

First test for 'Panel data'

May 2, 2016

1. In a linear panel regression model with fixed individual effects $y_{it} = \alpha + X'_{it}\beta + \mu_i + \nu_{it}$, the appropriate estimator can be written in the form $\hat{\beta} = (\mathbf{X}'\mathbf{Q}\mathbf{X})^{-1}\mathbf{X}'\mathbf{Q}y$. [11 points]
- (a) What is the matrix \mathbf{Q} in this expression? What does it actually do to the variables in \mathbf{X} and y when applied to them from the left, i.e. in $\mathbf{Q}\mathbf{X}$ and $\mathbf{Q}y$?
 - (b) Why is this not really a GLS (generalized least squares) estimator?
 - (c) Describe how you could obtain the estimate $\hat{\beta}$ from only one OLS regression.

2. In a panel analysis, you want to make the right choice among one-way, two-way, fixed-effects, and random-effects models. You apply standard restriction F tests with individual and time dummies, a Breusch-Pagan LM test for time and individual random effects, and a Hausman test. [12 points]
- (a) The restriction F test for individual effects rejects, whereas the test for time effects does not reject. Denoting, as usual, the time and individual dimension as T and N , how many restrictions are tested by these two tests? Do you think that pooled OLS will be a consistent estimator for β , given this outcome of the restriction tests?
 - (b) The Breusch-Pagan test for individual effects rejects, whereas the one for time effects does not reject. How many restrictions are tested by these tests? If we believe the result of the tests, will the one-way fixed-effects estimator for β be consistent?
 - (c) Two versions of the Hausman test, one-way (individual) FE/RE and two-way FE/RE, do not reject their null. What does this information imply? In summary, after looking at all reported tests, which estimator is suggested?

3. Economists are often interested in hedonic pricing, which refers to explaining the price of a good by its characteristics. A classic example for this approach are single-family homes. Presume a data set for such houses is available, N houses for T time periods, and prices P_{it} as well as three characteristics, such as the size and the age of the houses and the crime rate in the neighborhood, are available.[12 points]
- (a) Please try and give an interpretation of individual effects and of time effects in this model. How would you interpret the assumption that age and size are uncorrelated with the individual effects?
 - (b) Would you prefer a random-effects or a fixed-effects model for this example? What is the problem of the fixed-effects approach here?
 - (c) Presume that size and age of the house are actually uncorrelated with the individual effects, but the crime rate is correlated with the individual effects. How is the instrumental-variables estimator according to Hausman-Taylor constructed in this case?