CHAPTER 13
RETURN, RISK, AND THE SECURITY MARKET LINE

Answers to Concepts Review and Critical Thinking Questions

1. Some of the risk in holding any asset is unique to the asset in question. By investing in a variety of assets, this unique portion of the total risk can be eliminated at little cost. On the other hand, there are some risks that affect all investments. This portion of the total risk of an asset cannot be costlessly eliminated. In other words, systematic risk can be controlled, but only by a costly reduction in expected returns.

2. If the market expected the growth rate in the coming year to be 2 percent, then there would be no change in security prices if this expectation had been fully anticipated and priced. However, if the market had been expecting a growth rate different than 2 percent and the expectation was incorporated into security prices, then the government’s announcement would most likely cause security prices in general to change; prices would drop if the anticipated growth rate had been more than 2 percent, and prices would rise if the anticipated growth rate had been less than 2 percent.

3. a. systematic
   b. unsystematic
   c. both; probably mostly systematic
   d. unsystematic
   e. unsystematic
   f. systematic

4. a. a change in systematic risk has occurred; market prices in general will most likely decline.
   b. no change in unsystematic risk; company price will most likely stay constant.
   c. no change in systematic risk; market prices in general will most likely stay constant.
   d. a change in unsystematic risk has occurred; company price will most likely decline.
   e. no change in systematic risk; market prices in general will most likely stay constant.

5. No to both questions. The portfolio expected return is a weighted average of the asset returns, so it must be less than the largest asset return and greater than the smallest asset return.

6. False. The variance of the individual assets is a measure of the total risk. The variance on a well-diversified portfolio is a function of systematic risk only.

7. Yes, the standard deviation can be less than that of every asset in the portfolio. However, β cannot be less than the smallest beta because β_p is a weighted average of the individual asset betas.

8. Yes. It is possible, in theory, to construct a zero beta portfolio of risky assets whose return would be equal to the risk-free rate. It is also possible to have a negative beta; the return would be less than the risk-free rate. A negative beta asset would carry a negative risk premium because of its value as a diversification instrument.
9. Such layoffs generally occur in the context of corporate restructurings. To the extent that the market views a restructuring as value-creating, stock prices will rise. So, it’s not layoffs per se that are being cheered on. Nonetheless, Wall Street does encourage corporations to take actions to create value, even if such actions involve layoffs.

10. Earnings contain information about recent sales and costs. This information is useful for projecting future growth rates and cash flows. Thus, unexpectedly low earnings often lead market participants to reduce estimates of future growth rates and cash flows; price drops are the result. The reverse is often true for unexpectedly high earnings.

Solutions to Questions and Problems

Basic

1. total value = 40(\$35) + 30(\$25) = $2,150  
   \( \text{weight}_1 = 40(\$35)/\$2,150 = .6512 \) ;  \( \text{weight}_2 = 30(\$25)/\$2,150 = .3488 \)

2. \( E[r_p] = (\$600/\$1,800)(0.13) + (\$1,200/\$1,800)(0.22) = .19 \)

3. \( E[r_p] = .60(1.11) + .25(1.17) + .15(3.11) = .155 \)

4. \( E[r_s] = .1625 + .18w_x + .11(1 - w_x) ; \quad w_x = 0.75 \)
   investment in X = 0.75($10,000) = $7,500 ; investment in Y = (1 - 0.75)($10,000) = $2,500

5. \( E[r] = .3(0.02) + .7(0.23) = 16.7\% \)

6. \( E[r] = .3(-0.07) + .6(0.13) + .1(0.23) = 8\% \)

7. \( E[r_A] = .2(0.03) + .55(0.07) + .25(0.11) = 7.2\% \)
   \( E[r_B] = .2(-2) + .55(1.1) + .25(3.3) = 9.75\% \)
   \( \sigma_A^2 = .2(0.03 - 0.07)^2 + .55(0.07 - 0.07)^2 + .25(0.11 - 0.07)^2 = .00072 ; \quad \sigma_A = \sqrt{.00072} = .02676 \)
   \( \sigma_B^2 = .2(-2 - 0.975)^2 + .55(1 - 0.975)^2 + .25(3.3 - 0.975)^2 = .03122 ; \quad \sigma_B = \sqrt{.03122} = .1767 \)

8. \( E[r_p] = .2(1.15) + .6(2.25) + .2(3.35) = 25\% \)

9. a. boom: \( E[r_p] = (.07 + .12 + .33)3 = .1733 \) ; bust: \( E[r_p] = (.09 + .03 + 0)3 = .04 \)
    \( E[r_p] = .45(1.733) + .55(0.04) = .10 \)

   b. boom: \( E[r_p] = .15(0.07) + .15(0.12) + .7(0.33) = .2595 \) ; bust: \( E[r_p] = .15(0.09) + .15(0.03) + .7(0) = .018 \)
    \( E[r_p] = .45(2.595) + .55(0.18) = .12668 \)
    \( \sigma_p^2 = .45(2.595 - 1.2668)^2 + .55(0.018 - 1.2668)^2 = .01443 ; \quad \sigma_p = \sqrt{.01443} = .1204 \)

10. a. boom: \( E[r_p] = .4(3.3) + .2(4.5) + .4(3.3) = .342 \)
    good: \( E[r_p] = .4(1.12) + .2(1.10) + .4(1.15) = 1.28 \)
    poor: \( E[r_p] = .4(0.01) + .2(-1.15) + .4(-0.05) = -0.046 \)
    bust: \( E[r_p] = .4(-2.20) + .2(-3.0) + .40(-0.09) = -1.76 \)
    \( E[r_p] = .15(3.42) + .25(1.128) + .55(-0.046) + .05(-1.176) = .0492 \)
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\( \sigma_p^2 = .15(.342 - .0492)^2 + .25(.128 - .0492)^2 + .55(-.046 - .0492)^2 + .05(-.176 - .0492)^2 \)
\( \sigma_p^2 = .02193; \quad \sigma_p = [.02193]^{1/2} = .1481 \)

11. \( \beta_p = .3(1.2) + .2(6) + .1(1.5) + .4(8) = .95 \)

12. \( \beta_p = 1.0 = \beta_X + \beta_Y + \beta_B \); \( \beta_X = 1.4 \)

13. \( E[r_t] = .08 + (.17 - .08)(1.2) = .188 \)

14. \( E[r_t] = .12 = .06 + .06B_b; \quad B_b = 1.20 \)

15. \( E[r_t] = .17 = .075 + (E[r_{mk}]) - .075)(0.9); \quad E[r_{mk}] = .1806 \)

16. \( E[r_t] = .22 = r_t + (.16 - r_t)(1.6); \quad r_t = .06 \)

17. a. \( E[r_p] = (.13 + .07)/2 = .1 \)
b. \( \beta_p = 0.6 = \beta_X(0.9) + (1 - \beta_X)(0); \quad \beta_X = 0.6/0.9 = .6666; \quad \beta_X = 1 - .6666 = .3333 \)
c. \( E[r_p] = .11 = .13x_9 + .07(1 - x_9); \quad x_9 = .5; \quad \beta_p = .13(0.9) + .07(0) = .6 \)
d. \( \beta_p = 1.8 = \beta_X(0.9) + (1 - \beta_X)(0); \quad x_9 = 1.8/0.9 = 2; \quad \beta_X = 1 - 2 = -1 \)

The portfolio is invested 200% in the stock and -100% in the risk-free asset. This represents borrowing at the risk-free rate to buy more of the stock.

18. \( \beta_p = x_9(1.6) + (1 - x_9)(0) = 1.6x_9 \)
\( E[r_p] = .25 = .07 + MRP(1.60); \quad MRP = .18/1.6 = .1125 \)
\( E[r_p] = .07 + .1125\beta_p; \quad \text{slope of line} = MRP = .1125; \quad E[r_p] = .07 + .1125\beta_p = .07 + .18x_9 \)

\[
\begin{array}{cccccc}
 x_9 & E[r_p] & \beta_p & x_9 & E[r_p] & \beta_p \\
 0 & .07 & 0 & 100\% & .358 & 1.6 \\
 25 & .115 & 0.4 & 125 & .43 & 2 \\
 50 & .214 & 0.8 & 150 & .502 & 2.4 \\
 75 & .286 & 1.2 \\
\end{array}
\]

19. \( E[r_t] = .06 + .113\beta_b \)
\( .25 > E[r_X] = .06 + .113(1.59) = .2397; \quad Y \) plots above the SML and is undervalued.
\( .12 > E[r_t] = .06 + .113(0.44) = .1097; \quad Z \) plots above the SML and is undervalued.

20. \( [.25 - r_t]/1.59 = [.12 - r_t]/0.44; \quad r_t = .0703 \)

**Intermediate**

21. For a portfolio that is equally invested in large-company stocks and long-term bonds:
return = \( (12.7\% + 5.4\%)/2 = 9.05\% \)
For a portfolio that is equally invested in small stocks and Treasury bills:
return = \( (17.7\% + 3.8\%)/2 = 10.75\% \)

22. \( (E[r_A] - r_t)/\beta_A = (E[r_p] - r_t)/\beta_p \)
\( RF_p/\beta_A = RF_B/\beta_B; \quad \beta_A/\beta_B = RF_B/RF_A \)
23. a. boom: \( E[r_p] = 0.4(0.25) + 0.4(0.35) + 0.2(0.6) = 0.36 \)
   normal: \( E[r_p] = 0.4(0.15) + 0.4(0.1) + 0.2(0.05) = 0.11 \)
   bust: \( E[r_p] = 0.4(0) + 0.4(-0.25) + 0.2(-0.75) = -0.25 \)
   \( E[r_p] = 0.25(0.36) + 0.55(0.11) + 0.2(-0.25) = -0.1005 \)
   \( \sigma_p^2 = 0.25(0.36 - 1.005)^2 + 0.55(0.11 - 1.005)^2 + 0.2(-0.25 - 1.005)^2 = 0.04145 \)
   \( \sigma_p = \sqrt{0.4145} / 2 = 0.2036 \)

b. \( \text{RP} = E[r_T] - r_f = 0.1005 - 0.038 = 0.0625 \)

c. Approximate expected return = \( 0.1005 - 0.035 = 0.0655 \)
   \( (1 + E[r_T]) = (1 + h)(1 + e[r_T]) \)
   Exact expected return = \( e[r_T] = [1 - 0.035/1.035] - 1 = 0.0633 \)
   Approximate expected real risk premium = \( 0.1005 - 0.038 = 0.0625 \)
   Exact expected real risk premium = \( 0.0625/1.035 = 0.0604 \)

24. \( x_A = x_B = 70,000/250,000 = 0.28 \); \( x_c = x_f = 1 - x_A - x_B = 0.44 \)
   \( b_y = 0.7 = w_x(1.6) + w_y(1.25) + (1 - w_x - w_y)(0) \)
   solving these two equations in two unknown gives \( w_x = -0.3848684 \)
   \( w_y = 0.105263 \)
   \( w_e = 0.3322368 \)

25. \( E[r_p] = 0.115 = w_x(3) + w_y(2) + (1 - w_x - w_y)(0.06) \)
   \( \beta_p = b_y = 0.7 = w_x(1.6) + w_y(1.25) + (1 - w_x - w_y)(0) \)
   \( \alpha_1 = 0.115 - 0.06 - 0.08b_y = 0.35 \)
   \( \sigma_1^2 = 0.35^2 + 0.08^2 = 0.328 \)
   \( \alpha_2 = 0.06 - 0.328 \)
   \( \sigma_2^2 = 0.328^2 + 0.115^2 + 0.08^2 = 0.1005 \)

26. \( E[r_T] = 0.2(0.06) + 0.55(0.47) + 0.25(0.23) = 0.328 \)
   \( \sigma_T^2 = 0.328^2 + 0.06^2 = 0.10217 \)
   \( \sigma_T = \sqrt{0.10217} = 0.31965 \)

Although stock II has more total risk than I, it has much less systematic risk, since its beta is much smaller than I's. Thus I has more systematic risk, and II has more unsystematic and more total risk. Since unsystematic risk can be diversified away, I is actually the "riskier" stock despite the lack of volatility in its returns. Stock I will have a higher risk premium and a greater expected return.

27. \( E[r_{MCA}] = 0.23 = r_c + 1.35(r_m - r_c) \)
   \( r_m = (1.35r_c - 0.23)/0.35 \)
   \( r_f = (1.17 + 0.9(r_m - r_c)) \)
   \( r_{MC} = (0.17 + 0.35)/0.35 = 0.5 \)
   \( r_{MC} = (0.17 - 0.1r_f)/0.9 = 0.18889 - 0.11111r_f \)
   \( r_f = 0.05 \)