

**THE UNIVERSITY OF CHICAGO**  
**Graduate School of Business**  
Business 41202, Spring Quarter 2008, Mr. Ruey S. Tsay

**Homework Assignment #1**

**Due Date:** before class

- Campus class: April 8, 2008
- Evening class: April 8, 2008

**Data files:** Datasets are available from the course web site at <http://faculty.chicagosb.edu/ruey.tsay/teaching/sp2008>.

**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 have many digits in an answer.
- **Each student** needs to write his/her own solutions, even though discussions between students are encouraged.

**Assignment:**

1. Consider the daily stock return of the Apple Inc. (tick symbol AAPL) and the Standard and Poor's 500 Composite index from January 2000 to December 2007. The data are simple returns and in the file d-aaplsp0007.txt (three columns with date, AAPL, SP).
  - (a) Express the simple returns of Apple stock in percentages. Compute the sample mean, standard deviation, skewness, excess kurtosis, minimum, and maximum of the percentage simple returns.
  - (b) Transform the simple returns of AAPL to log returns and express the log returns in percentages. Compute the sample mean, standard deviation, skewness, excess kurtosis, minimum, and maximum of the percentage log returns.
  - (c) Is the sample mean of AAPL log returns statistically different from zero?
  - (d) Consider the simple returns of AAPL and S&P 500 index. Is there any difference between the mean returns of the two series?
2. Consider the monthly simple returns for the International Business Machines Corp. stock (tick symbol IBM) and the S&P 500 composite index from January 1977 to December 2007. The returns include dividend distributions, and the data file is m-ibmsp7707.txt. Transform the simple returns to log returns and express the log returns in percentages. Compute the sample mean, standard deviation, skewness, excess kurtosis, minimum, and maximum of each percentage log-return series.

3. Consider the monthly 3-month Treasury Bill rates on the secondary market from February 1, 1977 to January 1, 2008. The data file consists of four columns (namely, year, month, day, and rate). The rates are in percentages. Answer the following questions:
  - (a) Compute the mean, standard deviation, skewness, and kurtosis of the interest rate series.
  - (b) Compute the change series of interest rate, i.e.  $x_t = y_t - y_{t-1}$  with  $y_i$  being the  $i$ th observation of the interest rate. Compute the mean, standard deviation, skewness, and kurtosis of the change series.
  - (c) Obtain an empirical density function of the  $x_t$  series. [Show a density plot, which can be obtained using the command *density* in R.] Is the density function symmetric with respect to its mean?
4. Consider the daily log returns of Apple stock from January 2000 to December 2007 as in Problem 1. Conduct the following tests by (a) state the null and alternative hypotheses, (b) perform the test, and (c) draw your conclusions:
  - (a) Test the null hypothesis that the skewness measure of the returns is zero;
  - (b) Test the null hypothesis that the excess kurtosis of the returns is zero;
  - (c) Test the null hypothesis that the log returns is normally distributed. You may use the Jarque-Bera test.
5. Again, consider the monthly simple returns of IBM stock and the S&P 500 composite index from 1977 to 2007 and the 3-month Treasury Bill rates from February 1, 1977 to January 1, 2008. Since the Treasury Bill rates are annualized, we can approximate the monthly rates by dividing the rates by 12. Compute the monthly simple excess returns of the IBM stock and the S&P 500 index. [Note that the interest rates were reported on the first day of each month so that a time shift is used in the data files.] Answer the following questions:
  - (a) Are the mean excess returns of IBM stock and S&P 500 index significantly different from zero? Why?
  - (b) Is the mean excess return of the S&P 500 index positive? [In R, use the command `t.test(rt, alternative=c("greater"))`, where `rt` denotes the excess return.] What is the p-value of the test? If the significance level is 10%, what is your conclusion?
  - (c) Are the monthly excess returns of IBM stock symmetric with respect to the mean return?
  - (d) Do the monthly simple excess returns of IBM stock have heavy-tails? Why?

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