

Syllabus

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Chapter 1: Introduction and a Brief Review of Relevant Tools

I. Overview

II. Maximum Likelihood

- A. The Likelihood Principle
- B. The Maximum Likelihood Estimator (MLE)
- C. Asymptotic Properties of the MLE
 - Identification
 - Regularity conditions
 - Consistency
 - Asymptotic distribution

III. Generalized Method of Moments (GMM)

- A. General Formulation
- B. Estimation
- C. Asymptotic Properties
 - Consistency
 - Asymptotic distribution
 - Optimal weighting matrix

IV. Numerical Methods

- A. Differentiation
- B. Newton-Raphson Optimization
- C. Integration

Chapter 2: Panel Data

I. Introduction

II. Static Models

- A. The Fixed Effects Model. Within Groups Estimation

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- B. The Random Effects Model. Error Components
- C. Testing for Correlated Individual Effects

III. Dynamic Models

- A. Autoregressive Models with Individual Effects
- B. Difference GMM Estimation
- C. System GMM Estimation
- D. Specification Tests

Chapter 3: Discrete Choice

I. Binary Outcome Models

- A. Introduction
- B. The Linear Probability Model
- C. The General Binary Outcome Model
 - Maximum Likelihood Estimation
 - Asymptotic properties
 - Marginal effects
- D. The Logit Model
- E. The Probit Model
- F. Latent Variable Representation
 - Index function model
 - (Additive) Random utility model

II. Multinomial Models

- A. Multinomial Outcomes
- B. The General Multinomial Model
 - Maximum Likelihood estimation
 - Asymptotic properties
 - Marginal effects
- C. The Logit Model
 - The Multinomial Logit (MNL)
 - The Conditional Logit (CL)
- D. Latent Variable Representation
- E. Relaxing the Independence of Irrelevant Alternatives Assumption

The Nested Logit (NL)
Random Parameters Logit (RPL)
Multinomial Probit (MNP)

F. Ordered Outcomes

III. Endogenous Variables

A. Normal and continuous endogenous explanatory variable in Probit
B. Normal and binary exogenous explanatory variable in Probit
C. Moment estimation

IV. Binary Models for Panel Data

Chapter 4: Censoring, Truncation, and Selection

I. Introduction

II. Censoring and Truncation. The Tobit Model

A. Maximum Likelihood Estimation
B. Potential Inconsistency of the MLE
C. Alternative Methods for Censored Data
 Heckman Two-Step Estimator
 Median Regression
 Symmetrically Trimmed Mean

III. Selection

A. The Sample Selection Model
B. Heckman Two-Step Estimator

Chapter 5: Duration Models

I. Introduction

A. Motivation
B. Duration data

II. The Hazard Function

A. Hazard function for a discrete variable
B. Hazard function for a continuous variable
C. Some frequently used hazard functions
 Constant hazard
 The Weibull distribution

III. Conditional Hazard Functions: The Proportional Hazard Model

- A. The proportional hazard model
- B. Discrete durations

IV. Likelihood Functions

- A. Complete continuous durations
- B. Censored continuous durations
- C. Discrete durations

V. Unobserved Heterogeneity

- A. Unobserved heterogeneity vs spurious duration dependence
- B. Dealing with heterogeneity in continuous hazard models
- C. Dealing with heterogeneity in discrete hazard models

VI. Multiple-exit discrete duration models

- A. Discrete competing risk models
- B. Full information ML
- C. Limited information ML based on competing risk models

Chapter 6: Dynamic Discrete Choice Structural Models

I. Introduction

II. General Framework

- A. Model primitives and decision problem
- B. Baseline assumptions
- C. Value functions, conditional choice probabilities, and log-likelihood

III. Motivational Example: Rust's Engine Replacement Model

IV. Estimation

- A. Rust's nested fixed point algorithm
- B. Hotz and Miller's CCP estimation
- C. Aguirregabiria and Mira's nested pseudo-likelihood

V. Extensions

- A. Unobserved permanent heterogeneity
- B. Estimation of competitive equilibrium models
- C. Using randomized experimental data to validate structural models
- D. Estimation of dynamic discrete games with imperfect information

References

(These are core references. References for applications will be given in class)

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Grading

50% Final Exam. 20% Problem sets. 30% Replication exercise.