Problem Set 5: CAPM and Performance Measurement

I. *SML and the CAPM:*
   A. In a CAPM world, what is the beta (with respect to the market portfolio M) of a portfolio with $E[R_p]=20\%$, if $R_f=5\%$ and $E[R_m]=15\%$?
   B. In 1994, the rate of return on short-term government securities (perceived to be risk-free) was about 4%. Suppose the expected rate of return required by the market for a portfolio with a beta measure of 1 is 12%. According to the CAPM (SML):
      1. What is the expected rate of return on the market portfolio?
      2. What would be the expected rate of return on stock with a beta of 0?
      3. Suppose you consider buying a share of stock at $40. The stock is expected to pay $3 dividends next year and you expect it to sell then for $41. The stock’s systematic risk has been evaluated to be $\beta=-0.5$. Is the stock over or under priced?

II. *SML vs CML in the CAPM:*
   Assume that the CAPM holds in the economy. The following data is available about the market portfolio, the riskless rate and two assets, A and B. Remember $\beta_{i,m} = \sigma[R_i , R_m]/(\sigma[R_m]^2)$.

<table>
<thead>
<tr>
<th>Asset i</th>
<th>$E[R_i]$</th>
<th>$\sigma[R_i]$</th>
<th>$\beta_{i,m}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>m (market)</td>
<td>0.15</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>0.096</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>0.07</td>
<td>0.6</td>
<td></td>
</tr>
</tbody>
</table>

$R_f = 0.10$.

A. What is $\beta_{i,m}$ for $i$ equal to the market portfolio (i.e., $\beta_{m,m}$)?
B. What is the expected return on asset A (i.e., $E[R_A]$)?
C. What is the expected return on asset B (i.e., $E[R_B]$)?
D. Does asset A plot:
   1. on the SML (security market line)?
   2. on the CML (capital market line)?
E. Does asset B plot:
   1. on the SML?
   2. on the CML?
F. Could any investor hold asset A as her entire portfolio?
G. Could any investor hold asset B as her entire portfolio?
H. What is the correlation of asset A with the market portfolio?
I. What is the correlation of asset B with the market portfolio?
J. Can anything be said about the composition of asset A (i.e., what assets make up
Problem Set 5 Foundations of Finance

asset A)?

K. Can anything be said about the composition of asset B?

III. **Performance Measurement.** The following information is to be used to evaluate the performance of the Bull Fund and the Boom Fund.

<table>
<thead>
<tr>
<th>i</th>
<th>E[R_i]</th>
<th>σ[R_i]</th>
<th>σ[R_i, R_{S&amp;P}]</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;P</td>
<td>15</td>
<td>20</td>
<td>400</td>
</tr>
<tr>
<td>Bull</td>
<td>17</td>
<td>30</td>
<td>440</td>
</tr>
<tr>
<td>Boom</td>
<td>19</td>
<td>40</td>
<td>460</td>
</tr>
<tr>
<td>Riskfree</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

A. Calculate the Sharpe ratio for
1. the S&P 500 index fund.
2. the Bull fund.
3. the Boom fund.

B. Calculate Jensen’s alpha for
1. the S&P 500 index fund.
2. the Bull fund.
3. the Boom fund.

C. An investor who only cares about the mean and standard deviation of her portfolio’s return is trying to decide which of these funds to hold in combination with T-bills. Which fund should the investor choose?

D. An investor who only cares about the mean and standard deviation of her portfolio’s return is considering combining Bull with the S&P 500 index fund (the market portfolio) and the riskfree asset. Will Bull’s weight be positive, negative or zero in the investor’s portfolio?

E. An investor who only cares about the mean and standard deviation of her portfolio’s return is considering combining the Boom fund with the S&P 500 index fund (the market portfolio) and the riskfree asset. Will Boom’s weight be positive, negative or zero in the investor’s portfolio?