ECONOMETRICS II, FALL 2018

Homework 10. Due MONday November 19.

1. Verify formula (3) in Moulton's article for the simple case of m=3 (I may have used T instead of m in class). Assume the matrix of regressors is

$$X \;=\; \begin{pmatrix} x_1 \\ x_1 \\ x_1 \\ x_2 \\ x_2 \\ x_2 \end{pmatrix},$$

and the error variance matrix is

$$V \;=\; \sigma^2 \begin{pmatrix} 1 & \rho & \rho & 0 & 0 & 0 \\ \rho & 1 & \rho & 0 & 0 & 0 \\ \rho & \rho & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & \rho & \rho \\ 0 & 0 & 0 & \rho & 1 & \rho \\ 0 & 0 & 0 & \rho & \rho & 1 \end{pmatrix}.$$

2. Use the updated Matlab panel data program that I have posted and run it with clustered standard errors.

3. Now assume that the errors are clustered by time (year), rather than by state. Modify the program and run it again.

4. Simulate the model

$$x_t \;=\; 0.2 + x_{t-1} + w_t \;,$$

where W_t is a standard normal i.i.d. error term and $t+1, ..., T$.
a) Run the regression

$$x_t \;=\; \alpha + \beta * x_{t-1} + w_t \;.$$

100 times for each of $T = 20$, $T = 50$, and $T = 100$. Plot or tabulate the estimated value for β and for the t-statistic for $\beta = 1$.
b) For $T = 100$ (you may want to combine this with the previous), run the regression (Augmented Dickey-Fuller test)

$$\Delta x_t \;=\; \alpha + \beta * x_{t-1} + \gamma \Delta x_{t-1} + w_t$$

on the simulated data and calculate the $t-$statistic for the null hypothesis that is a unit root ($\beta = 0$). Count the number of times the value is smaller than –2.89 (I took the critical value from https://en.wikipedia.org/wiki/Augmented_Dickey_Fuller_test).