Homework #5

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Problem 1 The stock of Company A, a tech startup, has an expected return of .24 next year, with a standard deviation of .12. The stock of Company B, a tire manufacturer, has an expected return of .08, with a standard deviation of .05. The covariance between stocks A and B is .000675.

a. What is the correlation between stocks A and B? Interpret what the correlation means, in words.

b. What is the expected return and standard deviation of a stock portfolio that consists of 75% Company A stock, and 25% Company B stock? What about a portfolio that consists of 40% Company A stock, and 60% Company B stock?

c. Alice wants to invest in only these two stocks, but she wants her portfolio to have as little risk as possible, regardless of the return that this portfolio generates. What stock portfolio do you advise her to choose?

d. Bob would like to earn a return of .2 by investing in these two stocks. Naturally, he wants the least risky portfolio of Company A and Company B stock which will generate this return. What portfolio should Bob choose? What is the standard deviation of the portfolio you recommend?

e. Is there any sense in which Alice or Bob is a more savvy investor? Is one of their portfolios better than the other's? Explain.

Problem 2 Consider the two-asset CAPM model studied in class. Suppose that Asset 1 has an expected return of .08 and a standard deviation of .04, while Asset 2 has an expected return of .12 and a standard deviation of .1.

a. Draw the feasible set of (σ, μ) pairs from a portfolio of these two assets if the correlation between the two assets is -1. You have enough information to draw a very precise picture. Explain why your picture looks the way it does, in words.

b. Draw the feasible set of (σ, μ) pairs from a portfolio of these two assets if the correlation between the two assets is 1. You have enough information to draw a very precise picture. Explain why your picture looks the way it does, in words.

c. Draw the feasible set of (σ, μ) pairs from a portfolio of these two assets if the correlation between the two assets is 0. Your picture does not need to be exact.

d. What is the maximum value of $\rho_{1,2}$, the correlation between assets 1 and 2, for which the feasible set is backward bending? What value of $\sigma_{1,2}$, the covariance between assets 1 and 2, is implied by the value of $\rho_{1,2}$ in your answer?

e. Explain, in words, why a feasible set bends backwards if the correlation between the two assets is sufficiently low.

Problem 3 You are advising a client on his stock portfolio, which contains 3 stocks, in companies A, B, and C, with the following characteristics:

$$\begin{array}{lll} \mu_1 = .05 & \sigma_1 = .07 & \rho_{1,2} = .3956 \\ \mu_2 = .18 & \sigma_2 = .13 & \rho_{1,3} = .0893 \\ \mu_3 = .35 & \sigma_3 = .16 & \rho_{2,3} = .1731 \end{array}$$

a. Determine the three covariances, $\sigma_{1,2}$, $\sigma_{1,3}$, and $\sigma_{2,3}$.

b. Determine the expected return and standard deviation from the following stock portfolio: $(p_1, p_2, p_3) = (.1, .8, .1)$.

c. Suppose your client currently holds the stock portfolio in part b. Can you suggest to him an alternate portfolio, that would generate a return at least as high and have risk strictly less than his current portfolio (you can answer this by a guess and verify approach, or by using the spreadsheet threeassets.xls found on my website).

d. Explain to your client, who is not well versed in financial economics, why his choice of portfolio is sub-optimal. Use simple, everyday English!

Problem 4 Return to the three-stock example of question 3. Suppose that now, in addition to these three stocks, your client is also interested in putting some of her money into US treasury bills, which pay a risk-free return of 2.5%.

a. You have convinced you client to switch her stock portfolio to $(p_1, p_2, p_3) = (.091, .395, .514)$, which your computer program tells you is the tangent portfolio, or the point in the feasible set that has the property that a line from the point $(\sigma, \mu) = (0, .025)$ to that point has as large of a slope as possible. What is her overall expected return and standard deviation if she invests fraction .3 of her money in treasury bills, and fraction .7 in the stock portfolio you identified for her?

b. Suppose that she invests fraction s of her money into treasury bills, and fraction $1 - s$ into the stock portfolio identified in part a. What is the relationship between s and the expected return of her overall portfolio? Between s and the standard deviation of her overall portfolio?

c. It is a fact that some investors put most of their assets into stocks, while others prefer to put most of their money into safer assets, like treasury bills. Explain, in the context of the CAPM model studied in class, what accounts for this difference. What types of investors prefer a portfolio with mostly stocks?