

ECO 374 H1F: Forecasting and Time Series Econometrics
Department of Economics, University of Toronto
Short Written Assignment
Winter 2020

Submission details:

Your files should be uploaded on Quercus (SWA) by April 3, 2020, 11:59 pm. Submit **one** nb.pdf file with your code, computer output and graphs.

Note that the commands in your Rmd file should be ordered as specified below.

Assignment questions:

Question 1

- a. Download data on “Housing Starts: Total: New Privately Owned Housing Units Started” in the U.S. from the FRED database at St. Louis branch of the U.S. Federal Reserve Bank (series HOUST), at <https://fred.stlouisfed.org/series/HOUST>. The start of the data series should be adjusted to 1985-01-01, the frequency stays at Monthly.
- b. Load the data to RStudio, convert to ts format, and plot.
- c. Test for a unit root and state your conclusion.
- d. If unit root can't be rejected for the series then difference the data and test again for unit root, otherwise keep the original series. Call the resulting (either original or differenced) series “the working series”.
- e. Plot ACF and PACF of the working series.
- f. Based on these, choose and estimate two non-seasonal and one seasonal ARMA models. Label them m1, m2, and m3, respectively.
- g. Obtain an ARMA model using R's automatic model selection function.
- h. Obtain the AIC for models m1–m4 and comment on the outcome.
- i. Choose and estimate two seasonal Autoregressive Neural Network models, one with 5 nodes in the hidden layer (label m5) and one with 10 nodes in the hidden layer (label m6).

- j. Compare models m1–m6 based on measures of in-sample forecasting accuracy, and choose the model with the smallest RMSE and MAE.
- k. Using this model, obtain a forecast of the working series for 12 months ahead.
- l. Plot the working series from January 2015 and the forecast combined.

Question 2

- a. Import daily data on the NASDAQ Composite price index from yahoo finance directly into R, starting from January 1, 1998.
- b. Obtain Close values of the series and verify their class.
- c. Plot the index and its returns.
- d. Import daily price data on the equity of Amazon.com, Inc from yahoo finance directly into R, starting from January 1, 1998.
- e. Obtain Close values of the series and verify their class.
- f. Plot the price series and its returns.
- g. Specify an ARMA(1,0)-GARCH(1,1) model and estimate the volatility of both NASDAQ returns and Amazon returns.
- h. Plot the fitted volatility for each series.
- i. Compare the average fitted values and the last fitted values (latest date).