Fundamentals of Corporate Finance, 2/e

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Chapter 13: The Cost of Capital

Learning Objectives

1. EXPLAIN WHAT THE WEIGHTED AVERAGE COST OF CAPITAL FOR A FIRM IS AND WHY IT IS OFTEN USED AS A DISCOUNT RATE TO EVALUATE PROJECTS.
2. CALCULATE THE COST OF DEBT FOR A FIRM.
3. CALCULATE THE COST OF COMMON STOCK AND THE COST OF PREFERRED STOCK FOR A FIRM.

Learning Objectives

4. CALCULATE THE WEIGHTED AVERAGE COST OF CAPITAL FOR A FIRM, EXPLAIN THE LIMITATIONS OF USING A FIRM'S WEIGHTED AVERAGE COST OF CAPITAL AS THE DISCOUNT RATE WHEN EVALUATING A PROJECT, AND DISCUSS THE ALTERNATIVES TO THE FIRM'S WEIGHTED AVERAGE COST OF CAPITAL THAT ARE AVAILABLE.

The Firm's Overall Cost Of Capital

- Since unique risk can be eliminated by holding a diversified portfolio, systematic risk is the only risk that investors require compensation for bearing.
- We concluded in Chapter 7 that we could rely on the CAPM to arrive at the expected rate of return for a particular investment.
- In this chapter, we address the practical concerns that can make that concept difficult to implement.

The Firm's Overall Cost Of Capital

- Firms do not issue publicly traded shares for individual projects.
- As a result, firms have no way to directly estimate the discount rate that reflects the risk of the incremental cash flows from a particular project.

The Firm's Overall Cost Of Capital

- Financial managers deal with this problem by estimating the cost of capital for the firm as a whole and then requiring analysts within the firm to use this cost of capital to discount the cash flows for all projects.
- A problem with this approach is that it ignores the fact that a firm is really a collection of projects with varying levels of risk.

The Firm's Overall Cost Of Capital

- THE FINANCE BALANCE SHEET
  - **Is based on market values, rather than book values.**
  - **Total book value of assets reported on a balance sheet does not necessarily reflect total market value of those assets since book values are largely based on historical costs, while total market value of the assets equals the present value of total cash flows that those assets are expected to generate in future.**

The Firm's Overall Cost Of Capital

- THE FINANCE BALANCE SHEET
  - **Left-hand side of the accounting balance sheet reports the book values of a firm's assets, while the right-hand side reports how those assets were financed.**
  - **Values of the claims that investors hold must equal the value of the cash flows that they have a right to receive.**

The Firm's Overall Cost Of Capital

- THE FINANCE BALANCE SHEET
  - **Total market value of the debt and the equity of a firm equals the present value of the cash flows that the debt holders and the stockholders have the right to receive.**
  - **People who have lent money to a firm and the people who have purchased the firm's stock have the right to receive all of the cash flows that the firm is expected to generate in the future.**

The Firm's Overall Cost Of Capital

- THE FINANCE BALANCE SHEET
  - **MV of assets = MV of liabilities + MV of equity (13.1)**

Exhibit 13.1: The Finance Balance Sheet

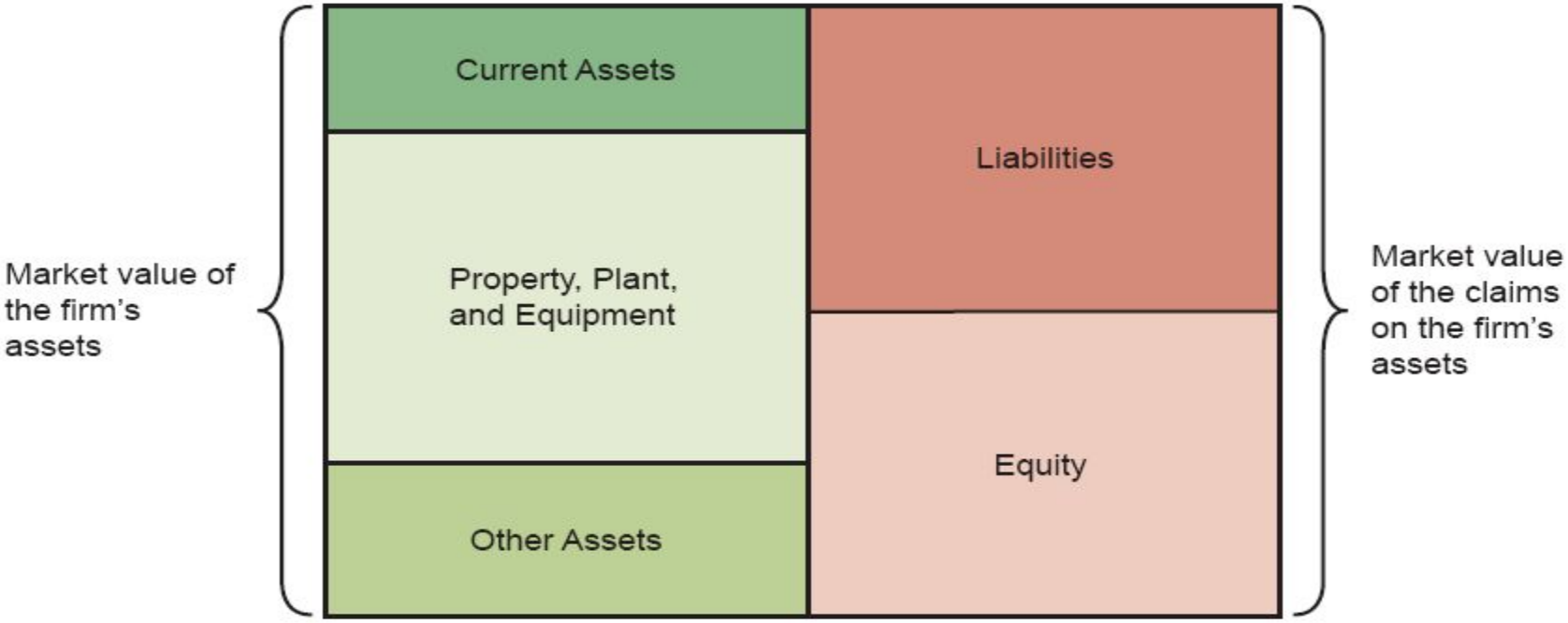


EXHIBIT 13.1
The Finance Balance Sheet

The market value of a firm's assets, which equals the present value of the cash flows those assets are expected to generate in the future, must equal the market value of the claims on those cash flows—the firm's liabilities and equity.

The Firm's Overall Cost Of Capital

- HOW FIRMS ESTIMATE THEIR COST OF CAPITAL
  - **If analysts at a firm could estimate the betas for each of the firm's individual projects, they could estimate the beta for the entire firm as a weighted average of the betas for the individual projects.**
  - **Analysts are not typically able to estimate betas for individual projects, they generally may not be able to use this approach.**

The Firm's Overall Cost Of Capital

- HOW FIRMS ESTIMATE THEIR COST OF CAPITAL
  - **Analysts must use their knowledge of the finance balance sheet, along with the concept of market efficiency, to estimate the cost of capital for the firm.**
  - **Rather than performing calculations for the individual projects represented on the left-hand side of the finance balance sheet, analysts perform a similar set of calculations for the different types of financing (debt and equity) on the right-hand side of the finance balance sheet.**

The Firm's Overall Cost Of Capital

- HOW FIRMS ESTIMATE THEIR COST OF CAPITAL
  - **As long as they can estimate the cost of each type of financing by observing that cost in the capital markets, they can compute the cost of capital for the firm by using the following equation:**

$$k_{Firm} = \sum_{i=1}^{n} x_i k_i = x_1 k_1 + x_2 k_2 + \ldots + x_n k_n \quad (13.2)$$

The Firm's Overall Cost Of Capital

- HOW FIRMS ESTIMATE THEIR COST OF CAPITAL
  - **If we divide the costs of capital into debt and equity portions of the firm, then we can use the above to arrive at the weighted average cost of capital (WACC) for the firm:**

$$k_{Firm} = x_{Debt}k_{Debt} + x_{Equity}k_{Equity}$$

The Firm's Overall Cost Of Capital

- WEIGHTED AVERAGE COST OF CAPITAL EXAMPLE
  - **The total value of a firm is $4,000,000 and it has $300,000 debt. The cost of debt is 6 percent and the cost of equity is 10 percent. What is the weighted average cost of capital of this firm?**

x_{Debt} = $300,000 / $4,000,000 = 0.075, or 7.5%

x_{Equity} = $3,700,000 / $4,000,000 = 0.925, or 92.5%

k_{Firm} = (0.075)(0.06) + (0.925)(0.10) = 0.097,or 9.7%

The Cost of Debt

- Analysts often cannot directly observe the rate of return that investors require for a particular type of financing and instead must rely on observed security prices to estimate the required rate.
- It makes sense to rely on security prices only if one believes that the financial markets are reasonably efficient.

The Cost of Debt

- If the markets were not efficient, estimates of expected returns that were based on market security prices would be unreliable.

The Cost of Debt

- KEY CONCEPTS FOR ESTIMATING THE COST OF DEBT
  - **With regard to the cost associated with each type of debt that a firm uses when we estimate the cost of capital for a firm, we are particularly interested in the cost of the firm's long-term debt.**
  - **Long-term debt refers to debt borrowing set to mature in more than one year.**

The Cost of Debt

- KEY CONCEPTS FOR ESTIMATING THE COST OF DEBT
  - **Debt with a maturity of more than one year can typically be viewed as permanent debt because firms often borrow the money to pay off this debt when it matures.**
  - **The cost of a firm's long-term debt is estimated on the date on which the analysis is done.**

The Cost of Debt

- KEY CONCEPTS FOR ESTIMATING THE COST OF DEBT
  - **Interest rate (or historical interest rate determined when the debt was issued) that the firm is paying on its outstanding debt does not necessarily reflect its current cost of debt.**
  - **Current cost of long-term debt is the appropriate cost of debt for WACC calculations.**
  - **WACC is the opportunity cost of capital for the firm's investors as of today.**

The Cost of Debt

- ESTIMATING THE CURRENT COST OF A BOND OR AN OUTSTANDING LOAN
  - **Current cost of debt for a publicly traded bond is derived from its yield to maturity calculation.**

    To do this, we first convert the bond data to reflect semiannual compounding as well as account for the effective annual interest rate (EAR) to account for the actual current annual cost of the debt.

    We must also account for the cost of issuing the bond–issuance costs using the net proceeds that the company receives from the bond rather than the price that is paid by the investor.

The Cost of Debt

- ESTIMATING THE CURRENT COST OF A BOND OR AN OUTSTANDING LOAN
  - **For the current cost of long-term bank or other private debt, the firm may simply call its banker and ask what rate the bank would charge if they decided to refinance the debt today.**

The Cost of Debt

- TAXES AND THE COST OF DEBT
  - **After-tax cost of interest payments equals the pretax cost times 1 minus the tax rate:**

$$k_{Debt}\ \text{after-tax} = k_{Debt}\ \text{pretax} \times (1 - t) \qquad (13.3)$$

The Cost of Debt

- AFTER-TAX COST OF DEBT EXAMPLE
  - **The before-tax cost of debt for a firm is 6 percent and the marginal tax rate is 20 percent. What is the after-tax cost of debt for the firm?**

$$k_{\text{Debt after-tax}} = 0.06 \times (1-0.2) = 0.048, \text{ or } 4.8\%$$

The Cost of Debt

- ESTIMATING THE COST OF DEBT FOR A FIRM
  - **To estimate the firm's overall cost of debt when it has several debt issues outstanding, we must first estimate the costs of the individual debt issues then calculate a weighted average of these costs.**

The Cost of Equity

- The cost of equity for a firm is a weighted average of the costs of the different types of stock that the firm has outstanding at a particular point in time.

The Cost of Equity

- COMMON STOCK
  - **Just as information about market rates of return is used to estimate the cost of debt, market information is also used to estimate the cost of equity.**
  - **There are several ways to do this and the most appropriate will depend on what information is available and how reliable the analyst believes it is.**

The Cost of Equity

- COMMON STOCK
  - **Text discusses three alternative methods for estimating the cost of common stock.**

    Method 1: Using the Capital Asset Pricing Model (CAPM)

    Method 2: Using the Constant-Growth Dividend Model

    Method 3: Using a Multistage-Growth Dividend Model

The Cost of Equity

- COMMON STOCK
  - **The Capital Asset Pricing Model (CAPM)**

    The first method for estimating the cost of common equity is the CAPM method:

$$E(R_i) = R_{rf} + \beta_i[E(R_m) - R_{rf}]$$

In this equation $E(R_i)$ is the cost of common stock capital (k_{cs}) when we are calculating the cost of equity and $E(R_i)$ is the market risk premium.

$$k_{cs} = R_{rf} + (\beta_{cs} \times \text{Market risk premium})$$

The Cost of Equity

- COMMON STOCK
  - **The Capital Asset Pricing Model (CAPM)**

    There are some practical considerations that must be considered when choosing the appropriate risk-free rate, beta, and market-risk premium for the above calculation.

    The recommended risk-free rate to use is the risk-free rate on a long-term Treasury security because the equity claim is a long-term claim on the firm's cash flows.

The Cost of Equity

- COMMON STOCK
  - **The Capital Asset Pricing Model (CAPM)**

    A long-term risk-free rate better reflects long-term inflation expectations and the cost of getting investors to part with their money for a long period of time than a short-term rate.

    One can estimate the Beta for that stock using a regression analysis.

    Identifying the appropriate beta is much more complicated if the common stock is not publicly traded.

The Cost of Equity

- COMMON STOCK
  - **The Capital Asset Pricing Model (CAPM)**

    This problem may be overcome by identifying a "comparable" company with publicly traded stock that is in the same business and that has a similar amount of debt.

    When a good comparable company cannot be identified, it is sometimes possible to use an average of the betas for the public firms in the same industry.

The Cost of Equity

- COMMON STOCK
  - **The Capital Asset Pricing Model (CAPM)**

    It is not possible to directly observe the market risk premium since we don't know what rate of return investors expect for the market portfolio.

    For this reason, financial analysts generally use a measure of the average risk premium investors have actually earned in the past as an indication of the risk premium they might require today.

The Cost of Equity

- COMMON STOCK
  - **The Capital Asset Pricing Model (CAPM)**

    From 1926 through the end of 2009, actual returns on the U.S. stock market exceeded actual returns on long-term U.S. government bonds by an average of 6.01 percent per year.

    If a financial analyst believes that the market-risk premium in the past is a reasonable estimate of the risk premium today, then he or she might use 6.01 percent (or a value close to it) as the market risk premium for the future.

The Cost of Equity

- COMMON STOCK
  - **The Constant-Growth Dividend Model**

    In the second method to estimate the cost of equity we use the constant growth valuation model we discussed in Chapter 9:

$$P_0 = \frac{D_1}{R - g}$$

We can rearrange this equation to solve for R; or as we now call it k_{cs} .

$$k_{cs} = \frac{D_1}{P_0} + g \qquad (13.5)$$

The Cost of Equity

- COMMON STOCK
  - **The Constant-Growth Dividend Model**

    In order to solve for the cost of common stock, we must estimate the dividend that stockholders will receive next period, D_1, as well as the rate at which the market expects dividends to grow over the long run, "g".

    This approach is useful for a firm that pays dividends that will grow at a constant rate.

    This approach might be consistent for an electric utility but not for a fast growing high-tech firm.

The Cost of Equity

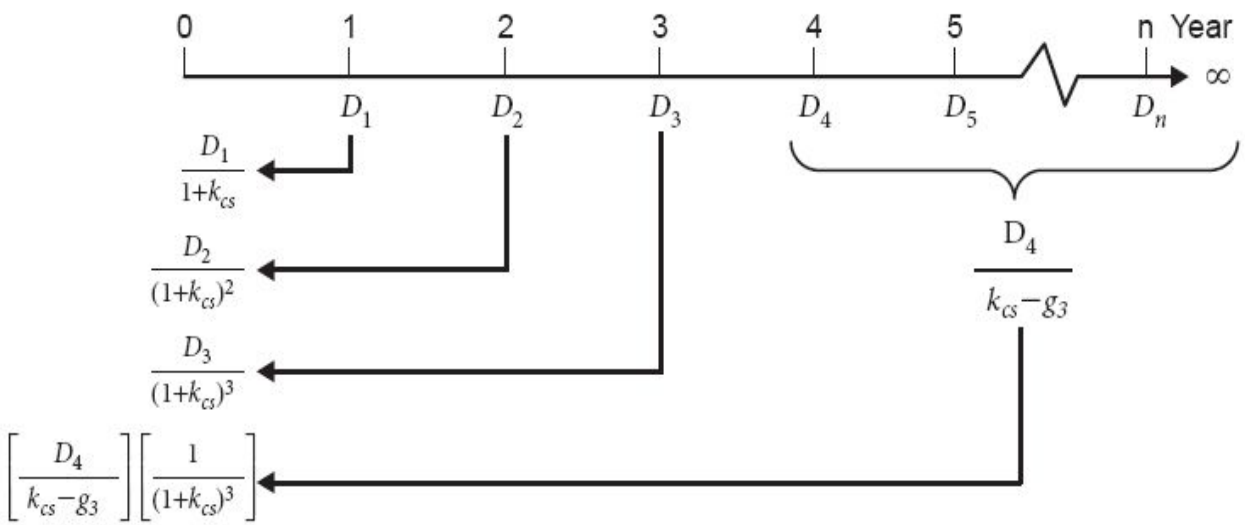
- COMMON STOCK
  - **Multistage-Growth Dividend Model**

    The third approach is based upon the supernormal-growth dividend model discussed in Chapter 9.

    The complexity of this approach lies in choosing the correct number of stages of forecasted growth as well as how long each stage will last.

    Because of the algebraic complexity in solving for the required rate of return, the value is generally solved for using a trial and error method, after forecasting the different stages of dividend growth.

Exhibit 13.2: The Three-Stage Dividend Growth Equation



$$P_0 = \frac{D_1}{1+k_{cs}} + \frac{D_2}{(1+k_{cs})^2} + \frac{D_3}{(1+k_{cs})^3} + \left[\frac{D_4}{k_{cs}-g_3}\right]\left[\frac{1}{(1+k_{cs})^3}\right]$$

EXHIBIT 13.2
The Three-Stage Dividend Growth Equation

In the three-stage dividend growth model shown here, the price of a share of stock is equal to the present value of dividends expected to be received at the end of years 1, 2, and 3, plus the present value of a growing perpetuity that begins in year 4 and whose dividends are assumed to grow at a constant rate g_3 forever.

Using Excel - Multistage-Growth Dividend Model

USING EXCEL

SOLVING FOR k_{CS} USING A MULTISTAGE-GROWTH DIVIDEND MODEL

Because trial and error calculations can be somewhat tedious when you perform them by hand, you may find it helpful to use a spreadsheet program. If you would like to use a spreadsheet program to solve the preceding problem yourself, the output from the spreadsheet below shows you how to do it using trial and error.

Once you input the indicated numbers and formulas into cells B3 through B14, you can then vary the number in cell B2 until the number in cell B8 equals $24. Once you have built the model, you can also use the "goal seek" or "solver" functions in Excel to avoid having to manually solve the problem by trial and error. See the "Help" feature in Excel for information on how to use these functions.

<>	A	B	C	D
1				Comment
2	k_{cs} =	0.12205		Change this number until the P_0 equals $24.00
3	g_1 =	0.15		Growth rate in year 1
4	g_2 =	0.10		Growth rate in year 2
5	g_3 =	0.07		Growth rate in year 3
6	g_4 =	0.05		Growth rate for perpetuity
7				
8	P_0 =	$24.00		Formula: =NPV(B2,B11:B14) - This formula calculates the present value of the
9				future dividends in cells B11 to B14 using the discount rate in cell B2.
10	Year			
11	1	$1.500		D_1
12	2	$1.725		D_2 = B11*(1+B3)
13	3	$1.898		D_3 = B12*(1+B4)
14	4	$31.619		D_4 = [B13*(1+B5)] + [B13*(1+B5)*(1+B6)]/(B2-B6) - This formula calculates the
15				value of D_4 plus the present value of all the cash flows after year 4 in year 4 dollars.
16				

The Cost of Equity

- COMMON STOCK
  - **Which Method Should We Use?**

    In practice, most people use the CAPM (Method 1) to estimate the cost of equity if the result is going to be used in the discount rate for evaluating a project.

The Cost of Equity

- PREFERRED STOCK
  - The characteristics of preferred stock allow us to use the perpetuity model, Equation 6.3 in chapter 6, to estimate the cost of preferred equity.
  - Just as with common stock, we can find the cost of preferred equity by rearranging the pricing equation for preferred shares:

$$k_{ps} = \frac{D_{ps}}{P_{ps}} \qquad (13.6)$$

The Cost of Equity

- COST OF PREFERRED STOCK EXAMPLE
  - **A share of preferred stock has a 5 percent dividend rate, $100 stated value and a price of $85. What is the cost of this preferred stock?**

$$D_{ps} = \$100*0.05 = \$5$$

$$k_{ps} = \frac{D_{ps}}{P_{ps}} = \frac{\$5}{\$85} = 0.059, \text{or} 5.9\%$$

The Cost of Equity

- PREFERRED STOCK
  - **Note that the CAPM can be used to estimate the cost of preferred equity, just as it can be used to estimate the cost of common equity.**

Using the WACC in Practice

- The after-tax version of the formula for the weighted-average cost of capital is:

$$WACC = x_{Debt}k_{Debtpretax}(1-t) + x_{ps}k_{ps} + x_{cs}k_{cs} \quad (13.7)$$

- It should be noted that the financial analyst should use market values rather than book values to calculate WACC.

Using the WACC in Practice

- LIMITATIONS OF WACC AS A DISCOUNT RATE FOR EVALUATING PROJECTS
  - **Financial theory tells us that the rate that should be used to discount these incremental cash flows is the rate that reflects their systematic risk.**
  - **This means that the WACC is going to be the appropriate discount rate for evaluating a project only when the project has cash flows with systematic risks that are exactly the same as those for the firm as a whole.**

Using the WACC in Practice

- LIMITATIONS OF WACC AS A DISCOUNT RATE FOR EVALUATING PROJECTS
  - **When a single rate, such as the WACC, is used to discount cash flows for projects with varying levels of risk, the discount rate will be too low in some cases and too high in others.**
  - **When the discount rate is too low, the firm runs the risk of accepting a negative-NPV project.**
  - **Estimated NPV will be positive even though the true NPV is negative.**

Using the WACC in Practice

- LIMITATIONS OF WACC AS A DISCOUNT RATE FOR EVALUATING PROJECTS
  - **When the discount rate is too high, the firm runs the risk of rejecting a positive-NPV project.**
  - **Estimated NPV will be negative even though the true NPV is positive.**
  - **The key point is that it is only really correct to use a firm's WACC to discount the cash flows for a project if the following conditions hold.**

Using the WACC in Practice

- LIMITATIONS OF WACC AS A DISCOUNT RATE FOR EVALUATING PROJECTS
  - **Condition 1: A firm's WACC should be used to evaluate the cash flows for a new project only if the level of systematic risk for that project is the same as that of the portfolio of projects that currently comprise the firm.**

Using the WACC in Practice

- LIMITATIONS OF WACC AS A DISCOUNT RATE FOR EVALUATING PROJECTS
  - **Condition 2: A firm's WACC should be used to evaluate a project only if that project uses the same financing mix—the same proportions of debt, preferred shares, and common shares—used to finance the firm as a whole.**

Exhibit 13.3: Potential Errors When Using the WACC

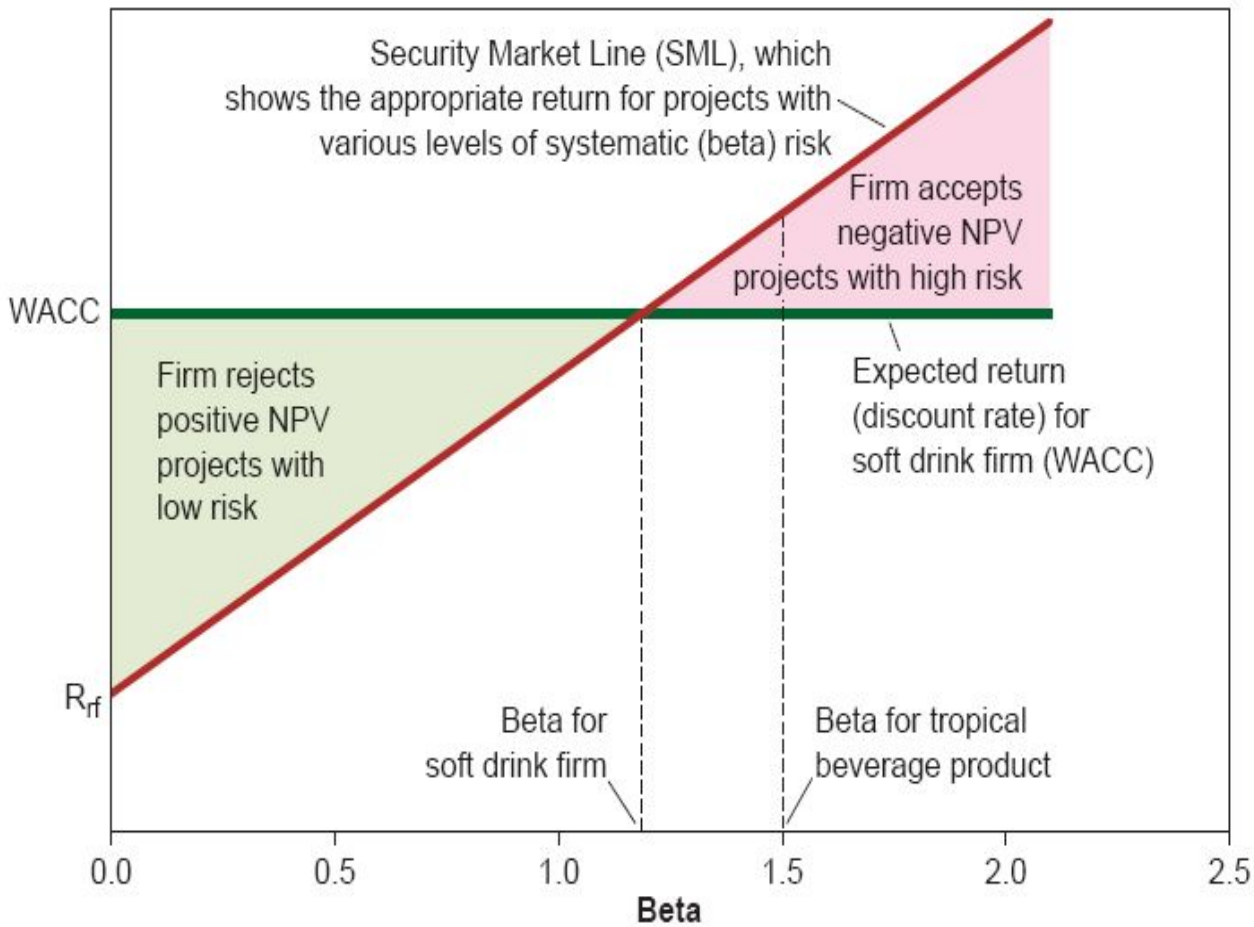


EXHIBIT 13.3
Potential Errors When Using the WACC to Evaluate Projects

Two types of problems can arise when the WACC for a firm is used to evaluate individual projects: a positive NPV project may be rejected or a negative NPV project may be accepted. For the tropical beverage example, if the expected return on that project was below the level indicated by the SML, but above the firm's WACC, the project might be accepted even though it would have a negative NPV.

Using the WACC in Practice

- ALTERNATIVES TO WACC FOR EVALUATING PROJECTS
  - **If the discount rate for a project cannot be estimated directly, a financial analyst might try to find a public firm that is in a business that is similar to the project.**
  - **This public company would be what financial analysts call a pure-play comparable because it is exactly like the project.**

Using the WACC in Practice

- ALTERNATIVES TO WACC FOR EVALUATING PROJECTS
  - **This approach is generally not feasible due to the difficulty of finding a public firm that is only in the business represented by the project.**
  - **Financial managers sometimes classify projects into categories based on their systematic risks.**
  - **They then specify a discount rate that is to be used to discount the cash flows for all projects within each category.**

Exhibit 13.4: Potential Errors When Using Multiple Discount Rates

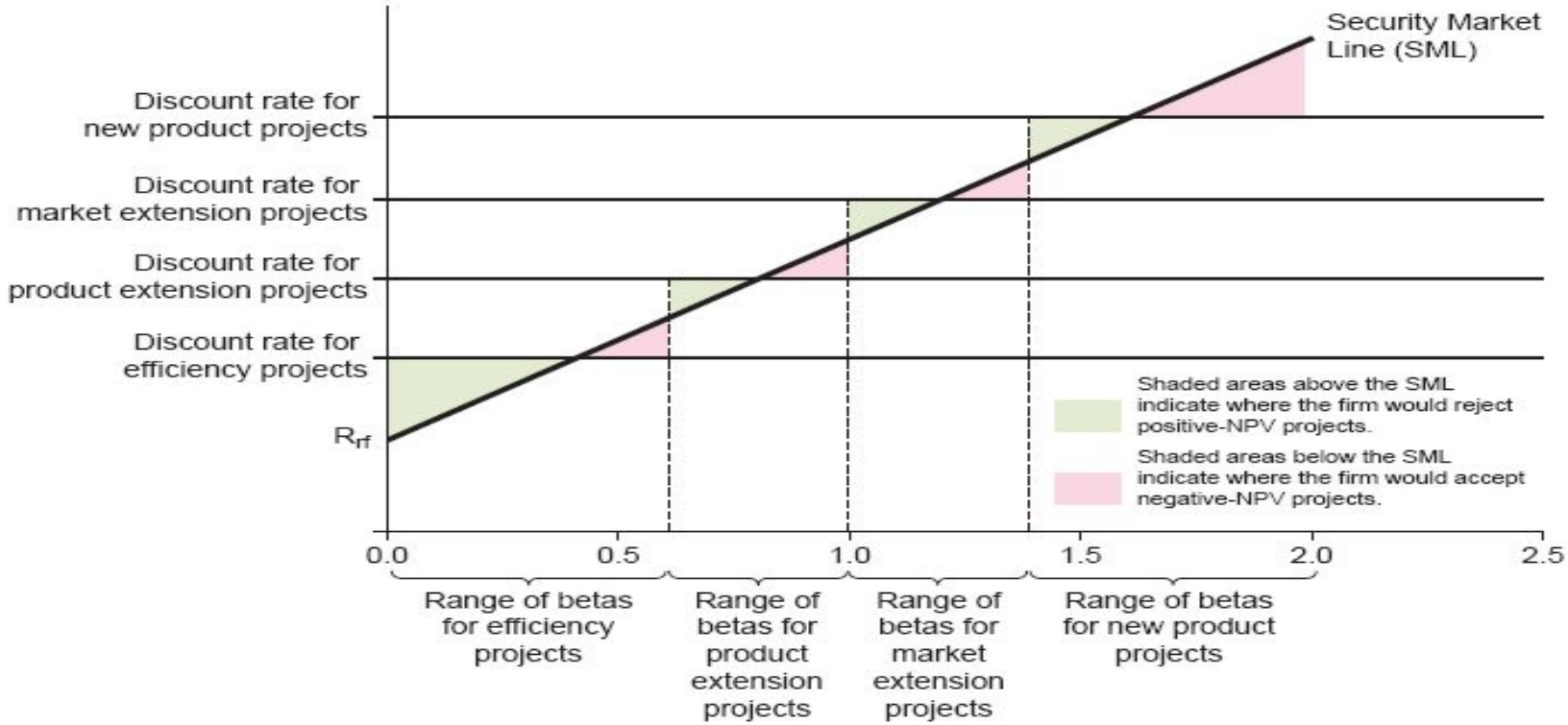


EXHIBIT 13.4

Potential Errors When Using Multiple Discount Rates to Evaluate Projects

The potential for errors—either rejecting a positive NPV project or accepting a negative NPV project—is smaller when discount rates better reflect the risk of the projects that they are used to evaluate. You can see this by noting that the total size of the shaded areas in this figure is smaller than the size of the shaded areas in Exhibit 13.3. In the ideal situation, where the correct discount rate is used for each project, there would be no shaded area at all in a figure like this.