$$K_n = \frac{\frac{D_1}{P_0} + g}{1 - F} \text{ or } K_n = \left(\frac{D_1}{P_0} + g\right)\frac{P_0}{P_n} \quad \text{(new common equity)} \qquad (11\text{–}4)$$

CAPM:

$$K_j = R_f + \beta_j(R_m - R_f) \quad \text{(retained earnings)} \qquad (11\text{–}5)$$

$$K_{jn} = \frac{K_j}{1 - F} \text{ or } K_{jn} = K_j\left(\frac{P_0}{P_n}\right) \quad \text{(new common equity)} \qquad (11\text{–}6)$$

$$K_a = \left(\frac{V_d}{V_a}\right)K_d + \left(\frac{V_p}{V_a}\right)K_p + \left(\frac{V_c}{V_a}\right)K_c \quad \text{(weighted average cost of capital)} \qquad (11\text{–}7)$$

4. $$X\left(\begin{array}{c}\text{Size of the investments that}\\ \text{retained earnings will support}\end{array}\right) = \frac{\text{Retained earnings}}{\text{\% of equity in the capital structure}} \qquad (11\text{–}8)$$

5. $$Z\left(\begin{array}{c}\text{Size of the investments that}\\ \text{lower} - \text{cost debt will support}\end{array}\right) = \frac{\text{Amount of lower} - \text{cost debt}}{\text{\% of debt in the capital structure}} \qquad (11\text{–}9)$$

DISCUSSION QUESTIONS

1. Why do we use the overall cost of capital for investment decisions even when an investment will be funded by only one source of capital (e.g., debt)? (LO1)
2. How does the cost of a source of capital relate to the valuation concepts presented in Chapter 10? (LO2)
3. In computing the cost of capital, do we use the historical costs of existing debt and equity or the current costs as determined in the market? Why? (LO3)
4. Why is the cost of debt less than the cost of preferred stock if both securities are priced to yield 10 percent in the market? (LO3)
5. What are the two sources of equity (ownership) capital for the firm? (LO3)
6. Explain why retained earnings has an opportunity cost associated with it. (LO3)
7. Why is the cost of retained earnings the equivalent of the firm's own required rate of return on common stock (K_e)? (LO3)
8. Why is the cost of new common stock (K_n) higher than the cost of retained earnings (K_e)? (LO3)
9. How are the weights determined to arrive at the optimal weighted average cost of capital? (LO4)
10. Explain the traditional, U-shaped approach to the cost of capital. (LO4)
11. Identify other variables (ratios) besides the debt-to-equity ratio that influence a company's cost of capital. You may wish to refer to Chapter 3 for possibilities. (LO4)
12. It has often been said that if the company can't earn a rate of return greater than the cost of capital, it should not make investments. Explain. (LO2)
13. What effect would inflation have on a company's cost of capital? (***Hint:*** Think about how inflation influences interest rates, stock prices, corporate profits, and growth.) (LO3)
14. What is the concept of marginal cost of capital? (LO5)
15. What limitations are there in using the dividend valuation model to determine the cost of equity capital? (LO3)
16. What is the justification for using market value weightings rather than book value weightings? (LO4)

INTERNET RESOURCES AND QUESTIONS

Two Canadian sites rate and grade debt. The ratings determine the spread corporations pay above Government of Canada securities:
standardandpoors.com
dbrs.com

Sites that identify current yields on bond issues:
financialpost.com
pfin.ca/canadianfixedincome/Default.aspx

The TSX and the *Financial Post* identify current pricing on preferreds and common stock, including P/E ratios and dividend yields:
tmx.com
financialpost.com/markets/index.html

Betas and other useful share information are available on many Canadian companies at NASDAQ Canada and Thomson Reuters: reuters.com

1. Calculate the cost of capital for a corporation listed on one of the major exchanges in Canada. Use current pricing on debt and equity from the sites identified above, and use the latest filed financial statement of the selected company. The financial statements will be available at sedar.com.
2. Update the information included in Table 11–2. Have any of the ratings changed? Can you suggest why the ratings have changed?
3. Find the betas, P/E ratios, and dividend yields for the companies listed in Table 11–2. What do they tell you about the relative risk of the companies?

PROBLEMS

1. Recently, Hertz Pain Relievers bought a massage machine that provided a return of 8 percent. It was financed by debt costing 7 percent. In August, Mr. Hertz came up with a heating compound that had a return of 14 percent. The chief financial officer, Mr. R. Ental, told him it was impractical because it would require the issuance of common stock at a cost of 16 percent to finance the purchase. Is the company following an appropriate approach to using its cost of capital?
2. Royal Petroleum Co. can buy a piece of equipment that is anticipated to provide a 9 percent return and can be financed at 6 percent with debt. Later in the year, the firm turns down an opportunity to buy a new machine that would yield a 16 percent return but would cost 18 percent to finance through common equity. Assume debt and common equity each represent 50 percent of the firm's capital structure at 6 percent cost of debt and 18 percent cost of equity.
   a. Compute the weighted average cost of capital.
   b. Which project(s) should be accepted?
3. Pogo Stick Co can issue debt yielding 9 percent. The company is paying at a 25 percent tax rate. What is the aftertax cost of debt?
4. A brilliant young scientist is killed in a plane crash. It is anticipated that he could have earned $240,000 a year for the next 50 years. The attorney for the plaintiff's estate argues that the lost income should be discounted back to the present at 4 percent. The lawyer for the defendant's insurance company argues for a discount rate of 8 percent. What is the difference between the present value of the settlement at 4 percent and 8 percent? Compute each one separately.

5. Calculate the aftertax cost of debt under each of the following conditions.

	Yield	Corporate Tax Rate
a	8.0%	22%
b	14.0%	36%
c	11.5%	42%

6. Calculate the aftertax cost of debt under each of the following conditions.

	Yield	Corporate Tax Rate
a	8.0%	18%
b	12.0%	34%
c	10.6%	15%

7. Calculate the aftertax cost of debt on a bond issue yielding 10 percent. The issuing company pays tax at a rate of 34 percent and will incur distribution costs of 1 percent on this bond issue.

8. The Goodsmith Charitable Foundation, which is tax-exempt, issued debt last year at 9 percent to help finance a new playground facility in Vancouver. This year the cost of debt is 25 percent higher; that is, firms that paid 11 percent for debt last year will be paying 13.75 percent this year.
   a. If the Goodsmith Charitable Foundation borrowed money this year, what would be the aftertax cost of debt, based on its cost last year and the 25 percent increase?
   b. If the receipts of the foundation were found to be taxable by CRA (at a rate of 30 percent because of involvement in political activities), what would be the aftertax cost of debt?

9. Waste Disposal Systems has an aftertax cost of debt of 6 percent. With a tax rate of 33 percent, what can you assume the yield is on the debt?

10. Octopus Transit has a $1,000 par value bond outstanding with 10 years to maturity. The bond carries an annual interest payment of $75, payable semiannually, and is currently selling for $1,092. Octopus is in a 35 percent tax bracket. The firm wishes to know what the aftertax cost of a new bond issue is likely to be. The yield to maturity on the new issue will be the same as the yield to maturity on the old issue because the risk and maturity date will be similar.
    a. Compute the yield to maturity on the old issue and use this as the yield for the new issue.
    b. Make the appropriate tax adjustment to determine the aftertax cost of debt.

11. Russell Container Company has a $1,000 par value bond outstanding with 20 years to maturity. The bond carries an annual interest payment of $95, and is currently selling for $920. Russell is in a 25 percent tax bracket. The firm wishes to know what the aftertax cost of a new bond issue is likely to be. The yield to maturity on the new issue will be the same as the yield to maturity on the old issue because the risk and maturity date will be similar.
    a. Compute the yield to maturity on the old issue and use this as the yield for the new issue.
    b. Make the appropriate tax adjustment to determine the aftertax cost of debt.

12. For Russell Container Company, described in the previous problem, assume the yield on the bonds goes up by one percentage point and that the tax rate is now 34 percent.
    a. What is the new aftertax cost of debt?
    b. Has the aftertax cost of debt gone up or down from the previous problem? Explain why.
13. Terrier Company is in a 40 percent tax bracket and has a bond outstanding that yields 10 percent to maturity.
    a. What is Terrier's aftertax cost of debt?
    b. Assume that the yield on the bond goes down by 1 percentage point, and due to tax reform, the corporate tax rate falls to 25 percent. What is Terrier's new aftertax cost of debt?
    c. Has the aftertax cost of debt gone up or down from part ***a*** to part ***b***? Explain why.
14. Suncor is planning to issue debt that will mature in the year 2037. In many respects the issue is similar to currently outstanding debt of the corporation. Using Table 11–2 in the chapter, identify
    a. The yield to maturity on similarly outstanding debt for the firm, in terms of maturity.
    b. Assume that because the new debt will be issued at par, the required yield to maturity will be 0.15 percent higher than the value determined in part ***a***. Add this factor to the answer in ***a***. (New issues at par sometimes require a slightly higher yield than old issues that are trading below par. There is less leverage and fewer tax advantages.)
    c. If the firm is in a 30 percent tax bracket, what is the aftertax cost of debt?
15. Schuss Inc. can sell preferred shares for $60 with an estimated flotation cost of $3.00. The preferred stock is anticipated to pay $7 per share in dividends.
    a. Compute the cost of preferred stock for Schuss Inc.
    b. Do we need to make a tax adjustment for the issuing firm?
16. The Meredith Company issued $100 par value preferred shares 10 years ago. The shares provided an 8 percent yield at the time of issue. Each preferred share is now selling for $75. What is the current yield or cost of preferred stock? (Disregard flotation costs.)
17. Radio Gaga can issue preferred shares at $25 with an annual dividend of $1.50. Flotation expenses of a new issue will be 5 percent. What is the cost of a preferred share issue?
18. The treasurer of Sutton Security Systems is asked to compute the cost of fixed income securities for her corporation. Even before making the calculations, she assumes the aftertax cost of debt is at least 2 percent less than that for preferred stock. Based on the following facts, is she correct?

    Debt can be issued at a yield of 10.5 percent, and the corporate tax rate is 34 percent. Preferred shares will be priced at $50 and pay a dividend of $4.40. The flotation cost on the preferred stock is $2.00.

19. Ellington Electronics wants you to calculate its cost of common stock. During the next 12 months, the company expects to pay dividends (D_1) of $1.50 per share, and the current price of its common stock is $30 per share. The expected growth rate is 8 percent.
    a. Compute the cost of retained earnings (K_e).
    b. If a $2 flotation cost is involved, compute the cost of new common stock (K_n).

20. Compute K_e and K_n under the following circumstances:
    a. $D_1 = \$4.60$; $P_0 = \$60$; $g = 6\%$; $F = \$4.00$.
    b. $D_1 = \$0.25$; $P_0 = \$20$; $g = 10\%$; $F = \$1.50$.
    c. E_1 (earnings at the end of period one) = $6; payout ratio equals 30 percent; $P_0 = \$25$; $g = 4.5\%$; $F = \$2$.
    d. D_0 (dividend at the beginning of the first period) = $3; growth rate for dividends and earnings (g) = 7%; $P_0 = \$42$; $F = \$3.00$.

21. Sam's Fine Garments sells jackets and sports coats in suburban malls throughout the country. Business has been good, as indicated by the six-year growth in earnings per share. The earnings have grown from $1.00 to $1.87.
    a. Determine the compound annual rate of growth in earnings ($n = 6$).
    b. Based on the growth rate determined in part **a**, project earnings for next year (E_1). Round to two places to the right of the decimal point.
    c. Assume the dividend payout ratio is 40 percent. Compute D_1. Round to two places to the right of the decimal point.
    d. The current price of the stock is $15. Using the growth rate (g) from part **a** and D_1 from part **c**, compute K_e.
    e. If the flotation cost is $1.75, compute the cost of new common stock (K_n).

22. The Tyler Oil Company's capital structure is as follows:

Debt	35%
Preferred stock	15
Common equity	50

    The aftertax cost of debt is 7 percent; the cost of preferred stock is 10 percent; and the cost of common equity (in the form of retained earnings) is 13 percent.

    Calculate Tyler Oil Company's weighted average cost of capital in a manner similar to Table 11–1.

23. As an alternative to the capital structure shown in the previous problem for Tyler Oil Company, an outside consultant has suggested the following modifications.

Debt	60%
Preferred stock	5
Common equity	35

    Under this new and more debt-oriented arrangement, the aftertax cost of debt is 8.8 percent, the cost of preferred stock is 10.5 percent, and the cost of common equity (in the form of retained earnings) is 15.5 percent.

    Recalculate Tyler's weighted average cost of capital. Which plan is optimal in terms of minimizing the weighted average cost of capital?

24. Given the following information, calculate the weighted average cost of capital for Genex Corporation. Line up the calculations in the order shown in Table 11–1.

Percent of Capital Structure:	
Debt	35%
Preferred stock	10
Common equity	55
Additional Information:	
Bond coupon rate	13%
Bond yield	11%
Dividend, expected common	$3.00
Dividend, preferred	$10.00
Price, common	$50.00
Price, preferred	$98.00
Flotation cost, preferred	$5.50
Corporate growth rate	8%
Corporate tax rate	30%

25. Given the following information, calculate the weighted average cost of capital for Hadley Corporation. Line up the calculations in the order shown in Table 11–1.

Percent of Capital Structure:	
Debt	30%
Preferred stock	10
Common equity	60
Additional Information:	
Corporate tax rate	34%
Dividend, preferred	$9.00
Dividend, expected common	$3.50
Price, preferred	$102.00
Corporate growth rate	6%
Bond yield	7%
Flotation cost, preferred	$3.20
Price, common	$70.00

26. Given the following information, calculate the weighted average cost of capital for Puppet Corporation.

Percent of Capital Structure:	
Debt	55%
Preferred stock	5
Common equity	40
Additional Information:	
Bond coupon rate	8.5%
Bond yield	7%
Bond flotation cost	2%
Dividend, expected common	$1.50
Price, common	$30.00
Dividend, preferred	5%
Flotation cost, preferred	3%
Flotation cost, common	4%
Corporate growth rate	6%
Corporate tax rate	35%

a. Calculate the cost of capital assuming use of internally generated funds.

b. Calculate the cost of capital assuming use of externally generated funds.

c. Why is there a difference? Why does only common equity change?

27. Valvano Publishing Company is trying to calculate its cost of capital for use in a capital budgeting decision. Mr. Washburn, the vice-president of finance, has given you the following information and asked you to compute the weighted average cost of capital.

The company currently has outstanding a bond with an 11 percent coupon rate and a convertible bond with a 7.1 percent rate. The firm has been informed by its investment dealer, Dean, Smith, and Company, that bonds of equal risk and credit rating are now selling to yield 13 percent. The common stock has a price of $45 and an expected dividend (D_1) of $2.52 per share. The firm's historical growth rate of earnings and dividends per share has been 14.5 percent, but security analysts on Bay Street expect this growth to slow to 11 percent in the future. The preferred stock is selling at $50 per share and carries a dividend of $5.50 per share. The corporate tax rate is 34 percent. The flotation costs are 3 percent of the selling price for preferred stock.

The optimum capital structure for the firm seems to be 35 percent debt, 10 percent preferred stock, and 55 percent common equity in the form of retained earnings.

Compute the cost of capital for the individual components in the capital structure, and then calculate the weighted average cost of capital.

28. McNabb Construction Company is trying to calculate its cost of capital for use in making a capital budgeting decision. Mr. Reid, the vice-president of finance, has given you the following information and has asked you to compute the weighted average cost of capital.

The company currently has an outstanding bond with a 9.5 percent coupon rate and another bond with a 7.8 percent rate. The firm has been informed by its investment dealer that bonds of equal risk and credit ratings are now selling to yield 10.5 percent. The common stock has a price of $98.44 and an expected dividend (D_1) of $3.15 per share. The historical growth pattern (g) for dividends is as follows:

$2.00
2.24
2.51
2.81

a. Compute the historical growth rate, round it to the nearest whole number, and use it for g.

The preferred stock is selling at $90 per share and pays a dividend of $8.50 per share. The corporate tax rate is 30 percent. The flotation cost is 2 percent of the selling price for preferred stock. The optimum capital structure for the firm is 30 percent debt, 10 percent preferred stock, and 60 percent common equity in the form of retained earnings.

b. Compute the cost of capital for the individual components in the capital structure, and then calculate the weighted average cost of capital.

29. Western Electric Utility Company faces increasing needs for capital. Fortunately it has an A (low) credit rating. The corporate tax rate is 30 percent. Western's treasurer is trying to determine the corporation's current weighted average cost of capital to assess the profitability of capital budgeting projects. Historically, the corporation's earnings and dividends per share have increased at about a 6 percent annual rate.

Western Electric's common stock is selling at $60 per share, and the company will pay a $4.50 per share dividend (D_1). The company's $100 preferred stock has been yielding 9 percent in the current market. Flotation costs for the company have been estimated by its investment dealer to be $1.50 for preferred stock. The company's optimum capital structure is 40 percent debt, 10 percent preferred stock, and 50 percent common equity in the form of retained earnings. Refer to the table below on bond issues for comparative yields on bonds of equal risks to Western Electric, maturing in 2038. Compute the values for parts ***a***, ***b***, ***c***, and ***d*** from the information given.

Data on Bond Issues

Issue	Rating	Price	Yield to Maturity
Utilities:			
Bell Canada 6.10%, 2035 . . .	BBB (high)	122.16	4.32
TransCanada 8.05%, 2039 . .	A (low)	154.69	4.20
Hydro One 4.89%, 2037	A (high)	117.30	3.66
Industrials:			
Loblaw 5.90%, 2036	BBB	120.38	4.31
Suncor 5.39, 2037	A(low)	115.08	4.26

a. Cost of debt, K_d

b. Cost of preferred stock, K_p

c. Cost of common equity in the form of retained earnings, K_e

d. Weighted average cost of capital

30. Eaton International Corporation has the following capital structure:

	Cost (after tax)	Weightings	Weighted Cost
Debt	7.1%	25%	1.78%
Preferred stock (K_p)	8.6	10	.86
Common equity (K_e) (retained earnings)	14.1	65	9.17
Total: Weighted average cost of capital (K_a)			11.81%

a. If the firm has $19.5 million in retained earnings, at what size capital structure will the firm run out of retained earnings?

b. The 7.1 percent cost of debt referred to above applied only to the first $14 million of debt. After that the cost of debt will go up. At what size capital structure will there be a change in the cost of debt?

31. The Nolan Corporation finds that it is necessary to determine its marginal cost of capital. Nolan's current capital structure calls for 45 percent debt, 15 percent preferred stock, and 40 percent common equity. Initially common equity will be in the form of retained earnings (K_e) and then new common stock (K_n). The costs of the various sources of financing are as follows: debt, 5.6 percent; preferred stock, 9.0 percent; retained earnings, 12.0 percent; and new common stock, 13.2 percent.

a. What is the initial weighted average cost of capital? (Include debt, preferred stock, and common equity in the form of retained earnings, K_e.)
b. If the firm has $12 million in retained earnings, at what size of investment will the firm run out of retained earnings?
c. What will the marginal cost of capital be immediately after that point? (Equity will remain at 40 percent of the capital structure, but it will all be in the form of new common stock, K_n.)
d. The 5.6 percent cost of debt referred to above applies only to the first $18 million of debt. After that the cost of debt will be 7.2 percent. At what size of investment will there be a change in the cost of debt?
e. What will the marginal cost of capital be immediately after that point? (Consider the facts in both parts ***c*** and ***d***.)

32. The Evans Corporation finds that it is necessary to determine its marginal cost of capital. Evans' current capital structure calls for 30 percent debt, 10 percent preferred stock, and 60 percent common equity. Initially, common equity will be in the form of retained earnings (K_e) and then new common stock (K_n). The costs of the various sources of financing are as follows: debt, 6.2 percent; preferred stock, 9.4 percent; retained earnings, 12 percent; and new common stock, 13.4 percent.
    a. What is the initial weighted average cost of capital? (Include debt, preferred stock, and common equity in the form of retained earnings, K_e.)
    b. If the firm has $20 million in retained earnings, at what size of investment will the firm run out of retained earnings?
    c. What will the marginal cost of capital be immediately after that point? (Equity will remain at 60 percent of the capital structure, but it will all be in the form of new common stock, K_n.)
    d. The 6.2 percent cost of debt referred to above applies only to the first $36 million of debt. After that, the cost of debt will be 7.8 percent. At what size of investment will there be a change in the cost of debt?
    e. What will the marginal cost of capital be immediately after that point? (Consider the facts in both parts ***c*** and ***d***.)

33. Eaton Electronic Company's treasurer uses both the capital asset pricing model and the dividend valuation model to compute the cost of common equity (also referred to as the required rate of return for common equity).

    Assume the following:

    $R_f = 7\%$, $K_m = 10\%$, $\beta_j = 1.6$, $D_1 = \$0.70$, $P_0 = \$19$, $g = 8\%$

    a. Compute K_j (required rate of return on common equity based on the capital asset pricing model).
    b. Compute K_e (required rate of return on common equity based on the dividend valuation model).

COMPREHENSIVE PROBLEMS

34. Medical Research Corporation is expanding its research and production capacity to introduce a new line of products. Current plans call for the expenditure of $100 million on four projects of equal size ($25 million) but with different returns. Project A is in blood clotting proteins and has an expected return of 18 percent. Project B relates to a hepatitis vaccine and carries a potential return of 14 percent. Project C, dealing with a cardiovascular compound, is expected to earn

11.8 percent, and Project D, an investment in orthopedic implants, is expected to show a 10.9 percent return.

The firm has $15 million in retained earnings. After a capital structure with $15 million in retained earnings is reached (in which retained earnings represent 60 percent of the financing), all additional equity financing must come in the form of new common stock.

Common stock is selling for $25.00 per share, and underwriting costs are estimated at $3.00 if new shares are issued. Dividends for the next year will be $0.90 per share (D1), and earnings and dividends have grown consistently at 11 percent per year.

The yield on comparative bonds has been hovering at 11 percent. The investment dealer believes the first $20 million of bonds could be sold to yield 11 percent, while additional debt might require a 2 percent premium and be marketed to yield 13 percent. The corporate tax rate is 30 percent. Debt represents 40 percent of the capital structure.

a. Based on the two sources of financing, what is the initial weighted average cost of capital? (Use K_d and K_e.)
b. At what size capital structure will the firm run out of retained earnings?
c. What will the marginal cost of capital be immediately after that point?
d. At what size capital structure will there be a change in the cost of debt?
e. What will the marginal cost of capital be immediately after that point?
f. Based on the information about potential returns on investments in the first paragraph and information on marginal cost of capital (in parts ***a***, ***c***, and ***e***), how large a capital investment budget should the firm use?
g. Graph the answer determined in part ***f***.

35. Masco Oil and Gas Company is a very large company with common stock listed on the Toronto Stock Exchange and bonds traded over the counter. As of the current balance sheet, it has three bond issues outstanding:

$150 million of 10% series	2027
$ 50 million of 7% series	2021
$ 75 million of 5% series	2016

The vice-president of finance is planning to sell $75 million of bonds next year to replace the debt due to expire. Present market yields on similar BB-rated bonds are 12.1 percent. Masco also has $90 million of 7.5 percent, non-callable preferred stock outstanding, and it has no intentions of selling any more preferred stock in the future. The preferred stock is currently priced at $80.00 per share, and its dividend per share is $7.80.

The company has had very volatile earnings, but its dividends per share have had a very stable growth rate of 8 percent, and this will continue. The expected dividend (D1) is $1.90 per share, and the common stock is selling for $40.00 per share. The company's investment dealer has quoted the following flotation costs to Masco: $2.50 per share for preferred stock and $2.20 per share for common stock.

On the advice of its investment dealer, Masco has kept its debt at 50 percent of assets and its equity at 50 percent. Masco sees no need to sell either common or preferred stock in the foreseeable future as it generates enough internal funds for its investment needs when these funds are combined with debt financing. Masco's corporate tax rate is 40 percent.