Cost of Capital

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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.**

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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,

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

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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%

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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 from financial press—many use the 1-year Treasury bill rate, say 6%.**

2. **Get *estimates* of market risk premium and security beta.**
   a. **Risk premium historical - - _____%**
   b. **Beta—historical**
      (1) Investment information services - e.g., S&P
      (2) Estimate from historical data

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

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

   = 0.06 + 1.40 x _____

   = _____%

- **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, <u>not</u> 12%.

- **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 $_____/_____ = **6.67%**, so this is what we use as the cost of preferred.

- **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 *after-tax* cost of debt is the pretax cost multiplied by (1 - corporate tax rate).

     After-tax cost of debt = R_D x (_____)

  4. Thus the weighted average cost of capital is

     WACC = (E/V) x R_E + (D/V) x R_D x (1 - T_c)

- **Eastman Chemical has 80 million shares of common stock outstanding. The book value is $19.10 and the market price is $62.375 per share. T-bills yield 5%, and the market risk premium is assumed to be 8.5%. The stock beta is 1.1.**

- **The firm has three debt issues outstanding.**

Coupon	Book Value	Market Value	Yield-to-Maturity
6.375%	$499m	$521m	5.70%
7.250%	$495m	$543m	6.50%
7.625%	$200m	$226m	6.60%

- **Cost of equity (SML approach):**

  R_E = .05 + 1.1 x (.085) = .05 + .0935 = .1435 ≈ **14.4%**

- **Cost of debt:**

  Multiply the proportion of total debt represented by each issue by its yield to maturity; the weighted average cost of debt = **6.2%**

- **Capital structure weights:**

  Market value of equity = 80 million x $62.375 = $4.99 billion
  Market value of debt = $521m + $543m + $226m = $1.29 billion

  V = $4.99 billion + $1.29 billion = $6.28 billion

  D/V = $1.29b/$6.28b = .2054 ≈ **21%**
  E/V = $4.99b/$6.28b = .7946 ≈ **79%**

- **WACC** = (.79 x .144) + (.21 x .062 x .65) = .1222 ≈ **12.2%**

  I. The Cost of Equity, R_E
     A. Dividend growth model approach
        $R_E = D_1 / P_0 + g$
     B. SML approach
        $R_E = R_f + \beta_E$ x ($R_M - R_f$)

  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.

III. The Weighted Average Cost of Capital

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.
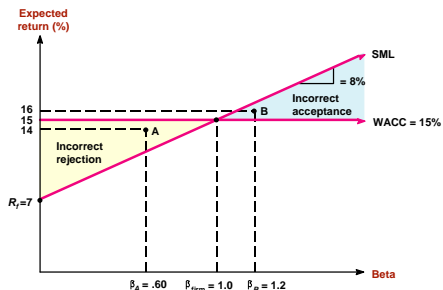
B. The WACC is calculated as

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

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 $V = E + D$.
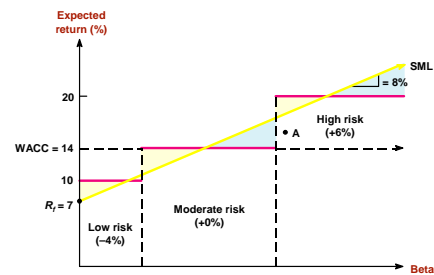

■ When is the WACC the appropriate discount rate?

■ Other approaches to getting a discount rate:
  ◆ Divisional cost of capital
  ◆ Pure play approach
  ◆ Subjective approach

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.

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.

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

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

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

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

   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.

- Independence Mining Corporation has 7 million shares of common stock outstanding, 1 million shares of 6 percent preferred outstanding, and 100,000 $1,000 par, 9 percent semiannual coupon bonds outstanding. The stock sells for $35 per share and has a beta of 1.0, the preferred stock 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 7 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 is equally as risky as the firm's typical project, what rate should they use to discount the project's cash flows?

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a. MV_D = _____ ($1,000) (.89) = $_____

MV_E = 7M($35) = $245M

MV_P = _____($60) = $_____

V = _____ +245 + _____ = $_____

D/V = _____ / _____ = .226,

E/V = _____/ _____ = .622, and

P/V = _____/ _____ = .152.

Solution to Problem 14.22 (continued)

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

MV_E = 7M($35) = $245M

MV_P = 1M($60) = $60M

V = 89M + 245M + 60M = $394M

D/V = 89M/394M = .226,

E/V = 245M/394M = .622, and

P/V = 60M/394M = .152.

14.A

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

R_E = .07 + _____(.08) = _____ %

B_0 = $_____ = $45(PVIFA$_{RD\%,30}$) + $1,000(PVIF$_{RD\%,30}$)

R_D = _____ %, and R_D (1 - T_c) = (._____)(1 - .34) = _____

R_P = $ _____ /$ _____ = _____ %

WACC = _____ (_____) + _____ (_____) + _____ (_____)

= 12.41%

14.A Solution to Problem (concluded)

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

R_E = .07 + 1.0(.08) = .13 = 15%

B_0 = $890 = $45(PVIFA$_{RD,30}$) + $1,000(PVIF$_{RD,30}$)

R_D = 10.474%, and R_D (1 - T_c) = (.10474)(1 - .34) = .0691 = 6.91%

R_P = $6/$60 = .10 = 10%

WACC = .622 (15) + .226 (6.91) + .152 (10)

= 12.41%

- An all-equity firm is considering the following projects. Assume the T-bill rate is 5% and the market expected return is 14%.

Project	Beta	Expected Return (%)
W	.60	11
X	.85	13
Y	1.15	15
Z	1.50	19

a. Which projects have a higher expected return than the firm's 14 percent cost of capital?

b. Which project(s) should be accepted?

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

a. Projects Y and Z, with expected returns of 15% and 19%, respectively, have higher returns than the firm's 14% cost of capital.

b. Using the firm's overall cost of capital as a hurdle rate, accept projects Y and Z. Now compute *required* returns after considering risk via the SML:

Project W = .05 + .60(___ - .05) = .104 < .11, so _____ W.
Project X = .05 + ___ (.14 - .05) = .127 < .13, so *accept* X.
Project Y = .05 + 1.15(.14 - .05) = ___ (</>) .15, so _____ Y.
Project Z = .05 + 1.50(.14 - .05) = .185 < .19, so _____ Z.

c. _____

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a. Projects Y and Z, with expected returns of 15% and 19%, respectively, have higher returns than the firm's 14% cost of capital.

b. Using the firm's overall cost of capital as a hurdle rate, accept projects Y and Z. Compute *required* returns considering risk via the SML:

Project W = .05 + .60(.14 - .05) = .104 < .11, so *accept* W.
Project X = .05 + .85(.14 - .05) = .127 < .13, so *accept* X.
Project Y = .05 + 1.15(.14 - .05) = .154 >.15, so *reject* Y.
Project Z = .05 + 1.50(.14 - .05) = .185 < .19, so *accept* Z.

c. Projects W and X would be incorrectly rejected and Project Y would be incorrectly accepted.

- A firm is considering a project that will result in initial after-tax cash savings of $6 million at the end of the first year, and these savings will grow at a rate of 3 percent per year indefinitely. The firm has a target debt/equity ratio of 1.5, a cost of equity of 17 percent, and an after-tax 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 the firm take on the project?

WACC = (_____)(.06) + (_____)(.17) = _____%

Project discount rate = _____% + 2%= _____%

NPV = - cost + PV cash flows

PV cash flows = [$_____ /(_____ - .03)] = $_____

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

Solution to Problem (concluded)

WACC = (.6)(.06) + (.4)(.17) = .11

Project discount rate = .11 + .02 = .13

NPV = - cost + PV cash flows

PV cash flows = [$6M/(.13 - .03)] = $60M

So the project should only be undertaken if its cost is <u>less than</u> $60M.