SYLLABUS: BAVARIAN GRADUATE PROGRAM IN ECONOMICS
Advanced Econometrics: August 18-23, 2019

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Goal: This course covers estimation of linear and nonlinear econometric models. The estimation methods include ordinary least squares, generalized least squares, maximum likelihood estimation, quasi-maximum likelihood estimation. We will also treat methods when some variables are endogenous, including basic instrumental variables and extensions to nonlinear models. The focus will be on applications to cross section data and panel data but will include some linear analysis for time series 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. Underlying the statistical properties is matrix algebra and multivariable calculus, including how these are combined with probability. I will not emphasize derivations but some of the material is easier to follow if you have facility with matrix algebra.

Sunday, August 18, 2019

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 Set)
16:00-16:30 Coffee Break
16:30-18:00 Fourth Session (Problem Set)
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
13:30-14:30 Third Session (Lecture)

Course Outline

The slides for the course are grouped into what I think are 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 lecture later in the same day. 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

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

· Regression with Time Series Data: Stationarity; Weak Dependence; Trends; Seasonality; Robust Standard Errors; GLS for Serial Correlation

· 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

· IV with Time Series Data; GMM

· 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

· Linear Panel Data Models: Instrumental Variables Methods

· Unbalanced Panels

Day 4

· Maximum Likelihood Estimation with Cross-Sectional Data

· Pooled MLE for Panel Data

· Quasi-MLE; QMLE in the Linear Exponential Family

· Limited Dependent Variable Models: Logit and Probit (Binary and Fractional Responses); Exponential Models

· Endogenous Explanatory Variables

Day 5

· Nonlinear Models with Panel Data; Joint MLE and Pooled MLE; Correlated Random; Robust Inference for Pooled MLE and QMLE

· Bootstrapping with Panel Data

· Common Nonlinear Panel Data Models

· Dynamic Models

· 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 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 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.

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.