AAE 875 Microeconometrics with Simulation
Tue/Thu 9:30am - 10:45am
Taylor Hall B30

CONTACT:

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Office Hours: Tue/Thu 8:00 to 9:15am and by appointment.

Email is the most reliable way to contact me. I am generally available outside of my office hours if the posted time is not convenient, though I prefer you make an appointment rather than just stopping by. I will often communicate with the class via email so please plan to check regularly.

COURSE DESCRIPTION

This course is focused on microeconometric techniques with emphasis on simulation methods and structural models. Researchers in applied microeconomics increasingly rely on agent-level data and structural models for inference and prediction. Standard linear estimation techniques are not well suited for these types of problems. In their place a variety of limited dependent variable, qualitative choice, and mixed continuous/discrete choice models and estimation techniques have become standard fare. Knowledge of these techniques is critical for conducting research in most areas of contemporary applied microeconomics. Assessment of the capabilities and limitations of these methods is also critical for judging the quality of research discoveries.

In this course we will study computational methods, simulation techniques, and econometric models suitable for analyzing micro-level data. The primary emphasis will be on gaining an intuitive grasp of how the models work and what is needed to implement them for applied research. We will not spend much time on formal proofs. Rather, we will use informal simulation experiments, case studies, and applied exercises to examine the intuition and working properties of the models. A critical component of this will be writing and running original code using the computer package MATLAB. You will need individual access to MATLAB for exercises and evaluations, via a lab or your personal computer.

This class is (and always will be) a work in progress. As such I will be refining the material and pedagogical approaches as we go along. Please feel free to provide comments/suggestions on the course as we move through the semester.

PREREQUISITES

This is an advanced course for PhD students who have already reached a level of comfort with microeconomics and statistics. I will enforce the following prerequisites:

- Completion of the core econometric and microeconomic sequences.
- A willingness to dig in and code the techniques we will discuss.

The latter is extremely important. The only real way to understand the simulation and computational techniques we will discuss is to code them from the ground up. This involves a commitment of time,
bearing the fixed costs of becoming a better programmer, and patience and attention to detail.

**REQUIRED TEXTBOOK**


**SUPPLEMENTAL AND RELATED BOOKS**


Note: I am still figuring out the reserve system here at UW. I will likely distribute scans of relevant material in the meantime.

**SOFTWARE**

We will use MATLAB as our matrix language program for the class. The software is available on university computer lab machines. Since some of the programs we will run take time to execute it may be convenient for you to obtain access to MATLAB on a personal machine. I believe you can obtain a student copy through DoIT for a nominal fee. If you do this make sure you also obtain the Statistics and Optimization toolkits.

There are several nice overview books on MATLAB and its functions. I have used *Matlab Guide 2nd Edition*, by D. Higham and N. Higham and found it very useful. If you are new to matrix programming I strongly suggest investing a few hours in going through this or a similar book.

**CLASS FORMAT:**

My goal for this class is to provide hands-on, applied exposure to the material. Lectures will consist of instruction on the analytical basis for the models and techniques we will look at, discussion of practical implementation issues, and presentation of case studies and informal simulation experiments. We will
also spend time going over coding techniques and challenges.

**GRADING:**

Grading for the course will be based on a number of homework problems (50%) and some type of exam/project (50%). The homework problems will involve programming and estimation in MATLAB. Based on the specific exercises I will give you instructions on how I want you to turn in your work, but generally you will need to provide your code, output, and required discussion. You may collaborate on the homework assignments, but each person should make at an initial independent effort to code the model or technique. In addition each student needs to turn in their own completed homework. Unless otherwise announced I will score the homework assignments as satisfactory/unsatisfactory. Late or incomplete assignments will be marked as unsatisfactory.

I will announce the exact timing and format of the exam/project during the semester. I am considering a replication exercise and/or some applied analysis and inference. I will give you more details as the semester unfolds. The due date of the project/exam will be late in the semester (probably around week 14) but not during finals week.

**LEARNING OUTCOMES:**

This is a hands-on class, and so the learning outcomes I want to see are mainly skill-based. Students will be able to code, execute, and interpret models using standard (e.g. multinomial logit) and contemporary (e.g. mixed logit) discrete choice models. Students will also be able to assess the strengths and weaknesses of the new simulation enabled approaches in general and for specific applications, and distinguish situations when these techniques may inform or mislead us. Other skill outcomes include understanding the mechanics of numerical optimization, generating pseudo random variable outcomes, and distinguishing between classical and Bayesian inference methods.
I) **Introduction** (1.5 weeks)
   A) Motivational examples
   B) Structural models, micro data, and unobserved heterogeneity
   C) Tutorial on MATLAB use

II) **Simulation Methods** (1 week)
   A) Drawing from densities
   B) Uses of simulation in estimation, inference, and informal experiments

III) **Numerical Methods and Review of Maximum Likelihood** (1 week)
   A) Maximization
   B) Integration
   C) Properties of maximum likelihood

IV) **Discrete choice models** (8.5 weeks total)
   A) Properties of discrete choice models (0.5 weeks)
   B) Multinomial logit (2 weeks)
      1. Endogenous regressors
   C) Multinomial probit (2 weeks)
      1. GHK simulator
   D) Mixed logit (2 weeks)
      1. Halton sequences
   E) Bayesian approaches (2 weeks)
      1. Gibbs sampling
      2. Metropolis-Hastings sampling
      3. Mixed logit revisited
      4. Multinomial probit revisited

V) **Limited Dependent variables** (3 weeks total)
   A) Univariate and multivariate tobit-type models (1 week)
   B) Count-type models (1 week)
   C) Corner solution models (1 week)
I. Introduction

Train, Chapter 1

Cameron and Trividi, Chapters 1, 2, 3


II. Simulation Tools

Train, Chapter 9


Cameron and Trividi, Chapter 12

Koop, Poirier, and Tobias, Chapter 11

Lynch, Chapters 4, 5

Judd, Chapters 8, 9

Miranda and Fackler, Chapter 5

III. Numerical Methods and Maximum Likelihood

Train, Chapter 8, 10

Cameron and Trividi, Chapters 10, 5

IV. Discrete Choice Models

Logit

Train, Chapters 2-3 (logit basics)

Train, Chapter 13 (endogenous regressors)


Probit

Train, Chapters 5, 10

**Mixed Logit**

Train, Chapter 6, 9, 10


**Bayesian Approaches**

Train, Chapter 12

Koop, Chapters 1, 9

Koop, Poirier, and Tobias, Chapters 2, 11, 14

Lynch, Chapters 3, 6

Cameron and Trividi, Chapter 13


V. **Limited Dependent Variables Models**

Tobit-type models

Cameron and Trividi, Chapter 16


Cameron and Trividi, Chapter 13

Koop, Poirier, and Tobias, Chapter 14

Count data models

Cameron and Trividi, Chapter 20


**Corner solution models**


