Problem Set 5: ICAPM and Performance evaluation.

I. ICAPM. Let TERM(Jan) be the difference in the yield on a long term hi-grade corporate bond and 1 month T-bill at the end of January. Suppose each individual cares about \{E[R_p(Jan)], \sigma[R_p(Jan)], \sigma[R_p(Jan), TERM(Jan)]\} when forming his/her portfolio \( p \) for January. The following additional information is available:

<table>
<thead>
<tr>
<th>( i )</th>
<th>( E[R_i(Jan)] )</th>
<th>( \beta_{i,M}^* )</th>
<th>( \beta_{i,TERM}^* )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>18%</td>
<td>1.4</td>
<td>0.4</td>
</tr>
<tr>
<td>Yellow</td>
<td>1.1</td>
<td>1.2</td>
<td>1.0</td>
</tr>
</tbody>
</table>

where \( \beta_{i,M}^* \) and \( \beta_{i,TERM}^* \) are regression coefficients from a regression of \( R_i(Jan) \) on \( R_m(Jan) \) and TERM(Jan):

\[
R_i = \phi_{i,0} + \beta_{i,M}^* R_m + \beta_{i,TERM}^* \text{TERM}(Jan) + e_i
\]

Also know that \( E[R_m(Jan)] = 14\% \) and \( R_f(Jan) = 8\% \).

A. What is the expected January return for Yellow?
B. What is the risk premium for bearing TERM risk?
C. Is the market on the minimum variance frontier? Why or why not?
D. Give one reason why an individual may care about the covariance of her portfolio return with TERM(Jan).
E. Characterize the portfolios that individuals hold in this economy.

II. Hedging Portfolios and the ICAPM. Suppose each individual cares about \{E[R_p(Jan)], \sigma[R_p(Jan)], \sigma[R_p(Jan), s_1(Jan)]\} when forming his/her portfolio \( p \) for January. The variable \( s_1(Jan) \) is a macroeconomic indicator that correlates positively with the state of the economy at the end of January. Investors care about the state of the economy because it affects their human capital values, though to differing degrees depending on the investor. Let \( R_{\text{HML}}(Jan) \) be the return on the hedging portfolio that all investors hold in combination with the market portfolio and the riskless asset; \( R_{\text{HML}}(Jan) \) has a large positive correlation with \( s_1(Jan) \). The following additional information is available:

<table>
<thead>
<tr>
<th>( i )</th>
<th>( E[R_i(Jan)] )</th>
<th>( \beta_{i,M}^h )</th>
<th>( \beta_{i,HML}^h )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td>10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HML</td>
<td>14%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KS Fund</td>
<td>?</td>
<td>1.1</td>
<td>-0.4</td>
</tr>
<tr>
<td>LM Fund</td>
<td>?</td>
<td>1.1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

where \( \beta_{i,M}^h \) and \( \beta_{i,HML}^h \) are regression coefficients from a regression of \( r_i(Jan) \) on \( r_m(Jan) \) and \( r_{\text{HML}}(Jan) \):

\[
r_i(Jan) = \phi_{i,0} + \beta_{i,M}^h r_m(Jan) + \beta_{i,HML}^h r_{\text{HML}}(Jan) + e_i \quad \text{and},

\[
r_i(Jan) = R_i(Jan) - R_f, r_m(Jan) = R_m(Jan) - R_f, \text{ and } r_{\text{HML}}(Jan) = R_{\text{HML}}(Jan) - R_f.
\]

Also know that \( R_f = 6\% \).
Problem Set 5  Foundations of Finance

A. What is the expected January return for KS?
B. What is the expected January return for LM?
C. Explain why these two assets have different expected January returns?
D. Describe an investor in this economy who would choose to hold a combination of the riskless asset and the mean-variance tangency portfolio. Characterize qualitatively this investor’s portfolio in terms of the weight invested in the hedging portfolio.
E. Consider a highly risk-averse investor whose job prospects at the end of January are closely linked to the state of the economy at the end of January. Characterize qualitatively this investor’s portfolio in terms of the weight invested in the hedging portfolio.

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>$\mu[R_i]$</th>
<th>$\sigma[R_i]$</th>
<th>$\sigma[R_i, R_{S&amp;P}]$</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?