Financial **T**Ime Series

Assignment #1

Data files: Datasets are available either from **quantmod** or from the course web.

Notes:

- All tests are based on the 5% significance level.
- Do not hand in computer output. Use *cut-and-paste* to summarize the output. There is no need to keep many digits in an answer.
- **Each student** needs to write his/her own solutions, even though discussions of the assignments between students are encouraged.

Assignment: `fBasics` of R is helpful in doing this assignment.

1. Consider the daily simple returns of Starbucks (SBUX) stock, CRSP value-weighted index (VW), CRSP equal-weighted index (EW), and the S&P composite index (SP) from January 3, 2007 to December 31, 2015. Returns of the three indexes include dividends. The data are in the file `d-sbux3dx-0715.txt` and the columns show permno of SBUX, date, SBUX, vwretd, ewretd, and sprtrn, respectively, with the last four columns showing the simple returns.
   (a) Compute the sample mean, standard deviation, skewness, excess kurtosis, minimum, and maximum of each simple return series.
   (b) Obtain the empirical density function of the simple returns of Starbucks stock. Are the daily simple returns normally distributed? Perform a normality test to justify your answer.
   (c) Transform the simple returns to log returns. Compute the sample mean, standard deviation, skewness, excess kurtosis, minimum, and maximum of each log return series.
   (d) Test the null hypothesis that the mean of the log returns of Starbucks stock is zero. Do the same test for S&P composite index.
   (e) Obtain the empirical density plot of the daily log returns of Starbucks stock and the value-weighted index index.
2. Answer the same questions as Problem 1 but using monthly returns for Apple (AAPL) stock, CRSP value-weighted index (VW), CRSP equal-weighted index (EW), and S&P composite index (SP) from January 2001 to December 2015. The returns include dividend distributions. Data file is `m-aapl3dx-0115.txt` with column names PERMNO of AAPL, date, AAPL, vwretd, ewretd, and sprtrn, respectively. [Note that, in the questions, replace SBUX by AAPL.]

3. Consider the daily log returns of Starbucks stock from January 2007 to December 2015 in Problem 1. Perform the tests and draw conclusions using the 5% significance level.

   (a) Construct a 95% confidence interval for the daily log returns of SBUX stock.

   (b) Test $H_0 : m_3 = 0$ versus $H_a : m_3 \neq 0$, where m_3 denotes the skewness of the return.

   (c) Test $H_0 : K = 3$ versus $H_a : K \neq 3$, where K denotes the kurtosis. (Excess kurtosis = 0.)

4. Consider the daily log returns of S&P composite index from January 3, 2007 to December 31, 2015 as in Problem 1. Perform the following tests: (a) Test the null hypothesis that the log return is symmetric with respect to its mean; (b) Test the null hypothesis that the excess kurtosis of the returns is zero; (c) Construct a 95% confidence interval for the expected daily log return of the S&P composite index.

5. Daily foreign exchange rates (spot rates) can be obtained from the Federal Reserve Bank in St Louis (FRED). The data are the noon buying rates in New York City certified by the Federal Reserve Bank of New York. Consider the exchange rates between the U.S. dollar and the Euro from January 3, 2005 to March 18, 2016. See the file `d-exuseu-0516.txt`. The file has four columns, namely year, month, day, and euro, respectively, where euro denotes the US dollars of one Euro. Answer the following questions:

   (a) Compute the daily log return of the exchange rate.

   (b) Compute the sample mean, standard deviation, skewness, excess kurtosis, minimum, and maximum of the log returns of the exchange rate.

   (c) Obtain a density plot of the daily log returns of Dollar-Euro exchange rate.

   (d) Test $H_0 : \mu = 0$ versus $H_a : \mu \neq 0$, where μ denotes the mean of the daily log return of Dollar-Euro exchange rate.

   (e) Are the log returns of the exchange rate normally distributed? Why?

Reading assignment: Chapter 1 and Chapter 2 (Sections 1 to 5) of the text.