Exercises – Week 43

Introduction to Financial Engineering

Note: You may choose to work in R or Matlab. Sometimes solutions will be available in one language, sometimes in both.

1. (single index model) Pick daily historical data for the following eight stocks: American Express, McDonald's, Google, Exxon Mobil Corporation, IBM, Nike, Walmart, Coca-Cola for the period January 1, 2008 to Jan 1, 2018. Also find data for the market (use S&P-500 as "the market", symbol: "SPY").

   (a) Calculate returns for all data

   (b) Calculate expected market return and the variance (remember to annualise!)

   (c) For each of the assets calculate the needed parameters for the single index model. Use linear regression to estimate β_i, α_i and σ_{ei}. Use these estimates to compute mean and covariance.

   (d) Calculate the real yearly co-variance matrix of the stock returns using the definition of (empirical) covariance.

   (e) Calculate and illustrate the efficient frontier based on the two different estimation methods.

   Hint: You can use R's built-in function lm(). See ?lm to view documentation and examples. In Matlab, use the function LinearModel.fit.