

# Economics 140 - Econometrics

A Consumer's Introduction to Causal Inference for the Social Sciences

Fernando Hoces de la Guardia

## Syllabus

### General Information

- Instructor: Fernando Hoces de la Guardia (fhoces@berkeley.edu)
- Graduate Student Instructors: Yige Wang (yigewang@berkeley.edu) and Elena Stacy (estacy@berkeley.edu)
- Class Meeting Times: MTWTh 8am - 9:30am @ Dwinelle Hall 145
- Section Meeting Times:
  - ES: Section 106, TuTh 2:00 - 3:30pm; Section 108, TuTh 3:30 - 5:00pm, @ Evans 9
  - YW: Section 102, MW 9:30 - 11:00am; Section 103, MW 2:00 - 3:30pm, @ Evans 3
- Office Hours:
  - FH: M 9:45-11:45 & W 9:45 - 10:45 @ 517 Evans and Zoom (<https://berkeley.zoom.us/j/3018730303>).
  - ES: T & Th from 12:30-1:30pm @ 626 and Zoom (<https://berkeley.zoom.us/j/3592976499>).
  - YW: M & W 11:30am to 1:30pm @ 542 and Zoom (<https://berkeley.zoom.us/j/93553122598>).
- Enrollment: Please see the Economics Department Head GSI, John Wieselthier (548 Evans, [headgsi@econ.berkeley.edu](mailto:headgsi@econ.berkeley.edu)), for ALL questions regarding enrollment.

### About this course

The goal of this course is to introduce students to foundational tools to Econometrics, with an emphasis on causality. This course will aim at increasing your skills to critically digest information on policy debates. These policies could range from a large number of people (e.g., does the implementation of a universal basic income lead to people spending more on alcohol and cigarettes?) to a few, or single, individuals (e.g., does exposing my kids to two additional hours a week of TV reduce their reading or math skills?). This course will help you to identify such questions and will provide you with language and methods to critically analyze them.

### Why a “consumer” approach?

Traditionally this course has been taught with the perspective of turning students into producers of econometrics (“econometricians”). This is a good way to learn this material if you are heavily motivated to pursue this track. However I fear that the heavy reliance on math and lack of real life applications may deter students from using these tools in the future both as consumers and producers of evidence. For this reason, and thanks to the emergence of new textbooks with this emphasis, in this course we will relegate math to a second seat, losing depth when examining concepts, in order to gain more breadth behind the main tools for causal inference. For students who are seeking to further pursue studies in Econometrics, I hope that this course

will provide the with a solid intuition, that will help motivate the more detailed methods, theories and proofs that will be developed in subsequent courses (e.g. Ec142, 143, 151, 172, etc). My primary goal is to equip you with the language and tools for causal analysis. And a close secondary goal is to get you excited about these tools so you can continue to use it for years to come and, maybe, decide to bring your unique perspective to the production of evidence.

## Textbooks

- **Required:** Angrist, J. D., & Pischke, J. S. (2014). Mastering 'Metrics: The path from cause to effect. Princeton university press.
  - Two assignments will correspond to short summaries of one chapter each.
  - In reserve at the Library.
  - \$14 Used on Amazon (click on “other sellers”).
- *Suggested:* Stock, J. H., & Watson, M. W. (2015). Introduction to econometrics 3rd ed.
  - Do not buy the 4th edition (>\$200!).
  - \$20 for paperback on Amazon.

## Key Concepts

### A: Required, to be reinforced

- Expectation/Mean	- Conditional expectation
- Standard deviation	- Populations/Samples
- Law of large number	- Hypothesis test/P-value
- Central limit theorem	

### B: New

- Selection Bias	- Omitted variable bias
- Randomized Control Trials	- Measurement error*
- Potential outcomes	- Collinearity*
- Regression as conditional expectation	- External validity
- Regression coefficients	- Instrumental variables
- Regression as conditional expectation	- Regression discontinuity
	- Difference in Difference

\*If we start running behind on the schedule, these are the two topics I am willing to sacrifice so we have enough time to cover everything else.

## Office hours

This semester I will hold office hours on Mondays and Wednesdays from 9:45 - 11:45am at 517 Evans. This means that during those hours, you need not have an appointment to talk to me, just stop by my office during that time. Office hours are a time when you can come to ask me for assistance in understanding course material or assignments, or they can merely be an opportunity to chat with me about the course or how the course relates to current events, college more generally, or anything else you want to talk about with me. Do not feel like you need to have a “good” question or reason to come to office hours—you can just pop in to say hello if you want! And, if you cannot make my office hours because you have a conflict, I’m happy to meet with you at other times, just make an appointment. (text adapted from A. Jack, The Privileged Poor 2019).

## Software

### Statistical software

I will use R in class and will ask you to play with simulations in Datahub. However, **learning R is not a goal of this course**. If you want to use the course to learn R, you can. I will encourage you to submit your homework, or create a version of your class notes using RMarkdown.

### Clickers

We will Clickers during the class to improve interactivity. We will not use clickers for graded exercises. Please do not use your phones, or laptops for other purposes during the class.

## Covid Policy

Unfortunately this course does not count with recordings or captures. If you test positive and have to miss class, you will have to catch up using slides, the book and notes from classmates. I recognize that this is far from ideal, but will work with you to minimize the effect of your class performance.

## Requirements

### Midterms

Given the summer structure, the midterms will cover up to the class before. However, questions on the midterm related to this class (the one before the midterm) will aim more at measuring general comprehension of the class concepts and less at measuring mastery obtained by working on practice questions or problem sets.

### Chapter Summaries

Students are encouraged to write chapter summaries for every chapter of their chosen book. Students are required to submit 2 reading reports during the semester. Each reading report will consist of a summary of a specific chapter of the assigned reading. The summary should be written with the students' own words and should not exceed 300 words. The summary will be chosen at random and announced 24hrs before submission.

### Problem Sets

There will be 4 problem sets. Each problem set will be posted on bCourses every two weeks, starting today, and will be due by 5pm on the dates specified in the calendar. Each student must submit a digital copy of their solutions to Gradescope. Scanned/photographed versions of pen and paper are accepted. Dates are indicated in the calendar below.

- Problem Set 1 - Friday July 1st - 5pm
- Problem Set 2 - Friday July 8th - 5pm
- Problem Set 3 - Friday July 22nd - 5pm
- Problem Set 4 - Friday August 12th - 5pm

### Final Exam

All the materials covered in the lectures. Similar to the midterms, questions related to the material covered in the last lecture (before review) will be more conceptual and will not expect the student to prepare with any material other than their lecture notes (of the last lecture).

## Grading

Course grades will be based on: Midterm Exams (30%, 15% each), Book Summaries (20%, 10% each), Final Exam (30%), Problem Sets (20%, 5% each). No credit will be given for late problem sets.

## Tentative Schedule

### Week 1: June 20th - 24th; Read Introduction of Mastering Metrics (MM)

- M: Holiday
- T: Econometrics and the Evidence-to-Policy pipeline
- W: Random variables and probability distribution/density functions
- Th: Expectation/Mean & Standard deviation/standard error

### Week 2: June 27th - July 1st; Ch 1 of MM

- M: Sampling - Law of large numbers and central limit theorem
- T: Thinking conditionally: Conditional Expectation/Mean
- W: Selection bias
- Th: Experimental ideal - Potential outcomes and Randomized Controlled Trials I
- **Friday, July 1st, 5pm: Submit PS 1**

### Week 3: July 4th - July 8th; Ch 1 of MM

- M: Holiday
- T: Randomized Controlled Trials II
- W: Hypothesis tests: t-statistic, p-value & p-hacking
- **Th: Midterm 1**

### Week 4: July 11th - July 15th; Ch 2 of MM

- M: 45 Min Discussion on midterm + Something fun
- T: Regression I - Conditioning
- W: Regression II - Residuals
- Th: Regression III- Interpreting coefficients (levels, logs, and binary vars)
- **Friday, July 15th, 5pm: Submit PS 2**

### Week 5: July 18th - July 22nd; Ch 2 of MM

- M: Omitted variable bias
- T: Measurement error
- W: Collinearity
- Th: External validity
- **Friday, July 22n, 5pm: Submit Chapter Summary 1**

### Week 6: July 25th - July 29th; Ch 3 of MM

- M: Slack
- **T: Midterm 2**
- W: 45 Min Discussion on midterm + Something fun
- Th: Instrumental Variables I
- **Friday, July 29th, 5pm: Submit PS 3**

**Week 7: August 1st - August 5th; Ch 4, 5 and 6 of MM**

- M: Instrumental Variables II
- T: Regression discontinuity
- W: Difference in Differences I
- Th: Difference in Differences II
- **Friday, August 5th, 5pm: Submit Chapter Summary 2**

**Week 8: August 8th - August 12th; Ch 7 of MM**

- M: Applying all the tools
- T: Non-standard topics: (i) Aggregation of evidence, and/or (ii) Narrative/exploratory approaches to causal questions (e.g, Desmond, Case & Deaton, Goldin, Sandel).
- W: Review
- **Th: Final**
- **Friday, August 12th, 5pm: Submit PS 4**