

Structural Econometrics

Syllabus

Lecturer: Junjian Yi

Academic Year 2023-2024, Semester 1

Time: Fri 6:40pm - 9:30pm

Venue: Chengzeyuan Classroom 132

1 Description

This course introduces the core of structural estimation methods in applied microeconomics, such as labor and demographic economics; health, education, and welfare; economic development and growth; business economics (e.g. marketing and personnel economics); public economics; empirical industrial organization; finance; and behavioral economics. We aim to equip students with solid structural estimation techniques for rigorous economic research.

In the first 2 weeks, we give a brief introduction on how structural estimation techniques are used in applied microeconomics, discuss the concept of identification in structural models, and study simulation-based estimation techniques.

In the remaining 14 weeks, we will cover 3 parts of topics:

1. Models with single-agent decision making:

- Static models with continuous choices: *Almost Ideal Demand System*
- Static models with discrete choices: The simple logit model and its extensions: (i) breaking free of IIA property; (ii) unobserved consumer heterogeneity; (iii) price endogeneity
- Dynamic models with discrete choices:
 - Modeling frameworks: (i) infinite horizon; (ii) finite horizon
 - Numerical methods: (i) value function iteration (VFI); (ii) policy function iteration (PFI); (iii) iteration over conditional choice probability (ICCP)

2. Models with multiple-agent interactions:

- Static discrete-choice games:
 - Modeling frameworks: (i) complete information; (ii) incomplete information
 - Estimation technique: method of moment inequality
- Dynamic discrete-choice games:
 - Estimation methodology: with the focus on Aguirregabiria and Mira (2007), Bajari et al. (2007), Pakes et al. (2007), Pesendorfer and Schmidt-Dengler (2008), Egedal et al. (2015), and Miessi Sanches et al. (2016)
 - Relevant applications
- Collective models: identification and applications

3. Models of treatment effects: Roy model, marginal treatment effects, and multivalued treatment effects

Apart from the lectures, we also provide 8 tutorial classes that introduce related programming techniques (using MATLAB).

1. An introduction to MATLAB, basic operations, built-in functions, and custom functions.
2. Numerical optimisation, MLE, GMM, and EM algorithm.
3. Monte Carlo methods, bootstrap, and simulation-based estimation.
4. Estimation of simple logit model and BLP demand model.
5. Value function iteration, policy function iteration, and iteration over conditional choice probability.
6. Recursion and solving dynamic models with finite horizon.
7. Estimating static games and collective models.
8. Marginal treatment effects models.

Prerequisites for students:

1. Econometrics (intermediate level + +)
2. Probability, Statistics, Calculus & Matrix algebra (undergraduate level + +)
3. GMM and MLE

Software: MatLab (preferred), R, and Python.

2 Grading

- Class attendance (5%)
- 4 coding assignments (30%):
 1. Estimate a static continuous-choice model using MLE and GMM, and conduct statistical inference using asymptotic theory and bootstrap. (Assigned in Week 2 and submitted in Week 6.)
 2. Estimate a BLP demand model, also involving simulation-based estimation. (Assigned in Week 6 and submitted in Week 10.)
 3. Estimate a dynamic discrete-choice model with infinite horizon using VFI, PFI and ICCP, and estimate a dynamic-discrete model with finite horizon using recursion. (Assigned in Week 10 and submitted in Week 14.)
 4. Estimate a static game and a marginal treatment effects model. (Assigned in Week 14 and submitted in Week 18.)
- In-class presentation (25%): Each student is required to select a paper from the presentation sign-up sheet to present. The sign-up sheet will be posted in the first week of the course.
- Research proposal (40%): Each student is required to submit a research proposal in hard copy by the end of the semester. In the proposal, each student should state the research question, review the related literature, propose the potential data sources, present the structure model, describe the estimation method, and show the counterfactual-simulation design.

3 Book Reference

- Adda and Cooper (2003)
- Train (2009)
- Aguirregabiria (2021)

4 Tentative Plan (Required Readings are in Boldface)

Part 0: Introduction (Week 1 - 2)

4.1 Brief Discussion on Structural Estimation in Applied Microeconomics

- **Wolpin (1996)**
- **Heckman (2000)**
- **Heckman (2001)**
- **Keane (2010)**
- Rust (2010)
- Low and Meghir (2017)
- DellaVigna (2018)
- **Galiani and Pantano (2021)**
- **Todd and Wolpin (2023)**

4.2 Identification in Structural Models

- **Matzkin (2007)**
- Andrews et al. (2017)
- Andrews et al. (2020a)
- Andrews et al. (2020b)
- Andrews et al. (2022)
- **Lewbel (2019)**

4.3 Simulation-Based Estimation

- **Stern (1997)**
- **Train (2009) Chapter 9-10**

Part I: Models with Single-agent Decision Making (Week 3 - 7)

Static Models with Discrete Choices

4.4 Simple Logit Model

- Train (2009) Chapter 2-5

4.5 Extension I: Breaking Free of IIA and Unobserved Consumer Heterogeneity

- Train (2009) Chapter 6-7

4.6 Extension II: Price Endogeneity

- Berry (1994)
- BLP: Berry et al. (1995)

Dynamic Models with Discrete Choices

4.7 General Surveys

- Aguirregabiria and Mira (2010)
- Keane et al. (2011)

4.8 Infinite Horizon

- Rust (1987)
- Hotz and Miller (1993)
- Hotz et al. (1994)
- Rust (1994) Sections 2.2-2.5 and 3.1, 3.2
- Aguirregabiria and Mira (2002)
- Bajari et al. (2007)
- Arcidiacono and Ellickson (2011)

- Su and Judd (2012)

4.9 Finite Horizon

- Wolpin (1984)
- Pakes (1986)
- Eckstein and Wolpin (1989)
- Rust (1994) Sections 2.1 and 3.3
- Keane and Wolpin (1994)
- **Keane and Wolpin (1997)**
- Arcidiacono and Jones (2003)
- Keane and Wolpin (2009)
- **Todd and Wolpin (2010)**

Part II: Models with Multiple-agent Interactions (Week 8 - 13)

Static Discrete-choice Games

4.10 Relevant Methodology: Method of Moment Inequality

- Chernozhukov et al. (2007)
- **Tamer (2010)**
- **Pakes (2010)**
- Ho and Pakes (2014)
- **Pakes et al. (2015)**
- Wollmann (2018)
- Fan and Yang (2020)

4.11 Games with Complete Information

- **Bresnahan and Reiss (1991)**
- **Berry (1992)**
- Mazzeo (2002)
- Jia (2008)
- Ciliberto and Tamer (2009)
- Ho (2009)
- Ellickson et al. (2013)
- **Eizenberg (2014)**
- Ciliberto et al. (2021)
- Fan and Yang (2022)

4.12 Games with Incomplete Information

- Seim (2006)
- **Sweeting (2009)**
- **Su (2014)**
- **Xiang (2021)**
- Xie (2022)
- Magnolfi and Roncoroni (2023)

Dynamic Discrete-choice Games:

4.13 General Surveys

- **Bajari et al. (2013)**
- **Aguirregabiria and Nevo (2013)**
- **Pesendorfer (2013)**

4.14 Estimation Methodology

- **Ericson and Pakes (1995)**
- **Aguirregabiria and Mira (2007)**
- **Bajari et al. (2007)**
- **Pakes et al. (2007)**
- **Pesendorfer and Schmidt-Dengler (2008)**
- Weintraub et al. (2008)
- Doraszelski and Satterthwaite (2010)
- Farias et al. (2012)
- Fershtman and Pakes (2012)
- **Egedal et al. (2015)**
- Iskhakov et al. (2016)
- **Miessi Sanches et al. (2016)**
- Abbring et al. (2018b)
- Abbring et al. (2018a)

4.15 Relevant Applications

- Goettler and Gordon (2011)
- Song (2011)
- **Aguirregabiria and Ho (2012)**
- **Ryan (2012)**
- Sweeting (2013)
- Collard-Wexler (2013)
- Fan and Xiao (2015)
- Igami (2017)

- Yang (2018)
- Frechette et al. (2019)
- Asker et al. (2020)
- **Cao et al. (2023)**

Collective Models

4.16 General Surveys

- **Browning et al. (2011)**
- **Chiappori and Mazzocco (2017)**

4.17 Identification

- Chiappori (1988)
- Chiappori (1992)
- Lewbel and Pendakur (2008)
- Bourguignon et al. (2009)
- **Chiappori and Ekeland (2009)**
- Cherchye et al. (2011)
- Cherchye et al. (2012)
- Bargain and Donni (2012)
- **Browning et al. (2013)**
- **Cherchye et al. (2015)**
- Cherchye et al. (2017)

4.18 Applications

- Browning et al. (1994)
- **Chiappori et al. (2002)**
- Blundell et al. (2005)
- Mazzocco (2007)
- Browning et al. (2013)
- **Lise and Yamada (2019)**
- Coles and Francesconi (2019)
- **Gayle and Shephard (2019)**
- Theloudis et al. (2022)

Part III: Structural Models of Treatment Effects (Week 14 - 16)

4.19 Brief Discussion on Selection Models

- **Heckman (1974)**
- **Heckman (1976)**
- **Heckman (1979)**
- **Heckman and Honore (1990)**
- **Vytlacil (2002)**
- Heckman (2010)
- French and Taber (2011)
- Kline and Walters (2019)

4.20 Marginal Treatment Effects

- **Heckman and Vytlačil (1999)**
- **Heckman and Vytlačil (2005)**
- Heckman et al. (2006)
- Carneiro and Lee (2009)
- **Carneiro et al. (2010)**
- Cornelissen et al. (2016)
- Brinch et al. (2017)

4.21 Multivalued Treatment Effects

- Heckman et al. (2008)
- **Lee and Salanié (2018)**
- **Heckman and Pinto (2018)**

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