

Homework 5

Eco 5316 Time Series Econometrics

Spring 2018

Due: Sunday, February 25, 11.55pm

Problem 1

Submit your solution in the form a short report, prepared using R Markdown. Compile the report into a pdf or an html file and upload it to your dropbox folder together with the source Rmd file.

- (a) Obtain monthly data for Total Nonfarm Payroll Employment, Not Seasonally Adjusted, available on FRED under code **PAYNSA** and on Quandl under **FRED/PAYNSA**. Import the 1975M1-2017M12 sample using `tq_get`.
- (b) Construct the following transformed time series
 1. change in Total Nonfarm Payroll Employment $\Delta E_t = E_t - E_{t-1}$
 2. log of Total Nonfarm Payroll Employment $\log E_t$
 3. log change in Total Nonfarm Payroll Employment $\Delta \log E_t = \log E_t - \log E_{t-1}$
 4. 12 month log change in Total Nonfarm Payroll Employment $\Delta_{12} \log E_t = \log E_t - \log E_{t-12}$
 5. twice differenced Total Nonfarm Payroll Employment $\Delta \Delta_{12} \log E_t = \Delta_{12} \log E_t - \Delta_{12} \log E_{t-1}$.

Plot the original and the transformed time series. Comment on their trends, volatility and seasonal patterns.

- (c) Plot ACF and PACF for $\log E_t, \Delta \log E_t, \Delta_{12} \log E_t, \Delta \Delta_{12} \log E_t$. Comment on their shape.
- (d) Perform the ADF and KPSS tests on $\log E_t, \Delta_{12} \log E_t, \Delta \Delta_{12} \log E_t$. Summarize the results.
- (e) Split the sample into two parts: estimation sample from 1975M1 to 2014M12, and prediction sample from 2015M1 to 2017M12. Use ACF and PACF from (c) to identify and estimate a suitable model for $\Delta \Delta_{12} \log E_t$ using **Arima**. Check the estimated model for adequacy - plot inverted AR and MA roots to check stationarity and invertibility using `plot`, diagnose residuals using `ggtsdiag`.
- (f) Use `auto.arima` to find the best model for $\log E_t$. Check the estimated model for adequacy - plot inverted AR and MA roots using `plot`, diagnose residuals using `ggtsdiag`.
- (g) Use the rolling scheme to generate a sequence of 1 period ahead forecasts for the prediction subsample, 2015M1-2018M12 using the same model specification as in (f).
- (h) Plot the forecast from (g) together with its confidence intervals and the actual data for the period 2008M1-2017M12.