CHAPTER 15
COST OF CAPITAL

Answers to Concepts Review and Critical Thinking Questions

1. It is the minimum rate of return the firm must earn overall on its existing assets. If it earns more than this, value is created.

2. Book values for debt are likely to be much closer to market values than are equity book values.

3. No. The cost of capital depends on the risk of the project, not the source of the money.

4. Interest expense is tax-deductible. There is no difference between pretax and aftertax equity costs.

5. The primary advantage of the DCF model is its simplicity. The method is disadvantaged in that (1) the model is applicable only to firms that actually pay dividends; many do not; (2) even if a firm does pay dividends, the DCF model requires a constant dividend growth rate forever; (3) the estimated cost of equity from this method is very sensitive to changes in g, which is a very uncertain parameter; and (4) the model does not explicitly consider risk, although risk is implicitly considered to the extent that the market has impounded the relevant risk of the stock into its market price. While the share price and most recent dividend can be observed in the market, the dividend growth rate must be estimated. Two common methods of estimating g are to use analysts' earnings and payout forecasts or to determine some appropriate average historical g from the firm's available data.

6. Two primary advantages of the SML approach are that the model explicitly incorporates the relevant risk of the stock and the method is more widely applicable than is the DCF model, since the SML doesn't make any assumptions about the firm's dividends. The primary disadvantages of the SML method are (1) three parameters (the risk-free rate, the expected return on the market, and beta) must be estimated, and (2) the method essentially uses historical information to estimate these parameters. The risk-free rate is usually estimated to be the yield on very short maturity T-bills and is, hence, observable; the market risk premium is usually estimated from historical risk premiums and, hence, is not observable. The stock beta, which is unobservable, is usually estimated either by determining some average historical beta from the firm and the market's return data, or using beta estimates provided by analysts and investment firms.

7. The appropriate aftertax cost of debt to the company is the interest rate it would have to pay if it were to issue new debt today. Hence, if the YTM on outstanding bonds of the company is observed, the company has an accurate estimate of its cost of debt. If the debt is privately-placed, the firm could still estimate its cost of debt by (1) looking at the cost of debt for similar firms in similar risk classes, (2) looking at the average debt cost for firms with the same credit rating (assuming the firm's private debt is rated), or (3) consulting analysts and investment bankers. Even if the debt is publicly traded, an additional complication is when the firm has more than one issue outstanding; these issues rarely have the same yield because no two issues are ever completely homogeneous.

8. *a.* This only considers the dividend yield component of the required return on equity.
    b. This is the current yield only, not the promised yield to maturity. In addition, it is based on the book value of the liability, and it ignores taxes.
    c. Equity is inherently more risky than debt (except, perhaps, in the unusual case where a firm's assets have a negative beta). For this reason, the cost of equity exceeds the cost of debt. If taxes are considered in this case, it can be seen that at reasonable tax rates, the cost of equity does exceed the cost of debt.

9. $R_{Sup} = .12 + .75(.08) = 18\%$
    Both should proceed. The appropriate discount rate does not depend on which company is investing; it depends on the risk of the project. Since Superior is in the business, it is closer to a pure play. Therefore, its cost of capital should be used. With an 18% cost of capital, the project has an NPV of $1 million regardless of who takes it.

10. If the different operating divisions were in much different risk classes, then separate cost of capital figures should be used for the different divisions; the use of a single, overall cost of capital would be inappropriate. If the single hurdle rate were used, riskier divisions would tend to receive funds for investment projects, since their return would exceed the hurdle rate despite the fact that they may actually plot below the SML and, hence, be unprofitable projects on a risk-adjusted basis. The typical problem encountered in estimating the cost of capital for a division is that it rarely has its own securities traded on the market, so it is difficult to observe the market's valuation of the risk of the division. Two typical ways around this are to use a pure play proxy for the division, or to use subjective adjustments of the overall firm hurdle rate based on the perceived risk of the division.

Solutions to Questions and Problems

Basic

1. $R_E = [\$2.10(1.07)/\$40] + .07 = 12.62\%$

2. $R_E = .05 + 1.15(.12 - .05) = 13.05\%$

3. $R_{E1} = .055 + 1.10(.08) = .1430$; $R_{E2} = [\$2.20(1.05)/\$32] + .05 = .1222$
    $R_E = (.1430 + .1222)/2 = 13.26\%$

4. $g_1 = (.45 - .40)/.40 = .1250$; $g_2 = (.52 - .45)/.45 = .1556$
    $g_3 = (.60 - .52)/.52 = .1538$; $g_4 = (.68 - .60)/.60 = .1333$
    $g = (.1250 + .1556 + .1538 + .1333)/4 = .1419$
    $R_E = [\$0.68(1.1419)/\$12.00] + .1419 = 20.66\%$

5. $R_P = \$5/\$92 = 5.43\%$

6. $P_0 = \$1,070 = \$50(PVIFA_{R\%,24}) + \$1,000(PVIF_{R\%,24})$; $R = 4.516\%$
    pre−tax cost of debt = YTM = 2(4.516%) = 9.033%
    $R_D = .09033(1 - .35) = 5.871\%$

7. *a.* $P_0 = \$1,050 = \$45(PVIFA_{R\%,44}) + \$1,000(PVIF_{R\%,44})$; $R = 4.25\%$
pre−tax cost of debt = YTM = 2(4.25%) = 8.49%
   b. $R_D = .0849(1 - .35) = 5.52\%$
   c.   The after-tax rate is more relevant because that is the actual cost to the company.

8. $BV_D = \$20M + 70M = \$90M$
$MV_D = 1.05(\$20M) + 0.61(\$70M) = \$63.7M$
$P_Z = \$610 = \$1,000(PVIF_{R\%,7})$; $R = 7.317\%$; $R_Z = .07317(1 - .35) = 4.756\%$
$R_D = 0.0552(21/63.7) + 0.04756(42.7/63.7) = 5.01\%$

9. *a.*   WACC = .50(.18) + .05(.065) + .45(.08)(1 − .35) = 11.67%
   b.   Since interest is tax deductible and dividends are not, we must look at the after-tax cost of debt, which is .08(1 − .35) = 5.20%. Hence, on an after-tax basis, debt is cheaper than the preferred stock.

10. WACC = .18(1/1.75) + .10(.75/1.75)(1 − .35) = 13.07%

11. WACC = .1250 = .15(E/V) + .08(D/V)(1 − .35)
.125(V/E) = .15 + .08(.65)(D/E)
.125(D/E + 1) = .15 + .052(D/E);   .073(D/E) = .0250;   D/E = .3425

12. *a.* $BV_E = 8.2M(\$5) = \$41M$; $BV_D = \$70M + \$50M = \$120M$
V = \$41M + 120M = \$161M: E/V = 41/161 = 0.2547;   D/V = 1 − E/V = 0.7453
   b. $MV_E = 8.2M(\$52) = \$426.4M$; $MV_D = 1.04(\$70M) + 0.97(\$50M) = \$121.3M$
V = \$426.4 + 121.3M = \$547.7; E/V = 426.4/547.7 = 0.7785;   D/V = 1 − E/V = 0.2215
   c.   The market value weights are more relevant.

13. $R_E = [\$4.00(1.06)/\$52] + .06 = .1415$
$P_1 = \$1,040 = \$40(PVIFA_{R\%,20}) + \$1,000(PVIF_{R\%,20})$;   R = 3.713%, YTM = 7.426%
$P_2 = \$970 = \$37.5(PVIFA_{R\%,12}) + \$1,000(PVIF_{R\%,12})$;   R = 4.071%, YTM = 8.142%
$R_D = (1 - .35)[(.6002)(.07426) + (.3998)(.08142)] = .05013$
WACC = .7785(.1415) + .2215(.05013) = 12.13%

14. *a.*   WACC = .13 = (1/1.9)(.18) + (.9/1.9)(1 − .35)R_D ; R_D = 11.45%
   b.   WACC = .13 = (1/1.9)R_E + (.9/1.9)(.075); R_E = 17.95%

15. $MV_D = 3,000(\$1,000)(1.03) = \$3.09M$; $MV_E = 90,000(\$45) = \$4.05M$
$MV_P = 13,000(\$108) = \$1.404M$;   V = \$3.09M + 4.05M + 1.404M = \$8.544M
$R_E = .06 + 1.20(.08) = 15.60\%$
$P_0 = \$1,030 = \$40(PVIFA_{R\%,40}) + \$1,000(PVIF_{R\%,40})$; R = 3.852%, YTM = 7.703%
$R_D = (1 - .35)(.07703) = 5.007\%$
$R_P = \$7/\$108 = 6.418\%$
WACC = .05007(3.09/8.544) + .1560(4.05/8.544) + .06481(1.404/8.544) = 10.27%

16. *a.* $MV_D = 100,000(\$1,000)(0.91) = \$91M$; $MV_E = 8M(\$32) = \$256M$
$MV_P = 500,000(\$67) = \$33.5M$; $V = \$91M + 256M + 33.5M = \$380.5M$
$D/V = 91/380.5 = .2392$; $P/V = 33.5/380.5 = .0880$; $E/V = 256/380.5 = .6728$

   b.   For projects equally as risky as the firm itself, the WACC should be used as the discount rate.
$R_E = .05 + 1.15(.10) = 16.50\%$
$P_0 = \$910 = \$45(PVIFA_{R\%,30}) + \$1,000(PVIF_{R\%,30})$; $R = 5.092\%$, $YTM = 10.18\%$
$R_D = (1 - .35)(.1018) = 6.6191\%$
$R_P = \$6/\$67 = 8.96\%$
$WACC = .1650(.6728) + .0896(.0880) + .06619(.2392) = 13.47\%$

17. *a.*   Projects X, Y and Z.

   b.   Using the firm's overall cost of capital as a hurdle rate, projects Y and Z. However, after considering risk via the SML:
$E[W] = .05 + .70(.12 - .05) = .0990 < .11$, so accept W.
$E[X] = .05 + .95(.12 - .05) = .1165 < .13$, so accept X.
$E[Y] = .05 + 1.05(.12 - .05) = .1235 < .14$, so accept Y.
$E[Z] = .05 + 1.60(.12 - .05) = .1620 > .16$, so reject Z.

   c.   Project W would be incorrectly rejected; project Z would be incorrectly accepted.

18. *a.*   He should look at the weighted average flotation cost, not just the debt cost.

   b. $f_T = .04(1/2) + .15(1/2) = .095$

   c. $X(1 - .095) = \$6M$; $X = cost = \$6M/(1 - .095) = \$6,629,834$
Even if the specific funds are actually being raised completely from debt, the flotation costs, and hence true investment cost, should be valued as if the firm's target capital structure is used.

19. $f_T = .60(.12) + .10(.06) + .30(.04) = .0900$
$X(1 - .0900) = \$12M$; $X = cost = \$12M/(1 - .0900) = \$13,186,813$

Intermediate

20. $WACC = (.75/1.75)(.06) + (1/1.75)(.16) = 11.71\%$
project discount rate $= 11.71\% + 2.00\% = 13.71\%$
$NPV = - cost + PV\ cash\ flows$; $PV = [\$4M/(.1371 - .05)] = \$45,901,639$
The project should only be undertaken if its cost is less than $45,901,639.

21. total costs $= \$1.4M + 105,000 = \$1.505M$; $\$1.505M(1 - f_T) = \$1.4M$; $f_T = .06976$
$f_T = .06976 = .10(E/V) + .03(D/V)$; $.06976(D/E + 1) = .10 + .03(D/E)$; $D/E = .7602$

Challenge

22. $WACC = (1/2.2)(.18) + (1.2/2.2)[(.20)WACC + (.80)(.09)(1 - .35)]$
$= .0818 + .5454[(.20)WACC + .0468]$
$= .0818 + (.10909)WACC + .0255$
$(.8909)WACC = .1073$ thus $WACC = .12049$
Flotation costs $= (1/2.2)(.08) + (1.2/2.2)[(.20)(0) + (.80)(.03)] = .0495$
Project cost $= \$40,000,000/(1 - .0495) = \$42,081,102$
$NPV = -\$42,081,102 + (\$5,500,000/.12049)$
$= -\$42,081,102 + \$45,647,019 = \$3,565,917$

23. The $6 million cost of the land 3 years ago is a sunk cost and irrelevant; the $9.25M appraised value of the land is an opportunity cost and is relevant. The relevant market value capitalization weights are:

$MV_D = 10,000(\$1,000)(0.92) = \$9.2M$; $MV_E = 250,000(\$70) = \$17.5M$

$MV_P = 10,000(\$95) = \$950,000$; $V = \$9.2M + 17.5M + .95M = \$27.65M$

$R_E = .05 + 1.4(.08) = 16.20\%$

$P_0 = \$920 = \$40(PVIFA_{R\%,30}) + \$1,000(PVIF_{R\%,30})$; $R = 4.49\%$, $YTM = 8.98\%$

$R_D = (1 - .35)(.0898) = 5.84\%$

$R_P = \$6/\$95 = 6.32\%$

   a. $f_T = (17.5/27.65)(.09) + (.95/27.65)(.07) + (9.2/27.65)(.04) = .0727$

          $X(1 - .0727) = \$14M$; $X = cost = \$14M/(1 - .0727) = \$15,097,209$

          $CF_0 = -\$9.20M - 15,097,209 - 900,000 = -\$25,197,209$

   b. $WACC = .02 + [(17.5/27.65)(.162) + (.95/27.65)(.0632) + (9.2/27.65)(.0584)] = .1441$

   c. $BV_5 = \$5,250,000$; after-tax salvage value $= \$5M + .35(\$5,250,000 - 5M) = \$5,087,500$

   d. $OCF = [(P - v)Q - FC](1 - t) + tD$

           $= [(\$10,400 - 8,500)(10,000) - 350,000](1 - .35) + .35(\$14M/8) = \$12,735,000$

   e $Q = (FC + D)/(P - v) = (\$350,000 + 1,750,000)/(\$10,400 - 8,500) = 1,105$ units

   f.

Year	Flow Cash	
0	–$25,197,209	IRR = 44.09%
1	$12,735,000	NPV = $21,150,084.74
2	$12,735,000	discount rate = WACC = 14.41%
3	$12,735,000	
4	$12,735,000	
5	$18,722,500	