Investment Theory | Prof. Lorenzo Naranjo
FIN 5320 | Fall 2025

Problem Set 4

Instructions: This problem set is due on 9/26 at 11:59 pm CST and is an individual assignment. All problems must be handwritten. Scan your work and submit a PDF file.

Problem 1. What must be the beta of a portfolio with $\mathrm{E}(r_P) = 18\%$, if $r_f = 6\%$ and $\mathrm{E}(r_M) = 14\%$?

Problem 2. Two portfolios A and B are such that $\mathrm{E}(r_A) = 12\%$ and $\mathrm{E}(r_B) = 9\%$. If the economy has only one factor, and $\beta_A = 1.2$ and $\beta_B = 0.8$, what must be the risk-free rate?

Problem 3. Here are data on two companies. The T-bill rate is 4% and the market risk premium is 6%.

Company	$1 Discount Store	Everything $5
Forecasted return	12%	11%
Standard deviation of returns	8%	10%
Beta	1.5	1.0

a. What would be the fair return for each company, according to the capital asset pricing model (CAPM)?
b. Explain whether each company in the above table is underpriced, overpriced, or properly priced.

Problem 4. The market price of a security is $50. Its expected rate of return is 14%. The risk-free rate is 6% and the market risk premium is 8.5%. You know that the stock is expected to pay a constant dividend in perpetuity.

a. Compute the stock dividend assuming that you can value the stock by discounting future dividends using the perpetuity formula

$$P = \frac{D}{\mathrm{E}(r)}.$$

b. What will be the new market price of the security if its correlation coefficient with the market portfolio doubles (and all other variables remain unchanged)?

Problem 5. The following are estimates for two stocks.

Stock	Expected Return	Beta	Firm-Specific Standard Deviation
A	13%	0.8	30%
B	18%	1.2	40%

The market index has a standard deviation of 22% and the risk-free rate is 8%.

a. What are the standard deviations of stocks A and B?

b. Suppose that we were to construct a portfolio with proportions:

Stock A	0.30
Stock B	0.45
T-bills	0.25

Compute the expected return, standard deviation, beta, and nonsystematic standard deviation of the portfolio.

Problem 6. Consider the two (excess return) index model regression results for A and B:

$$R_A = 1\% + 1.2R_M + e_A$$

$$\text{R-square} = 0.576$$

Residual Standard Deviation = 10.3%

and

$$R_B = -2\% + 0.8R_M + e_B$$

$$\text{R-square} = 0.436$$

Residual Standard Deviation = 9.1%

a. Which stock has more firm-specific risk?
b. Which stock has greater market risk?
c. For which stock does market movement has a greater fraction of return variability?
d. If r_f was constant at 6% and the regression had been run using total rather excess returns, what would have been the regression intercept for stock A?

Problem 7. Suppose that the index model for stocks A and B is estimated from excess returns with the following results:

$$R_A = 3\% + 0.7R_M + e_A$$

$$R_B = -2\% + 1.2R_M + e_B$$

$$\sigma_M = 20\%; \text{R-square}(A) = 0.20; \text{R-square}(B) = 0.12$$

a. What is the standard deviation of each stock?
b. Break down the variance of each stock to the systematic and firm-specific components.
c. What are the covariance and correlation coefficient between the two stocks?
d. What is the covariance between each stock and the market index?
e. Assume you create a portfolio P with investment proportions of 0.60 in A and 0.40 in B.
    i. What is the standard deviation of the portfolio?
    ii. What is the beta of your portfolio?
    iii. What is the firm-specific variance of your portfolio?
    iv. What is the covariance between the portfolio and the market index?
f. Assume you create a portfolio Q, with investment proportions of 0.50 in the risky portfolio P, 0.30 in the market index, and 0.20 in T-bills. Portfolio P is composed of 60% of stock A and 40% of stock B.
    i. What is the standard deviation of the portfolio?

ii. What is the beta of your portfolio?
iii. What is the firm-specific variance of your portfolio?
iv. What is the covariance between the portfolio and the market index?