# Econometrics I

Paul T. Scott

Fall 2021

Lecture time: Thursday 2:00-4:30pm
Location: KMC 5-80
Office hours (Zoom): Tues 5-6pm
(all times US East)
Office Hours link: `https://nyu.zoom.us/j/2633368734`
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## Course Description

This is an econometrics course for first-year PhD students 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, and structural estimation. Professor Chris Conlon will teach Econometrics II in the spring.

## Prerequisites

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

Because the assignments will require programming and data analysis, the more experience you have with mathematical programming, the better. You may use any software you like for the assignments. I recommend R or python (both open source) for those who don't already have much experience with another language.

The course will not involve programming instruction, but I will give some examples of working code in R.

## Materials

I don't require a specific textbook, but you should own at least one econometrics textbook. Suggested textbook: *Econometric Analysis* (8th edition) by William Greene. The calendar below lists chapters from Greene corresponding to the lecture material.

Other useful textbooks:

- Wooldridge, *Econometric Analysis of Cross Section and Panel Data*: somewhat more advanced and a very useful reference.
- Hansen, Econometrics: free and somewhat more advanced.
- Angrist and Pischke, *Mostly Harmless Econometrics*: great as a complement to one of the above, but I don't recommend it as your primary econometrics reference.

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 a final research project (40%).

Assignments will have a mixture of theoretical questions and data-based questions. For each assignment, you should turn in (1) a PDF document presenting your results (and showing your work), and (2) your code. You are encouraged to discuss assignments with your classmates and work together (learning from your peers is very important during your PhD), but you must turn in your own work (including your own code). Assignments should be submitted to me by email before class.

Late assignments will receive partial credit with penalties in proportion to how late they are. Assignments more than one week late will not receive credit.

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 final project should consist of 1-3 students. The project can be on any topic (subject to my approval).

For the final project, 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. I encourage you to look beyond incredibly famous papers with many thousands of citations for two reasons. First, there is usually a large subsequent literature – too large for you to become an expert on just for this project. Second, these term projects can eventually become (or lead to things that will become) parts of your dissertation or published papers. That's more likely to happen if you take on a topic that hasn't already been over-studied.

Any regrade requests should be submitted in writing.

## Getting Help

I will hold office hours over Zoom weekly from 5-6pm on Tuesday. I am also available by appointment – please do not hesitate to contact me to set up a meeting.

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

## Tentative Outline

| Session | Date | Chapters (Greene) | Topics and deliverables |
|---|---|---|---|
| 1 | 9/9 | 1-4 | Introduction, Least Squares Estimation |
| | 9/16 | | No Class |
| 2 | 9/23 | 1-4 | Least Squares Estimation |
| 3 | 9/30 | 5, 9 | Asymptotics, Inference, Standard Errors<br>***Assignment 1 due*** |
| 4 | 10/7 | 6 | (Quasi-)Experiments, Endogeneity, Treatment Effects |
| 5 | 10/14 | 8.1-8.5 | Instrumental Variables, Simultaneity |
| 6 | 10/21 | 10, 13 | Instrumental Variables, Simultaneity<br>***Assignment 2 due*** |
| 7 | 10/28 | 11 | Panel Data, Fixed and Random Effects |
| 8 | 11/4 | 14, 17, 18 | Maximum Likelihood<br>***Final project proposals due*** |
| 9 | 11/11 | 14, 17, 18 | Binary and Discrete Choice, Nonparametrics and Kernels<br>***Assignment 3 due*** |
| 10 | 11/18 | | Model Selection, Machine Learning |
| | 11/25 | | No Class - Thanksgiving |
| 11 | 12/2 | | Structural Estimation<br>***Assignment 4 due*** |
| 12 | 12/9 | | Structural Estimation |
| 13 | 12/15 | | ***Final project presentations (Wednesday!)*** |
| | 12/20 | | ***Final projects due (Monday)*** |