Assignment 4 Spring 2018

DUE DATE: Friday 10^{th}, May 2019.

I pledge to the Honor Code and to obey all rules for taking and performing homework assignments as specified by the course instructor.

Full name ________________________ **Student ID.** ____________

There are five questions.

Question1.

Consider the monthly unemployment rates of Michigan (MI), Illinois (IL), and Indiana (IN)from 1976.1 to 2017.2.The data are in m-unrate-MIILIN.txt. Build a VAR model for this 3-dimensional time series. Simplify (or refine) the model by removing insignificant parameters with threshold of t-ratio 1.645, and perform model checking.

1.1 Write down the final fitted model.

1.2 Obtain the plots of impulse response function of the fitted model and explain the relationship among the monthly unemployment rates of Michigan, Illinois, and Indiana from 1976.1 to 2017.2.

Question2.

Consider the monthly growth rate of M1 money supply of China and the growth rate of monthly crude oil price. The original data are from FRED. The crude oil prices are MCOILWTICO, Western Texas Intermediate. The data are in m-m1cnwti.txt with first column containing M1 series.

2.1 Obtain the time series plots of the bivariate time series, say z_t.

2.2 Build a VAR model for z_t, including simplification and model checking. Write down the fitted model.

2.3 Obtain the impulse response functions of the fitted model. What is the relationship between the M1 money supply of China and crude oil price, which represents commodity prices.

2.4 Obtain 1-step to 6-step ahead predictions of z_t at the forecast origin 2015.2.

2.5 Obtain the forecast error variance decomposition and explain it.

Question3.

Consider the daily exchange rates between U.S. dollar and Japanese Yen and Euro from April 20, 2005 to March 31, 2017 for 3001 observations. The data are available from FRED and are also in the file d-exjpuseu.txt. The first column denotes Japanese Yens of one U.S. dollar whereas the second column denotes U.S. dollars per Euro.

3.1 Obtain the time series plots of the log series of the exchange rates.

3.2 Build a VAR model for the bivariate exchange rate series, including model checking.

3.3 Based fitted model, is there any cross-dynamic dependence between the two exchange rate series? Why?

Question4.

Consider four components of U.S. monthly industrial production index from January 1947 February 2017 for 842 data points. The four components are durable consumer goods (IPD- CONGD), nondurable consumer goods (IPNCONGD), business equivalent (IPBUSEQ), and materials (IPMAT). The original data are available from the Federal Reserve Bank of St. Louis and are seasonally adjusted. Note that IPMAT starts at January 1939.

4.1 Construct the growth rate series zt of the four industrial production index, i.e. take the first difference of the log data. Obtain time plots of zt. Comment on the time plot.

4.2 Build a VAR model for zt, including simplification and model checking. Write down the fitted model.

4.3 Compute 1-step to 6-step ahead predictions of zt at the forecast origin h = 841 (February 2017).

Obtain 95 % interval forecasts for each component series.

Question5.

Consider the daily returns of the stock you have selected and submited at the begining of EE435 class from January 2, 2009 to April 30, 2019. Let r_t be the percentage log returns.

5.1 Is the expected value of r_t zero? Why? Are there any serial correlations in r_t? Why?

5.2 Fit a Gaussian ARMA-GARCH model to the r_t series. Obtain the normal QQ- plot of the standardized residuals, and write down the fitted model. Is the model adequate? Why?

5.3 Build an ARMA-GARCH model with Student-t innovations for the log return series. Perform model checking and write down the fitted model.

5.4 Obtain 1-step to 5-step ahead mean and volatility forecasts using the fitted ARMA-GARCH model with Student-t innovations.