## **CHAPTER 9**

#### Risk and the Cost of Capital

## **Answers to Problem Sets**

1. Overestimate

2. Company cost of capital = 10 x .4 + (10 + .5 x 8) x .6 = 12.4%

After-tax WACC = (1 - .35) x 10 x .4 + (10 + .5 x 8) x .6 = 11.0%

3. .297, or 29.7% of variation was due to market movements; .703 or 70.3% of the variation was diversifiable. Diversifiable risk shows up in the scatter about the fitted line. The standard error of the estimated beta was unusually high at .436. If you said that the true beta was 2 x .436 = .872 either side of your estimate, you would have a 95% chance of being right.

4. a. The expected return on debt. If the debt has very low default risk, this is

close to its yield to maturity.

b. The expected return on equity.

c. A weighted average of the cost of equity and the after-tax cost of debt, where the weights are the relative market values of the firm’s debt and equity.

d. The change in the return of the stock for each additional 1% change in the market return.

e. The change in the return on a portfolio of all the firm’s securities (debt and equity) for each additional 1% change in the market return.

f. A company specializing in one activity that is similar to that of a division of a more diversified company.

g. A certain cash flow occurring at time *t* with the same present value as an uncertain cash flow at time *t*.

5. Beta of assets = .5 × .15 + .5 × 1.25 = .7

6. A diversifiable risk has no affect on the risk of a well-diversified portfolio and therefore no affect on the project’s beta. If a risk is diversifiable it does not change the cost of capital for the project. However, any possibility of bad outcomes does need to be factored in when calculating expected cash flows.

7. Suppose that the expected cash flow in Year 1 is 100, but the project proposer provides an estimate of 100 × 115/108 = 106.5. Discounting this figure at 15% gives the same result as discounting the true expected cash flow at 8%. Adjusting the discount rate, therefore, works for the first cash flow but it does not do so for later cash flows (e.g., discounting a 2-year cash flow of 106.5 by 15% is *not* equivalent to discounting a 2-year flow of 100 by 8%).

8. a. A (higher fixed cost)

b. C (more cyclical revenues).

9. a. False

b. False

c. True

10. a. PV =

= 

b.CEQ1/1.05 = 110/1.10, CEQ1 = $105; CEQ2 /1.052 = 121/1.102, CEQ2 = $110.25.

c.Ratio1 = 105/110 = .95; Ratio2 = 110.25/121 = .91.

11. a. requity = rf + β × (rm – rf) = 0.04 + (1.5 × 0.06) = 0.13 = 13%

b. 

rassets = 0.094 = 9.4%

c. The cost of capital depends on the risk of the project being evaluated. If the risk of the project is similar to the risk of the other assets of the company, then the appropriate rate of return is the company cost of capital. Here, the appropriate discount rate is 9.4%.

d. requity = rf + β × (rm – rf) = 0.04 + (1.2 × 0.06) = 0.112 = 11.2%



rassets = 0.0832 = 8.32%

12. a.



b. r = rf + β × (rm – rf) = 0.05 + (0.836× 0.06) = 0.10016 = 10.016%

13. a. The R2 value for Toronto Dominion was 0.25, which means that 25% of total risk comes from movements in the market (i.e., market risk). Therefore, 75% of total risk is unique risk.

The R2 value for Canadian Pacific was 0.30, which means that 30% of total risk comes from movements in the market (i.e., market risk). Therefore, 70% of total risk is unique risk.

1. The variance of Toronto Dominion is: (25)2 = 625

Market risk for Toronto Dominion: 0.25 × 625 = 156.25

Unique risk for Alcan: 0.75 × 625 = 468.75

1. The t-statistic for βCP is: 1.04/0.20 = 5.20

This is significant at the 1% level, so that the confidence level is 99%.

d. rTD = rf + βTD × (rm – rf) = 0.05 + [0.82 × (0.12 – 0.05)] = 0.1074 = 10.74%

e. rTD = rf + βTD × (rm – rf) = 0.05 + [0.82 × (0 – 0.05)] = 0.0090 = 0.90%

14. The total market value of outstanding debt is $300,000. The cost of debt capital is 8 percent. For the common stock, the outstanding market value is:

$50 × 10,000 = $500,000. The cost of equity capital is 15 percent. Thus, Lorelei’s weighted-average cost of capital is:



rassets = 0.124 = 12.4%

15. a. rBN = rf + βBN × (rm – rf) = 0.05 + (01.01 × 0.07) = 0.1207 = 12.07%

rIND = rf + βIND × (rm – rf) = 0.05 + (01.24 × 0.07) = 0.1368 = 13.68%

b. No, we can not be confident that Burlington’s true beta is not the industry average. The difference between βBN and βIND (0.23) is less than two times the standard error (2 × 0.19 = 0.38), so we cannot reject the hypothesis that βBN = βIND with 95% confidence.

c. Burlington’s beta might be different from the industry beta for a variety of reasons. For example, Burlington’s business might be more cyclical than is the case for the typical firm in the industry. Or Burlington might have more fixed operating costs, so that operating leverage is higher. Another possibility is that Burlington has more debt than is typical for the industry so that it has higher financial leverage.

16. Financial analysts or investors working with portfolios of firms may use industry betas. To calculate an industry beta we would construct a series of industry portfolio investments and evaluate how the returns generated by this portfolio relate to historical market movements.

17. We should use the market value of the stock, not the book value shown on the annual report. This gives us an equity value of 500,000 shares times $18 = $9 million. So Binomial Tree Farm has a debt/value ratio of 5/14 = 0.36 and an equity /value ratio of 9/14 = 0.64.

18. a. If you agree to the fixed price contract, operating leverage increases. Changes in revenue result in greater than proportionate changes in profit. If all costs are variable, then changes in revenue result in proportionate changes in profit. Business risk, measured by βassets, also increases as a result of the fixed price contract. If fixed costs equal zero, then:

βassets = βrevenue. However, as PV(fixed cost) increases, βassets increases.

b. With the fixed price contract:

PV(assets) = PV(revenue) – PV(fixed cost) – PV(variable cost)



PV(assets) = $97,462,710

Without the fixed price contract:

PV(assets) = PV(revenue) – PV(variable cost)



PV(assets) = $111,111,111

19. a. The threat of a coup d’état means that the *expected* cash flow is less than $250,000. The threat could also increase the discount rate, but only if it increases market risk.

* 1. The expected cash flow is: (0.25 × 0) + (0.75 × 250,000) = $187,500

Assuming that the cash flow is about as risky as the rest of the company’s business:

PV = $187,500/1.12 = $167,411

20. a. Expected daily production =

(0.2 × 0) + 0.8 × [(0.4 x 1,000) + (0.6 x 5,000)] = 2,720 barrels

Expected annual cash revenues = 2,720 x 365 x $15 = $49,640,000

1. The possibility of a dry hole is a diversifiable risk and should not affect the discount rate. This possibility should affect forecasted cash flows, however. See Part (a).

21. a. Using the Security Market Line, we find the cost of capital:

r = 0.07 + [1.5 × (0.16 – 0.07)] = 0.205 = 20.5%

Therefore:



|  |  |  |  |
| --- | --- | --- | --- |
| b. | CEQ1 = | 40×(1.07/1.205) = | 35.52 |
|  | CEQ2 = | 60×(1.07/1.205)2 = | 47.31 |
|  | CEQ3 = | 50×(1.07/1.205)3 = | 35.01 |

|  |  |  |  |
| --- | --- | --- | --- |
| c. | a1 = | 35.52/40 = | 0.8880 |
|  | a2 = | 47.31/60 = | 0.7885 |
|  | a3 = | 35.01/50 = | 0.7002 |

d. Using a constant risk-adjusted discount rate is equivalent to assuming that at decreases at a constant compounded rate.

22. At t = 2, there are two possible values for the project’s NPV:



Therefore, at t = 0:



23. It is correct that, for a high beta project, you should discount *all* cash flows at a high rate. Thus, the higher the risk of the cash outflows, the less you should worry about them because, the higher the discount rate, the closer the present value of these cash flows is to zero. This result does make sense. It is better to have a series of payments that are high when the market is booming and low when it is slumping (i.e., a high beta) than the reverse.

The beta of an investment is independent of the sign of the cash flows. If an investment has a high beta for anyone paying out the cash flows, it must have a high beta for anyone receiving them. If the sign of the cash flows affected the discount rate, each asset would have one value for the buyer and one for the seller, which is clearly an impossible situation.

24. a. Since the risk of a dry hole is unlikely to be market-related, we can use the same discount rate as for producing wells. Thus, using the Security Market Line:

rnominal = 0.06 + (0.9 × 0.08) = 0.132 = 13.2%

We know that:

(1 + rnominal) = (1 + rreal) × (1 + rinflation)

Therefore:



b.



c. Expected income from Well 1: [(0.2 × 0) + (0.8 × 3 million)] = $2.4 million

Expected income from Well 2: [(0.2 × 0) + (0.8 × 2 million)] = $1.6 million

Discounting at 8.85 percent gives:



d. For Well 1, one can certainly find a discount rate (and hence a “fudge factor”) that, when applied to cash flows of $3 million per year for 10 years, will yield the correct NPV of $5,504,600. Similarly, for Well 2, one can find the appropriate discount rate. However, these two “fudge factors” will be different. Specifically, Well 2 will have a smaller “fudge factor” because its cash flows are more distant. With more distant cash flows, a smaller addition to the discount rate has a larger impact on present value.