

Asset Pricing

Homework 5

Due at 24:00 pm (KST) on Thursday

Submit one file: written solutions with executable Python code in Jupyter Notebook(.ipynb)

**Subjects**

**[Session4. CAPM and APT]**

1. Investment Science

**Chapter 7.** The CAPM

**Chapter 8.** Other Pricing Models

2. Advanced Portfolio Construction and Analysis with Python (Coursera)

**Week 1.** Style & Factors

**Assignment 1.**

Summarize this week's study

**Assignment 2.**

Make a problem about the above subjects

**Assignment 3.**

Solve the following problems

**Problem 1. (N risky Assets)**

There are N risky assets with returns .

The expected return and the variance-covariance are denoted by

Let be the weights of the risky assets in the portfolio.

Using the Lagrange Multiplier Methods, Find the optimal weights of portfolio under given the target expected return

**Problem 2. (N risky Assets + one risk-free Asset)**

There are N risky assets with returns and the risk-free asset with risk-free rate .

The expected return and the variance-covariance are denoted by

Let be the weights of the risky assets in the portfolio. The weight of the risk-free asset is

Solve the following sub-problems.

1) Using the Lagrange Multiplier Methods, Find the optimal weights of portfolio under given the target expected return

2) Find the weight vector of the Tangency Portfolio.

3) Find the variance of the optimal portfolio.

4) Use the risk-aversion parameter to indicate the weight of the optimal portfolio. (Definition of risk aversion parameter )

5) Show that under a given constraint, all optimal portfolios have the same Sharpe Ratio and that all optimal portfolios are above the CAL of the Tangency portfolio.

**Problem 3.**

Explain that Tangency Portfolio becomes Market Portfolio under the assumption of CAPM, and show that CAL of Tangency Portfolio becomes CML (Capital Market Line).

**Problem 4.**

1) Follow the proof on page 184 of the textbook to induce the formula of CAPM.

2) Derive the CAPM formula for by using Equation (6.9) in Chapter 6 of the Text book. Hint: Note that Apply equation (6.9) both to asset k and to the market itself.

**Problem 5. (Optional)**

Is beta constant? Write down your inference.