Workshop - "Longitudinal methods" (Gauthier & Le Goff)

Title

The linear Fixed-Effects model with Individual Slopes: Estimation and model selection

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Abstract

Fixed-effects (FE) mod unobserved heterogeneity, a major problem of causal inference with non-experimental data. As panel data have become available from large-scale national panel surveys, the standard FE model has gained more and more attention in sociology and economics. The advantage of the FE approach compared to other panel estimators is that it relies on variation within units only and thus rules out bias due to time-constant unobservable confounders. However, consistency of the standard FE estimator relies on the assumption of parallel slopes. This assumption may often be too strict.

Fortunately, the FE approach can be extended to allow for heterogeneous growth that is systematically related to the causal variable. The extended model, the Fixed-effects model with Individual-specific Slopes (FEIS) (Brüderl and Ludwig 2015; Polachek and Kim 1994; Wooldridge 2010), relies on a weaker form of the strict exogeneity assumption as needed for conventional FE estimation. Notably, we can relax the parallel trends assumption. While the model is often used with aggregate panel data (small N, large T), it has been seldomly applied to panel survey data (large N, small T). Moreover, existing applications for large N data are mostly based on a special, easy to estimate, version of the general FEIS model, called the "random trend" or the "random growth" model, where change in the outcome over calendar time is unit-specific. However, FEIS can be applied more generally. The main practical reason why researchers do not use FEIS models seems to be that it has not been implemented in standard statistical software.

In this presentation, we introduce the FEIS model and highlight its ability to deal with heterogeneous slopes in comparison to the standard FE model. We show by example how the FEIS model can be estimated with Stata (Ludwig 2015) and R (Rüttenauer and Ludwig 2019). Furthermore, we introduce two extended versions of the standard Hausman test: an Artificial Regression Test (ART) and a Bootstrapped Hausman Test (BSHT). These extended versions test for the presence of heterogeneous slopes and thereby detect biased estimates of the conventional random-effects (RE) and FE estimators. Based on these tests, we devise a strategy for model selection. We provide results from Monte Carlo simulations comparing the performance of estimators and statistical specification tests in situations with heterogeneous slopes. The simulations show that relying on the conventional Hausman test of RE versus FE estimates might often lead to choice of a wrong model. The extended ART and BSHT have good size and power in most experimental settings. Hence, they will often help with picking the correct model. We conclude with some guidelines for practical research.

References

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