Exercises Sheet 8

Financial Engineering 2022

Note: The choice of software is up to the students. We recommend that you work in Python, but you can also choose to in R or Matlab. We do not provide solutions for all exercises in all languages.

These exercises deal with portfolio optimisation, especially on how restrictions change the efficient frontier. It's useful to have the reading materials for Lecture 8 and/or the slides at hand. It's recommended to program the following exercises such that an arbitrary number of assets can be handled.

1. (portfolios, diversification, efficient frontier) Use the data from Exercise Sheet 7. Assume the risk free rate is 2% (or otherwise estimate it based on the USD 3m LIBOR rate found online – for instance on www.bankrate.com).

   (a) Calculate the efficient frontier for a combination of McDonalds and Coca Cola without a risk-free asset and the CML with the risk-free asset included.

   (b) Now add Microsoft to the portfolio and redo the previous question. Add the new efficient frontier and the CML to the same graph. Comment on your findings.

2. (portfolios, diversification, efficient frontier) Use the data and code from Exercise 1 and modify to include:

   (a) No bank account (risk-less lending) and no short selling allowed. Plot this in the same graph as with short selling allowed and comment on your findings

   (b) Risk-less lending is allowed and no short selling. Plot this in the same graph as above.

   (c) No more than $1/2$ of the wealth invested in each asset