Problem Set #8
Spring 2017

1. In the problem set #7 you estimated an AR(4) for the growth rate of U.S. exports. Re-estimate this regression, this time computing both classical and robust standard errors. Is there a difference between the two standard errors?

2. In the problem set #7 you estimated an AR(4) for the growth rate of U.S. investment. Re-estimate this regression using robust standard errors.

   (a) Can you test and reject the hypothesis that the coefficient on the fourth lag is zero?

   (b) Interpret the p-value for the coefficient on the second lag.

   (c) Interpret the confidence interval for the coefficient on the first lag.

3. In the problem set #7 you estimated an AR(4) for the growth rate of U.S. residential investment. Using robust standard errors, interpret the estimated coefficient on the first lag, its standard error, t ratio, p-value, and confidence interval.

4. We are going to do a little simulation experiment to help understand the random nature of autoregressive estimates. This is an extension of the simulation work from previous problem sets. Take the AR(1) model
$$y_t = \alpha + \beta y_{t-1} + e_t$$
   where the errors e_t are iid white noise $N(0,1)$, $\alpha = 0$ and $\beta = .9$.

   (a) Simulate a series of length $T = 120$ with initial value $y_1 = 0$. Estimate a AR(1) model.

   (b) Repeat a total of 5 times, so that you have 5 simulated time-series y_t, and 5 estimates $\hat{\alpha}$ and $\hat{\beta}$. Hint: Write a .do file, and create 5 time-series $y1$, $y2$, $y3$, $y4$ and $y5$ using the identical commands.

   (c) Calculate the mean and standard deviations of the 5 slope estimates $\hat{\beta}$.

   (d) How does your standard deviation compare with the standard errors reported by STATA?

5. The file "liquor.dta" includes a variable *sporting* which is monthly retail sales, 1992m1-2016m12, for sporting goods stores.

   (a) Graph the time series

   (b) What model should be used for the trend? Seasonal? Cycle?

   (c) Estimate the model for forecast horizons 1 through 12

   (d) Generate point and 90% interval forecast for each horizon, and plot your forecasts.

6. Director Hastings asserts that the GDP of Kamistan follows an AR(1) process. Agent Bauer believes an informant, who told him that it is an AR(4) process. Hastings says: "I believe it is an AR(1) process until you prove otherwise." What evidence should Bauer provide to convince Hastings?

7. Data analysts Chloe O'Brian and Dana Walsh have an disagreement whether an AR(2) model (Walsh) or an AR(3) model (O'Brian) does a better job of forecasting background telephone noise. What practical method can be used to settle the dispute?

8. The AIC and BIC are a function of the number of estimated parameters. What is the relevant number of estimated parameters in an AR(1) model? AR(2)? An AR(k) model?

9. When you have N total number of observations on a series y_t, how many effective number of observations T are used when estimating an AR(1) model? AR(2)? An AR(k) model?

10. Autoregressions are estimated for U.S. unemployment rate among women, age 20+. The sum of of squared residuals for some models are given in the following table. The sample size (common across models) is $T = 747$. Find the best forecasting model for women's unemployment rate based on the AIC.

	SSR
AR(0)	1191
AR(8)	41.58
AR(10)	41.46
AR(12)	41.23
AR(14)	40.51
AR(16)	39.97
AR(18)	39.43
AR(20)	39.23

11. Take the quarterly investment growth series *pdi* from the file "realgdpgrowth.dta". Select an autoregressive model using the AIC criterion.