School of Economics

College of Business and Economics

FINAL ASSESSMENT: SUPPLEMENTARY EXAM JANUARY 2020

Course : Applied Econometric Techniques (AET9X01)

Moderator : Dr A Pholo

Time : 180 minutes

Marks : 100 points

Question 1 (10)

Considering a dynamic linear panel data model, compare the Anderson-Hsiao estimate to the GMM estimate when $T = 3$ and when $T > 3$.

Question 2 (10)

Considering the equation

$$y_1 = x_1\beta_1 + u_1$$

where x_1 is a vector of explanatory variables, all of which are exogenous in the population, and u_1 is an error term and supposing that selection is determined by the equation

$$y_2 = \left\{ \begin{array}{ll} 1 & x_2\delta_2 + v_2 \geq 0 \\ 0 & otherwise \end{array} \right\}$$

where $y_2 = 1$ if we observe y_1 and zero otherwise. In case there is a selectivity bias, explain how to proceed to get a consistent estimate of β_1.

Question 3 (20)

Considering the following dynamic linear panel data

$$y_{it} = \alpha y_{i,t-1} + \beta x_{it} + (\eta_i + \upsilon_{it})$$

1. What are the implications of imposing more restrictive assumptions in terms of the number of moment restrictions? (5)

2. Describe the set of moment restrictions when x_{it} is predetermined

   - in scalar form; (5)
   - in matrix form. (5)

3. What happens if x_{it} is uncorrelated with the individual effects. (5)

Question 4 (10)

Explain the Central Limit Theorem (CLT). Show how it may be used to justify the assumption that the stochastic disturbance term is normally distributed.

Question 5 (10)

The Stata file selection_data contains data on the wage, the age, the education, the marital status and the number of children of 2000 individuals.

- Perform a regression of the wage on the education and the age considering that error term is likely to be auto-correlated within each county. (2)
- Then, estimate the same equation by the two-step Heckit model using the marital status as the exclusion restriction. Compare the OLS results with the Heckit results. Is there any selectivity bias? Justify the choice of the exclusion restriction. (8)

Question 6 (20)

1. Consider the following linear population model

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_K x_K + u \tag{1}$$

$$E(u) = 0, \quad Cov(x_j, u) = 0, \quad j = 1, 2, \ldots, K-1 \tag{2}$$

   where x_K might be correlated with u. Determine the conditions that an instrument z_l should satisfy in this framework.

2. Now write equation (1) as

$$y = x\beta + u \tag{3}$$

   Assuming that the K population orthogonality conditions hold ($E(z'u) = 0$), derive the mathematical expression of the vector β. From that expression derive the rank condition for identification.

Question 7 (20)

An unobserved effects model explaining current murder rates in terms of the number of executions in the last three years is

$$mrdrte_{it} = \theta_t + \beta_1 exec_{it} + \beta_2 unem_{it} + c_i + u_{it} \tag{4}$$

where $mrdrte_{it}$ is the number of murders in state i during year t, per 10,000 people; $exec_{it}$ is the total number of executions for the current and prior two years, and $unem_{it}$ is the current unemployment rate, included as a control.

1. Using the data for 1990 and for 1993 in MURDER.DTA, estimate this model by first differencing. Notice that you should allow different year intercepts.

2. Under what circumstances would $exec_{it}$ not be strictly exogenous (conditional on c_i)? Assuming that no further lags of $exec$ appear in the model and that $unem$ is strictly exogenous, propose a method for consistently estimating β when $exec$ is not strictly exogenous.

3. Apply the method from part 2 to the data in MURDER.DTA. Be sure to also test the exogeneity of the instrument. Do your results differ much from those in part 1?

4. What happens to the estimates from parts 1 and 3 if Texas is drpped from the analysis?