SYLLABUS: BAVARIAN GRADUATE PROGRAM IN ECONOMICS
Advanced Econometrics: August 5-9, 2024

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Goal: This course covers estimation and applications of linear and nonlinear econometric models with a focus on "microeconometrics." The estimation methods include ordinary least squares, generalized least squares, maximum likelihood estimation, and quasi-maximum likelihood estimation. We will also cover methods when some variables are endogenous, particularly instrumental variables methods for linear models with cross-sectional data. We will cover linear panel data and nonlinear panel data models in some detail, allowing for endogeneity with respect to unobserved heterogeneity and time-varying unobservables. We will apply the methods to linear difference-in-differences with pooled cross sections and panel data.

Background: I will 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. Nevertheless, most of the presentation focuses on understanding assumptions and applying the methods.

Sunday, August 4, 2024

19:00 Welcome Meeting/Dinner

Monday-Thursday Daily Schedule:

8:00-9:00 Breakfast
9:00-10:30 First Session (Lecture)
10:30-11:00 Coffee Break
11:00-12:30 Second Session (Lecture)
12:30-14:00 Lunch
14:00-16:00 Third Session (Lecture/Problem Session)
16:00-16:30 Coffee Break
16:30-18:00 Fourth Session (Problem Session)
18:00-19:00 Free Time
19:00 Dinner

Friday Schedule:

8:00-9:00 Breakfast
9:00-10:30 First Session (Lecture)
10:30-11:00 Coffee Break
11:00-12:30 Second Session (Lecture)
12:30-13:30 Lunch
13:30-15:00 Third Session (Lecture)

Course Outline

I have created five sets of slides, each corresponding to a different day. Ideally, we will cover all of the material in the slides, but on some days we might not get through all of the material. Material from one day will not spill over into later days: each day we will start fresh on the listed topics. This structure allows us to stay on track to finish the fundamental material in the course. I will post the slides along with Stata files and labs, at least a week prior to the course. During the course, I will post daily summaries and lab solutions.

 Day 1
  · Regression with Cross-Sectional Data: Algebraic, Finite Sample, and Asymptotic Properties of OLS; Functional Form; Multicollinearity; Treatment Effects Estimation;
   · OLS with Pooled Cross Sections; Difference-in-Differences Structures

Day 2
  · Instrumental Variables and Two Stage Least Squares with Cross-Sectional Data: Asymptotic Properties; Testing Endogeneity and Overidentification; Weak Instruments
   · Generalized Method of Moments with Cross-Sectional Data
   · Optimal Instruments
   · Models Nonlinear in Endogenous Explanatory Variables

Day 3
   · Linear Panel Data Models: Estimation and Inference Using Pooled OLS, Random Effects, Fixed Effects, First Differencing; Robust Inference
   · Comparison of Estimators and Testing Key Assumptions
   · Difference-in-Differences with Panel Data

Day 4
  · Linear Panel Data Models with Endogenous Explanatory Variables: RE2SLS and FE2SLS; Specification Tests; First Differencing Methods
   · Estimation under Sequential Exogeneity
   · Models with Lagged Dependent Variables
   · Unbalanced Panels

Day 5
   · Maximum Likelihood Estimation and Quasi-MLE with Cross-Sectional Data
   · Limited Dependent Variable Models: Logit and Probit for Binary and Fractional Responses; Exponential Models
   · Joint MLE and Pooled MLE; Correlated Random Effects; Robust Inference for Pooled MLE and QMLE
  · Common Nonlinear Panel Data Models

Final Exam

I will provide several questions at least one week ahead of the exam, some of which will appear verbatim on the exam. Other exam questions will be variations on those distributed, and there will be a handful of multiple choice questions. You may bring five sheets of standard paper (DINA4) with your own notes written on front and back.

Even though you will have answered some questions ahead of time, you are to transcribe your answers to the exam booklet. In terms of the exam scoring, I will award more points to parts within a question that are more difficult. Also, I will award more points to questions that you were not given prior to the exam. Therefore, to increase your chances of being in the top five, you may want to attempt the more challenging problems. For passing the exam, the selection of questions should not be important.

Course Material

I will make available slides, problem sets, Stata data sets, solutions to the problem sets, and daily summaries.

Textbooks

For the first two days of the course, I will be drawing on material from a variety of sources, including my own (unpublished) lecture notes. Greene and Hayashi contain the material on OLS, 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.

F. Hayashi (2000), *Econometrics*, Princeton University Press.

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.