Time Series Econometrics
Assignment 3

Bo Hu

1. Consider the Instrumental Variable Estimation in Section 1.5 of the lecture note. Suppose we further assume that $\mathbb{E}(\varepsilon_i^2|z_i) = \sigma_0^2$ and that the dimension of z_i is the same as the dimension of x_i (that is, $l = k$). Simplify the asymptotic variance of the IV estimator.

2. Let $\{X_t\}$ and $\{Y_t\}$ be two weakly stationary time series with autocovariance functions $\gamma_X(\cdot)$ and $\gamma_Y(\cdot)$, respectively. Suppose that X_s is uncorrelated with Y_t for any choice of s and t. Let $Z_t = X_t + Y_t$. Show that $\{Z_t\}$ is weakly stationary, and get the autocovariance function of $\{Z_t\}$.

3. Let $\{Y_t\}_{t=-\infty}^{\infty}$ be an iid sequence of random variables with mean 0 and variance σ^2. Define $X_t = a + bt + Y_t$ where a, b are constants and define

$$W_t = (2q+1)^{-1} \sum_{i=-q}^{q} X_{t+i}.$$

   where q is a positive integer. Compute the mean and the autocovariance function of $\{W_t\}$. Is $\{W_t\}$ weakly stationary?

4. (From Wooldrige (2010) Problem 4.13) Use the data in `cornwell.csv` (from Cornwell and Trumball, 1994) to estimate a model of county level crime rates `crmrte`, using the year 1987 only. To get full credit, you need to print out your code and submit it.

   (a) Using logarithms of all variables, estimate a model relating the crime rate to the deterrent variables `prbarr`, `prbconv`, `prbpris`, and `avgsen`. (Don't forget to include the constant term in the regression).

   (b) Add log(`crmrte`) for 1986 as an additional explanatory variable, and comment on how the estimated elasticities differ from part (a).

   (c) Use the Wald test to test for the joint significance of all the wage variables (again in logs), taking the model from part (b) as the restricted model. Report the p-value.