Econometrics

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Class Hours: Thursday 4:55-7:30pm
Office: KMC 7-77
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Course Description

This is an econometrics course for first-year PhD students and advanced undergrads who are interested in doing quantitative research in the social sciences. The aim of the course is to teach you to use popular applied econometric methods while developing your theoretical understanding of those methods. Topics include least squares, asymptotic theory, hypothesis testing, instrumental variables, difference-in-differences, regression discontinuity, treatment effects, panel data, maximum likelihood, discrete choice models, machine learning, and model selection.

Prerequisites

I will assume you are proficient in calculus and basic probability and statistics.

Because the assignments will require programming and data analysis, experience with mathematical programming is strongly recommended (otherwise, you will be responsible to learn as we go along, which is feasible, but a lot of work). You may use any software you like for the assignments (I recommend R for those who don't already have much experience with another language).

The class will also use some basic linear algebra concepts (matrix multiplication, inversion, rank). Like mathematical programming experience, experience with linear algebra is also recommended, but it may be feasible to pick up as we go along.

Materials

Main textbook: *Econometric Analysis* (8th edition) by William Greene.

Optional supplementary references (no need to spend money here):

- If you are not already proficient with mathematical programming, you should consult a reference such as one of the following. (These resources are constantly evolving, so please let me know if you have new suggestions.)
  - Stern's Data Bootcamp course.
  - Analytics Vidhya's R tutorial.
  - Sargent and Stachurski's Lectures in Quantitative Economics, which has introductions to Python and Julia.
- The Khan Academy has a free linear algebra course.

Assignments and Grading

Your grade will be based on four individual assignments (15% each) and one group research project (40%).

Assignments will have a mixture of theoretical questions and data-based questions. For each assignment, you should turn in (1) a document presenting your results, and (2) your code. You may work together, but you must turn in your own work (including your own code). Assignments should be submitted to me by email before class.

The group project will consist of three deliverables:

1. A short description of your proposed project (up to three pages), submitted in the middle of the semester.
2. A presentation of your results during the final class session.
3. A research paper, turned in at the end of the semester (along with your code).

Your team for the group project should consist of 1-3 students. The project can be on any topic (subject to my approval). I suggest choosing a published paper to reproduce, and in addition to reproducing the results, find at least one new way to test, extend, or improve on the paper's econometric analysis.

All regrade requests should be submitted in writing.

Getting Help

I will hold office hours weekly at TBD. I am also available by appointment – please contact me by email to set one up.

Please feel free to send me smaller questions by email, and I will try to respond within 48 hours.

Outline

Session	Date	Chapters	Topics and deliverables
1	9/6	1,2	Introduction, Basic Statistics
2	9/13	3,4	Least Squares Estimation
3	9/20	5	Asymptotic Theory, Testing and Inference ***Assignment 1 due***
4	9/27	9	Robust Estimation, Delta Method, Bootstrap
5	10/4	6	(Quasi-)Experiments, Endogeneity, Instrumental Variables ***Assignment 2 due***
6	10/11	6	Treatment Effects, Difference in Differences, Regression Discontinuity
7	10/18	8.1-8.5, 10, 13	Instrumental Variables, Simultaneity, GMM
8	10/25	11	Panel Data, Fixed and Random Effects ***Assignment 3 due***
9	11/1	7, 12	Nonlinear Estimation, Nonparametric Estimation ***Group project proposals due***
10	11/8	14	Maximum Likelihood, Sample Selection
11	11/15	17,18	Binary Choice, Discrete Choice (guest lecturer: Prof. Chris Conlon) ***Assignment 4 due***
	11/22		No Class
12	11/29		Project Workshop
13	12/6 12/13		***Group project presentations*** ***Group research papers due***