EXERCISES -9 (SOLUTIONS)

1.

a. In a well-diversified portfolio the only source of risk is the market risk. Thus,

$$\sigma_i = \beta_i \sigma_m = 1.3 \times 20 = 26\%$$

b. The standard deviation of a well-diversified portfolio with beta equal to zero is zero.

c. Using the previous formula with respect to beta we obtain:

$$\beta_i = \frac{\sigma_i}{\sigma_m} = \frac{15}{20} = 0.75$$

d. The beta of the portfolio would be less than 1. This comes from the fact that in a poorly-diversified a part of the risk is due to unique risk.

2. See the Excel file “Chapter 10_ Exercise 2.xls”.

3.

a. If market rises by 5% the stock will fall by 1.25%. If it falls by 5% then the stock will rise by 1.25%.

b. The stock with negative β will go the furthest in counterbalancing the risk inherent in the market. Therefore I should invest on the stock with β = -0.25.

4.

a. Your current portfolio provides an expected return of 9% with an annual standard deviation of 10%. First we find the portfolio weights for a combination of Treasury bills (security 1: standard deviation = 0%) and the index fund (security 2: standard deviation = 16%) such that portfolio standard deviation is 10%. In general, for a two security portfolio:

$$\sigma_P^2 = x_1^2\sigma_1^2 + 2x_1x_2\sigma_1\sigma_2\rho_{12} + x_2^2\sigma_2^2$$

$$(0.10)^2 = 0 + 0 + x_2^2(0.16)^2$$

$$x_2 = 0.625 \Rightarrow x_1 = 0.375$$

Further,

$$r_p = x_1r_1 + x_2r_2$$

$$r_p = (0.375 \times 0.06) + (0.625 \times 0.14) = 0.11 = 11.0\%$$

Therefore, he can improve his expected rate of return without changing the risk of the portfolio.

b. With equal amounts in the corporate bond portfolio (security 1) and the index fund (security 2), the expected return is:

$$r_p = x_1r_1 + x_2r_2$$

$$r_p = (0.5 \times 0.09) + (0.5 \times 0.14) = 0.115 = 11.5\%$$

$$\sigma_P^2 = x_1^2\sigma_1^2 + 2x_1x_2\sigma_1\sigma_2\rho_{12} + x_2^2\sigma_2^2$$

$$\sigma_P^2 = (0.5)^2(0.10)^2 + 2(0.5)(0.5)(0.10)(0.16)(0.10) + (0.5)^2(0.16)^2$$

$$\sigma_P^2 = 0.0097$$

$$\sigma_P = 0.985 = 9.85\%$$

Therefore, you can do even better by investing equal amounts in the corporate bond portfolio and the index fund. The expected return increases to 11.5% and the standard deviation of the portfolio decreases to 9.85%.

5.

a. $r_{equity} = r_f + \beta \times (r_m - r_f) = 0.04 + (1.5 \times 0.06) = 0.13 = 13\%$

b. $r_{assets} = \frac{D}{V} r_{debt} + \frac{E}{V} r_{equity} = \left(\frac{\$4 million}{\$10 million} \times 0.04 \right) + \left(\frac{\$6 million}{\$10 million} \times 0.13 \right)$

$r_{assets} = 0.094 = 9.4\%$

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. $r_{equity} = r_f + \beta \times (r_m - r_f) = 0.04 + (1.2 \times 0.06) = 0.112 = 11.2\%$

$$r_{assets} = \frac{D}{V} r_{debt} + \frac{E}{V} r_{equity} = \left(\frac{\$4 million}{\$10 million} \times 0.04 \right) + \left(\frac{\$6 million}{\$10 million} \times 0.112 \right)$$

$r_{assets} = 0.0832 = 8.32\%$

6.

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 β_{assets}, also increases as a result of the fixed price contract. If fixed costs equal zero, then: $\beta_{assets} = \beta_{revenue}$. However, as PV(fixed cost) increases, β_{assets} increases.

b. With the fixed price contract:
PV(assets) = PV(revenue) – PV(fixed cost) – PV(variable cost)

$$PV(assets) = \frac{\$20 million}{0.09} - (\$10 million) \times (\text{annuity factor } 6\%, 10 years) - \frac{\$10 million}{(0.09) \times (1.09)^{10}}$$

PV(assets) = $101,687,000

Without the fixed price contract:

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

$$PV(assets) = \frac{\$20 million}{0.09} - \frac{\$10 million}{0.09}$$

PV(assets) = $111,111,111

7.

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.

b. The expected cash flow is: (0.75 × 250) + (0.25 × 0) = \$187,500 million.

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

$$PV = \frac{187.5}{1.12} = 167.41$$