Homework 1

Readings

Read Chapters 2 and 4 in Statistics and Data Analysis for Financial Engineering and use the samples in R lab sections to do this exercise.

Assignment

Consider large cap stock index S&P500 and small cap stock index Russell 2000. Data sets with the adjusted closing prices are available on bCourses (Homework -> HW1). Use these datasets to answer the questions below.

1. Create daily, monthly, and annual return and log return time series (12 timeseries total) and plot them.
2. Compute sample mean, sample stdev, skewness and kurtosis for each data set.
3. Plot density function and cumulative distribution function for the empirical distributions together with normal distribution with the same mean and variance. Do the returns, log returns look normally distributed?
4. Do the returns, log returns look normally distributed in a QQ-plot?
5. Test for normality of returns and log returns using the Shapiro-Wilk test? What is the p-value? Can you reject the null hypothesis of a normal distribution at 0.01 in each case? Note: For the daily timeseries, you should sample 5000 observations of your data.
6. Create several t probability plots of the returns and log returns using a number of choice of the degrees-of-freedom parameter (df). What value of df gives a plot that is as linear as possible?

You are encouraged to create a script file with R commands to automate the process and save time.

Submit your answers on Gradescope in the submission format provided. Plots of `420x280` pixels work well with the format.