STAT 6351: Assignment #1

Notes

- Data files are available either from `quantmod` or from the course web.
- Use 5% significance level in all tests.
- Do not hand in computer output; use cut-and-paste to summarize the output. There is no need to report values with many digits, usually 4 significant digits suffices.

Questions

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 an (smooth) empirical density plot of the daily log returns of Starbucks stock and the value-weighted index.
2. Answer the same questions as in 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 question parts you should replace SBUX by AAPL.)

3. Consider the daily log returns of Starbucks (SBUX) stock computed in Problem 1(c). Perform the following tests and draw conclusions at the 5% significance level.

   (a) Construct a 95% confidence interval for the "expected" daily log return.

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

   (c) Test $H_0 : K = 3$ vs. $H_a : K \neq 3$, where K denotes the kurtosis of the log return. (Note: a kurtosis of 3 corresponds to an excess kurtosis of 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 US 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 amount of US dollars for one Euro. Answer the following questions.

   (a) Compute the daily log returns of the Dollar-Euro exchange rate, and plot them as a time series. Call these returns r_t.

   (b) Compute the sample mean, standard deviation, skewness, excess kurtosis, minimum, and maximum of r_t.

   (c) Obtain a density plot of r_t.

   (d) Test $H_0 : \mu = 0$ vs. $H_a : \mu \neq 0$, where $\mu = \mathbb{E}(r_t)$.

   (e) Is r_t normally distributed? Justify your answer by means of an appropriate test.

   (f) Obtain an autocorrelation plot of r_t. What is the value of the autocorrelation at lag 1?

   (g) Is r_t serially correlated? Justify your answer by means of an appropriate test.

   (h) Does r_t appear to be stationary? Why?