

ECO 341, The Midterm

1. Some General Questions

- Consider the following stochastic process: $h_t = 0.8t^2 + e_t$. Does this process have a unit root?
- Will differencing make the process from 1a stationary?
- Consider the following stochastic process: $h_t = 1.2 + h_{t-1} + e_t$. Does this process have a unit root?
- Using 1c, form forecasts for h_{t+1} and h_{t+2} .

Bonus. Construct confidence intervals for your forecasts from 1d.

2. VARs

Consider the following data generating process

$$y_t = \alpha + \beta y_{t-1} + e_{1t} \quad (1)$$

$$y_t - z_t = 0.95(y_{t-1} - z_{t-1}) + e_{2t} \quad (2)$$

where e_{1t} and e_{2t} are mean-zero, white noise error terms.

- Represent this DGP as a single equation using matrices.
- Which values of α and β result in a stationary system?
- Which values of α and β result in an oscillatory system?
- How would you test whether this system is stationary. Describe the process, do not just provide Stata code.
- How would you choose the lag length to estimate this system (assuming that you do not know that the true DGP includes just one lag)?
- Suppose that you find that all variables are I(0). How would you estimate them using a VAR?
- Suppose that you find that all variables are I(1). Why will a VAR in first-differences be misspecified?

h. How would you remedy the misspecification from g ?

3. Panel Data

You have a panel consisting of data for 100 police precincts in U.S. cities for all months between 2000 and 2014. Your variables consist of:

i. $Force_{it}$, indicates the frequency of police encounters where some level of police force is used in that precinct.

ii. $Race_{it}$, the percentage of the population in that precinct that is in some racial group.

iii. $CrimeRate_{it}$, a measure of the crime rate in that precinct

Your dependent variable is $Force_{it}$:

a. True or False? Random Effects is the correct specification for estimating the effect of race on how often police use force. (Note: Your score will depend almost entirely on your explanation. Don't just answer "True" or "False," you will get no credit if you do.)

b. How would you formally test whether random effects is preferable to fixed effects?

c. Suppose that you want to run fixed effects. What kind of fixed effects (dummy variables) do you think your specification should include.

d. How would you formally test among the different types of fixed effects that you might include in your specification.

Bonus: Discuss whether a Panel VAR may be preferable to the standard panel data estimators that you discussed in *a-d*.