Midterm test for 'Panel Data'

May 2010

1. Two researchers are estimating models on one-way panels that are randomly drawn from a powerful panel-data generator. With a probability of 0.5, a set of panel data is generated with random effects, otherwise with fixed effects. Persons A and B are aware of this design, but they do not know whether the current sample is RE or FE generated. Person A always applies the fixed-effects LSDV method, person B always uses an fGLS method tuned to random effects.

   (a) After 100 rounds of this game, which of the two will have obtained the better estimates on average?

   (b) The winner of this game offers a new set of 100 rounds. The loser now changes her strategy and applies Hausman tests to the data sets. Whenever the Hausman test rejects its null, she applies fGLS, and when it accepts, she uses LSDV. Who will win this second contest?

2. In a *one-way random-effects* model with only time effects,

$$\begin{aligned} y_{it} &= \alpha + X_{it}'\beta + u_{it}, \\ u_{it} &= \lambda_t + \nu_{it}, \end{aligned}$$

   time effects are denoted by λ_t (variance is σ_λ^2); the remainder error is ν_{it} (variance is σ_ν^2).

   (a) Give a representation of the errors variance matrix $\mathrm{E}uu'$. You may use Kronecker products or represent the shape of the matrices directly.

   (b) Show that $\sigma_\nu^{-2}(\mathbf{I}_{NT} - \bar{\mathbf{J}}_N \otimes \mathbf{I}_T) + (\sigma_\nu^2 + N\sigma_\lambda^2)^{-1}(\bar{\mathbf{J}}_N \otimes \mathbf{I}_T)$ for $\bar{\mathbf{J}}_N = N^{-1}\mathbf{J}_N$ provides an inverse to this matrix.

   (c) Why could you be interested in determining this matrix inverse?

3. For each of the following applications, try and give an interpretation of potential individual effects and time effects. Also indicate whether you would tend to prefer random or fixed individual effects.

   (a) The number of overnight stays in the nine Austrian länder is regressed on precipitation (rain and snow) over a time span of some thirty years (annual data).

   (b) The number of sparrows is counted at 250 locations and it is regressed on the population density of cats at these places. Data have been collected for three consecutive years ($T = 3$). Original locations cannot be disclosed because of data protection considerations.