Homework 5

Eco 5316 Time Series Econometrics
Spring 2019
Due: Saturday, March 8, 11.55pm

Problem 1

Submit your solution for this problem to your student folder in the `TTU-ECO5316` github repo under the file name `yourlastname_eco5316_hw5q1.r`. Create a pull request to add it to the `students` branch of the `jduras\TTU-ECO5316` repo.

(a) Obtain monthly data for Total Nonfarm Payroll Employment, Not Seasonally Adjusted, available on FRED under code `PAYNSA`. Import the 1975M1-2018M12 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, seasonal patterns.

(c) Use `ggseasonplot` to create seasonal plots for ΔE_t and $\Delta \log E_t$. Comment on the seasonal patterns.

(d) 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.

(e) Perform the ADF and KPSS tests on $\log E_t, \Delta_{12} \log E_t, \Delta\Delta_{12} \log E_t$. Summarize the results.

(f) Split the sample into two parts: estimation sample from 1975M1 to 2014M12, and prediction sample from 2015M1 to 2018M12. 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 - diagnose residuals using `ggtsdiag`.

(g) Use `auto.arima` to find the best model for $\log E_t$. Check the estimated model for adequacy - diagnose residuals using `ggtsdiag`.

(h) Use `slide` from `tsibble` package to create a rolling scheme sequence of 1 period ahead forecasts for the prediction subsample 2015M1-2018M12 using the same model specification as in (g).

(i) Plot the forecast for E_t from (h) together with its confidence intervals and the actual data for the period 2008M1-2018M12.

(j) Use the forecast for E_t from (h) to construct the forecast for ΔE_t, plot it together with the actual data.

(k) Construct and plot the forecast errors for E_t and for ΔE_t.