MACROECONOMETRICS FINAL EXAM SPRING, 2020

This Exam is due on May 25 and is strictly individual. You until from 7PM to send your work to Fabio (stohler.fabio@novasbe.pt). Please deliver all your work including any R code you used to support your answers. Answer the questions as you would in a project. Include tables and figures in an organized way. Put the R script and other less relevant tables and figures in the appendix. Good luck!

1. (25 pts) Cointegration - Consider the annual real gross domestic products per capita of four OECD countries. The countries are: United States, Germany, United Kingdom, and France. The real GDP are in 2011 U.S. dollars, and the sample period is from 1960 to 2011 for 52 annual observations. The data can be found in `data_final_2020_Q1.xls`. Let z_t be the log series of the data.

   (a) (5 pts) Test for cointegration using the number of lags equal to 2. Are the log series cointegrated? Why?

   (b) (5 pts) What is the cointegrating vector, if any?

   (c) (5 pts) Perform unit-root test to confirm the stationarity if the cointegrated process.

   (d) (10 pts) Estimate the VECM and interpret the speed of adjustment coefficients. Plot the IRFs and report the FEVD for 5 periods. Comment on your findings.

2. (25 pts) State Space Models - FAVAR. Use McCracken and Ng FRED-MD data base (see details at https://s3.amazonaws.com/files.fred.stlouisfed.org/fred-md/Appendix_Tables_Update.pdf) to estimate a FAVAR model to the US economy. You can find the data in `data_final_2020_Q2.csv`

   (a) (5 pts) Create a function that based on the transformation code transforms the variable as wanted. Apply all data transformations to all series (read the documentation of the transformation codes carefully).

   (b) (5 pts) Estimate 3 principal components from the dataset ending in February 2020 (included). How much of the variation of Real Personal Income and Civilian Unemployment Rate is explained by the 3 factors? (Hint: the data needs to be standardized and centered).

   (c) (10 pts) Estimate a FAVAR using FEDFUNDS as the only observed variable. Follow the class notes on the FAVAR replication of BBE(2005), but now applying it to this updated monthly dataset. (clean the factors, order the variables in the correct way, etc). Show the IRF with respect to a FEDFUNDS shocks for 5 variables of your choosing for 60 periods and discuss your findings.

   (d) (5 pts) Use the estimated FAVAR to predict Real Personal Income and Civilian Unemployment Rate in March. Compare your findings with the BLS report. (Hint: do not forget to transform the variables back to their original units)/

3. (20 pts) GARCH Models. Use quantmod to download the Dow Jones Industrial Average (DJIA).

   (a) (5 pts) Is it stationary? Why or why not?

   (b) (5 pts) If not, transform the series appropriately and estimate a ARMA model for the mean.

   (c) (5 pts) Estimate a GARCH model.

(d) (5 pts) Plot the fitted conditional volatility and compare it with the CBOE Volatility Index: VIX (VIXCLS) series.

4. (25 pts) Non-Linear Models. Predicting Ordinary and Severe Recessions with a Two-State Markov-Switching Dynamic Factor Model: Real Gross Domestic Product for Portugal (CLVMNACSCAB1GQPT).

   (a) (5 pts) Is it stationary? Apply the hp filter. Is it stationary?

   (b) (5 pts) Estimate a two-state Markov-switching model on the hp-filtered cycle with 4 lags using the NTS library (useful for univariate analysis).

   (c) (5 pts) Interpret the model fit and check the model adequacy.

   (d) (10 pts) Plot the smoothed regime probabilities and interpret them.

The End.