Revision Course – Asset Management
Portfolio Construction and CAPM

Exercises

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1 Portfolio Construction

Exercise 2
Consider three assets, A, B, and C, with variance-covariance matrix $\mathbf{\Sigma}$ and expected rates of return r_A, r_B, and r_C:

$$\mathbf{\Sigma} = \begin{array}{c} \\ A \\ B \\ C \end{array} \begin{array}{c} \begin{array}{ccc} A & B & C \end{array} \\ \begin{pmatrix} 2 & 1 & 0 \\ 1 & 2 & 1 \\ 0 & 1 & 2 \end{pmatrix} \end{array} \quad \text{and} \quad \mathbf{R} = \begin{pmatrix} r_A \\ r_B \\ r_C \end{pmatrix} = \begin{pmatrix} 0.4 \\ 0.4 \\ 0.8 \end{pmatrix}$$

1. Find the minimum variance portfolio (MVP).
2. Find a second efficient portfolio. (Hint: tangency portfolio (TP) with $r_f = 0$)
3. If the risk free rate is $r_f = 0.2$, find an efficient portfolio of risky assets (TP) and compute the expected return and variance of this portfolio.
4. Calculate the expected return and the variance for an efficient portfolio which has a 50% weight in the MVP and 50% in the TP.

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2 CAPM

Exercise 3 (based on BKM, Chapter 9, Exercise 21)
Suppose the rate of return on short-term government securities (perceived to be risk-free) is about 5%. Suppose also that the market risk premium is 7%. According to the capital asset pricing model:

1. What is the expected rate of return on the market portfolio?
2. What would be the expected rate of return on a risk neutral stock?
3. Suppose you consider buying a share of stock at \$40. The stock is expected to pay \$3 dividends next year and you expect it to sell then for \$41. The stock risk has been evaluated at $\beta = -0.5$. Is the stock overpriced or underpriced?

Exercise 4 (BKM, Chapter 9, Exercise 9)
Consider the next figure which gives a security analysts expected return on two stocks for two particular market returns:

Market Return	Aggressive Stock	Defensive Stock
5%	-2%	6%
25%	38%	12%

1. What are the betas of the two stocks?
2. What is the expected rate of return on each stock if the market return is equally likely to be 5% or 25%?
3. If the T-Bill rate is 6% and the market return is equally likely to be 5% or 25%, draw the SML for this economy.
4. Plot the two securities on the SML graph. What are the alphas of each?

Exercise 5 (BKM, Chapter 9, Exercise 20)
Two investment advisers are comparing performance. One averaged a 19% rate of return and the other a 16% rate of return. However, the beta of the first investor was 1.5, whereas that of the second was 1.

1. Can you tell which investor was a better selector of individual stocks (aside from the issue of general movements in the market)?

2. If the T-bill rate were 6% and the market return during the period were 14%, which investor would be the superior stock selector?

3. What if the T-bill rate were 3% and the market return were 15%?

Exercise 6 (BKM, Chapter 9, Exercise 23)

1. A mutual fund with $\beta = 0.8$ has an expected rate of return of 14%. If $r_f = 5\%$, and you expect the rate of return on the market portfolio to be 15%, should you invest in this fund? What is the fund's alpha?

2. What passive portfolio comprised of a market-index portfolio and a money market account would have the same beta as the fund? Show that the difference between the expected rate of return on this passive portfolio and that of the fund equals the alpha from part (a).