

Chapter 14

Cost of Capital

Chapter Organization

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T14.2 The Cost of Capital: Issues

- Key issues:
 - ◆ What do we mean by “cost of capital”
 - ◆ How can we come up with an estimate?
- Preliminaries
 1. Vocabulary—the following all mean the same thing:
 - a. Required return
 - b. Appropriate discount rate
 - c. Cost of capital (or cost of money)
 2. The cost of capital is an *opportunity cost*—it depends on where the money *goes*, not where it *comes from*.
 3. For now, assume the firm’s capital structure (mix of debt and equity) is fixed.

T14.3 The Dividend Growth Model Approach

- Estimating the cost of equity: the dividend growth model approach

According to the *constant growth* model,

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

Rearranging,

$$R_E = \frac{D_1}{P_0} + g$$

T14.4 Example: Estimating the Dividend Growth Rate

Year	Dividend	Dollar Change	Percentage Change
1990	\$4.00	-	-
1991	4.40	\$0.40	10.00%
1992	4.75	0.35	7.95
1993	5.25	0.50	10.53
1994	5.65	0.40	7.62

Average Growth Rate
 $(10.00 + 7.95 + 10.53 + 7.62)/4 = 9.025\%$

T14.5 Example: The SML Approach

■ According to the CAPM: $R_E = R_f + \beta_E \times (R_M - R_f)$

1. Get the risk-free rate (R_f) from financial press—many use the 1-year Treasury bill rate, say 6%.

2. Get *estimates* of market risk premium and security beta.

a. Historical risk premium — _____%

b. Beta—historical

(1) Investment information services - e.g., S&P, Value Line

(2) Estimate from historical data

3. Suppose the beta is 1.40, then, using the approach:

$$\begin{aligned} R_E &= R_f + \beta_E \times (R_M - R_f) \\ &= 6\% + 1.40 \times \underline{\hspace{2cm}} \\ &= \underline{\hspace{2cm}} \end{aligned}$$

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2. Get *estimates* of market risk premium and security beta.

a. Historical risk premium — $R_M - R_f = 9.4\%$

b. Beta — historical

(1) Investment information services - e.g., S&P, Value Line

(2) Estimate from historical data

3. Suppose the beta is 1.40, then, using the approach:

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

$$= 6\% + 1.40 \times 9.4\%$$

$$= 19.16\%$$

T14.6 The Costs of Debt and Preferred Stock

■ Cost of debt

1. The cost of debt, R_D , is the interest rate on *new* borrowing.
2. The cost of debt is *observable*:
 - a. Yield on currently outstanding debt.
 - b. Yields on newly-issued similarly-rated bonds.
3. The *historic* debt cost is irrelevant -- why?

Example: We sold a 20-year, 12% bond 10 years ago at par. It is currently priced at 86. What is our cost of debt?

The *yield to maturity* is _____%, so this is what we use as the cost of debt, not 12%.

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Example: We sold a 20-year, 12% bond 10 years ago at par. It is currently priced at 86. What is our cost of debt?

The *yield to maturity* is 14.8%, so this is what we use as the cost of debt, not 12%.

T14.6 Costs of Debt and Preferred Stock (concluded)

■ Cost of preferred

1. Preferred stock is a *perpetuity*, so the cost is

$$R_P = D/P_0$$

2. Notice that cost is simply the dividend yield.

Example: We sold an \$8 preferred issue 10 years ago. It sells for \$120/share today.

The dividend yield *today* is \$ 8 / 120 = 6.67%, so this is what we use as the cost of preferred.

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T14.7 The Weighted Average Cost of Capital

- Capital structure weights

1. Let: E = the *market* value of the equity.
 D = the *market* value of the debt.

Then: $V = E + D$, so $E/V + D/V = 100\%$

2. So the firm's capital structure weights are E/V and D/V .
3. Interest payments on debt are tax-deductible, so the *aftertax* cost of debt is the pretax cost multiplied by $(1 - \text{corporate tax rate})$.

Aftertax cost of debt = $R_D \times (1 - T_c)$

4. Thus the weighted average cost of capital is

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

T14.8 Example: Eastman Chemical's WACC

- Eastman Chemical has 78.26 million shares of common stock outstanding. The book value per share is \$22.40 but the stock sells for \$58. The market value of equity is \$4.54 billion. Eastman's stock beta is .90. T-bills yield 4.5%, and the market risk premium is assumed to be 9.2%.
- The firm has four debt issues outstanding.

Coupon	Book Value	Market Value	Yield-to-Maturity
6.375%	\$ 499m	\$ 501m	6.32%
7.250%	495m	463m	7.83%
7.635%	200m	221m	6.76%
7.600%	<u>296m</u>	<u>289m</u>	7.82%
Total	\$1,490m	\$1,474m	

T14.8 Example: Eastman Chemical's WACC

- Cost of equity (R_E by the SML approach) :

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

- Cost of debt(R_D):

Multiply the proportion of total debt represented by each issue by its yield to maturity; the weighted average cost of debt

- Capital structure weights:

Market value of equity = Shares Outstanding \times \$Share Price = _____

Market value of debt = Sum of the issues = _____

$$V = E + D =$$

$$\text{Debt weight} = D/V$$

$$\text{Equity weight} = E/V$$

- $WACC = (E/V) \times R_E + (D/V) \times R_D \times (1 - T_c) =$

T14.8 Example: Eastman Chemical's WACC (concluded)

- Cost of equity (SML approach):

$$R_E = .045 + .90 \times (.092) = .045 + .0828 = .1278 \approx 12.8\%$$

- Cost of debt:

Multiply the proportion of total debt represented by each issue by its yield to maturity; the weighted average cost of debt = 7.15%

- Capital structure weights:

Market value of equity = 78.26 million \times \$58 = \$4.539 billion

Market value of debt = \$501m + \$463m + \$221m + \$289m = \$1.474 billion

$V = \$4.539 \text{ billion} + \$1.474 \text{ billion} = \6.013 billion

$D/V = \$1.474\text{b}/\$6.013\text{b} = .2451 \approx 25\%$ $E/V = \$4.539\text{b}/\$6.013\text{b} = .7549 \approx 75\%$

- $WACC = .75 (12.8) + .25 \times 7.15(1 - .35) = 10.76\%$

T14.9 Summary of Capital Cost Calculations (Table 14.1)

I. The Cost of Equity, R_E

A. Dividend growth model approach

$$R_E = D_1 / P_0 + g$$

B. SML approach

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

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.

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.

T14.9 Summary of Capital Cost Calculations (concluded)

III. The Weighted Average Cost of Capital (WACC)

- A. The WACC is the required return on the firm as a whole. It is the appropriate discount rate for cash flows similar in risk to the firm.
- B. The WACC is calculated as

$$WACC = (E/V) \times R_E + (D/V) \times R_D \times (1 - T_c)$$

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.

T14.10 Divisional and Project Costs of Capital

- When is the WACC the appropriate discount rate?

When the project is about the same risk as the firm.

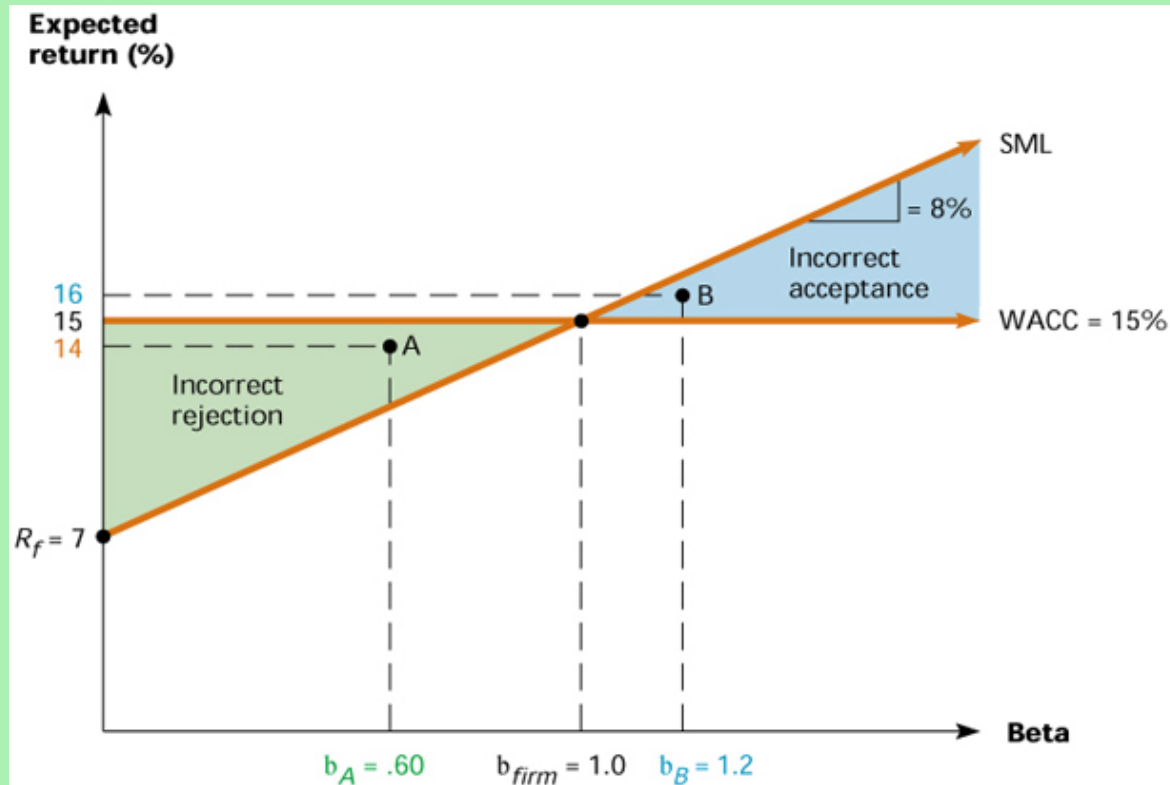
- Other approaches to estimating a discount rate:

- ◆ *Divisional cost of capital*

- ◆ *Pure play approach*

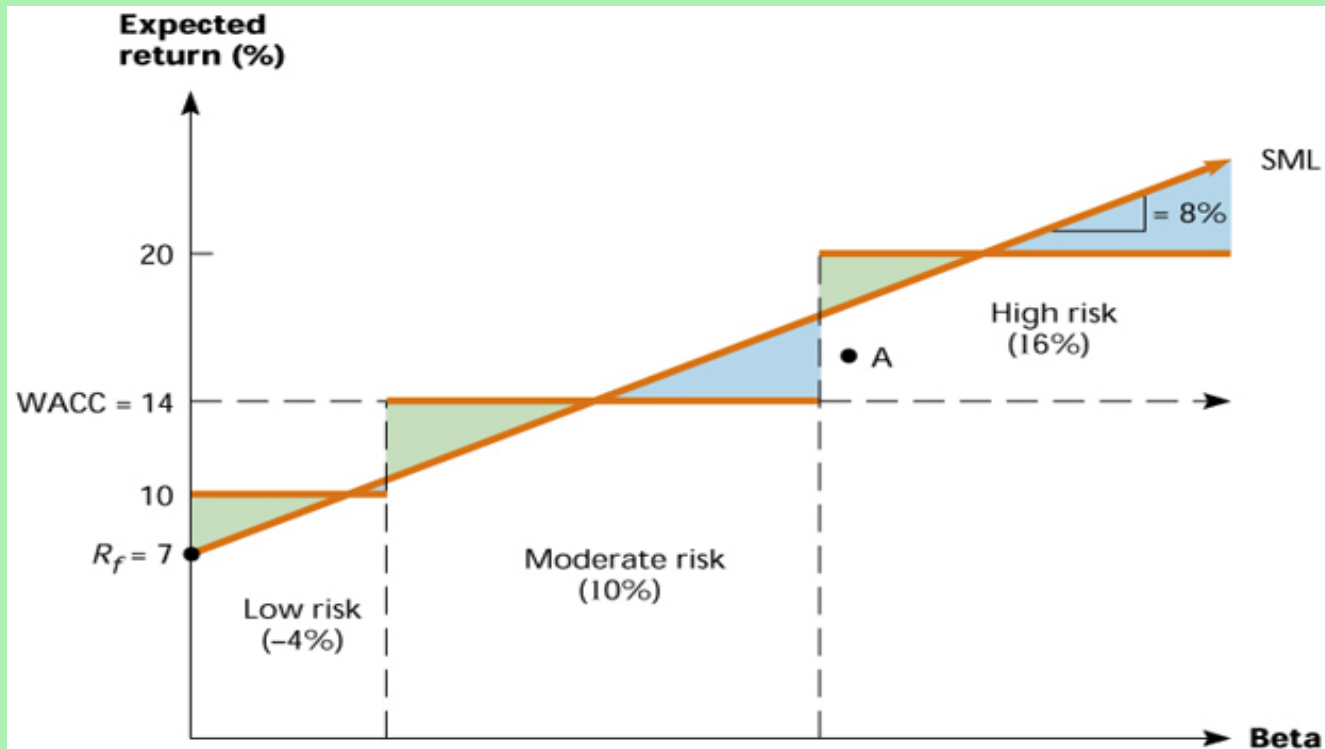
- ◆ *Subjective approach*

T14.11 The Security Market Line and the Weighted Average Cost of Capital (Figure 14.1)



If a firm uses its WACC to make accept-reject decisions for all types of projects, it will have a tendency towards incorrectly accepting risky projects and incorrectly rejecting less risky projects.

T14.12 The Security Market Line and the Subjective Approach (Figure 14.2)



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.

T14.13 Comments on Bombardier WACC

- Short-term versus long-term financing in estimating WACC
- Market versus Book Value

$$WACC = (E/V) \times R_E + (D/V) \times R_D \times (1 - T_c)$$

- YTM on bonds, and the cost of debt: R_D
- The cost of preferred stock in the WACC calculation

$$V = E + P + D$$

$$WACC = (E/V) \times R_E + (P/V) \times R_P + (D/V) \times R_D \times (1 - T_c)$$

- Multiple estimates for the cost of equity

T14.14 Chapter 14 Quick Quiz

1. What is the relationship between cost of capital and firm value?

Cet. par., the lower the cost of capital, the higher the value of the firm.

2. When we use the dividend growth model to estimate the firm's cost of equity, we make a key assumption about future dividends of the firm. What is that assumption?

We assume that dividends will grow at a constant growth rate, g .

3. In calculating the firm's WACC, we use the market value weights of debt and equity, if possible. Why?

Because market values reflect the market's expectations about the size, timing, and risk of future cash flows.

4. What happens if we use the WACC to evaluate all potential investment projects, regardless of their risk?

Estimated NPVs will be understated (overstated) for projects which are less risky (riskier) than the firm.

T14.14 Chapter 14 Quick Quiz (continued)

5. How are flotation costs accounted for in estimating the cost of capital?
- First, obtain the flotation costs of each component of capital. Call the flotation cost of equity f_E , and the flotation cost of debt, f_D .
 - Obtain the weighted average flotation cost, f_A :
$$f_A = (E/V) \times f_E + (D/V) \times f_D$$
 - The “true cost” of the project = project cost/(1 - f_A).

Example:

The Lecter Meat Packing Co. would like to raise \$110 million to build a new plant in Argentina. The flotation costs of debt and equity are 5% and 18%, respectively. The firm's market value capital structure consists of equal amounts of debt and equity. What is the true cost of the new plant project?

Solution:

The weighted average flotation cost = $.50(5) + .50(18) = 11.5\%$ The true cost of the project is $\$110M/(1 - .115) = \$124.29M$.

T14.15 Solution to Problem 14.16

- Elway Mining Corporation has 8 million shares of common stock outstanding, 1 million shares of 6 percent preferred outstanding, and 100,000 9 percent semiannual coupon bonds outstanding, par value \$1,000 each. The common stock currently sells for \$35 per share and has a beta of 1.0, the preferred stock currently sells for \$60 per share, and the bonds have 15 years to maturity and sell for 89 percent of par. The market risk premium is 8 percent, T-bills are yielding 5 percent, and the firm's tax rate is 34 percent.
 - a. What is the firm's market value capital structure?
 - b. If the firm 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?

T14.15 Solution to Problem 14.16 (continued)

$$a. \quad MV_D = \quad (\$1,000) (.89) = \$ \quad$$

$$MV_E = 8M(\$35) = \$280M$$

$$MV_P = \quad (\$60) = \$ \quad$$

$$V = \$ \quad + 280M + \quad = \$ \quad$$

$$D/V = \$ \quad / \quad = .207,$$

$$E/V = \$ \quad / \quad = .653, \text{ and}$$

$$P/V = \$ \quad / \quad = .140.$$

T14.15 Solution to Problem 14.16 (continued)

$$a. \quad MV_D = 100,000 (\$1,000) (.89) = \$89M$$

$$MV_E = 8M(\$35) = \$280M$$

$$MV_p = 1M(\$60) = \$60M$$

$$V = 89M + 280M + 60M = \$429M$$

$$D/V = 89M/429M = .207,$$

$$E/V = 280M/429M = .653, \text{ and}$$

$$P/V = 60M/429M = .140.$$

T14.15 Solution to Problem 14.16 (concluded)

- b. For projects as risky as the firm itself, the WACC is the appropriate discount rate. So:

$$R_E = .05 + \underline{\hspace{1cm}} (.08) = \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \%$$

$$B_0 = \$\underline{\hspace{1cm}} = \$45(PVIFA_{R_D,30}) + \$1,000(PVIF_{R_D,30})$$

$$R_D = \underline{\hspace{1cm}} \%, \text{ and } R_D (1 - T_c) = (. \underline{\hspace{1cm}})(1 - .34) = \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \%$$

$$R_P = \$ \underline{\hspace{1cm}} / \$ \underline{\hspace{1cm}} = \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \%$$

$$\begin{aligned} \text{WACC} &= \underline{\hspace{1cm}} (\underline{\hspace{1cm}}) + \underline{\hspace{1cm}} (\underline{\hspace{1cm}}) + \underline{\hspace{1cm}} (\underline{\hspace{1cm}}) \\ &= \underline{\hspace{1cm}} \% \end{aligned}$$

T14.15 Solution to Problem 14.16 (concluded)

- b. For projects as risky as the firm itself, the WACC is the appropriate discount rate. So:

$$R_E = .05 + 1.0(.08) = .13 = 13\%$$

$$B_0 = \$890 = \$45(PVIFA_{R_D,30}) + \$1,000(PVIF_{R_D,30})$$

$$R_D = 10.474\%, \text{ and } R_D (1 - T_c) = (.10474)(1 - .34) = .0691 = 6.91\%$$

$$R_p = \$6/\$60 = .10 = 10\%$$

$$\begin{aligned} \text{WACC} &= .653 (13) + .207 (6.91) + .14 (10) \\ &= 11.32\% \end{aligned}$$

T14.16 Solution to Problem 14.17

- An all-equity firm is considering the following projects. Assume the T-bill rate is 5% and the market expected return is 12%.

<i>Project</i>	<i>Beta</i>	<i>Expected Return (%)</i>
W	.60	11
X	.85	13
Y	1.15	13
Z	1.50	19

- Which projects have a higher expected return than the firm's 12 percent cost of capital?
- Which projects should be accepted?
- Which projects would be *incorrectly* accepted or rejected if the firm's overall cost of capital is used as a hurdle rate?

T14.16 Solution to Problem 14.17 (concluded)

- a. Projects X, Y, and Z with expected returns of 13%, 13%, and 19%, respectively, have higher returns than the firm's 12% cost of capital.
- b. Using the firm's overall cost of capital as a hurdle rate, accept projects W, X, and Z. Compute *required* returns considering risk via the SML:

$$\text{Project W} = .05 + .60(.12 - .05) = .092 < .11, \text{ so } \textit{accept W}.$$

$$\text{Project X} = .05 + .85(.12 - .05) = .1095 < .13, \text{ so } \textit{accept X}.$$

$$\text{Project Y} = .05 + 1.15(.12 - .05) = .1305 > .13, \text{ so } \textit{reject Y}.$$

$$\text{Project Z} = .05 + 1.50(.12 - .05) = .155 < .19, \text{ so } \textit{accept Z}.$$

- c. Project W would be incorrectly rejected and Project Y would be incorrectly accepted.

T14.17 Solution to Problem 14.20

- True North, Inc. is considering a project that will result in initial aftertax cash savings of \$6 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 .5, a cost of equity of 18 percent, and an aftertax cost of debt of 6 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 True North take on the project?

T14.17 Solution to Problem 14.20 (concluded)

$$\text{WACC} = (\text{_____})(.06) + (\text{_____})(.18) = \text{_____}\%$$

$$\text{Project discount rate} = \text{_____}\% + 2\% = \text{_____}\%$$

$$\text{NPV} = - \text{cost} + \text{PV cash flows}$$

$$\text{PV cash flows} = [\$ \text{_____} / (\text{_____} - .05)] = \$ \text{_____}$$

So the project should only be undertaken if its cost is less than \$_____.

T14.17 Solution to Problem 14.20 (concluded)

$$\text{WACC} = (.3333)(.06) + (.6666)(.18) = .14$$

$$\text{Project discount rate} = .14 + .02 = .16$$

$$\text{NPV} = - \text{cost} + \text{PV cash flows}$$

$$\text{PV cash flows} = [\$6\text{M}/(.16 - .05)] = \$54.55\text{M}$$

So the project should only be undertaken if its cost is less than \$54.55M.