SYLLABUS: BAVARIAN GRADUATE PROGRAM IN ECONOMICS
Advanced Econometrics: March 3, 4, 7-11, 2022

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Goals: This is a course in advanced econometrics offered by BGPE. The course covers estimation of linear and nonlinear econometric models. The estimation methods include ordinary least squares, generalized least squares, maximum likelihood estimation, and quasi-maximum likelihood estimation. We will also study methods when some variables are endogenous, including basic instrumental variables and control function methods. The focus will be on applications to cross-sectional data and panel data but will include some time series analysis.

Background: I assume a working knowledge of probability and statistics – including manipulations involving conditional expectations and the basic limit theorems, such as the law of large numbers and the central limit theorem. Underlying the statistical properties are matrix algebra and multivariable calculus, including how these are combined with probability.

Thursday, March 3

12:30-13:00 Welcome

Daily Schedule:

13:00-14:30 First Session (Lecture)
14:30-14:45 Break
14:45-16:15 Second Session (Lecture)
16:15-16:30 Break
16:30-18:00 Third Session (Question/Answer and Lab)

Course Outline

The slides for the course are grouped into natural topics rather than what we will necessarily cover during a particular lecture session. Consequently, the material for some slides may spill over into a subsequent lecture. However, material will not spill over into later days: each day we will start fresh on the listed topics. This structure will allow us to stay on track to finish the fundamental material in the course.

Day 1

  · Ordinary Least Squares with Cross-Sectional Data
     Algebraic, Finite Sample, and Asymptotic Properties of OLS
     Functional Form
     Multicollinearity and Selection of Regressors
  · Weighted Least Squares

Day 2

· Regression with Time Series Data
     Stationarity, Weak Dependence, Trends, and Seasonality
     Robust Standard Errors
     GLS for Serial Correlation
· OLS with Pooled Cross Sections
     Difference-in-Differences

Day 3

· Instrumental Variables with Cross-Sectional Data
    Asymptotic Properties of Two Stage Least Squares
    Testing Endogeneity and Overidentification
    Weak Instruments
    Heterogeneous Treatment Effects and LATE

Day 4

· Linear Panel Data Models with Exogenous Explanatory Variables
     Pooled OLS, Random Effects, Fixed Effects, First Differencing
     Comparison of Estimators
     Testing Key Assumptions
· Heterogeneous Trend Models and Heterogeneous Slopes

Day 5

· Linear Panel Data Models with Endogenous Explanatory Variables
     RE and FE 2SLS
     Specification Tests
     First Differencing Methods
· Estimation under Sequential Exogeneity
· Unbalanced Panels

Day 6

· Maximum Likelihood Estimation
  Quasi-MLE
  Bootstrapping
· Binary and Fractional Response Models
· Exponential Models Nonnegative Outcomes: Poisson Regression
· Endogenous Explanatory Variables
  Control Function Methods

Day 7

· Joint MLE and Pooled MLE with Panel Data
  Robust Inference
  Bootstrapping with Panel Data
· Binary and Fractional Response Models with Panel Data
· Models for Nonnegative Responses
· Models with Unobserved Heterogeneity and Endogeneity

Course Material

I will make available lecture notes, slides, problem sets, and Stata data sets. The "lecture notes" in some cases are merely expanded versions of the slides. I include the material in the interests of continuity as you study the notes on your own.

Textbooks

For the first three days of the course I will be drawing on material from a variety of sources, including my own (unpublished) lecture notes and Wooldridge (2010). Greene and Hayashi contain the material on OLS and GLS, presented at an advanced level. The treatment in Wooldridge (2019, Appendix E) is terse but has several of the important derivations.

For panel data and nonlinear models I will rely mainly on Wooldridge (2010). The other texts have nice treatments of many of the topics. Cameron and Trivedi is an especially good reference for bootstrapping.

A.C. Cameron and P.K. Trivedi, *Microeconometrics: Methods and Applications*, Cambridge University Press, 2005.

W.H. Greene, *Econometric Analysis*, Prentice Hall, 8th edition, 2018.

J.W. Wooldridge, *Introductory Econometrics: A Modern Approach*, Cengage, 7th edition, 2019.

J.M. Wooldridge, *Econometric Analysis of Cross Section and Panel Data*, MIT Press, 2nd edition, 2010.