Exercise - Week 10

Part 1: Testing Unit Roots

- We want to test whether the series of inflation rates in the United States has a stochastic trend, or unit root. Open the data file, called **phillips.dta**. The variable **inf** is the series of inflation rates and **inf_1** is the one-period lagged series of inflation rates.

1 First, type **tsset year** in order to let STATA know this is a time series data set. Draw the scatter plot of the inflation rates and year to see how the time series are evolved across time period, **twoway connected inf year**. How does it look?

2 Take the first difference of the inflation rates by typing **gen dinf = inf - inf_1**. Draw the scatter plot of the first differences of inflation rates and year to see how the first differences look.

3 Suppose we model this series with AR(1) process:

$$\text{inf}_t = \mu + \rho \text{inf}_{t-1} + u_t.$$

We want to test the null hypothesis that it has a unit root:

$$H_0 : \rho = 1 \quad vs \quad H_1 : \rho < 1.$$

As we learned, we can equivalently rewrite the model and the null hypothesis:

$$\Delta\text{inf}_t = \mu + \theta \text{inf}_{t-1} + u_t$$

$$H_0 : \theta = 0 \quad vs \quad H_1 : \theta < 0.$$

Run the regression of Δinf_t on inf_{t-1} and get the t-statistic on the coefficient θ. The critical values for unit root t test are given below:

Sig. Level	1%	5%	10%
Critical Value	-3.43	-2.86	-2.57

What's your conclusion?

Part 2: Vector Autoregressions

- We want to learn how to use STATA to estimate VAR model. Open the file, called **consump.dta**. The variables **gc** (**gy**) are the growth rates of consumption and disposal income in the United States over the period of 1959 till 1995.

1 First, type **tsset year**. Draw scatter plots of the consumption growths and income growths with time year to see how these series were evolved over time. (**twoway (connected gc year) (connected gy year)**). How do they look? Does each series appear to affect the other?

2 Suppose we model these series using VAR(2) as follows:

$$gc_t = \mu_{10} + \rho_{11} gc_{t-1} + \rho_{12} gc_{t-2} + \gamma_{11} gy_{t-1} + \gamma_{12} gy_{t-2} + u_{1t}$$

$$gy_t = \mu_{20} + \rho_{21} gc_{t-1} + \rho_{22} gc_{t-2} + \gamma_{21} gy_{t-1} + \gamma_{22} gy_{t-2} + u_{2t}$$

Estimate the model and draw a set of impulse response functions, by typing **varbasic gc gy, irf**. (The default of varbasic is VAR with order 2.) Interpret the estimation results and connect them with the four different impulse response functions.

3 Now we want to test the Granger causality between the consumption growth and the income growth. In order to do this, type **vargranger**. Does gc Granger cause gy? And does gy Granger cause gc? Do these tests make sense when you look at the above estimation results?

Part 3: Spurious regression

- Open the STATA do-file, **spurious.do**. Look into the program and discuss each part in the program.
- Run the program and see the estimation result and the scatter plots. Repeat this process several time. What do you find?