will have to be raised externally. Watta's flotation costs for selling debt and equity are 2 percent and 16 percent, respectively. If flotation costs are considered, what is the true cost of the new project?

ANSWERS TO CHAPTER REVIEW AND SELF-TEST PROBLEMS

15.1 We start off with the SML approach. Based on the information given, the expected return on Watta's common stock is:

$$R_E = R_f + \beta_E \times (R_M - R_f)$$
$$= 6\% + .80 \times 6\%$$
$$= 10.80\%$$

We now use the dividend growth model. The projected dividend is $D_0 \times (1 + g) = \$1.20 \times 1.08 = \$1.296$, so the expected return using this approach is:

$$R_E = D_1/P_0 + g$$
$$= \$1.296/45 + .08$$
$$= 10.88\%$$

Because these two estimates, 10.80 percent and 10.88 percent, are fairly close, we will average them. Watta's cost of equity is approximately 10.84 percent.

15.2 Because the target debt–equity ratio is .50, Watta uses $.50 in debt for every $1 in equity. In other words, Watta's target capital structure is 1/3 debt and 2/3 equity. The WACC is thus:

$$WACC = (E/V) \times R_E + (D/V) \times R_D \times (1 - T_C)$$
$$= 2/3 \times 10.84\% + 1/3 \times 9\% \times (1 - .35)$$
$$= 9.177\%$$

15.3 Because Watta uses both debt and equity to finance its operations, we first need the weighted average flotation cost. As in the previous problem, the percentage of equity financing is 2/3, so the weighted average cost is:

$$f_A = (E/V) \times f_E + (D/V) \times f_D$$
$$= 2/3 \times 16\% + 1/3 \times 2\%$$
$$= 11.33\%$$

If Watta needs $30 million after flotation costs, then the true cost of the project is $30 million$/(1 - f_A) = \$30$ million$/.8867 = \$33.83$ million.

CONCEPTS REVIEW AND CRITICAL THINKING QUESTIONS

1. **WACC** On the most basic level, if a firm's WACC is 12 percent, what does this mean?

2. **Book Values versus Market Values** In calculating the WACC, if you had to use book values for either debt or equity, which would you choose? Why?

3. **Project Risk** If you can borrow all the money you need for a project at 6 percent, doesn't it follow that 6 percent is your cost of capital for the project?

4. **WACC and Taxes** Why do we use an aftertax figure for cost of debt but not for cost of equity?

5. **DCF Cost of Equity Estimation** What are the advantages of using the DCF model for determining the cost of equity capital? What are the disadvantages? What specific piece of information do you need to find the cost of equity using this model? What are some of the ways in which you could get this estimate?

6. **SML Cost of Equity Estimation** What are the advantages of using the SML approach to finding the cost of equity capital? What are the disadvantages? What specific pieces of information are needed to use this method? Are all of these variables observable, or do they need to be estimated? What are some of the ways in which you could get these estimates?

7. **Cost of Debt Estimation** How do you determine the appropriate cost of debt for a company? Does it make a difference if the company's debt is privately placed as opposed to being publicly traded? How would you estimate the cost of debt for a firm whose only debt issues are privately held by institutional investors?

8. **Cost of Capital** Suppose Tom O'Bedlam, president of Bedlam Products, Inc., has hired you to determine the firm's cost of debt and cost of equity capital.

   a. The stock currently sells for $50 per share, and the dividend per share will probably be about $5. Tom argues, "It will cost us $5 per share to use the stockholders' money this year, so the cost of equity is equal to 10 percent ($5/50)." What's wrong with this conclusion?

   b. Based on the most recent financial statements, Bedlam Products' total liabilities are $8 million. Total interest expense for the coming year will be about $1 million. Tom therefore reasons, "We owe $8 million, and we will pay $1 million interest. Therefore, our cost of debt is obviously $1 million/8 million = 12.5%." What's wrong with this conclusion?

   c. Based on his own analysis, Tom is recommending that the company increase its use of equity financing because "debt costs 12.5 percent, but equity costs only 10 percent; thus equity is cheaper." Ignoring all the other issues, what do you think about the conclusion that the cost of equity is less than the cost of debt?

9. **Company Risk versus Project Risk** Both Dow Chemical Company, a large natural gas user, and Superior Oil, a major natural gas producer, are thinking of investing in natural gas wells near Houston. Both companies are all equity financed. Dow and Superior are looking at identical projects. They've analyzed their respective investments, which would involve a negative cash flow now and positive expected cash flows in the future. These cash flows would be the same for both firms. No debt would be used to finance the projects. Both companies estimate that their projects would have a net present value of $1 million at an 18 percent discount rate and a −$1.1 million NPV at a 22 percent discount rate. Dow has a beta of 1.25, whereas Superior has a beta of .75. The expected risk premium on the market is 8 percent, and risk-free bonds are yielding 12 percent. Should either company proceed? Should both? Explain.

10. **Divisional Cost of Capital** Under what circumstances would it be appropriate for a firm to use different costs of capital for its different operating divisions? If the overall firm WACC were used as the hurdle rate for all divisions, would the riskier divisions or the more conservative divisions tend to get most of the investment projects? Why? If you were to try to estimate the appropriate cost of capital for different divisions, what problems might you encounter? What are two techniques you could use to develop a rough estimate for each division's cost of capital?

1. **Calculating Cost of Equity** The Mays Co. just issued a dividend of $2.60 per share on its common stock. The company is expected to maintain a constant 6 percent growth rate in its dividends indefinitely. If the stock sells for $60 a share, what is the company's cost of equity?

2. **Calculating Cost of Equity** The City Street Corporation's common stock has a beta of 1.2. If the risk-free rate is 4.5 percent and the expected return on the market is 13 percent, what is the company's cost of equity capital?

3. **Calculating Cost of Equity** Stock in Country Road Industries has a beta of 1.25. The market risk premium is 7 percent, and T-bills are currently yielding 5 percent. Country Road's most recent dividend was $2.10 per share, and dividends are expected to grow at a 5 percent annual rate indefinitely. If the stock sells for $34 per share, what is your best estimate of the company's cost of equity?

4. **Estimating the DCF Growth Rate** Suppose In a Snap Ltd. just issued a dividend of $1.25 per share on its common stock. The company paid dividends of $.85, $.90, $1.04, and $1.10 per share in the last four years. If the stock currently sells for $45, what is your best estimate of the company's cost of equity capital using the arithmetic average growth rate in dividends? What if you use the geometric average growth rate?

5. **Calculating Cost of Preferred Stock** Holdup Bank has an issue of preferred stock with a $5 stated dividend that just sold for $87 per share. What is the bank's cost of preferred stock?

6. **Calculating Cost of Debt** Decline, Inc., is trying to determine its cost of debt. The firm has a debt issue outstanding with 12 years to maturity that is quoted at 94 percent of face value. The issue makes semiannual payments and has an embedded cost of 7 percent annually. What is the company's pretax cost of debt? If the tax rate is 35 percent, what is the aftertax cost of debt?

7. **Calculating Cost of Debt** Jiminy's Cricket Farm issued a 30-year, 9 percent semi-annual bond 7 years ago. The bond currently sells for 108 percent of its face value. The company's tax rate is 35 percent.
   a. What is the pretax cost of debt?
   b. What is the aftertax cost of debt?
   c. Which is more relevant, the pretax or the aftertax cost of debt? Why?

8. **Calculating Cost of Debt** For the firm in Problem 7, suppose the book value of the debt issue is $70 million. In addition, the company has a second debt issue on the market, a zero coupon bond with seven years left to maturity; the book value of this issue is $50 million, and the bonds sell for 61 percent of par. What is the company's total book value of debt? The total market value? What is your best estimate of the aftertax cost of debt now?

9. **Calculating WACC** Mullineaux Corporation has a target capital structure of 50 percent common stock, 5 percent preferred stock, and 45 percent debt. Its cost of equity is 15 percent, the cost of preferred stock is 6 percent, and the cost of debt is 8 percent. The relevant tax rate is 35 percent.
   a. What is Mullineaux's WACC?
   b. The company president has approached you about Mullineaux's capital structure. He wants to know why the company doesn't use more preferred stock financing because it costs less than debt. What would you tell the president?

10. **Taxes and WACC** Cookie Dough Manufacturing has a target debt–equity ratio of .80. Its cost of equity is 17 percent, and its cost of debt is 10 percent. If the tax rate is 35 percent, what is the company's WACC?

11. **Finding the Target Capital Structure** Fama's Llamas has a weighted average cost of capital of 10.2 percent. The company's cost of equity is 14 percent, and its pretax cost of debt is 8.4 percent. The tax rate is 35 percent. What is the company's target debt–equity ratio?

12. **Book Value versus Market Value** Filer Manufacturing has 12 million shares of common stock outstanding. The current share price is $64, and the book value per share is $9. Filer Manufacturing also has two bond issues outstanding. The first bond issue has a face value of $90 million, has a 7.5 percent coupon, and sells for 93 percent of par. The second issue has a face value of $85 million, has a 7 percent coupon, and sells for 96.5 percent of par. The first issue matures in 10 years, the second in 6 years.

   a. What are Filer's capital structure weights on a book value basis?
   b. What are Filer's capital structure weights on a market value basis?
   c. Which are more relevant, the book or market value weights? Why?

13. **Calculating the WACC** In Problem 12, suppose the most recent dividend was $4.10 and the dividend growth rate is 6 percent. Assume that the overall cost of debt is the weighted average of that implied by the two outstanding debt issues. Both bonds make semiannual payments. The tax rate is 35 percent. What is the company's WACC?

14. **WACC** Jungle, Inc., has a target debt–equity ratio of .70. Its WACC is 10.5 percent, and the tax rate is 35 percent.

   a. If Jungle's cost of equity is 15 percent, what is its pretax cost of debt?
   b. If instead you know that the aftertax cost of debt is 5.9 percent, what is the cost of equity?

15. **Finding the WACC** Given the following information for Bellevue Power Co., find the WACC. Assume the company's tax rate is 35 percent.

   Debt: 5,000 7 percent coupon bonds outstanding, $1,000 par value, 20 years to maturity, selling for 92 percent of par; the bonds make semiannual payments.

   Common stock: 100,000 shares outstanding, selling for $57 per share; the beta is 1.15.

   Preferred stock: 13,000 shares of 7 percent preferred stock outstanding, currently selling for $104 per share.

   Market: 8 percent market risk premium and 6 percent risk-free rate.

16. **Finding the WACC** Titan Mining Corporation has 8.5 million shares of common stock outstanding, 200,000 shares of 7 percent preferred stock outstanding, and 85,000 8.5 percent semiannual bonds outstanding, par value $1,000 each. The common stock currently sells for $34 per share and has a beta of 1.20, the preferred stock currently sells for $83 per share, and the bonds have 15 years to maturity and sell for 93 percent of par. The market risk premium is 9 percent, T-bills are yielding 5 percent, and Titan Mining's tax rate is 35 percent.

   a. What is the firm's market value capital structure?
   b. If Titan Mining is evaluating a new investment project that has the same risk as the firm's typical project, what rate should the firm use to discount the project's cash flows?

17. **SML and WACC** An all-equity firm is considering the following projects:

Project	Beta	Expected Return
W	.75	11%
X	.90	13
Y	1.15	14
Z	1.60	16

The T-bill rate is 5 percent, and the expected return on the market is 12 percent.

a. Which projects have a higher expected return than the firm's 12 percent cost of capital?

b. Which projects should be accepted?

c. Which projects would be incorrectly accepted or rejected if the firm's overall cost of capital were used as a hurdle rate?

18. **Calculating Flotation Costs** Suppose your company needs $15 million to build a new assembly line. Your target debt–equity ratio is .90. The flotation cost for new equity is 8 percent, but the flotation cost for debt is only 5 percent. Your boss has decided to fund the project by borrowing money because the flotation costs are lower and the needed funds are relatively small.

a. What do you think about the rationale behind borrowing the entire amount?

b. What is your company's weighted average flotation cost, assuming all equity is raised externally?

c. What is the true cost of building the new assembly line after taking flotation costs into account? Does it matter in this case that the entire amount is being raised from debt?

19. **Calculating Flotation Costs** Southern Alliance Company needs to raise $30 million to start a new project and will raise the money by selling new bonds. The company will generate no internal equity for the foreseeable future. The company has a target capital structure of 60 percent common stock, 10 percent preferred stock, and 30 percent debt. Flotation costs for issuing new common stock are 10 percent, for new preferred stock, 7 percent, and for new debt, 4 percent. What is the true initial cost figure Southern should use when evaluating its project?

20. **WACC and NPV** Stranger, Inc., is considering a project that will result in initial aftertax cash savings of $3.5 million at the end of the first year, and these savings will grow at a rate of 5 percent per year indefinitely. The firm has a target debt–equity ratio of .70, a cost of equity of 13 percent, and an aftertax cost of debt of 5.5 percent. The cost-saving proposal is somewhat riskier than the usual project the firm undertakes; management uses the subjective approach and applies an adjustment factor of +2 percent to the cost of capital for such risky projects. Under what circumstances should the company take on the project?

INTERMEDIATE
(Questions 20–23)

21. **Flotation Costs** Goodbye, Inc., recently issued new securities to finance a new TV show. The project cost $10.5 million, and the company paid $750,000 in flotation costs. In addition, the equity issued had a flotation cost of 8 percent of the amount raised, whereas the debt issued had a flotation cost of 3 percent of the amount raised. If Goodbye issued new securities in the same proportion as its target capital structure, what is the company's target debt–equity ratio?

22. **Calculating the Cost of Debt** Ying Import has several bond issues outstanding, each making semiannual interest payments. The bonds are listed in the following table. If the corporate tax rate is 34 percent, what is the aftertax cost of Ying's debt?

Bond	Coupon Rate	Price Quote	Maturity	Face Value
1	6.00%	102	5 years	$20,000,000
2	7.60	110	8 years	40,000,000
3	7.20	99	15½ years	45,000,000
4	8.90	112	25 years	60,000,000

23. **Calculating the Cost of Equity** Floyd Industries stock has a beta of 1.15. The company just paid a dividend of $.60, and the dividends are expected to grow at 5 percent. The expected return of the market is 11.5 percent, and Treasury bills are yielding 5.5 percent. The most recent stock price for Floyd is $54.

a. Calculate the cost of equity using the DCF method.
b. Calculate the cost of equity using the SML method.
c. Why do you think your estimates in (a) and (b) are so different?

CHALLENGE
(Questions 24–26)

24. **Flotation Costs and NPV** Photochronograph Corporation (PC) manufactures time series photographic equipment. It is currently at its target debt–equity ratio of 0.8. It's considering building a new $75 million manufacturing facility. This new plant is expected to generate aftertax cash flows of $10.9 million in perpetuity. The company raises all equity from outside financing. There are three financing options:

1. *A new issue of common stock:* The flotation costs of the new common stock would be 8 percent of the amount raised. The required return on the company's new equity is 17 percent.
2. *A new issue of 20-year bonds:* The flotation costs of the new bonds would be 4 percent of the proceeds. If the company issues these new bonds at an annual coupon rate of 9 percent, they will sell at par.
3. *Increased use of accounts payable financing:* Because this financing is part of the company's ongoing daily business, it has no flotation costs, and the company assigns it a cost that is the same as the overall firm WACC. Management has a target ratio of accounts payable to long-term debt of .20. (Assume there is no difference between the pretax and aftertax accounts payable cost.)

What is the NPV of the new plant? Assume that PC has a 35 percent tax rate.

25. **Flotation Costs** Trower Corp. has a debt–equity ratio of 0.75. The company is considering a new plant that will cost $125 million to build. When the company issues new equity, it incurs a flotation cost of 8 percent. The flotation cost on new debt is 3.5 percent. What is the initial cost of the plant if the company raises all equity externally? What if it typically uses 60 percent retained earnings? What if all equity investment is financed through retained earnings?

26. **Project Evaluation** This is a comprehensive project evaluation problem bringing together much of what you have learned in this and previous chapters. Suppose you have been hired as a financial consultant to Defense Electronics, Inc. (DEI), a large, publicly traded firm that is the market share leader in radar detection systems (RDSs). The company is looking at setting up a manufacturing plant overseas to produce a new line of RDSs. This will be a five-year project. The company bought some land three years ago for $8 million in anticipation of using it as a toxic dump site for waste chemicals, but it built a piping system to safely discard the chemicals instead. The land was appraised last week for $10.2 million. The company wants to build its new manufacturing plant on this land; the plant will cost $30 million to build. The following market data on DEI's securities are current:

Debt:	25,000 7 percent coupon bonds outstanding, 15 years to maturity, selling for 92 percent of par; the bonds have a $1,000 par value each and make semiannual payments.
Common stock:	450,000 shares outstanding, selling for $75 per share; the beta is 1.3.
Preferred stock:	30,000 shares of 5 percent preferred stock outstanding, selling for $72 per share.
Market:	8 percent expected market risk premium; 5 percent risk-free rate.

DEI uses G.M. Wharton as its lead underwriter. Wharton charges DEI spreads of 9 percent on new common stock issues, 7 percent on new preferred stock issues, and 4 percent on new debt issues. Wharton has included all direct and indirect issuance costs (along with its profit) in setting these spreads. Wharton has recommended to DEI that it raise the funds needed to build the plant by issuing new shares of common stock. DEI's tax rate is 35 percent. The project requires $900,000 in initial net working capital investment to get operational. Assume Wharton raises all equity for new projects externally.

a. Calculate the project's initial time 0 cash flow, taking into account all side effects.

b. The new RDS project is somewhat riskier than a typical project for DEI, primarily because the plant is being located overseas. Management has told you to use an adjustment factor of +2 percent to account for this increased riskiness. Calculate the appropriate discount rate to use when evaluating DEI's project.

c. The manufacturing plant has an eight-year tax life, and DEI uses straight-line depreciation. At the end of the project (that is, the end of year 5), the plant can be scrapped for $5 million. What is the aftertax salvage value of this manufacturing plant?

d. The company will incur $400,000 in annual fixed costs. The plan is to manufacture 17,000 RDSs per year and sell them at $10,000 per machine; the variable production costs are $9,000 per RDS. What is the annual operating cash flow (OCF) from this project?

e. DEI's comptroller is primarily interested in the impact of DEI's investments on the bottom line of reported accounting statements. What will you tell her is the accounting break-even quantity of RDSs sold for this project?

f. Finally, DEI's president wants you to throw all your calculations, assumptions, and everything else into the report for the chief financial officer; all he wants to know is what the RDS project's internal rate of return (IRR) and net present value (NPV) are. What will you report?

MINICASE

Cost of Capital for Hubbard Computer, Inc.

You have recently been hired by Hubbard Computer, Inc. (HCI), in its relatively new treasury management department. HCI was founded eight years ago by Bob Hubbard and currently operates 74 stores in the Southeast. The company is privately owned by Bob and his family, and it had sales of $97 million last year.

HCI primarily sells to customers who shop in the stores. Customers come to the store and talk with a sales representative. The sales representative assists the customer in determining the type of computer and peripherals that are necessary for the individual customer's computing needs. After the order is taken, the customer pays for the order immediately, and the

computer is made to fill the order. Delivery of the computer averages 15 days, and it is guaranteed in 30 days.

HCI's growth to date has come from its profits. When the company had sufficient capital, it would open a new store. Other than scouting locations, relatively little formal analysis has been used in its capital budgeting process. Bob has just read about capital budgeting techniques and has come to you for help. For starters, the company has never attempted to determine its cost of capital, and Bob would like you to perform the analysis. Because the company is privately owned, it is difficult to determine the cost of equity for the company. Bob wants you to use the pure play approach to estimate the cost of capital for HCI, and he has chosen Dell as a representative company. The following steps will allow you to calculate this estimate:

1. Most publicly traded corporations are required to submit quarterly (10Q) and annual reports (10K) to the SEC detailing the financial operations of the company over the past quarter or year, respectively. These corporate filings are available on the SEC Web site at www.sec.gov. Go to the SEC Web site; follow the "Search for Company Filings" link and the "Companies & Other Files" link; enter "Dell Computer"; and search for SEC filings made by Dell. Find the most recent 10Q or 10K, and download the form. Look on the balance sheet to find the book value of debt and the book value of equity. If you look further down the report, you should find a section titled "Long-term Debt and Interest Rate Risk Management" that will provide a breakdown of Dell's long-term debt.

2. To estimate the cost of equity for Dell, go to finance. yahoo.com and enter the ticker symbol DELL. Follow the links to answer the following questions: What is the most recent stock price listed for Dell? What is the market value of equity, or market capitalization? How many shares of stock does Dell have outstanding? What is the most recent annual dividend? Can you use the dividend discount model in this case? What is the beta for Dell? Now go back to finance.yahoo. com and follow the "Bonds" link. What is the yield on three-month Treasury bills? Using the historical market risk premium, what is the cost of equity for Dell using CAPM?

3. You now need to calculate the cost of debt for Dell. Go to www.nasdbondinfo.com, enter Dell as the company, and find the yield to maturity for each of Dell's bonds. What is the weighted average cost of debt for Dell using the book value weights and using the market value weights? Does it make a difference in this case if you use book value weights or market value weights?

4. You now have all the necessary information to calculate the weighted average cost of capital for Dell. Calculate this using book value weights and market value weights, assuming Dell has a 35 percent marginal tax rate. Which number is more relevant?

5. You used Dell as a pure play company to estimate the cost of capital for HCI. Are there any potential problems with this approach in this situation?