ECON 6511: Advanced Applied Econometrics
Homework 2
Due in class January 24, 2018

1. (Based on Wooldridge, Chapter 12, Problem 2) Let $\{e_t : t = -1, 0, 1, \ldots\}$ be a sequence of independent, identically distributed random variables with mean zero and variance one. Define a stochastic process by

$$x_t = e_t - \frac{1}{2}e_{t-1} + \frac{1}{2}e_{t-2}, \quad t = 1, 2, \ldots$$

   (a) Find $E(x_t)$ and $Var(x_t)$. Do either of these depend on t?

   (b) Show that $Corr(x_t, x_{t+1}) = -\frac{1}{2}$ and $Corr(x_t, x_{t+2}) = \frac{1}{3}$. Note: For two random variables a and b, $Corr(a, b) = \frac{Cov(a,b)}{\sigma_a \sigma_b}$.

   (c) What is $Corr(x_t, x_{t+h})$ for $h > 2$?

   (d) Is $\{x_t\}$ covariance stationary? Is it weakly dependent?

2. (Based on Wooldridge, Chapter 12, Problem 5) For the U.S. economy, let *gprice* denote the monthly growth in the overall price level and let *gwage* be the monthly growth in hourly wages. These are both obtained as differences of logarithms: $gprice = \Delta\log(price)$ and $gwage = \Delta\log(wage)$.

   (a) Using the monthly data in WAGEPRC.dta, estimate a distributed lag model:

$$\begin{aligned} gprice =& \alpha + \beta_1 gwage_t + \beta_2 gwage_{t-1} + \beta_3 gwage_{t-2} + \beta_4 gwage_{t-3} + \beta_5 gwage_{t-4} \\ &+ \beta_6 gwage_{t-5} + \beta_7 gwage_{t-6} + \beta_8 gwage_{t-7} + \beta_9 gwage_{t-8} + \beta_{10} gwage_{t-9} \\ &+ \beta_{11} gwage_{t-10} + \beta_{12} gwage_{t-11} + \beta_{13} gwage_{t-12} + u_t \end{aligned}$$

   and sketch the estimated lag distribution. At what lag is the effect of *gwage* on *gprice* largest? Which lag has the smallest coefficient?

   (b) For which lags are the t statistics less than two?

   (c) What is the estimated long-run propensity? Is it much different than one? Explain what the LRP tells us in this example.

   (d) What regression would you run to obtain the standard error of the LRP directly?

3. Use the data in PHILLIPS.dta for this exercise.

   (a) Estimate an AR(1) model for the unemployment rate. Use this equation to predict the unemployment rate for 2004. Compare this with the actual unemployment rate for 2004. (You can find this information in a recent *Economic Report of the President*.)

(b) Add a lag of inflation to the AR(1) model from part (a). Is inf_{t-1} statistically significant?

(c) Use the equation from part (b) to predict the unemployment rate for 2004. Is the result better or worse than in the model from part (a)?

4. (Wooldridge, Chapter 12, C2)

(a) Using the data in WAGEPRC.dta, estimate the distributed lag model from Problem 2 above. Regress $\hat{u}_t$ on $\hat{u}_{t-1}$ to test for AR(1) serial correlation.

(b) Reestimate the model using iterated Cochrane-Orcutt (CO) estimation. What is your new estimate of the long-run propensity?

(c) Using iterated CO, find the standard error for the LRP. Determine whether the estimated LRP is statistically different from one at the 5% level.