ARE 213 Applied Econometrics: Syllabus
Department of Agricultural and Resource Economics
UC Berkeley, Fall 2025

Lectures: Tue/Thu 4:10-5:30pm, 241 Giannini
Instructor: Kirill Borusyak (he/him)
Contact: k.borusyak@berkeley.edu
Office Hours: time TBA, 222 Giannini starting 2nd week of class, or by appointment
There are no GSIs or sections for this course.
Anonymous form for course feedback: https://forms.gle/CyTmLD3KZEcQyQqT9

Course Description

The goal of this course is for students to learn a set of statistical tools and research designs that are useful in conducting high-quality empirical research on topics in applied microeconomics and related fields. Since most applied economic research examines questions with direct policy implications, this course will focus on methods for estimating causal effects. This course differs from many other econometrics courses in that it is oriented towards applied practitioners rather than future econometricians. It therefore emphasizes research design (relative to statistical technique) and applications (relative to theoretical proofs), though it covers some of each.

Prerequisites

Since 2025, ARE 212 and ARE 213 form a sequence. Thus, it is **recommended** (but not required) to have taken ARE 212 before this class. In particular, we will go quickly over the potential outcomes model (which is underlying everything in the course!) and randomized controlled trials, and we will skip the "selection on observables" research design entirely. If you haven't studied those topics before, please study last year's lecture handouts posted online (parts A2 and B) or other similar materials as soon as possible.

The **requirement** is for the students to have sufficient background in econometric theory. Any of ARE 210/212 and ECON 240A/240B satisfy this requirement. Otherwise, students need to demonstrate that they are familiar with such concepts as (1) method of moments estimation, (2) nonparametric regression, and (3) the asymptotic variance of OLS under heteroskedasticity. A rule of thumb is that unless your classes have covered at least two out of these three, ARE213 is not for you. Exceptions can be made but all non-ARE students **must email me within a week from the first class** on how they satisfy the pre-requisite; please attach the syllabi of the relevant classes.

Assignments and Grading

You will be assigned around 4-6 problem sets. You must work cooperatively on the problem sets in groups (group sizes TBD) and submit them together as a group. Problem sets must be typed on a computer. They will cover theoretical material of the course as well as giving you an opportunity to apply the methods we discuss in real data. Detailed instructions will be

provided. Late problem sets will not be accepted. However, the lowest score among the problem sets will be dropped, no questions asked.

Your group will also make a short presentation (length TBD) on a recent empirical paper from a field of your interest, discussing it from the methodological point of view and criticizing it constructively. Detailed instructions will be provided.

There will also be an in-person final exam. Please see bCourses for example questions from the past. You can use a cheat sheet in the exam; specific instructions will be provided.

The total grade averages performance on problem sets (20% total), presentation (10%), and the final exam (70%).

Information regarding the schedule and location of the final exam will be available at https://registrar.berkeley.edu/scheduling/academic-scheduling/final-exam-guide-schedules. Please do not ask me when or where the final is. We assume no responsibility for erroneous information if you ask us when/where the final is, as any information we give you on this matter can only be weakly *less* accurate than what is on the Registrar website.

Statistical Software

For the empirical parts of the problem sets, you may use any software that you wish but Stata and R are recommended; Python should work for most analyses, too. Solutions will be posted in Stata. Some problem sets may require that you use more primitive commands, rather than the "canned" commands.

Readings and Textbooks

The course is not based on any one text. Readings for each topic are shown here (and may be updated during the course): link

Some useful textbooks are below. I recommend getting a physical or electronic copy of *Mostly Harmless Econometrics* (but it is not required).

- [*MHE*] Angrist, Joshua and Jorn-Steffen Pischke (2009). *Mostly Harmless Econometrics*. Princeton University Press.

- [*JW*] Wooldridge, Jeffrey (2002). *Econometric Analysis of Cross Section and Panel Data.* MIT Press. *(Or second edition from 2010, but references are currently given to the first edition)*

- [*IW*] Imbens, Guido and Jeffrey Wooldridge (2009). New developments in econometrics: Lecture notes. https://www.cemmap.ac.uk/resource/new-developments-in-econometrics/

- [*CT*] Cameron, A. Colin and Pravin Trivedi (2005). *Microeconometrics: Methods and Applications*. Cambridge University Press.

- *[SW]* Wager, Stefan (2024). *Causal Inference: A Statistical Learning Approach*. https://web.stanford.edu/~swager/causal_inf_book.pdf

- *[PD]* Ding, Peng (2025). *Linear Models and Extensions*. https://arxiv.org/abs/2401.00649

- *[SC]* Cunningham, Scott (2021). *Causal Inference: The Mixtape.* https://mixtape.scunning.com/

Course Outline:

A. Recap of regression and causality
    1. Key facts about regression. Statistical inference
    2. Potential outcomes and randomized control trials

B. ~~Selection on observables~~ *[Covered in ARE 212]*

C. Instrumental variables (IVs)
    1. IV mechanics. Weak instruments
    2. IV with treatment effect heterogeneity
    3. Examiner designs ("judge IVs")

D. Panel data methods
    1. Linear panel data methods
    2. Dynamic panels
    3. Canonical difference-in-differences (DiD) and event studies
    4. DiD with staggered adoption
    5. Nonlinear panel methods. Synthetic controls and factor models

E. Regression discontinuity (RD) designs
    1. RD basics: Sharp RD designs
    2. Extensions: Fuzzy RD, spatial RD, RD extrapolation, etc.

F. Spillovers and equilibrium effects
    1. Peer effects
    2. Formula instruments and recentering. Shift-share instruments

G. Miscellaneous topics: some subset of…
    1. Uncovering causal mechanisms
    2. Nonlinear models: Poisson regression, multinomial choice, quantile regression

3. Machine learning and causality
4. *Topics of your interest (email me in advance!)*

H. Student presentations

Academic Integrity

Please refer to UCB guidance on academic integrity: https://conduct.berkeley.edu/integrity/. If you are not clear about the expectations for completing an assignment or taking a test or examination, be sure to seek clarification from your instructor beforehand.

While collaborations with classmates outside your problem set group is allowed and encouraged, copying any solutions from them or from any other source (such as previous generations of students or instructor's solutions) is considered plagiarism and strictly prohibited.

GenAI Policy

Limited use of GenAI tools, such as ChatGPT, is permitted for take-home assignments (problem sets and the presentation). As a rule of thumb, no more than 20% of your answer to any question or subquestion can be produced by GenAI.

Permitted uses include:

- Uses similar to Google Search
- Correcting grammar and spelling
- Getting help with an error **your** code produces or a step in the proof that **you** are stuck with

Asking ChatGPT to solve any subquestion of the problem, whether theoretical and empirical, is not permitted. Please contact the instructor when in doubt.

Any substantive use of GenAI software (i.e., beyond grammar, spelling, and as a search engine) must be acknowledged. For instance, each block of code written fully or mostly by GenAI must be marked as such.

Students suspected of unpermitted use of GenAI may be asked to complete a written statement of academic integrity and an in-person interview to explain their work.

Classroom Climate

We are all responsible for creating a learning environment that is welcoming, inclusive, equitable, and respectful. If you feel that these expectations are not being met, please consult your instructors, or seek assistance from campus resources (please see Academic Accommodations).

Accommodations

Students with DSP accommodations should have the DSP office inform the instructor within the first three weeks of classes. In general it is logistically infeasible to grant last-minute requests for accommodations just prior to exams or assignment due dates. The purpose of academic accommodations is to ensure that all students have a fair chance at academic success. Disability, or hardships such as basic needs insecurity, uncertain documentation and immigration status, medical and mental health concerns, pregnancy and parenting, significant familial distress, and experiencing sexual violence or harassment, can affect one's ability to satisfy particular course requirements. Students have the right to reasonable academic accommodations, without having to disclose personal information to instructors, and thus arrangements should be made via DSP. For more information about accommodations, scheduling conflicts related to religious creed or extracurricular activities, please see Academic Accommodations.