

Exercises – Week 45

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. (Two-fund separation) Using the data from Week 40, Exercise 1).
 - (a) Calculate the portfolio weights for the global minimum variance portfolio
 - (b) Calculate the portfolio weights for the tangent portfolio
 - (c) Pick a point μ_C between μ_{GMV} and μ_{tan} and calculate the portfolio weights for this portfolio
 - (d) Find a fraction α such that α invested in the GMV-portfolio and $1 - \alpha$ invested in the tangent portfolio matches the portfolio in the previous question
 - (e) Confirm that for each asset, the ratio of excess return to its' covariance with the tangent portfolio is identical. Hint: The covariance of asset with the tangent portfolio is easily obtained by multiplying portfolio weights with the covariance matrix.

2. (Empirical testing of CAPM) 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, 2009 to Jan 1, 2019. Also find data for the market (use S&P-500 as "the market", symbol: "SPY").
- (a) Calculate daily returns for all data
 - (b) Calculate expected market return and the variance
 - (c) Calculate β for each stock using the definition of β
 - (d) Plot historical average returns as a function of β
 - (e) Does the stock data look consistent with CAPM?
 - (f) Repeat the analysis using weekly returns – does this change anything?