ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Principles of Finance

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Assignment 5

Instructions

- Assignments should be done in groups of 2 to 3 students.
- You should remain with the same group through the entire course.
- Submit on Moodle only one copy of solutions per group.
- For each assignment you can get a maximum of 100 points.
- All assignments turned in late will not be graded (zero points).

Due date

The due date is indicated on Moodle.

1. Suppose that you currently have $250,000 invested in a portfolio with an expected return of 12% and a volatility of 10%. The efficient (tangent) portfolio has an expected return of 17% and a volatility of 12%. The risk-free rate of interest is 5%. (15 points)

   (a) What is the Sharpe ratio of your portfolio?

   (b) Provide the equation of the capital market line (CML)?

   (c) You want to maximize your expected return without increasing your risk. Without increasing your volatility beyond its current 10%, what is the maximum expected return in percent you could earn? What is the maximum expected return in $ you could earn?

2. Your investment portfolio consists of $15,000 invested in only one stock, Microsoft. Suppose the risk-free interest rate is 5%, Microsoft stock has an expected return of 12% and a volatility of 40%, and the market portfolio has an expected return of 10% and a volatility of 18%. Under the CAPM assumptions: (20 points)

(a) What alternative investment has the lowest possible volatility while having the same expected return as Microsoft? What is the volatility of this investment?

(b) What alternative investment has the highest possible expected return while having the same volatility as Microsoft? What is the expected return of this investment?

3. Consider a market with two risky securities, A and B, and a risk-free asset. A and B have an expected return of 0.05 and 0.08, and a variance of 0.09 and 0.15, respectively. The returns on the two risky securities are uncorrelated. The risk-free rate is 3%. Two portfolio managers hold the following efficient portfolios. (10 points)

	Risk-free	Asset A	Asset B
Portfolio manager 1	-$2,000	$4,000	$6,000
Portfolio manager 2	$1,000	$2,500	$3,750

(a) Determine the composition of the tangency portfolio.

(b) Suppose that a new regulation bans portfolio managers from borrowing. How would the portfolios of the two managers qualitatively change? Hint: use a graph.

4. Suppose you have $25,000 in cash to invest. You decide to sell short $12,500 worth of XYZ Industries and invest the proceeds from your short sale, plus your $25,000 into one year U.S. treasury bills earning 5%. At the end of the year, you decide to liquidate your portfolio. What is the return on your portfolio if XYZ Industries has the following realized returns? (15 points)

	P_0	Div_1	P_1
XYZ Industries	$62.5	$2.5	$72.5

5. Suppose that the CAPM assumptions hold. The expected return of the market is 9% and its volatility is 10%. The risk-free rate is 3%. An investor is looking to invest in the following three stocks: (20 points)

	ρ_{jM}	σ_j
A	0.8	6%
B	0.3	40%
C	-0.2	9%

ρ_{jM} is the correlation between the market return and the return on asset j. σ_j is the volatility of the return on asset j.

(a) Calculate the expected returns of the three stocks.

(b) Calculate the expected return of a portfolio that consists of 60% stock A, 30% stock B and 10% stock C.

(c) Calculate the beta of the portfolio in (b).

(d) Calculate the idiosyncratic risk of each stock.

(e) If market is the only source of covariance between the three stocks, what will be the volatility of the portfolio in (b)? what are its idiosyncratic and systematic risks?

6. Suppose that the risk-free rate is 4%, and the market portfolio has an expected return of 10% with a volatility of 16%. Merck & Co. stock has a volatility of 20% and a correlation with the market of 0.06. What is Merck's beta with respect to the market? If you assume that the CAPM assumptions hold, then what is the expected return on Merck & Co. ? (5 points)

7. Suppose that the risk-free rate is 2% and the CAPM assumptions hold. Assume there are three risky stocks A, B and C. Stock A has a beta of 1.4. Stock B has an expected return of 8% and a beta of 0.75 and stock C has an expected return of 15%. (15 points)

   (a) Calculate the expected return of stock A and the beta of stock C.

   (b) What is the beta of the market portfolio?

   (c) What is the composition of the market portfolio if the weight of stock C is one third of that of stock B?