Chapter 12
The Capital Asset Pricing Model

12-1. All investors will want to maximize their Sharpe ratios by picking efficient portfolios. When a riskless asset exists this means that all investors will pick the same efficient portfolio, and because the sum of all investors’ portfolios is the market portfolio this efficient portfolio must be the market portfolio.

12-2. 

a. Under the CAPM assumptions the market is efficient, that is, a leveraged position in the market has the highest expected return of any portfolio for a given volatility and the lowest volatility for a given expected return. By holding a leveraged position in the market portfolio you can achieve an expected return of

\[ E[R_p] = r_t + x (E[R_m] - r_t) = 5\% + x \times 5\% \]

Setting this equal to 12\% gives \( 12 = 5 + 5x \Rightarrow x = 1.4 \)

So the portfolio with the lowest volatility that has the same return as Microsoft has $15,000 \times 1.4 = $21,000 in the market portfolio and borrows $21,000 - $15,000 = $6,000, that is -$6,000 in the in force asset.

b. A leveraged portion in the market has volatility \( \eta \)

\[ SD(R_p) = xSD(R_m) = x \times 18\% \]

Setting this equal to the volatility of Microsoft gives

\( 40\% = x \times 18\% \)

\[ x = \frac{40}{18} = 2.222 \]

So the portfolio with the highest expected return that has the same volatility as Microsoft has $15,000 \times 2.2 = $33,000 in the market portfolio and borrows $33,000 - $15,000 = $18,333.33, that is – $18,333.33 in the in force asset.

12-3. \[ SD(R_p) = xSD(R_m) = 1.4 \times 18 = 25.2\% \]

Note that this is considerably lower than Microsoft’s volatility.

12-4. \[ E[R_p] = r_t + x (E[R_m] - r_t) = 5\% + 2.222 \times 5\% = 16.11\% \]

Note that this is considerably higher than Microsoft’s expected return.
12-5. The sign of the risk premium of a negative beta stock is negative; assuming the market risk premium is positive, the risk premium has the same sign as beta.

12-6. 

a. \[ \beta_J = 0.06 \times \frac{0.2}{0.16} = 0.075 \]

b. \[ E[R_J] = 0.04 + 0.075(0.1 - 0.04) = 4.45\% \]

12-7. The risk premium of a zero beta stock is zero. If you substitute a zero beta stock with a risk free asset the expected return of the portfolio will remain the same but the volatility will go up.

12-8. \[ \beta = (0.6)(2.16) + (0.4)(0.69) = 1.572 \]

\[ E[R] = 4 + (1.572)(10 - 4) = 13.432\% \]
12-10. Total value of the market = 10×10 + 20×12 + 8×3 + 50×1 + 45×20 = $1.314 billion

<table>
<thead>
<tr>
<th>Stock</th>
<th>Portfolio Weight</th>
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<tbody>
<tr>
<td>A</td>
<td>10×10 / 1314 = 7.61%</td>
</tr>
<tr>
<td>B</td>
<td>20×12 / 1314 = 18.26%</td>
</tr>
<tr>
<td>C</td>
<td>8×3 / 1314 = 1.83%</td>
</tr>
<tr>
<td>D</td>
<td>50 / 1314 = 3.80%</td>
</tr>
<tr>
<td>E</td>
<td>45×20 / 1314 = 68.49%</td>
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</tbody>
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12-11. Total value of all 4 stock = 13×1000 + 22×1.25 + 43×30 + 5×10 = $14,367.5 billion

<table>
<thead>
<tr>
<th>Stock</th>
<th>Portfolio Weight</th>
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</thead>
<tbody>
<tr>
<td>Golden Seas</td>
<td>13×1000 / 14367.5 = 90.48%</td>
</tr>
<tr>
<td>Jacobs and Jacobs</td>
<td>22×1.25 / 14367.5 = 0.19%</td>
</tr>
<tr>
<td>MAG</td>
<td>43×30 / 14367.5 = 8.98%</td>
</tr>
<tr>
<td>PDJB</td>
<td>5×10 / 14367.5 = 0.35%</td>
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12-12. The portfolio weight of the stock that went up remains no change.

12-13. The beta of Nike is 0.47605.

12-14. 
   a. The alpha of Nike is 1.56. (See spreadsheet application.)
   b. The confidence interval is –1.15 to 4.28. The p-value is 0.25, so it is not significant.

12-15. No investors will hold a levered position in the market portfolio.

12-16. The market portfolio will be efficient.

12-17. Either investors believe they are earning a positive alpha but are not or investors care about things other than expected return and volatility.
Method 2: Use the implied discount rate from a constant growth model calibrated to current prices.

12-19. There are at least three reasons why an empirical test of the CAPM might indicate that the model does not work: (1) the proxy portfolio for the market portfolio is not correct; (2) beta is measured with error; (3) expected returns are measured with error.