

Faculty of Economics

R301b Econometrics II: Cross Section and Panel Data

This course consists of 18 hours of lectures dealing with estimation and inference using both cross-section and panel data.

Topics covered will be taken from: Generalised Method of Moments, random utility models in discrete choice, heterogeneity and endogeneity in binary choice models, program evaluation and treatment effects, fixed and random effects estimators for panel data, nonlinear and dynamic panel data models, count data models, Bayesian methods for latent variables, and machine learning for predictive and causal inference.

We may consider the material in three Parts

- Part I - Nonlinear Models for Discrete Data
- Part II - Linear Panel Data Models
- Part III - Topics in Bayesian Microeconometrics
- Part IV - Machine Learning and Nonparametric Estimators

Topics

We will examine a selection of the following topics:

1. Discrete Choice I: Binary Response Models
 - a. Revealed and Stated Preference Models
 - b. Partial Effects and Average Partial Effects
 - c. Endogeneity in Binary Response
2. Alternative Estimators for Nonlinear Models with Endogeneity
 - a. Alternative Estimators for Binary Response Models
 - b. Binary Response with Endogenous Continuous Variates
 - c. Binary Response with Endogenous Discrete Variates
3. Discrete Choice II: Multinomial Response Models
 - a. Theoretical Underpinnings of Discrete Choice Models
 - b. The Specification of a Random Utility Model
 - c. Identification
 - d. The Logit Model
 - e. Independence of Irrelevant Alternatives
 - f. Endogeneity and Discrete Choice
4. Discrete Choice III - The Mixed Logit Model
 - a. The Mixed Logit Model
 - b. Error and Random Coefficient Models
 - c. Towards Flexible Substitution Patterns
5. Panel Data I - Linear Unobserved Effects Panel Data Models
 - a. Introduction to Panel Data Models
 - b. Weak and Strict Exogeneity

- c. The Fixed Effects Estimator
 - d. The Random Effects Estimator
 - e. The Correlated Random Effects Estimator
 - f. Hausman Tests
6. Panel Data II - Panel Data Discrete Choice Models
- a. Unobserved Heterogeneity in Binary Response Models
 - b. Fixed Effects Logit and Random Effects Probit
 - c. Dynamic Panel Binary Response Models
7. Panel Data III - Large T Panels
- a. The N and T Dimensions
 - b. Random Coefficient Models
 - c. Dynamic Panels: small T
 - d. Dynamic Heterogeneous Panels: large T
 - e. Pooled Mean Group Estimators
- 8.
- 8.1 Bayes, Inverse Probability and Conjugate Priors
- a. Bayesian Inference and Heart Attacks
 - b. From Inverse Probability to Bayesian Inference
 - c. Bayesian Methods with Conjugate Priors
 - d. Posterior Assessment for a Proportion
- 8.2 Fundamentals of Bayesian Inference
- a. Bayes Theorem for Events and parameters
 - b. De Finetti's Representation Theorem
 - c. Parameter Uncertainty
 - d. Model Uncertainty
 - e. Multiplicity
 - f. Hierarchical Models for Combining Data
 - g. Model Selection and Model Averaging
- 8.3 The EM Algorithm and Data Augmentation for Latent Variable Models
- a. The EM Algorithm
 - b. Data Augmentation for Missing Data Models
 - c. Bayesian Inference for Binary Choice
 - d. Bayesian Inference for the Mixed Logit Model
 - e. Semiparametric Estimators and the EM Algorithm
9. Programme Evaluation and Treatment Effects
- a. Overview
 - b. Types of Treatment Effects
 - c. Ignorability of Treatment
 - d. Endogenous Selection
 - e. Matching Estimators
 - f. The Difference-in-Difference Estimator

10. Machine Learning and Decision Trees

- a. What is Machine Learning
- b. Training, Testing and Cross Validation
- c. Classification and Regression Trees
- d. Causal Trees
- e. Application: Time of Use Tariffs and Smart Meter Data

11. Count Data Models

- a. Count Modelling: Fully Parametric versus Mean-Variance
- b. MLE versus Quasi MLE
- c. Overdispersion in Count Data
- d. Mixture Models: A Negative Binomial Extension
- e. GMM for Conditional Mean

Assessment

The examination for this module will be by a 2-hour written exam.

Readings

Wooldridge, J. (2010). *Econometric Analysis of Cross-Section and Panel Data*. MIT.

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

J. Freidman, T. Hastie, R. Tibshirani (2009). *The Elements of Statistical Learning*. Springer, publishers.