# Homework 7

Eco 4306 Economic and Business Forecasting
Spring 2019
Due: Friday, April 19, before the class

## Problem 1

Download the workfile in JNJ.zip containing earnings per share for Johnson and Johnson U.S.

(a) Set the sample to 1960Q1-1978Q4. Create two time series plots, the first one showing earnings per share for Johnson and Johnson $JNJ_t$, and the second one showing the log transformed earnings per share for Johnson and Johnson $\log JNJ_t$.

(b) Comment on the behavior of the two series $JNJ_t$ and $\log JNJ_t$ over time.

(c) Perform the Augmented Dickey-Fuller unit root test for log transformed earnings per share $\log JNJ_t$, and then also for the first difference of the log transformed earnings per share $\Delta \log JNJ_t$. Make sure to include the correct terms (constant/trend) in the two tests based on the trending behavior of $\log JNJ_t$ and $\Delta JNJ_t$.

(d) Comment on the results of the unit root tests: is $\log JNJ_t$ integrated of order 0, so $I(0)$, or integrated of order 1, so $I(1)$?

(e) Estimate a model for the first difference of log transformed earnings per share that only includes a constant: $\Delta \log JNJ_t = \beta_0 + \varepsilon_t$.

(f) Obtain the actual, fitted, residuals graph, and also the correlogram for residuals.

(g) Comment on the two graphs from (f), and explain why they tell us that residuals in the model in (c) are not white noise.

(h) Modify the model from (e) by adding AR components, to address the issue identified in (g). Verify that the residuals in the modified model are white noise - obtain the new actual, fitted, residuals graph, and the new correlogram for residuals.

(i) Use the model from (h) to create a multistep forecast for $JNJ_t$ for period 1979Q1-1981Q1. Also generate the standard errors for this forecast to construct the lower and upper bounds of the 95% confidence interval. Plot the actual data together with the forecast and its 95% confidence interval. Report the RMSE for this forecast.

(j) Use the model from (h) to create a sequence of one step ahead forecasts for $JNJ_t$ for period 1979Q1-1981Q1 using fixed forecasting scheme. Also generate the standard errors for this forecast to construct the lower and upper bounds of the 95% confidence interval. Plot the actual data together with the forecast and its 95% confidence interval. Report the RMSE for this forecast.

(k) Comment on the precision of the forecasts in (i) and (j) based on their plots and their RMSEs.

(l) Compare the RMSEs for the forecasts in (i) and (j) with the RMSEs for the model with deterministic trend from lec16slides.pdf.