

Practice Questions for Exam 1

The exam will consist of multiple-choice questions (roughly about 10%), qualitative questions (roughly about 45%) and quantitative questions that require you to calculate and analyze (roughly about 45%). The exam will cover chapters 1, 2.1-2.4, 3.1-3.9, 4.6, 5.1-5.6, 6-8.1, 17, and everything we have done in class. You should know how to derive and calculate other optimal levels of variables.

There will be 7-9 problems. The following are examples of the types of problems you may be asked to solve.

PROBLEM 1: What would be the ramifications of misestimating the correlations of multiple assets in a diversified portfolio? Would this be more of a problem at certain parts of the business cycle? What about for certain types of investors?

PROBLEM 2: Patricia opens a brokerage account and purchases 800 shares of Biogenetics at \$30 per share. Patricia borrows \$9,000 from her broker to help pay for the purchase. Assume the interest rate on the loan is 0% and the stocks pay no dividends.

- a) What is the margin in Patricia's account when she first purchases the stock?
- b) If the share price falls to \$20 per share by the end of the year, what is the remaining margin in her account? If the maintenance margin requirement is 40%, will she receive a margin call?
- c) Continue to suppose that the price falls to \$20. What is the rate of return on her investment?

PROBLEM 3: Francesca decides to invest in MiddHarbor, and she expects the price to fall. She invests in MiddHarbor when the price is \$80 per share. She sells short 100 shares.

- a) What is the monetary value of the cash or securities Francesca would put into her brokerage account if the broker's initial margin requirement is 50% of the value of the short position?
- b) How high can the price of the stock go before Francesca gets a margin call if the maintenance margin is 40% of the value of the short position?
- c) What will be Francesca's rate of return if MiddHarbor goes up by 10% during the next year and the stock pays no dividends?

PROBLEM 4: Asset allocation with two risky securities (Equity, Debt) and a safe asset.

- a) Write the optimization problem (the objective function, the set of choice variables, and the constraints) to derive the optimal risky portfolio.
- b) Suppose you successfully calculated the expected returns and standard deviation of the optimal risky portfolio. How do you derive the optimal complete portfolio?

- c) How do you know the derived portfolio is optimal graphically? Draw and label the indifference curve, CAL, and the opportunity set of risky assets below. Explain the relationships between the indifference curve, CAL, and the opportunity set of risky assets.
- d) Suppose that the investor becomes more risk-averse. Show what has changed in the diagram above, and find the new tangency portfolio. *Hint: To see the change clearly, you can assume “A” rises substantially.*
- a. Will this investor still choose the same composition for the risky portfolio?
- b. Will this investor increase, decrease, or not change the weight on safe assets?

PROBLEM 5: You are considering investing \$1,000 in a T-bill that pays 0.05 and a risky portfolio, P, constructed with two risky securities, X and Y. The weights of X and Y in P are 0.60 and 0.40, respectively. X has an expected rate of return of 0.14 and variance of 0.01, and Y has an expected rate of return of 0.10 and a variance of 0.0081. What would be the dollar value of your positions in X, Y, and the T-bills, respectively, if you decide to hold a portfolio that has an expected outcome of \$1,120?

Hint: Calculate rate of return of the complete portfolio and rate of return of the risky portfolio first, and then you can calculate the weights on the T-bill and the risky portfolio. By deriving the weights on T-bills, X, and Y, you can derive the dollar amounts.

PROBLEM 6: Initial portfolio value of \$500,000 is allocated: the investor has \$150,000 in T-bills, \$250,000 in stocks, and \$100,000 in corporate bonds. Assume that each has different growth rates: the T-bills are expected to return 2% annually compounded semi-annually, the stocks are expected to return 4% annually compounded monthly, and the bonds are expected to return 3% annually compounded quarterly.

- a) What is the annual rate of return on each asset class? *Hint: Calculate EAR, where the numbers of payments per year are 2, 12, and 4 respectively. $T=1$.*
- b) What is the expected value of the portfolio after 1 year?
- c) (Assume that the stocks actually returned 5% each month, what is the value of the portfolio after 1 year?
- d) What are the portfolio weights after one year for each asset class? Why are these different from the starting weights?

PROBLEM 7: An investment manager typically invests in 30 equities drawn from several industries. A client commented: “I trust your stock-picking ability and believe that you should invest my funds in your five best ideas. Why invest in 30 companies when you obviously have stronger opinions on a few of them?”

- a) The investment manager plans to respond to her client within the context of modern portfolio theory. Contrast the concepts of systematic risk and firm-specific risk, and give an example of each type of risk.

- b) Critique the client’s suggestion. Discuss how both systematic and firm-specific risk change as the number of securities in a portfolio is increased.

PROBLEM 8: Minimum Variance Portfolio

Consider a portfolio consisting of two risky assets: a stock fund and a bond fund. The correlation coefficient between the returns of these two assets is given by ρ . Follow the notation we used in class, such as σ_E , σ_D , and σ_P .

- a) When $\rho = 1$, express the portfolio standard deviation (σ_P) using arbitrary weights (w_D, w_E).

- b) When $\rho = -1$, express the portfolio standard deviation (σ_P) using arbitrary weights (w_D, w_E).

We now want to find the minimum variance portfolio.

- c) Taking ρ as given (don't substitute any number to ρ), write the optimization problem (the objective function, the set of choice variables, and the constraints) to derive the minimum variance portfolio.

- d) Solve the problem above and express the solution (w_E^*, w_D^*) by $(\sigma_E, \sigma_D, \text{Cov}(r_E, r_D))$.

Suppose a stock fund has a standard deviation of 7% and a debt fund has a standard deviation of 12%. The correlation between the two funds is $\rho = -1$. Assume there is no borrowing.

- e) What are the optimal weights of a stock fund and a bond fund in the risky portfolio? What is the resulting standard deviation of this risky portfolio? Show your derivation.

- f) In this minimum variance portfolio, what is the standard deviation?

- g) Suppose that this investor is currently holding a stock fund only and wants to purchase either a stock fund or T-bills additionally. Should they purchase debt or T-bills to reduce the risk of their complete portfolio? Assume that they do not want to reduce their holding in the stock fund.