## ECO 5720 Additional Sample Questions

Chapter 14

Suppose the relationship between city-level crime and unemployment rate is given by:

$$crmrte_{it} = \beta_0 + \beta_1 unem_{it} + a_i + u_{it}$$

where i: city t: year crmrte: crime rate (i.e., crimes per 1000 people) unem: unemployment rate a: unobserved city effect capturing time-invariant factors affecting crime u: idiosyncratic errors such as law enforcement effort.

1. What does it mean to perform a fixed effects or within transformation on the above equation?

Answer: First, for each city or i, we average over time to obtain

$$\overline{crmrte}_i = \beta_0 + \beta_1 \overline{unem}_i + a_i + \overline{u}_i.$$

Next, subtracting the time-averaged variables from the original equation, we obtain an equation in terms of the time-demeaned variables

$$crmrte_{it} - \overline{crmrte}_i = \beta_1(unem_{it} - \overline{unem}_i) + (u_{it} - \overline{u}_i)$$

or

$$cr\ddot{m}rte_{it} = \beta_1 u\ddot{n}em_{it} + \ddot{u}_{it}.$$

This is the equation obtained after the fixed effects or within transformation.

2. What is the advantage of performing a fixed effects or within transformation in this case?

Answer: In this case, if a is correlated with unem, the ordinary least squares (OLS) estimators are biased and inconsistent. However, the fixed effects transformation eliminates time-invariant unobservables as denoted by a. Accordingly, we can avoid the bias arising due to the correlation between a and unem.

3. What assumption regarding the correlation between a and unem would a random effects model make? Is that a reasonable assumption?

Answer: Here, a random effects model would assume a and unem to be uncorrelated. It does not appear to be a reasonable assumption since some time-invariant city characteristics such as geography may affect crmrte as well as unem.