



Instructions

In the final group project for Introduction to Financial Engineering, the task is to dig deeper into your results from portfolio optimization using financial theory. You will continue to analyse the same eight stocks as in the previous project.

In the next pages, the precise questions are stated. BUT the ordering of questions is to illustrate the order of which the questions is naturally addressed when doing the various calculations and analysis. You should write one coherent, self-contained report where you provide the theory, the results from your analysis and the conclusions summarized and/or presented in graphs and tables.

Along with the report, you must submit a file/folder with code that documents the calculations. The code must be executable in one click from the desktop of any computer with the correct software included. This means that any sub-functions used must be distributed as well and that data needs to be downloaded from the Internet or entered manually as the first thing in your code.

The total number of pages is 2 including this front page.

Estimation of CAPM and FF

Use daily FF-data from Kenneth French's website to fit the CAPM and to fit the FF three factor model. When doing this analysis, do not forget to be critical about whether assumptions are fulfilled. You may find inspiration in Example 18.6 on how to solve this question.

Empirical testing of CAPM

Plot annualised expected return as a function of the stocks' β s. Does the stock data look consistent with CAPM? Comment on your findings.

Interpretation of FF

For each of the eight stocks, consider the factor loadings on SML and HML. Do the stocks behave as small or large stocks? Are the stocks value stocks or growth stocks? Comment on your findings.

The Efficient Frontier(s)

Calculate the covariance matrices obtained by CAPM and by FF and compare with the sample covariance matrix used in the previous project. Illustrate the three efficient frontiers and the GMV-portfolio and tangent portfolio. All of this can and should be done exact and not by numerical optimisation! If the three obtained frontiers look VERY different, check if you have an error in your code or have forgotten to annualise. You may use the sample mean of returns as input to all three efficient frontiers.

Diversification effect

Considering an equally weighted portfolio of the eight stocks. When the risk of this portfolio is assessed using CAPM, how much is the nonmarket-risk reduced? Answer this by comparing $\bar{\sigma}_\epsilon$ to $\sigma_{\epsilon,P}$. For more details, consider p. 503-504 in the textbook.

Rolling estimate of β

Look at your eight stocks, make a rolling estimate of β using the past years data (252 trading days). This means that your first estimate is obtained on Jan 2, 2015 (because this gives you 252 returns to work with). Plot the β s as a function of time and comment on the variability of β over time.