

# Second test for 'Panel data'

June 10, 2015

1. Consider the static linear panel regression model  $y_{it} = X'_{it}\beta + u_{it}$ ,  $t = 1, \dots, T$ ,  $i = 1, \dots, N$ , with  $u_{it} = \mu_i + \zeta_{it}$  and  $\zeta_{it}$  a random walk, such that  $\zeta_{it} = \zeta_{i,t-1} + \nu_{it}$  and  $\nu_{it}$  Gaussian white noise.  $X$  contains two strictly exogenous variables  $X^{(1)}, X^{(2)}$ . [12 points]
  - (a) You consider estimating this model in first differences by GLS. What is the covariance matrix  $\Omega$  required for this GLS estimator? Will this estimator be unbiased? How many observations do you use in this regression?
  - (b) Now suppose  $X$  contains a third regressor  $y_{i,t-1}$  such that the model becomes dynamic. If you continue using the estimator suggested in (a), will it be consistent for fixed  $T$  as  $N \rightarrow \infty$ ? How many observations do you use in this regression?
  - (c) Which instruments have been suggested by Arellano and Bond for the situation in (b) for the three covariates  $\Delta y_{i,t-1}, \Delta x_{i,t}^{(1)}, \Delta x_{i,t}^{(2)}$ ?
  - (d) If you find that the two exogenous covariates are correlated with each other, does it change any of the above answers?

2. You have a panel of 10 years of monthly wage inflation data for 20 European countries, and you are interested in whether ‘inflation has a unit root’. [12 points]
- (a) You find that the two most popular tests for this problem are the Levin-Lin-Chu and the Im-Pesaran-Shin test. You apply the former test, and it rejects. If you accept this result as true, does it make sense to investigate cointegration between inflation rates in neighboring countries?
  - (b) By contrast, if you apply the IPS test and it rejects, could it make sense to investigate such cointegration across countries?
  - (c) What is the idea of a second-generation test?

3. You have panel data on 100 persons during 12 years who either own a laptop or not, and you also have data on three personal characteristics: income, years of education, gender. [11 points]
- (a) You decide to use a fixed-effects logit model. Try and write down the model formally (formula for the logistic distribution function not required,  $F$  suffices).
  - (b) What is the interpretation of the individual effects?
  - (c) If you use a dynamic version of the same model, with one lag of the dependent variable, what is the interpretation of ‘spurious state dependence’ and of ‘true state dependence’ here?