**CHAPTER 12**

***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 their market values than are book values for equity.

**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 DGM 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 DGM 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 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 DGM model, since the SML doesn’t make any assumptions about the firm’s dividends. The primary disadvantages of the SML method are (1) estimating three parameters: the risk-free rate, the expected return on the market, and beta, 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 is not directly 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 riskier 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.** RSuperior = .12 + .75(.08) = .18 or 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

*NOTE: All end-of-chapter problems were solved using a spreadsheet. Many problems require multiple steps. Due to space and readability constraints, when these intermediate steps are included in this solutions manual, rounding may appear to have occurred. However, the final answer for each problem is found without rounding during any step in the problem.*

 *Basic*

**1.** With the information given, we can find the cost of equity, using the dividend growth model. Using this model, the cost of equity is:

 RE = [$2.20(1.06)/$43] + .06

 RE = .1142 or 11.42%

**2.** Here we have information to calculate the cost of equity, using the CAPM. The cost of equity is:

RE = .045 + 1.10(.12 – .045)

 RE = .1275 or 12.75%

**3.** We have the information available to calculate the cost of equity, using the CAPM and the dividend growth model. Using the CAPM, we find:

RE = .04 + 0.90(.07) = .1030 or 10.30%

 And using the dividend growth model, the cost of equity is

 RE = [$1.90(1.05)/$41] + .05 = .0987 or 9.87%

 Both estimates of the cost of equity seem reasonable. If we remember the historical return on large capitalization stocks, the estimate from the CAPM model is slightly lower than average, and the estimate from the dividend growth model is about one percent lower than the historical average, so we cannot definitively say one of the estimates is incorrect. Given this, we will use the average of the two, so:

 RE = (.1030 + .0987)/2 = .1008 or 10.08%

**4.** To use the dividend growth model, we first need to find the growth rate in dividends. So, the increase in dividends each year was:

g1 = ($2.03 – 1.96)/$1.96

 g1 = .0357 or 3.57%

 g2 = ($2.20 – 2.03)/$2.03

 g2 = .0837 or 8.37%

g3 = ($2.30 – 2.20)/$2.20

 g3 = .0455 or 4.55%

 g4 = ($2.46 – 2.30)/$2.30

 g4 = .0696 or 6.96%

So, the average arithmetic growth rate in dividends was:

g = (.0357 + .0837 + .0455 + .0696)/4

 g = .0586 or 5.86%

 Using this growth rate in the dividend growth model, we find the cost of equity is:

RE = [$2.46(1.0586)/$65.00] + .0586

 RE = .0987 or 9.87%

 Calculating the geometric growth rate in dividends, we find:

 $2.46 = $1.96(1 + g)4

 g = .0584 or 5.84%

 The cost of equity using the geometric dividend growth rate is:

 RE = [$2.46(1.0584)/$65.00] + .0584

 RE = .0985 or 9.85%

**5.** The cost of preferred stock is the dividend payment divided by the price, so:

RP = $5.50/$97

 RP = .0567 or 5.67%

**6.** The pretax cost of debt is the YTM of the company’s bonds, so:

P0 = $1,080 = $37(PVIFAR%,14) + $1,000(PVIFR%,14)

 R = 2.992%

 YTM = 2 × 2.992%

 YTM = 5.98%

 And the aftertax cost of debt is:

RD = .0598(1 – .38)

 RD = .0371 or 3.71%

**7.** *a.* The pretax cost of debt is the YTM of the company’s bonds, so:

 P0 = $940 = $35(PVIFAR%,46) + $1,000(PVIFR%,46)

 R = 3.777%

 YTM = 2 × 3.777%

 YTM = 7.55%

*b.* The aftertax cost of debt is:

 RD = .0755(1 – .35)

 RD = .0491 or 4.91%

*c.* The aftertax rate is more relevant because that is the actual cost to the company.

**8.** The book value of debt is the total par value of all outstanding debt, so:

BVD = $90,000,000 + 60,000,000

 BVD = $150,000,000

 To find the market value of debt, we find the price of the bonds and multiply by the number of bonds. Alternatively, we can multiply the price quote of the bond times the par value of the bonds. Doing so, we find:

MVD = 0.94($90,000,000) + .525($60,000,000)

 MVD = $116,100,000

 The YTM of the zero coupon bonds is (Remember, even on zero coupon bonds, for consistency, the “payments” are assumed to be semiannual):

PZ = $525 = $1,000(PVIFR%,20)

 R = .0327 or 3.27%

 Which means the YTM is:

 YTM = 3.27% × 2

 YTM = 6.55%

 So, the aftertax cost of the zero coupon bonds is:

 RZ = .0655(1 – .35)

 RZ = .0426 or 4.26%

The aftertax cost of debt for the company is the weighted average of the aftertax cost of debt for all outstanding bond issues. We need to use the market value weights of the bonds. The total aftertax cost of debt for the company is:

RD = .0491[(0.94)($90,000,000)/$116,100,000] + .0426[(.525)($60,000,000)/$116,100,000]

 RD = .0473 or 4.73%

**9.** *a.* Using the equation to calculate the WACC, we find:

 WACC = .60(.125) + .05(.055) + .35(.072)(1 – .35)

 WACC = .0941 or 9.41%

*b.* Since interest is tax deductible and dividends are not, we must look at the aftertax cost of debt, which is:

 RD = .072(1 – .35)

 RD = .0468 or 4.68%

 Hence, on an aftertax basis, debt is cheaper than the preferred stock.

**10.** Here, we need to use the debt-equity ratio to calculate the WACC. A debt-equity ratio of .65 implies a weight of debt of .65/1.65 and an equity weight of 1/1.65. Using this relationship, we find:

WACC = .13(1/1.65) + .08(.65/1.65)(1 – .35)

 WACC = .0993 or 9.93%

**11.** Here, we have the WACC and need to find the debt-equity ratio of the company. Setting up the WACC equation, we find:

 WACC = .112 = .15(E/V) + .08(D/V)(1 – .35)

 Rearranging the equation, we find:

 .112(V/E) = .15 + .08(.65)(D/E)

 Now we must realize that the V/E is just the equity multiplier, which is equal to:

 V/E = 1 + D/E

 .112(D/E + 1) = .15 + .052(D/E)

 Now, we can solve for D/E as:

 .06(D/E) = .038

 D/E = .6333

**12.** *a.* The book value of equity is the book value per share times the number of shares, and the book value of debt is the face value of the company’s debt, so:

 BVE = 6,000,000($4) = $24,000,000

 BVD = $70,000,000 + 35,000,000 = $105,000,000

 So, the total value of the company is:

 V = $24,000,000 + 105,000,000 = $129,000,000

 And the book value weights of equity and debt are:

 E/V = $24,000,000/$129,000,000 = .1860

 D/V = 1 – E/V = .8140

 *b.* The market value of equity is the share price times the number of shares, so:

 MVE = 6,000,000($61) = $366,000,000

 Using the relationship that the total market value of debt is the price quote times the par value of the bond, we find the market value of debt is:

 MVD = 0.98($70,000,000) + 0.97($35,000,000) = $102,550,000

 This makes the total market value of the company:

 V = $366,000,000 + 102,550,000 = $468,550,000

 And the market value weights of equity and debt are:

E/V = $366,000,000/$468,550,000 = .7811

 D/V = 1 – E/V = .2189

 *c.* The market value weights are more relevant because they represent a more current valuation of the debt and equity.

**13.** First, we will find the cost of equity for the company. The information provided allows us to solve for the cost of equity using the dividend growth model, so:

 RE = [$2.85(1.06)/$61] + .06

 RE = .1095 or 10.95%

 Next, we need to find the YTM on both bond issues. Doing so, we find:

 P1 = $980 = $35(PVIFAR%,40) + $1,000(PVIFR%,40)

 R = 3.595%

 YTM = 3.595% × 2

 YTM = 7.19%

 P2 = $970 = $32.50(PVIFAR%,24) + $1,000(PVIFR%,24)

 R = 3.756%

 YTM = 3.436% × 2

 YTM = 6.87%

 To find the weighted average aftertax cost of debt, we need the weight of each bond as a percentage of the total debt. We find:

 wD1 = .98($70,000,000)/$102,550,000

 wD1 = .6689

 wD2 = .97($35,000,000)/$102,550,000

 wD2 = .3311

 Now we can multiply the weighted average cost of debt times one minus the tax rate to find the weighted average aftertax cost of debt. This gives us:

 RD = (1 – .35)[(.6689)(.0719) + (.3311)(.0687)]

 RD = .0460 or 4.60%

 Using these costs we have found and the weight of debt we calculated earlier, the WACC is:

 WACC = .7811(.1095) + .2189(.0460)

 WACC = .0956 or 9.56%

**14.** *a.* Using the equation to calculate WACC, we find:

 WACC = .084 = (1/1.70)(.11) + (.70/1.70)(1 – .35)RD

 RD = .0721 or 7.21%

 *b.* Using the equation to calculate WACC, we find:

 WACC = .084 = (1/1.70)RE + (.70/1.70)(.052)

 RE = .1064 or 10.64%

**15.** We will begin by finding the market value of each type of financing. We find:

 MVD = 8,500($1,000)(1.05) = $8,925,000

 MVE = 210,000($83) = $17,430,000

MVP = 12,000($98) = $1,176,000

And the total market value of the firm is:

V = $8,925,000 + 17,430,000 + 1,176,000

V = $27,531,000

 Now, we can find the cost of equity using the CAPM. The cost of equity is:

 RE = .048 + 1.15(.07)

 RE = .1285 or 12.85%

 The cost of debt is the YTM of the bonds, so:

 P0 = $1,050 = $39(PVIFAR%,50) + $1,000(PVIFR%,50)

 R = 3.68%

 YTM = 3.68% × 2

 YTM = 7.36%

 And the aftertax cost of debt is:

 RD = (1 – .35)(.0736)

 RD = .0478 or 4.78%

 The cost of preferred stock is:

 RP = $5.75/$98

 RP = .0587 or 5.87%

 Now we have all of the components to calculate the WACC. The WACC is:

 WACC = .0478($8,925/$27,531) + .1285($17,430/$27,531) + .0587($1,176/$27,531)

 WACC = .0994 or 9.94%

 Notice that we didn’t include the (1 – TC) term in the WACC equation. We used the aftertax cost of debt in the equation, so the term is not needed here.

**16.** *a.* We will begin by finding the market value of each type of financing. We find:

 MVD = 175,000($1,000)(.96) = $168,000,000

 MVE = 7,500,000($64) = $480,000,000

 MVP = 500,000($108) = $54,000,000

 And the total market value of the firm is:

 V = $168,000,000 + 480,000,000 + 54,000,000

 V = $702,000,000

 So, the market value weights of the company’s financing is:

 D/V = $168,000,000/$702,000,000 = .2393

 P/V = $54,000,000/$702,000,000 = .0769

 E/V = $480,000,000/$702,000,000 = .6838

 *b.* For projects equally as risky as the firm itself, the WACC should be used as the discount rate.

 First, we can find the cost of equity using the CAPM. The cost of equity is:

 RE = .055 + 1.20(.068)

 RE = .1366 or 13.66%

 The cost of debt is the YTM of the bonds, so:

 P0 = $960 = $41(PVIFAR%,30) + $1,000(PVIFR%,30)

 R = 4.341%

 YTM = 4.341% × 2

 YTM = 8.68%

 And the aftertax cost of debt is:

 RD = (1 – .34)(.0868)

 RD = .0573 or 5.73%

 The cost of preferred stock is:

 RP = $7/$108

 RP = .0648 or 6.48%

 Now, we can calculate the WACC as:

 WACC = .2393(.0573) + .0769(.0648) + .6838(.1366)

 WACC = .1121 or 11.21%

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

 *b.* Using the CAPM to consider the projects, we need to calculate the expected return of the project, given its level of risk. This expected return should then be compared to the expected return of the project. If the return calculated using the CAPM is higher than the project expected return, we should accept the project; if not, we reject the project. After considering risk via the CAPM:

 E[W] = .05 + .70(.12 – .05) = .0990 < .10, so accept W

 E[X] = .05 + .85(.12 – .05) = .1095 > .105, so reject X

 E[Y] = .05 + 1.25(.12 – .05) = .1375 < .14, so accept Y

 E[Z] = .05 + 1.75(.12 – .05) = .1725 > .17, so reject Z

1. Project W would be incorrectly rejected; Project Z would be incorrectly accepted.

**18.** We will begin by finding the market value of each type of financing. We find:

 MVD = 9,000($1,000)(1.04) = $9,360,000

 MVE = 225,000($64.50) = $14,512,500

MVP = 8,000($94) = $752,000

And the total market value of the firm is:

V = $9,360,000 + 14,512,500 + 752,000

V = $24,624,500

 Now, we can find the cost of equity using the CAPM. The cost of equity is:

 RE1 = .05 + .85(.12 – .05)

 RE1 = .1095 or 10.95%

 We can also find the cost of equity, using the dividend discount model. The cost of equity with the dividend discount model is:

 RE2 = ($2.70/$64.50) + .05

 RE2 = .0919 or 9.19%

 Both estimates for the cost of equity seem reasonable, so we will use the average of the two. The cost of equity estimate is:

 RE = (.1095 + .0919)/2

 RE = .1007 or 10.07%

 The cost of debt is the YTM of the bonds, so:

 P0 = $1,040 = $31(PVIFAR%,40) + $1,000(PVIFR%,40)

 R = 2.939%

 YTM = 2.939% × 2

 YTM = 5.86%

 And the aftertax cost of debt is:

 RD = (1 – .35)(.0586)

 RD = .0381 or 3.81%

 The cost of preferred stock is:

 RP = $4.50/$94

 RP = .0479 or 4.79%

 Now, we have all of the components to calculate the WACC. The WACC is:

 WACC = .0381($9,360,000/$24,624,500) + .0479($752,000/$24,624,500)

 + .1007($14,512,500/$24,624,500)

 WACC = .0753 or 7.53%

**19.** The bonds have 26 years to maturity so the price today is:

 P0 = $1,000/(1 + .081/2)52

 P0 = $126.89

 The market value of the debt is:

 MVD = 135,000($126.89) = $17,129,527.04

 So, the total value of the firm is:

 V = $17,129,527.04 + 45,000,000

 V = $62,129,527.04

 This means the weight of debt in the capital structure is:

 D/V = $17,129,527.04/$62,129,527.04

 D/V = .2757

**20.** To find the required return for the project, we need to adjust the company’s WACC for the level of risk in the project. A debt-equity ratio of .80 implies a weight of debt of .80/1.80 and a weight of equity of 1/1.80, so the company’s WACC is:

 WACC = (.80/1.80)(.0780) + (1/1.80)(.1450)

 WACC = .1152 or 11.52%

 Adjusting for risk, the project discount rate is:

 Project discount rate = .1152 + .03

 Project discount rate = .1452 or 14.52%

 *Intermediate*

**21.** First, we need to find the project discount rate. The project discount rate is the company’s cost of capital plus a risk adjustment factor. A debt-equity ratio of .50 implies a weight of debt of .50/1.50 and a weight of equity of 1/1.50, so the company’s WACC is:

 WACC = (.50/1.50)(.064) + (1/1.50)(.13)

 WACC = .1080 or 10.80%

 Adjusting for risk, the project discount rate is:

 Project discount rate = .1080 + .02

 Project discount rate = .1280 or 12.80%

 The company should only accept the project if the NPV is zero (hopefully greater than zero.) The cash flows are a growing annuity. The present value of a growing annuity can be found with the dividend discount equation. So, the present value of the savings is:

 PV = [$5,100,000/(.1280 – .03)]

 PV = $52,040,816.33

 The project should only be undertaken if its cost is less than $52,040,816.33.

**22.** To find the aftertax cost of equity for the company, we need to find the weighted average of the four debt issues. We will begin by calculating the market value of each debt issue, which is:

 MV1 = 1.05($20,000,000)

 MV1 = $21,000,000

 MV2 = .954($40,000,000)

 MV2 = $38,160,000

 MV3 = 1.038($45,000,000)

 MV3 = $46,710,000

 MV4 = 1.057($60,000,000)

 MV4 = $63,420,000

 So, the total market value of the company’s debt is:

 MVD = $21,000,000 + 38,160,000 + 46,710,000 + 63,420,000

 MVD = $169,290,000

 The weight of each debt issue is:

 w1 = $21,000,000/$169,290,000

 w1 = .1240 or 12.40%

 w2 = $38,160,000/$169,290,000

 w2 = .2254 or 22.54%

 w3 = $46,710,000/$169,290,000

 w3 = .2759 or 27.59%

 w4 = $63,420,000/$169,290,000

 w4 = .3746 or 37.46%

 Next, we need to find the YTM for each bond issue. The YTM for each issue is:

 P1 = $1,050 = $42.50(PVIFAR%,10) + $1,000(PVIFR%,10)

 R1 = .03644 or 3.644%

 YTM1 = 3.644% × 2

 YTM1 = 7.29%

 P2 = $954 = $34(PVIFAR%,16) + $1,000(PVIFR%,16)

 R2 = .03789 or 3.789%

 YTM2 = 3.789% × 2

 YTM2 = 7.58%

 P3 = $1,038 = $41(PVIFAR%,31) + $1,000(PVIFR%,31)

 R3 = .03887 or 3.887%

 YTM3 = 3.887% × 2

 YTM3 = 7.77%

 P4 = $1,057 = $43.50(PVIFAR%,50) + $1,000(PVIFR%,50)

 R4 = .04081 or 4.081%

 YTM4 = 4.081% × 2

 YTM4 = 8.16%

 The weighted average YTM of the company’s debt is thus:

 YTM = .1240(.0729) + .2254(.0758) + .2759(.0777) + .3746(.0816)

 YTM = .0781 or 7.81%

 And the aftertax cost of debt is:

 RD = .0781(1 – .034)

 RD = .0516 or 5.16%

**23.** *a.* Using the dividend discount model, the cost of equity is:

 RE = [(0.75)(1.05)/$81] + .05

 RE = .0597 or 5.97%

*b.* Using the CAPM, the cost of equity is:

 RE = .05 + 1.25(.1150 – .05)

 RE = .1313 or 13.13%

 *c.* When using the dividend growth model or the CAPM, you must remember that both are estimates for the cost of equity. Additionally, and perhaps more importantly, each method of estimating the cost of equity depends upon different assumptions.

 *Challenge*

**24.** We can use the debt-equity ratio to calculate the weights of equity and debt. The debt of the company has a weight for long-term debt and a weight for accounts payable. We can use the weight given for accounts payable to calculate the weight of accounts payable and the weight of long-term debt. The weight of each will be:

 Accounts payable weight = .15/1.15 = .1304

 Long-term debt weight = 1/1.15 = .8696

 Since the accounts payable has the same cost as the overall WACC, we can write the equation for the WACC as:

 WACC = (1/1.6)(.15) + (0.6/1.6)[(.1304)WACC + (.8696)(.07)(1 – .35)]

 Solving for WACC, we find:

 WACC = .0938 + .375[(.1304)WACC + .0396]

 WACC = .0938 + (.0489)WACC + .0148

 (.9511)WACC = .1161

 WACC = .1142 or 11.42%

 Since the cash flows go to perpetuity, we can calculate the present value using the equation for the PV of a perpetuity. The NPV is:

 NPV = –$65,000,000 + ($7,750,000/.1142)

 NPV = $2,880,380.38

**25.** *a.* The $7 million cost of the land 3 years ago is a sunk cost and irrelevant; the $7.6 million appraised value of the land is an opportunity cost and is relevant. So, the total initial cash flow is:

 CF0 = –$7,600,000 – 13,000,000 – 825,000

 CF0 = –$21,425,000

 *b.* To find the required return for the project, we need to adjust the company’s WACC for the level of risk in the project. We begin by calculating the market value of each type of financing, so:

 MVD = 45,000($1,000)(0.95) = $42,750,000

 MVE = 750,000($94) = $70,500,000

 MVP = 35,000($92) = $3,220,000

 The total market value of the company is:

 V = $42,750,000 + 70,500,000 + 3,220,000

 V = $116,470,000

 Next, we need to find the cost of funds. We have the information available to calculate the cost of equity, using the CAPM, so:

 RE = .0520 + 1.20(.07)

 RE = .1360 or 13.60%

 The cost of debt is the YTM of the company’s outstanding bonds, so:

 P0 = $950 = $34(PVIFAR%,40) + $1,000(PVIFR%,40)

 R = .03639 or 3.639%

 YTM = 3.639% × 2

 YTM = 7.28%

 And the aftertax cost of debt is:

 RD = (1 – .34)(.0728)

 RD = .0480 or 4.80%

 The cost of preferred stock is:

 RP = $6.20/$92

 RP = .0674 or 6.74%

 So, the company’s WACC is:

 WACC = .0480($42,750/$116,470) + .0674($3,220/$116,470) + .1360($70,500/$116,470)

 WACC = .1018 or 10.18%

 The company wants to use the subjective approach to this project because it is located overseas. The adjustment factor is 2 percent, so the required return on this project is:

 Project required return = .1018 + .02

 Project required return = .1218 or 12.18%

 *c.* The annual depreciation for the equipment will be:

 $13,000,000/8 = $1,625,000

 So, the book value of the equipment at the end of five years will be:

 BV5 = $13,000,000 – 5($1,625,000)

 BV5 = $4,875,000

 So, the aftertax salvage value will be:

 Aftertax salvage value = $1,500,000 + .34($4,875,000 – 1,500,000)

 Aftertax salvage value = $2,647,500

 *d.* Using the tax shield approach, the OCF for this project is:

 OCF = [(P – v)Q – FC](1 – t) + TCD

 OCF = [($10,400 – 9,600)(13,000) – 2,300,000](1 – .34) + .34($13,000,000/8)

 OCF = $5,898,500

 *e.* We have calculated all cash flows of the project. We just need to make sure that in Year 5 we add back the aftertax salvage value, the recovery of the initial NWC, and the aftertax value of the land in five years since it will be an opportunity cost. So, the cash flows for the project are:

 *Year*  *Flow Cash*

 0 –$21,425,000

 1 5,898,500

 2 5,898,500

 3 5,898,500

 4 5,898,500

 5 17,271,000

 Using the required return of 12.18 percent, the NPV of the project is:

 NPV = –$21,425,000 + $5,898,500(PVIFA12.18%,4) + $17,271,000/1.12185

 NPV = $6,143,391.29

 And the IRR is:

 NPV = 0 = –$21,425,000 + $5,898,500(PVIFAIRR%,4) + $17,271,000/(1 + IRR)5

 IRR = 21.40%