Advanced Dynamic Panel Data Methods

Course Outline

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Textbooks on (Micro-)Econometrics

- Verbeek, M. (2017). *A Guide to Modern Econometrics*, 5th Edition. Wiley.
  - ⇒ concise introduction
- Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data*, 2nd Edition. MIT Press.
  - ⇒ classic text; thorough/extensive
- Cameron, A. C., and P. K. Trivedi (2022). *Microeconometrics Using Stata*, 2nd Edition. Stata Press.
  - ⇒ introduction with Stata focus

Textbooks on Panel Data

- Arellano, M. (2003). *Panel Data Econometrics*. Oxford University Press.
  - ⇒ DOI: 10.1093/0199245282.001.0001
  - ⇒ advanced/technical
- Baltagi, B. H. (2021). *Econometric Analysis of Panel Data*, 6th Edition. Springer.
  - ⇒ DOI: 10.1007/978-3-030-53953-5
  - ⇒ encyclopaedic; includes some more recent developments
- Hsiao, C. (2022). *Analysis of Panel Data*, 4th Edition. Cambridge University Press.
  - ⇒ DOI: 10.1017/9781009057745
  - ⇒ classic motivating text

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- Arellano, M., and S. R. Bond (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies 58* (2), 277–297.
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Panel Data

- Panel data (also known as longitudinal data) refers to repeated observations (usually over time) of the same subjects.
  - Units (also referred to as subjects or groups) can be individuals, households, firms, regions, countries, financial assets, etc. We will index units by subscript $i = 1, 2, \ldots, N$.
  - The data could be observed, for example, on a daily, weekdaily, weekly, monthly, quarterly, or annual frequency. We will index time periods by subscript $t = 1, 2, \ldots, T$.
  - While subjects i are typically in no particular order, time periods t have a natural ordering.

Panel Data

- Compared to cross-sectional data (with only one observation per subject) and time-series data (with multiple observations for a single subject), panel data allows us to consider simultaneously the variation across subjects and (dynamic) changes over time.
  - This allows us to account for unobserved heterogeneity and dependence/correlation across subjects, as well as persistence/dynamic adjustment processes over time.
  - Without panel data, such unobserved characteristics might lead to an omitted-variables bias. Panel data often allows us to deal with such problems without relying on excluded instruments.

Panel Data

- Depending on the relative size of the two dimensions N and T, we distinguish between macro panels ($T \gg N$) and micro panels ($N \gg T$).
  - With macro panels, the dynamic properties of the data series are an important concern; for example, stationarity, cointegration, structural breaks. Macro panels are often used for prediction purposes.
  - In this course, we focus on micro panels with relatively small T, where questions of causal relationships are often in the forefront.

Course Outlook

- This course covers large-N/short-T linear dynamic panel data models for continuous/non-discrete outcome variables.
  - Main characteristics of the econometric model will be a lagged dependent variable and unobserved unit-specific heterogeneity.
  - While stationarity per se is not a concern with short T, certain aspects of the initial conditions of the dynamic process can be of relevance.
  - We will maintain the assumption of independently drawn cross-sectional units – i.e., no cross-sectional dependence.
  - Different estimators for such models will be presented with a main focus on the generalized method of moments (GMM).
  - Special emphasis will be placed on model specification (variable classification, specification testing, model selection), and common pitfalls will be highlighted.
  - Properties of estimators will be highlighted graphically with artificial/simulated data.
  - Empirical examples in *Stata* will illustrate the theoretical concepts.