ARE 213 Syllabus
Applied Econometrics

Department of Agricultural and Resource Economics
UC Berkeley, Fall 2023

Lectures: Tue/Thu 12:40-2pm, 141 Giannini

Instructor: Kirill Borusyak (he/him)
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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/ZV6GYcmCn3BBrLCj8

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

Students should have taken at least one PhD-level econometrics course at the level of ARE 210 and 212. In Economics the equivalent level of preparation would be ECON 240A and 240B. Other courses are counted if and only if they cover GMM estimation and derivation of the asymptotic variance of OLS under heteroskedasticity (please attach the syllabus). All non-ARE students must email me with the information on how they satisfy the pre-requisite within a week from the first class.

Assignments and Grading

You will be assigned problem sets (number TBD). You must work cooperatively on the problem sets in groups of 3 to 5 and submit them together as a group. Problem sets must be typed on a computer. 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.

There will also be a final examination. Grades will be based on performance on problem sets (30% total), final exam (65%), and class participation (5%).

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

You may use any software that you wish but Stata and R are recommended. Problem set solutions will be posted in Stata. In some problem sets it will be required that you use more primitive commands, rather than the "canned" commands.

Textbooks and Readings

The course is not based on any one text. Some useful (but a bit dated) texts 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.

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

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

- [*JW*] Wooldridge, Jeffrey (2002). *Econometric Analysis of Cross Section and Panel Data.* MIT Press.

Readings for each topic are shown here (and may be updated during the course): link

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.

Course Outline (* optional, time permitting)

A. Introduction: regression and causality (~4 hours)
    1. Key facts about regression
    2. Potential outcomes and randomized control trials

B. Selection on observables (~5 hours)
    1. Regression adjustment
    2. Propensity score methods

C. Panel data methods (10-12 hours)
    1. Linear panel data methods recap
    2. Canonical difference-in-differences (DiD) and event studies
    3. DiD with staggered adoption
    4. Synthetic control methods and factor models

D. Instrumental variables (IVs) (10-12 hours)
    1. Recap of IV mechanics. Weak instruments
    2. IV with treatment effect heterogeneity
    3. Control function approaches
    4. Examiner designs ("judge IVs")
    5. Shift-share IV designs
    6. Formula instruments and recentering. Parametric models of interference (spillovers)

E. Regression discontinuity (RD) designs (4-6 hours)
    1. Sharp and fuzzy RD designs
    2. RD extrapolation and RD aggregation
    3. Spatial RD

F. Miscellaneous topics
    1. Statistical inference: clustering, *bootstrap, *randomization inference
    2. Nonlinear models: Poisson regression, *quantile regression
    3. * More on interference

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