

## Exercise - Week 9

### Part 1: Simulation of Some Time Series

- We want to get familiar with how several canonical examples of nonstationary time series look like. We will have a series of simulation exercises below.

1 First, we want to generate a time series with changing mean across time:

$$Y_t = \beta_0 + \beta_1 t + u_t,$$

where  $u_t \sim N(0, \sigma^2)$ . To do this,

- download a do-file, called *changingmean.do*.
- open the file, using the STATA do-file editor.
- discuss what this simulation is about before running the program.
- let's run the program and check whether the results are as you expect.
  
- Now increase the variance from  $\sigma^2 = 1$  to  $\sigma^2 = 16$ . What's happening?

2 We also want to generate the following time series, called the random walk:

$$Y_t = Y_{t-1} + u_t,$$

where  $u_t \sim N(0, \sigma^2)$  and  $\sigma = 1$ . Similarly, open the file, called *rwalk.do*. Look carefully into the program. Now let's run the program several times. What do you see in each case?

3 Finally, we want to generate a series, called the random walk with drift:

$$Y_t = \beta_0 + Y_{t-1} + u_t,$$

where  $u_t \sim N(0, \sigma^2)$  and  $\sigma = 1$ . Run the program and see the results. What do you expect if one increase the variance, say  $\sigma = 2$  and 4. Modify the program to increase the variance accordingly and run them.