Econ 587, Summer 2016
Problem Set 2
Due (tentatively): Tuesday, June 28

1. In this first exercise you will estimate the form of Okun's law that is in the article

Knotek, Edward S. "How Useful is Okun's Law? Economic Review, Federal Reserve Bank of Kansas City, Fourth Quarter 2007, vol. 92, no. 4., pp. 73-104.

i. Estimate the dynamic version of Okun's law shown in Table 1, page 79 but use the ***annualized*** change in unemployment and the ***annualized*** growth rate of GDP (instead of just the change in unemployment and the growth rate of GDP). Use the full sample (1948.1-2007.4).

ii. Test whether the author chose the correct lag length by evaluating models with one additional and one fewer lags of Δu and $\%\Delta y$.

iii. Spilt the sample at 1984:1 and test whether the model is stable over the sample break.

iv. Calculate the growth rate of GDP consistent with stable unemployment pre-1984 and post-1984.

2. Suppose $y_t = \varepsilon_t - .3\varepsilon_{t-1} + .17\varepsilon_{t-2}$

where $\varepsilon_t \sim WN(0, \sigma^2)$

(i) Derive the theoretical ACF for lags 1 through 4, provide a sketch of the ACF.

(ii) Simulate y_t in Stata or R. Make the series 200 observations long (which is equivalent to quarterly observations from 1959:1-2008:4). Estimate the ACF (present only lags 1-8). Does it match your theoretical prediction? Why? [Programming hint: This is very easy to do in R: use the `arima.sim` command. To do in Stata, I suggest you check out http://waynecain.blogspot.com/2011/03/simulating-arma-process-using-stata.html.]

(iii) Estimate the appropriate ARMA model. Present your estimated output. Evaluate the Q-statistic for the residuals at lag 8.

3. Suppose $y_t = .28y_{t-1} + \varepsilon_t$

where $\varepsilon_t \sim WN(0, 1.15)$

What is the variance of y_t? (your answer will be an actual number)

4. Download the following time series from FRED:

a. real GDP (annualized growth rate) quarterly, 1984.1-2009.4.
b. three-month T-bill rate, monthly, 1990-2009.4.
c. labor productivity (output per hour of all persons, OPHPBS) quarterly 1984.1-2009.3.

Identify and estimate the appropriate ARMA model for each series. Report only the final model for each.

5. The accompanying dataset `ps2prob5_data.csv` contains 145 observations of the following series:

$$y_t = .3y_{t-1} + .13y_{t-2} - .2y_{t-3} - .1y_{t-4} + .14y_{t-5} + .07y_{t-6} - .035y_{t-7} + .02y_{t-8} + \varepsilon_t$$

But suppose you do not know the "true" model above and you are interested in identifying the appropriate lag length based on some sort of lag length selection criterion.

Your task is to develop your very own lag length selection criterion that weighs the cost of adding additional lags of a variable against the benefits of adding additional lags of a variable. Report your criteria, and your final model based on that criterion. Does your lag-length criteria select the "true" model? If not, what would you have to change to make it select the "true model?