

FINC460 - Midterm Exam

NAME: _____ SECTION: _____

1. Please do not open this exam until directed to do so.
2. This exam is 1 1/2 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. State clearly any assumptions you are making.
6. This is a closed book exam. No books or notes are permitted, except for a formula sheet. Calculators are permitted. Laptops are permitted but you are only allowed to use Excel and a blank worksheet.
7. Brevity is strongly encouraged on all questions.
8. The exam is worth 110 points.
9. Relax, and good luck!

Hints:

1. *Think through problems before you start working. Draw pictures.*
2. *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 weren't able to solve the earlier part, assume something.*
3. *Remember, setting up the problem correctly will get you most of the points.*

Short questions (40pts)

Assess the validity of the following statements (True, False or Uncertain) and explain your answers. Each question is worth 8pts.

1. Even if the CAPM holds, two assets with the same market betas need not have the same expected returns.

FALSE: According to the CAPM, only market betas capture differences in risk-premia across securities. Thus, stocks with the same market beta should have the same expected return.

2. The CAPM implies that all investors should hold a combination of the risk-free asset and the S&P 500 index.

FALSE/UNCERTAIN: Investors should be holding the market portfolio and the risk-free asset. The S&P 500 index is an imperfect proxy for the former.

3. All assets should have zero alpha with respect to the mean-variance efficient portfolio.

TRUE: Comes from the definition of the MVE portfolio (see Lecture 2). Intuitively, if we could find an asset that had a non-zero alpha with respect to that portfolio, we could combine the two and create a portfolio that had a higher sharpe ratio. But that cannot be possible, since we started from portfolio which has the highest sharpe ratio, i.e. the MVE portfolio. Note that this statement is true regardless of whether the CAPM is true or not. The CAPM is simply the statement that the MVE portfolio is the market.

4. Empirical evidence suggests that firms that raise money by issuing new shares tend on average to have lower returns after their secondary offering than before. The fact that stock issuance predicts future returns is evidence against market efficiency.

TRUE/UNCERTAIN: Taken at face value, this statement suggests a violation of market efficiency. Secondary Equity Offerings are public information, and as such should not be predicting returns, holding systematic risk constant. However, SEOs may be associated with changes in the systematic risk of equity. For instance if the firm has outstanding debt, issuing more shares lowers the leverage of the firm and thus the equity beta. Thus, it is possible that post-SEO, firms have lower average

returns than before simply because equity now is a less risky claim than it used to be.

Notice that dilution does NOT affect expected returns, as long as the market is efficient. Dilution would imply lower *prices* pos-SEO, but not lower *returns*.

5. The Fama-French 3 factor model implies that an asset's expected return is linearly related to its market beta, its market capitalization and its ratio of book equity to market equity.

FALSE: The Fama-French 3 factor model implies that an asset's expected return is linearly related to its market beta, its beta with SMB (a portfolio long small stocks and short large stocks) and its beta with HML (a portfolio long value and short growth firms).

Question 2 (70pts)

For parts 1-6 of this question, assume the CAPM properly prices all assets. There are only 3 stocks in this economy: A, B and C. You have the following data available to you:

Security	Expected Return	Beta	Standard Deviation	Market Capitalization
Risk-Free Asset		0.0	0%	-
Market Portfolio				100b
Stock A	6.5%		25%	30b
Stock B	8.6%		30%	50b
Stock C	7.0%		35%	20b

The blank entries in the table are intentional! You should assume that the risk-free rate is the same for borrowing or lending, **and that assets A, B and C are uncorrelated with each other.**

Recall that portfolios on the minimum-variance frontier are those consisting *only* of risky assets which, for a given level of expected return, achieve the lowest possible level of volatility.

1. (10 points) Which of these assets (if any) lie on the capital allocation line?

The market portfolio and the risk-free asset are the only ones that lie on the capital allocation line

2. (10 points) Find the expected return and standard deviation of the market portfolio.

The market portfolio is comprised of stocks A, B and C. The expected

return on the market portfolio equals:

$$E(R_M) = 0.3 \times 6.5\% + 0.5 \times 8.6\% + 0.2 \times 7.0\% = 7.64\%$$

The variance of the market portfolio equals

$$\text{var}(R_M) = 0.3^2 \times 0.25^2 + 0.5^2 \times 0.30^2 + 0.2 \times 0.35^2 = 0.033$$

and it's standard deviation is

$$\sigma_M = \sqrt{\text{var}(R_M)} = \sqrt{0.033} = 0.181$$

3. (10 points) Find the betas of stocks A, B and C. *We will use the fact that A, B and C are uncorrelated with each other, i.e. $\text{cov}(A, B) = \text{cov}(B, C) = \text{cov}(A, C) = 0$:*

$$\begin{aligned}\text{cov}(R_A, R_M) &= \text{cov}(R_A, 0.3 R_A + 0.5 R_B + 0.2 R_C) \\ &= \text{cov}(R_A, 0.3 R_A) + \text{cov}(R_A, 0.5 R_B) + \text{cov}(R_A, 0.2 R_C) \\ &= 0.3 \text{cov}(R_A, R_A) = 0.3 \text{var}(R_A) = 0.3 \times 0.25^2 = 0.01875\end{aligned}$$

similarly

$$\begin{aligned}\text{cov}(R_B, R_M) &= 0.5 \text{var}(R_B) = 0.5 \times 0.3^2 = 0.045 \\ \text{cov}(R_C, R_M) &= 0.2 \text{var}(R_C) = 0.2 \times 0.35^2 = 0.0245\end{aligned}$$

and

$$\begin{aligned}\beta_A &= \frac{\text{cov}(R_A, R_M)}{\text{var}(R_M)} = \frac{0.01875}{0.033} = 0.568 \\ \beta_B &= \frac{\text{cov}(R_B, R_M)}{\text{var}(R_M)} = \frac{0.045}{0.033} = 1.363 \\ \beta_C &= \frac{\text{cov}(R_C, R_M)}{\text{var}(R_M)} = \frac{0.0245}{0.033} = 0.742\end{aligned}$$

4. (10 points) Find the risk-free rate. *Now that we have the betas, we can find the risk-free rate from the CAPM equation, for any asset:*

$$E(R_A) - R_f = \beta_A(E(R_M) - r_f)$$

solving for the risk-free rate gives us $r_f = 5\%$

5. (10 points) Assuming you have a risk aversion coefficient of 3, what combination of the assets above should you hold? Specify the fraction of your wealth that you will put in each of the five assets.

Given that the CAPM holds, we will pick a combination of the risk-free asset and the market portfolio. We will put a weight w^ into the market and $1 - w^*$ into the risk-free asset, where*

$$w^* = \frac{E[R_M] - r_f}{A\text{var}(R_M)} = \frac{7.64\% - 5\%}{3 \cdot 0.033} = 0.266$$

6. Again assume that you have a risk aversion coefficient of 3. Now assume that you can only hold one of the three risky assets (A, B or C) in combination with the risk-free asset.

- (a) (5 points) Which of the three should you hold, and why? (Just specify A, B or C and explain).

Now that we can only pick one of the three assets, A, B or C, we will combine the one with the highest Sharpe ratio with the risk-free asset. So,

$$\begin{aligned}SR_A &= \frac{6.5\% - 5\%}{25\%} = 0.06 \\SR_B &= \frac{8.6\% - 5\%}{30\%} = 0.12 \\SR_C &= \frac{7.0\% - 5\%}{35\%} = 0.056\end{aligned}$$

We will pick B, and put a weight of w_B into it and $1 - w_B$ into the risk-free asset, where

$$w_B = \frac{E[R_B] - r_f}{A \text{var}(R_B)} = \frac{8.6\% - 5\%}{3 \cdot 0.3^2} = 0.133$$

- (b) (5 points) How would your answer change if your risk aversion coefficient were very large? (Specify A, B or C and explain) *Our answer wouldn't change. We would still pick B, but we would invest less in it.*

7. (10 points) You are about to launch a new private equity fund, that will look for value opportunities in privately held firms abroad. You believe that you will have a beta of 0.8 with the market portfolio, a standard deviation of 50%, yet be able to offer your investors an average return of 8.1% per year. Your investors can invest freely in all assets apart from your fund. What is the maximum fee you can charge your investors? *According to your projections, your fund will have an α of*

$$\begin{aligned}\alpha &= E(R_F) - r_f - \beta_F (E(R_M) - r_f) \\ &= 0.081 - 0.05 - 0.8 (0.0764 - 0.05) \\ &= 0.00988\end{aligned}$$

That is the maximum fee that investors are willing to pay. As long as your fund has a positive post-fee alpha, they will be willing to invest money with you, because they can combine your fund with the market portfolio and achieve a higher Sharpe Ratio.

*Note: Your answer would be different if your investors were restricted to **only** invest in your fund (and the risk-free asset). Then, you would charge a fee such that the Sharpe Ratio of your fund is equal to the Sharpe Ratio of the market (see midterm Winter 2008).*