FINC460 - Final Exam

Winter 2008

NAME: _____ SECTION: _____

1. Please do not open this exam until directed to do so.
2. This exam is 3 hours long.
3. Please write your name and section number on the front of this exam, and on any examination books you use.
4. Please show all work required to obtain each answer. Answers without justification will receive no credit.
5. This is a closed book exam. No books, notes or laptops are permitted. Calculators are permitted.
6. Brevity is strongly encouraged on all questions.
7. The exam is worth 105 points.
8. Relax, and good luck!

Hints:

1. *Think through problems before you start working*
2. *Draw pictures*
3. *If you get stuck on part of a problem, go on to the next part. You may need to use answers from earlier parts of the question to calculate answers to the later parts. If you werent able to solve the earlier part, assume something.*
4. *Remember, setting up the problem correctly will get you most of the points.*

Short questions

Assess the validity of the following statements (True, False or Uncertain) and explain your answers.

1. (5 points) Since its variance is always positive, a risky asset can *never* have a negative rate of expected return.

2. (5 points) A fund manager can increase his Sharpe Ratio by leveraging his portfolio with the risk-free asset.

3. (5 points) A factor model is a statistical model for returns that assumes that individual firms have no idiosyncratic risk.

4. (5 points) The stock price of acquisition targets increases before take-over announcements. This is a clear violation of efficient markets.

5. (5 points) The CAPM states that the market portfolio is the single source of systematic risk and β is its price, i.e. the slope of the SML.

Question 1

A two-factor APT describes the returns of all well-diversified portfolios. The two factors are unexpected changes in production (factor 1) and an inflation factor (factor 2).

- Over the next year, the market expects production to grow at 5% and inflation to be 2%
- The prices of all well diversified portfolios are set so that their expected returns over the next year are given by:

$$E(\tilde{r}_i) = 0.05 + 0.08\ b_{i,1} - 0.06\ b_{i,2}.$$

  where $b_{i,k}$ denotes portfolio i's loading on the k'th factor.

- The market believes that the standard deviations of $\tilde{f}_1$ and $\tilde{f}_2$, over the next year are all 0.10 (10%), and that the two factors are uncorrelated.
- The return generating process for portfolios A, B and C over the next year are:

$$\begin{aligned} \tilde{r}_A &= E(\tilde{r}_A) + 0.7\tilde{f}_1 - 0.5\tilde{f}_2 \\ \tilde{r}_B &= E(\tilde{r}_B) + 1.2\tilde{f}_1 + 0.3\tilde{f}_2 \\ \tilde{r}_C &= E(\tilde{r}_C) + 1.1\tilde{f}_1 - 1.2\tilde{f}_2 \end{aligned}$$

Based on this scenario, answer the following questions:

1. (5 points) Find the expected return of portfolio A

2. (5 points) Find the return standard deviation of portfolio A.

3. (5 points) What is the risk-free rate implied by the absence of arbitrage?

4. (5 points) If production grows by 10% over the next year, and inflation is exactly what the market expects, what will the return on portfolio A be?

5. (10 points) The second factor here is an inflation factor. Give an economic rationale for why the factor risk premium for this inflation factor should be positive or negative. Specifically, answer the following questions. *All explanations should* very *brief, but a complete answer should include an economic story, and not only be based on numbers.*

   a) Consider portfolio B which has a positive loading on this factor. Will the return on B be unexpectedly high or low in when inflation is higher or lower than expected?

   b) Based on this, would you think that B would have a higher or lower expected return than portfolio C? Explain.

6. (10 points) Assume that you believe very strongly that inflation will be a great deal lower than the market expects. Your estimate for inflation for the next year is zero, while, as discussed above, the market expects that it will be 2%. Assume that you wish to construct a portfolio (using A, B and C) which will take advantage of this. You do not wish to have any exposure to risk related to production, but you want your portfolio to earn an extra 4% /year (above what the market expects) if your conjecture about inflation is correct.

   (a) What would the factor loadings of your portfolio be?

   (b) What fraction of your portfolio should be invested in A, B, and C?

   (c) What does the market think the expected return on your portfolio is (per year)?

   (d) What do you think the expected return on your portfolio is

7. (10 points) Assume that you estimate that the market portfolio is an equally weighted average of the returns of portfolios A, B and C. This means that returns on the market portfolio are given by

$$r_M = \frac{1}{3}r_A + \frac{1}{3}r_B + \frac{1}{3}r_C$$

Does the CAPM hold in this economy?

Hint 1: All portfolios on the frontier are diversified, which means that they are linear combinations of the two factors (more precisely the factor-mimicking portfolios).

Hint 2: The MVE portfolio weights when there are two risky assets A and B ($x_B = (1 - x_A)$) are:

$$x_A = \frac{E(\tilde{r}_A^e)\sigma_B^2 - E(\tilde{r}_B^e)cov(\tilde{r}_A^e, \tilde{r}_B^e)}{E(\tilde{r}_A^e)\sigma_B^2 + E(\tilde{r}_B^e)\sigma_A^2 - [E(\tilde{r}_A^e) + E(\tilde{r}_B^e)]\, cov(r_A^e, r_B^e)}$$

Question 2

You are managing the endowment of the Minnesota Institute of Technocracy (MIT). You are currently 100% invested into the market portfolio and this is your only source of income. Assume that the risk-free rate is 4%.

Your analyst has gathered data on the following two mutual funds:

	μ	σ	β_{MKT}	β_{HML}	β_{SMB}	β_{MOM}
A	18%	19%	0.4	1.1	0.1	1.2
B	18%	11%	0.2	-0.3	-0.9	0.1

where β_i refers to the beta of fund returns with factor i, i.e. the market portfolio (MKT), the two Fama-French factors (SMB, HML) and the momentum strategy (MOM). Also, μ refers to the expected return on the fund and σ its standard deviation.

In addition, you know that expected returns on the market is 7%, on the HML factor is 5%, on the SMB factor its 3% and on the momentum strategy is 9%. The standard deviation of all 4 factors is 10% and assume that they are uncorrelated with each other.

a) (10 points) Based on the table above, what can you infer about the investment style of two funds, A and B?

b) (10 points) You are thinking of switching 10% of your assets out of the market portfolio and into one of these funds. In other words, before you were 100% invested in the market portfolio, now you will be 90% invested in the market and 10% invested in one of these two funds. Which one would you pick?

c) (10 points) Now you remember that, being a technology school, a lot of the alumni donations come from technology firms, which tend to be growth firms. Suppose your *overall* endowment portfolio can be described as

$$R_E = 1 \times MKT - 0.5 \times HML.$$

as opposed to $R_E = 1 \times MKT$ in part B. Does your answer to the previous question change?