Advanced Microeconometrics

ECO-20513/50213: Microeconometría Avanzada

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January 14, 2025

This course will study the applications of econometrics to the analysis of cross-sectional and panel datasets. First, we will review the Ordinary Least Squares ("OLS") model and discuss the issues that come up in practical applications of OLS. Second, we will study three types of econometric model that are frequently used in empirical work: the instrumental variables model, limited dependent variable models, and panel data models. Third, we will analyze the causal inference framework and review so-called "quasi-experimental" methods such as differences-in-differences and regression discontinuity. Finally, we will compare structural estimation models to the causal inference framework, using the differentiated product demand model as an example.

By the end of this course, you should be able to do the following:

1. understand and apply the econometric methods that will be most useful for writing an undergraduate or graduate thesis in economics;
2. critically read and understand the econometric methods used in recent papers in applied microeconomics fields; and
3. write programs in Python for simulation and data analysis.

Prerequisites

This course is offered for both undergraduate (20513) and graduate (50213) students. I expect that everyone has taken the standard undergraduate sequence in probability,

statistics, and econometric theory. You should expect some overlap in course content if you have already taken Applied or Advanced Microeconometrics.

Lectures

The lectures will be held on Tuesday and Thursday mornings, 8:30 to 10:00 a.m., in PF 103. Lectures will be held in person. There will be a mix of whiteboard notes, slide presentations, programming demonstrations, and interactive exercises. If possible, please bring a laptop to the lecture to participate in the interactive exercises. If you have to miss a lecture for health or other reasons, you should talk to your classmates to catch up on any material you missed.

I would like you to treat the lectures as an opportunity for active participation and discussion. Please feel free to stop me and ask questions. I kindly request that you avoid using your phone or laptop for non-course-related activities during the lecture.

During the semester, I may need to miss one or two lectures because of research-related travel. I will make up for any missed lectures using a combination of recorded lecture material and extra office hours.

Textbook

There is no single required textbook for the course. The four sections of the course will be principally based on the following materials:

1. **OLS and its applications**
   Stock and Watson (2020), *Introduction to Econometrics*, Chapters 4–9.
2. **Additional econometric models**
   Stock and Watson (2020), *Introduction to Econometrics*, Chapters 10–12.
   Plus extra textbook readings to be provided later.
3. **Causal inference**
   Cunningham (2021), *Causal Inference: The Mixtape*.

4. **Structural estimation models**
   Reiss and Wolak, "Structural Econometric Modeling: Rationales and Examples from Industrial Organization", Sections 1-7.
   Train (2009), *Discrete Choice Methods with Simulation*, Chapters 2-6.

In additional, there will be readings from academic journals with applications of the methods we study in the course. These articles will be provided as part of the homework assignments.

Homework Assignments

There will be weekly homework assignments to practice the econometric methods discussed in the lectures. You will prepare your answers to these assignments in the Jupyter Notebook format, export your notebook to PDF format, and upload the PDF to Canvas. Jupyter Notebooks allow you to seamlessly integrate Python code, the output of your code, and your written interpretation of the results in a single document. A perfect score on the assignments will require you to show: (i) the Python code that you used, (ii) formatted results of your analysis (e.g., tables, graphs, or numerical summaries), and (iii) your interpretation of the results.

You can complete your assignments in Google Colab or on your own computer using Jupyter Notebook-compatible platforms like VS Code. While you are free to work locally, I cannot provide technical support for setting up Python on your computer.

You are encouraged to work together on the assignments. AI tools, such as ChatGPT or those integrated into Colab, may be used to assist in coding, debugging, or understanding concepts. However, the final submission must be your own work, written in your own words, and reflect your own understanding.

Written Examinations

There will be a midterm exam on **March 20**. The final exam will be given as announced in the official exam schedule. The final exam will be cumulative and based on all material from throughout the course.

A makeup for the midterm or final exam will be allowed only for a documented medical or family emergency. You must submit your documentation to *Dirección*

Escolar so that they can provide me with an official excuse letter. I reserve the right to choose how to make up a missed exam. This may include an oral exam and/or using your results from the other exam.

Oral Examination (*Undergraduate students only*)

For students enrolled in ECO 20513, I will schedule an oral exam towards the end of the semester. The format will be similar to an interview for a research economic analyst position, with questions about the course concepts and short exercises to demonstrate your programming expertise. Please view this as an opportunity to demonstrate what you have learned during the semester, rather than a confrontational exercise.

Research Seminar Reports (*Graduate students only*)

For students enrolled in ECO 50213, I ask that you attend the applied research seminars in CIE (Fridays, 12:00 p.m.) and the Business School (Thursdays, 1:00 p.m.). I will send an announcement about the relevant seminars with the paper to be presented. For **two** of these seminars, you should write a short referee report of the paper (two or three pages), with a brief summary and a critical evaluation of the research methods used. The report will be due one week after the seminar. If you are interested, let me know if you want to meet the speaker.

Contact Information

There are two ways to contact me for help with any aspect of the course.

1. I am available for office hours on Tuesdays, 12:00 p.m. to 1:00 p.m., in the economics department in Río Hondo (in the small office in front of the secretary's office). You do not need to make an appointment.
2. Please feel free to send me an email, either using a Canvas message or directly to: shaun.mcrae@itam.mx.

Course Grade

The calculation of your overall grade will use the following percentage shares:

Homework assignments	20%
Midterm exam	20%
Oral exam OR referee reports	20%
Final exam	40%

I will translate your final percentage grade into the official numerical grade based on the following conversion table:

95–100% 10
85–94% 9
75–84% 8
65–74% 7
55–64% 6
Below 55% . . . . . NA

If you are close to the cutoff between two grades, I may assign you the higher grade, as long as you have regularly attended and participated in the lectures.