ARE 213 Syllabus
Applied Econometrics

Department of Agricultural and Resource Economics
University of California, Berkeley
Fall 2021

Lectures: Mon/Wed/Fri 1:00-2:00, 247 Cory
Section: Mon 12:00-1:00, 240 Mulford

Course Website: https://bcourses.berkeley.edu/

Instructor: Michael Anderson
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Office Hours: M 9:30-10:30 am, Th 10:30-11:30 am
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GSI: Joel Ferguson
Contact: joel_ferg@berkeley.edu
Office Hours: Th 12:00-1:00 pm, F 10:00-12:00 pm

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 be familiar with basic probability and statistics, matrix algebra, and the classical linear regression model at the level of ARE 212 (in Economics the equivalent level of preparation would be some strange combination of ECON 140, 141, 240A, and 240B).

Assignments and Grading

We will assign 5 to 7 problem sets during the course of the semester. You must work cooperatively on the problem sets in groups of 2 to 5. There will also be a final examination. Grades will be based on performance on problem sets (50%), final exam (45%), and class participation (5%). Late problem sets will incur a penalty of –10% per day late. The last problem set must be submitted on-time; it will not be accepted if late.

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 or the GSI 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 solutions for problem sets will be handed out in Stata and R. Demonstrations during lectures will also be conducted in Stata or R. In the long run, if you are doing applied microeconometrics, you will almost surely end up using one of these two packages. However, in some problem sets it will be recommended that you use Stata's or R's more primitive commands, or the Mata language, rather than the "canned" commands.

Textbooks and Notes

The course is not based on any one text, but Guido Imbens' formal econometrics notes (both from a previous iteration of ARE 213 and from a NBER econometrics course) will form a core reference. The course will also make reference to the three textbooks listed below. At a minimum, I recommend purchasing the *Mostly Harmless Econometrics* text. It is mostly harmless.

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

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

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

- [*WNE*] Imbens, Guido and Jeffrey Wooldridge (2007). *What's New In Econometrics*, NBER Summer Course.

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

1. Introduction

A. Ordinary Least Squares and Agnostic Regression (8/25 & 8/27)

CT Chapters 4.1 - 4.5.

JW Chapter 2.

AP Chapter 3.1.

Geiser, Saul and Maria Veronica Santelices. "Validity Of High-School Grades In Predicting Student Success Beyond The Freshman Year: High-School Record vs. Standardized Tests as Indicators of Four-Year College Outcomes." *Center for Studies in Higher Education Research and Occasional Paper Series CSHE.6.07*, 2007.

Hertenstein, Matt, Carrie Hansel, Alissa Butts, and Sarah Hile. "Smile Intensity in Photographs Predicts Divorce Later in Life." *Motivation and Emotion*, 2009, 33, 99–105.

*Mullainathan, Sendhil and Jann Spiess. "Machine Learning: An Applied Econometric Approach." *Journal of Economic Perspectives*, 2017, 31, 87–106.

B. Introduction to Causality and Research Design (8/30 & 9/1)

CT Chapter 2.

AP Chapters 1 - 2.

WNE Lecture 1, Section 2.

*Holland, Paul "Statistics and Causal Inference." *Journal of the American Statistical Association*, 1986, 81, 945–960.

*Rubin, Donald "Statistics and Causal Inference: Comment: Which Ifs Have Causal Answers?" *Journal of the American Statistical Association*, 1986, 81, 961–962.

Willer, Robb, Christabel Rogalin, Bridget Conlon, and Michael Wojnowicz. "Overdoing Gender: A Test of the Masculine Overcompensation Thesis." *American Journal of Sociology*, 2013, 118(4), 980–1022.

C. Cautionary Notes (9/3 & 9/8)

*Lalonde, Robert. "Evaluating Econometric Evaluations of Training Programs with Experimental Data." *American Economic Review*, 1986, 76, 604–620.

*Freedman, David. "Statistical Models and Shoe Leather." *Sociological Methodology*, 1991, 21, 291–313.

Scheiber, Noam. "Freaks and Geeks: How Freakonomics is Ruining the Dismal Science." *The New Republic*, 2007, April 2, 27–31.

2. Selection on Observables Designs

A. Regression Adjustment (9/10, 9/13, & 9/15)

CT Chapters 4.1 - 4.5.

AP Chapter 3.2.

WNE Lecture 1, Section 3.1.

JW Chapters 4, 18.3.1.

Yule, G. Udny. "An Investigation into the Causes of Changes in Pauperism in England, Chiefly During the Last Two Intercensal Decades (Part I.)." *Journal of the Royal Statistical Society*, 1899, 62, 249–295. (possibly the first published paper with multiple regression estimates)

Krueger, Alan. "How Computers Have Changed the Wage Structure: Evidence from Micro Data." *Quarterly Journal of Economics*, 1993, 108, 33–60.

*DiNardo, John and Jorn-Steffen Pischke. "The Returns to Computer Use Revisited: Have Pencils Changed the Wage Structure Too?" *Quarterly Journal of Economics*, 1997, 112, 291–303.

Altonji, Joseph, Todd Elder, and Christopher Taber. "Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools." *Journal of Political Economy*, 2005, 113, 151–184.

Belloni, Alexandre, Victor Chernozhukov, and Christian Hansen. "High-Dimensional Methods and Inference on Structural and Treatment Effects." *Journal of Economic Perspectives*, 2014, 28, 29–50.

CT Chapter 9.

Blundell, Richard and Alan Duncan. "Kernel Regression in Empirical Microeconomics." *The Journal of Human Resources*, 1998, 33, 62–87.

Cleveland, William. "Robust Locally Weighted Regression and Smoothing Scatterplots." *Journal of the American Statistical Association*, 1979, 74, 829–836.

B. Nonparametric regression (9/17, 9/20, & 9/22)

CT Chapter 9.

Blundell, Richard and Alan Duncan. "Kernel Regression in Empirical Microeconomics." *The Journal of Human Resources*, 1998, 33, 62–87.

Cleveland, William. "Robust Locally Weighted Regression and Smoothing Scatterplots." *Journal of the American Statistical Association*, 1979, 74, 829–836.

C.The Propensity Score and Dimensionality Reduction (9/24, 9/27, 9/29, & 10/1)

CT Chapter 25.4.

AP Chapter 3.3.

WNE Lecture 1, Sections 3.2 - 3.4 and 5 - 7.

JW Chapter 18.3.2.

Rosenbaum, Paul and Donald Rubin. "Reducing Bias in Observational Studies Using Subclassification on the Propensity Score." *Journal of the American Statistical Association*, 1984, 79, 516–524.

*Dehejia, Rajeev and Sadek Wahba. "Causal Effects in Non-Experimental Studies: Reevaluating the Evaluation of Training Programs." *Journal of the American Statistical Association*, 94, 1999, 1053–1062.

Arceneaux, Kevin, Alan Gerber, and Donald Green. "Comparing Experimental and Matching Methods Using a Large-Scale Voter Mobilization Experiment." *Political Analysis*, 2006, 14, 37–62.

Griffen, Andrew and Petra Todd. "Assessing the Performance of Nonexperimental Estimators for Evaluating Head Start." *Journal of Labor Economics*, 2017, 35, S7–S63.

*Shadish, William, M. H. Clark, and Peter Steiner. "Can Nonrandomized Experiments Yield Accurate Answers? A Randomized Experiment Comparing Random and Nonrandom Assignments." *Journal of the American Statistical Association*, 2008, 103, 1334–1356.

Dale, Stacy and Alan Krueger. "Estimating the payoff to attending a more selective college: An application of selection on observables and unobservables." *Quarterly Journal of Economics*, 2002, 117, 1491–1527.

Anderson, Michael. "The Benefits of College Athletic Success: An Application of the Propensity Score Design." *Review of Economics and Statistics*, 2017, 99, 119–134.

Imbens, Guido. "Matching methods in practice: Three examples." *Journal of Human Resources*, 2015, 50, 373–419.

3. Selection on Unobservables Designs

A. Panel Data Models

i. Classical Panel Data Models (10/4, 10/6, 10/8, & 10/11)

CT Chapter 21.

AP Chapter 5.1.

JW Chapter 10.

Griliches, Zvi and Jerry Hausman. "Errors in Variables in Panel Data." *Journal of Econometrics*, 1986, 31, 93–118.

Deschênes, Olivier and Michael Greenstone. "The Economic Impacts of Climate Change: Evidence from Agricultural Output and Random Fluctuations in Weather." *American Economic Review*, 2007, 97, 354–385.

Currie, Janet and Duncan Thomas. "Does Head Start Make a Difference?" *American Economic Review*, 1995, 85, 341–364.

Fernández-Val, Ivan and Martin Weidner. "Individual and time effects in nonlinear panel models with large N, T." *Journal of Econometrics*, 2016, 192(1), 291–312.

ii. Double/Triple Differences and Event Studies (10/13, 10/15 & 10/18)

CT Chapter 22.6, 25.5.

AP Chapter 5.2.

WNE Lecture 10.

Ashenfelter, Orley, and Michael Greenstone. "Using Mandated Speed Limits to Measure the Value of a Statistical Life." *Journal of Political Economy*, 2004, 112(1), S226–67.

Kellogg, Ryan and Hendrik Wolff. "Daylight Time and Energy: Evidence from an Australian Experiment." *Journal of Environmental Economics and Management*, 2008, 56, 207–220.

iii. Case Studies with Synthetic Controls (10/20 & 10/22)

Card, David. "The Impact of the Mariel Boatlift on the Miami Labor Market." *Industrial and Labor Relations Review*, 1990, 43, 245–257.

Card, David and Alan Krueger. "Minimum Wages and Employment: A Case Study of the Fast-food Industry in New Jersey and Pennsylvania." *American Economic Review*, 1994, 84, 487–496.

Abadie, Alberto, Alexis Diamond and Jens Hainmueller. "Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program." *Journal of the American Statistical Association*, 2010, 105, 493–505.

B. Instrumental Variables Models

i. The IV Estimator (10/25 & 10/27)

CT Chapter 4.8.

AP Chapter 4.1 - 4.3.

JW Chapter 5.

*Angrist, Joshua. "Lifetime Earnings and the Vietnam Era Draft Lottery: Evidence from Social Security Administrative Records." *American Economic Review*, 1990, 80, 313–336.

*Angrist, Joshua and Alan Krueger, "Instrumental Variables and the Search for Identification: From Supply and Demand to Natural Experiments." *Journal of Economic Perspectives*, 2001, 15, 69–86.

ii. Heterogeneous/Marginal Treatment Effects (10/29, 11/1, & 11/3)

CT Chapter 25.7.

AP Chapter 4.4 - 4.5, 4.6.3.

WNE Lecture 5.

JW Chapter 18.4.

Angrist, Joshua, Guido Imbens, and Donald Rubin. "Identification of Causal Effects Using Instrumental Variables." *Journal of the American Statistical Association*, 1996, 91, 444–455.

iii. 2SLS and Weak Instruments (11/5 & 11/8)

CT Chapter 4.9.

AP Chapter 4.6.4.

WNE Lecture 13.

*Angrist, Joshua and Alan Krueger. "Does Compulsory School Attendance Affect Schooling and Earnings?" *Quarterly Journal of Economics*, 1991, 106, 979–1014.

*Bound, John, David Jaeger, and Regina Baker. "Problems With Instrumental Variables Estimation When the Correlation Between the Instruments and the Endogenous Explanatory Variable Is Weak." *Journal of the American Statistical Association*, 1995, 90, 443–450.

Small, Dylan and Paul Rosenbaum. "War and Wages: The Strength of Instrumental Variables and Their Sensitivity to Unobserved Biases." *Journal of the American Statistical Association*, 2008, 103, 924–933.

iv. Control Function Approaches (11/10)

CT Chapter 25.3.4.

AP Chapter 4.6.1.

WNE Lecture 6.

Wooldridge, Jeffrey. "Control function methods in applied econometrics." *Journal of Human Resources,* 2015, 50, 420–45.

C. Regression Discontinuity Designs (11/12, 11/15, & 11/17)

CT Chapter 25.6.

AP Chapter 6.

WNE Lecture 3.

Thistlethwaite, Donald and Donald Campbell. "Regression-Discontinuity Analysis: An Alternative to the Ex Post Fact Experiment." *Journal of Educational Psychology*, 1960, 51, 309–317.

*Imbens, Guido and Thomas Lemieux. "Regression Discontinuity Designs: A Guide to Practice." *Journal of Econometrics*, 2008, 142, 615–635.

Gelman, Andrew and Guido Imbens. "Why High-order Polynomials Should not be Used in Regression Discontinuity Designs." *Journal of Business and Economic Statistics*, 2019, 37, 447–456.

Lee, David and Thomas Lemieux. "Regression Discontinuity Designs in Economics." *Journal of Economic Literature*, 2010, 48, 281–355.

Hoekstra, Mark. "The Effect of Attending the Flagship State University on Earnings: A Discontinuity-Based Approach." *Review of Economics and Statistics,* 2009, 91: 717–724.

McCrary, Justin. "Manipulation of the Running Variable In the Regression Discontinuity Design: A Density Test." *Journal of Econometrics*, 2008, 142, 698–714.

DiNardo, John and David Lee. "Economic Impacts of New Unionization on Private Sector Employers: 1984-2001." *Quarterly Journal of Economics*, 2004, 119, 1383–1441.

Anderson, Michael and Jeremy Magruder. "Learning from the Crowd: Regression Discontinuity Estimates of the Effects of an Online Review Database." *Economic Journal*, 2012, 122, 957–989.

Calonico, Sebastian, Matias Cattaneo, and Rocio Titiunik. "Robust Nonparametric Confidence Intervals for Regression-discontinuity Designs." *Econometrica*, 2014, 82, 2295–2326.

4. The Problem of Statistical Inference

A. Temporal and Spatial Dependence (11/19 & 11/22)

CT Chapter 24.5.

AP Chapter 8.2.

*Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan. "How Much Should We Trust Differences-in-Differences Estimates?" *Quarterly Journal of Economics*, 2004, 119, 249–275.

Cameron, Colin, Jonah Gelbach, and Doug Miller. "Robust Inference with Multi-way Clustering." *Journal of Business and Economic Statistics*, 2011, 29, 238–249.

Sjoquist, David, and John Winters. "Building the Stock of College-Educated Labor Revisited." *Journal of Human Resources*, 2012, 47, 270–285.

B. Randomization Inference (11/29)

Fisher, R. A. *The Design of Experiments*, 1980, Chapter 2. Oliver and Boyd.

Rosenbaum, Paul. "Interference Between Units in Randomized Experiments." *Journal of the American Statistical Association*, 2007, 102, 191–200.

*Anderson, Michael. "Multiple Inference and Gender Differences in the Effects of Early Intervention: A Reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects." *Journal of the American Statistical Association*, 2008, 103, 1481–1495.

C. Resampling (12/1)

CT Chapter 11.

Efron, Bradely and Robert Tibshirani. "Bootstrap Methods for Standard Errors, Confidence Intervals, and Other Measures of Statistical Accuracy." *Statistical Science*, 1986, 1, 54–75.

Cameron, Colin, Jonah Gelbach, and Doug Miller. "Bootstrap-Based Improvements for Inference With Clustered Errors." *Review of Economics and Statistics*, 2008, 90, 414–427.

D. Multiplicity Adjustment (12/3)

Anderson, Michael. "Multiple Inference and Gender Differences in the Effects of Early Intervention: A Reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects." *Journal of the American Statistical Association*, 2008, 103, 1481–1495.

*Bennett, Craig, Abigail Baird, Michael Miller, and George Wolford. "Neural Correlates of Interspecies Perspective Taking in the Post-Mortem Atlantic Salmon: An Argument for Multiple Comparisons Correction." *Journal of Serendipitous and Unexpected Results*, 2010, 1, 1–5.

5. Additional Topics (not covered in lecture)

A. Maximum Likelihood Estimation

CT Chapters 5.1 - 5.3, 5.6, 5.7.

JW Chapter 13.

B. Duration Models

CT Chapter 17.

JW Chapter 20.

Lancaster, Tony. "Econometric Methods for the Duration of Unemployment." *Econometrica*, 1979, 47, 939–956.