MA 550 – Homework 6

Due Thursday, 5pm, December 3, 2020

Homework Assignment Policy and Guidelines

(a) Homework assignment should be submitted electronically through `Canvas`, and your submission should be combined into ONE PDF file. Credit will not be given for homework turned in late.

(b) Homework assignments should be well organized. It is required that you show your work in order to receive credit.

(c) It's highly recommended to use R Markdown to write up your homework solutions, especially for problems that involve data analysis. But this is not required.

(d) When writing up solutions via R Markdown, please refrain from showing lengthy results/output for data analysis problems. Please display only relevant results.

(e) If you are not to use R Markdown, please keep the R code and/or R output for all the relevant problems in a *well organized appendix*, and please refrain from copying and pasting R code and/or R output directly into your answers.

(f) For problems that involve technical writing, strive to be clear, concise, and cogent. Organize figures and tables in an efficient manner while maintaining clarity.

(g) For problems that involve data analysis, always interpret the results in the context of the study. This may include comments on whether the results are meaningful or not. Think of your answers as a mini technical report of your findings and follow the guidelines on technical writing.

(h) You may discuss most homework problems with others including your peers and instructor, but you must write up your homework solutions by yourself in order to receive credit. Similarly, you must write your own computer code and obtain your computer output independently.

1. Please read Sections 1 and 2 of the paper by Poon & Taylor (*Stock returns and volatility: An empirical study of the UK stock market*, Journal of Banking & Finance 1992, 16, 37-43), and work on the following questions.

- The file 'DailyLogRet-intc9608.txt' contains the daily log returns of Intel from Jan 2, 1996 to Dec 31, 2008. (See Eq (1) of Poon & Taylor (1992) for the definition of log return.) Denote by $R_{d,t}$ the daily log return on day d for month t.

  (a) Construct monthly log return for month t using the formula: $R_t = \sum_{d=1}^{n_t} R_{d,t}$, where n_t is the number of trading days in month t.

  (b) Use Eq. (2) of Poon & Taylor (1992) to construct the monthly variance σ_t^2.

(c) Similar to Table 1 of Poon & Taylor (1992), report the summary statistics for Intel daily and monthly log returns. Comment on your findings.

(d) Similar to Table 2 of Poon & Taylor (1992), report the summary statistics for σ_t^2 and $\ln \sigma_t^2$. Comment on your findings.

(e) Following the analysis in Poon & Taylor (1992), find an appropriate ARIMA for $\ln \sigma_t^2$. Report your empirical results in a table similar to Table 3 of Poon & Taylor (1992). Comment on your findings.

(f) Test for the unit root using the regression equation (5) of Poon & Taylor (1992). Make your conclusions.

2. Consider the monthly U.S. unemployment rate from January 1948 to March 2009 in the file 'm-unrate.txt'. The data are seasonally adjusted and obtained from the Federal Reserve Bank of St Louis.

(a) Perform exploratory data analysis including a time plot, summary statistics, sample ACF, sample PACF, and sample EACF.

(b) Build an *appropriate* ARMA model for the series.

(c) Use the model to forecast the unemployment rate for the April, May, June, and July of 2009.

(d) Does the fitted model imply the existence of business cycles? Why?

(e) In addition, plot the spectral density of the fitted ARMA model and find the frequency that maximizes the spectral density. What is the corresponding period?

(Note that there are more than one model fits the data well. You only need an adequate model.)

3. [Bonus Question, 20 points] Consider the demand for electricity of a manufacturing sector in the United States. The data are logged, denote the demand of a fixed day of each month, and are in 'power6.txt'. Build an *appropriate* time series model for the series and use the fitted model to produce 1- to 12-step-ahead forecasts.