

Tools for Causal Inference

Version: April 3, 2018

Prof. Darin Christensen¹

¹ 6341 Public Policy
darinc@luskin.ucla.edu
(310) 825-7196

1 Course Information

- **Location:** Public Affairs 4371
- **Schedule:** TR, 2-3:15p
- **Office Hours:** W, 8-10:30a; F, by appointment.
- **Course Website:** piazza.com/ucla/spring2018/pp290dis1/home
- **Prerequisites:** This course assumes knowledge of multiple regression and a statistical software program (e.g., R or Stata).

2 Course Objectives

Everyone wants evidence-based policy. Yet, that's not a very precise bar: nearly every policy argument is based on some evidence. The more important and difficult question is determining whether (or under what assumptions) the evidence presented is credible. **The primary goal of this course is to make you a more critical consumer of empirical evidence.**

We accomplish that goal in several steps. After reviewing the purpose and objectives of impact (or program) evaluation, we briefly discuss common approaches: cross-sectional, before-after comparisons, and case studies of program beneficiaries. We discuss the strong assumptions that these methods require and how they are often violated in practice. Lest you become hopeless about our ability to evaluate impact, we then cover a suite of experimental and quasi-experimental approaches: randomized controlled trials, matching, regression discontinuities, difference-in-differences, and instrumental variables. These research designs rely on more defensible assumptions and, thus, permit more confident conclusions about what works. Time permitting, we end the course by discussing issues that affect all of these methods, including attrition, spillovers between comparison groups, and external validity.

We start by spotting problems with common approaches and end by exploring methods that help to solve these problems. That sequence is intentional. As this course proceeds, I will expect you to not just offer criticisms, but also ideas about how to improve the studies we read. Your future colleagues will appreciate your input more if you not only spot problems, but also help solve them.

3 Learning Goals

By the end of the quarter, you should be able to:

1. Identify and describe a selection problem;
2. Explain the intuition behind different experimental and quasi-experimental approaches to identifying causal effects;
3. Implement simple experimental or quasi-experimental designs in R or Stata.

These goals are ranked in order of importance — I care more about your ability to spot and articulate a selection problem than your coding skills.

4 Books

Joshua D Angrist and Jörn-Steffen Pischke. *Mastering 'Metrics: The Path from Cause to Effect*. Princeton University Press, December 2014 ²

² As of Dec. 2016, this was available for less than \$30 on Amazon.

Paul J Gertler, Sebastian Martinez, Patrick Premand, Laura B Rawlings, and Christel M J Vermeersch. *Impact Evaluation in Practice*. World Bank Group, September 2016 [[Link](#)]

5 Assignments and Grading

5.1 Participation (10%)

I expect that you'll attend every class (barring illness or another legitimate excuse), do the required readings in advance, and contribute to discussion. Posting links to relevant articles, posing questions, and commenting on the class website will also contribute to your participation grade.

5.2 2 "Blog" Posts (15%)

[~500 words each] In these short posts, I expect you to dissect a news article or report. Your post should (1) identify the causal claim made by the author (and the implied counter-factual), (2) discuss the evidence offered in support, and (3) raise concerns about the method used.

Due Dates: 04/10, 04/17; posted to the class discussion board by 11:59p. These will be evaluated on a scale of {✓-, ✓, ✓+}.

Abridged Example: An article reports that barefoot runners experience less knee pain (Causal Claim). The counter-factual is the knee

pain experienced by the same runner (running the same route) with and without shoes. The underlying study surveyed 25 shoe-wearing and 25 barefoot runners and asked them to report their knee pain on a scale from 1-10. The researchers found that pain was 10% lower among barefoot runners (Evidence). You, however, are concerned because barefoot runners may have higher pain tolerances. (They are, after all, running barefoot.) Second, you worry that barefoot running is more popular among young runners, who are less likely to report pain regardless of their footwear or lack thereof (Your Concerns).

5.3 Problem Sets (30%)

These problem sets allow you to apply the reasoning and coding skills we cover in class. They will typically provide data and ask you to perform some descriptive analysis and then implement a research design we discussed in class. I anticipate three problem sets focused on RCTs, matching (or RD), and difference-in-differences, respectively.

If you're working in R, all problem sets should be completed in R Markdown. If you're working in Stata, you can use markdown or Word to compile your problem sets. **All problem sets should be submitted as PDFs.** These will be evaluated on a scale of $\{\checkmark-, \checkmark, \checkmark+\}$.³

³ I will post detailed solutions online but cannot grade every problem. Please come to office hours if you have any questions.

5.4 Midterm (20%)

The midterm exam offers an opportunity to assess your progress on the learning goals. As such, part of the exam will test your problem solving skills; another component will ask you to perform empirical analysis. *The mid-term will be conducted during class time. However, you can take the exam from the location of your choice. You will need R or Stata to complete the exam.*

5.5 Final Exam (25%)

As with the midterm, this is an opportunity to evaluate your cumulative progress on the learning goals. You will need R or Stata to complete the exam.

6 Course Policies

6.1 Late Submissions

Homework assignments and final projects will be docked a letter grade for every day that they are late. For example, an A project submitted in the first 24 hours after the deadline will receive an B. If

that same project is submitted 24 to 48 hours after the deadline, the grade drops to a C.

6.2 Academic Accommodations

Academic Accommodations. Students needing academic accommodations based on a disability should contact the [Center for Accessible Education \(CAE\)](#). When possible, students should contact the CAE within the first two weeks of the term as reasonable notice is needed to coordinate accommodations. For more information visit.

6.3 Academic Integrity

Please review [UCLA's rules related to academic integrity](#).⁴ If you're feeling overwhelmed or are unsure about the collaboration policy, please speak with me; don't risk violating the honor code. Unfortunately, past MPP students have been investigated and punished by the Office of the Dean of Students.

⁴ <http://goo.gl/DCIwSN>

Collaboration Policy:

- **Blog Posts:** There is no collaboration on the blog posts. You are welcome to discuss ideas with classmates, but originality will be rewarded; very similar answers, penalized.
- **Problem Sets:** You can work with peers (in groups of four or less). However, you must write every line of code and text that appears in any assignment that you submit. In short, never copy code or use other students' words to describe your approach or results.
- **Midterm and Final Exams:** This is an individual assessment that helps us identify any knowledge gaps. I want to know what you know, so there's no collaboration.

7 Resources

7.1 Mental Health

Let Public Policy's Student Affairs Officer (SAO) [Annie Kim](#) know if you are having academic or personal problems that affect your ability to participate fully in your education. If you feel comfortable, let me know as well.

[UCLA Counseling and Psychological Services](#) offers services and programs in a confidential environment to promote mental health and wellness.

7.2 *Immigration*

The [Bruin Resource Center's \(BRC\) Undocumented Student Program](#) offers caring and personalized support to undergraduate and graduate undocumented students.

Even if you are not undocumented, you may be able to get legal help for a family member. The USP office provides immigration legal services to students and their family members through a partnership with the [UC Undocumented Legal Services Center](#).

7.3 *Software*

I will teach in R. However, everything I do can also be done in Stata. If you prefer to work in Stata and feel confident in your ability to do so without instruction, then you're welcome to use Stata throughout the course. *I will not troubleshoot Stata code.*

8 Course Schedule

Legend: ✱: Required; † Skim Abstract/Intro; ● Optional.

Two Notes:

- The readings are not long, but they are difficult and technical. I've assigned fewer pages to give you more time to work through the material.
- The technical readings often cover the same topics, but use different language or examples to explain the key concepts. It's often helpful to see concepts explained different ways. The Gertler et al. (2016) chapters tend to be shorter and focus more on the intuition; the Angrist and Pischke (2015) chapters are more thorough and offer more examples, but are also more technical. *You should read both.*

1 Purpose of Impact Evaluation (3 Classes)

1.1 Why do we care about impact evaluation? (4/3)

- ✱ Ch. 1. "Think Again, Again." Abhijit Banerjee and Esther Duflo. *Poor Economics*. PublicAffairs, 2012 [\[Link\]](#)
- ✱ Ch. 1. "Why Evaluate?" Gertler et al. (2016)

- The Evaluation Gap Working Group. When Will We Ever Learn? Improving Lives through Impact Evaluation. *CGD Working Paper*, May 2006 [\[Link\]](#)

1.2 Counterfactual Thinking: The Potential Outcome Model (4/5)

- ✱ Ch. 3. "Causal Inference and Counterfactuals." Gertler et al. (2016)
- † Paul J Ferraro. Counterfactual thinking and impact evaluation in environmental policy. In Matthew Birnbaum and Per Mickwitz, editors, *New Directions for Evaluation*, pages 75–84. Wiley Subscription Services, Inc., A Wiley Company, March 2009 [\[Link\]](#)
- ✱ Ch. 2, pp. 20-29. "Basic Issues of Evaluation." Shahidur R Khandker, Gayatri B Koolwal, and Hussain A Samad. *Handbook On Impact Evaluation*. The World Bank, Washington D.C., December 2009 [\[Link\]](#)

- Ch. 1 & 2, "The Counterfactual Method" Stephen L Morgan and Christopher Winship. *Counterfactuals and Causal Inference*. Cambridge, 2007 [\[Link\]](#)

1.3 Individual and Average Treatment Effects (4/10)

- ⊕ Blog Post Due
- ✱ Intro, Ch. 1. *only* pp. xi-11. Angrist and Pischke (2015)

- Guido W Imbens and Donald B Rubin. Rubin causal model. In Steven N Durlauf and Lawrence E Blume, editors, *The New Palgrave Dictionary of Economics*, pages 1–15. 2008 [\[Link\]](#)

2 *Common (Often Confounded) Approaches (2 Classes)*

2.1 *The Design of Observational Studies (4/12)*

- * Paul R Rosenbaum. Dilemmas and Craftsmanship. In *Design of Observational Studies*, pages 3–20. Springer New York, New York, NY, October 2009 [\[Link\]](#)
- * Sections 4.3-4.4.1, starts with “Selection Bias.” Gary King, Robert O Keohane, and Sidney Verba. *Designing Social Inquiry: Scientific Inference in Qualitative Research*. Princeton University Press, 1994 [\[Link\]](#)
- * Michael A Clemens and Gabriel Demombynes. When Does Rigorous Impact Evaluation Make a Difference? The Case of Millennium Villages. *CGD Working Paper*, October 2010 [\[Link\]](#)

2.2 *Common Approaches (4/17)*

- ⊕ Blog Post Due
- * (Read Part 1, skim Part 2.) Part 1, “M&E concepts and considerations.” International Federation of Red Cross and Red Crescent Societies. Project/programme monitoring and evaluation (M&E) guide. Technical report, 2011 [\[Link\]](#)
- * NGO Case Study Guides:
 - “How to write a Case Study: Guide for NGOs” [\[Link\]](#)
 - “Writing good case studies: seven top tips” [\[Link\]](#)

- † Jasjeet S Sekhon. Quality Meets Quantity: Case Studies, Conditional Probability, and Counterfactuals. *Perspectives on Politics*, 2(2):281–293, June 2004 [\[Link\]](#)

3 *Randomized Experiments (2 Classes)*

3.1 *Randomized Experiments: Logic (4/19)*

- * Ch. 4, “Randomized Assignment.” Gertler et al. (2016)
- * Ch. 1, “Randomized Trials.” Angrist and Pischke (2015)

- Ch. 1 & 2. Alan S Gerber and Donald P Green. *Field Experiments: Design, Analysis, and Interpretation*. W. W. Norton, 2012 [\[Link\]](#)

3.2 Randomized Experiments: Applications (4/24)

- ★ Alan S Gerber, Donald P Green, and Christopher W Larimer. Social Pressure and Voter Turnout: Evidence from a Large-Scale Field Experiment. *American Political Science Review*, 102(01):33–48, February 2008 [[Link](#)]
- † Benjamin A Olken. Monitoring Corruption: Evidence from a Field Experiment in Indonesia Benjamin A. Olken. *Journal of Political Economy*, 115(2):200–249, April 2007 [[Link](#)]
- † Katherine Casey, Rachel Glennerster, and Edward Miguel. Reshaping Institutions: Evidence on Aid Impacts Using a Preanalysis Plan. *Quarterly Journal of Economics*, pages 1755–1812, 2012 [[Link](#)]

- Johannes Haushofer and Jeremy Shapiro. The Short-term Impact of Unconditional Cash Transfers to the Poor: Experimental Evidence from Kenya. *Working Paper*, April 2016 [[Link](#)]
- Raj Chetty, Nathaniel Hendren, and Lawrence Katz. The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Project. *American Economic Review*, 106(4), 2016 [[Link](#)]
- Daniel E Ho and Kosuke Imai. Estimating Causal Effects of Ballot Order from a Randomized Natural Experiment: The California Alphabet Lottery, 1978–2002. *Public Opinion Quarterly*, 72(2):216–240, 2008 [[Link](#)]

4 Matching (2 Classes)

4.1 Matching: Logic (4/26)

- ★ Ch. 8, “Matching.” Gertler et al. (2016)
- ★ Ch. 2, “Regression.” Angrist and Pischke (2015)

- Ch. 4, “Matching Estimators of Causal Effects.” Stephen L Morgan and Christopher Winship. *Counterfactuals and Causal Inference*. Cambridge, 2007

4.2 Matching: Applications (5/1)

- ★ Christopher Blattman and Jeannie Annan. The Consequences of Child Soldiering. *The Review of Economics and Statistics*, 92(4):882–898, November 2010 [[Link](#)]
- † Maya Sen. How judicial qualification ratings may disadvantage minority and female candidates. *Journal of Law and Courts*, 2(1):33–65, 2014 [[Link](#)]
- † Carolyn Heinrich, Alessandro Maffioli, and Gonzalo Vazquez. A Primer for Applying Propensity-Score Matching. *IDB Impact-Evaluation Guidelines*, 2010 [[Link](#)]

Michael J Gilligan and Ernest J Sergenti. Do UN Interventions Cause Peace? Using Matching to Improve Causal Inference. *Quarterly Journal of Political Science*, 3:89–122, August 2008 [[Link](#)]

- Alberto Abadie, Alexis Diamond, and Jens Hainmueller. Comparative Politics and the Synthetic Control Method. *American Journal of Political Science*, 59(2):495–510, February 2015 [[Link](#)]

5 *Mid-Term* (5/3)

6 *Regression Discontinuity* (2 Classes)

6.1 *Regression Discontinuity: Logic* (5/8)

- ★ Ch. 6, “Regression Discontinuity Design.” Gertler et al. (2016)
- ★ Ch. 4, “Regression Discontinuity Designs.” Angrist and Pischke (2015)

- Christopher Skovron and Rocio Titiunik. A Practical Guide to Regression Discontinuity Designs in Political Science. *Working Paper*, October 2015 [[Link](#)]

6.2 *Regression Discontinuity: Applications* (5/10)

- ★ Robert S Erikson and Rocio Titiunik. Using Regression Discontinuity to Uncover the Personal Incumbency Advantage. *Quarterly Journal of Political Science*, 10(1):101–119, May 2015 [[Link](#)]
- † Daniel J Hopkins. Translating into Votes: The Electoral Impacts of Spanish-Language Ballots. *American Journal of Political Science*, 55(4):814–830, October 2011 [[Link](#)]
- † Melissa Dell. The Persistent Effects of Peru’s Mining Mita. *Econometrica: Journal of the Econometric Society*, 78(6):1863–1903, 2010 [[Link](#)]

- Jonathan S Krasno and Donald P Green. Do Televised Presidential Ads Increase Voter Turnout? Evidence from a Natural Experiment. *Journal of Politics*, 70(1):245–261, January 2008 [[Link](#)]
- Elisabeth R Gerber and Daniel J Hopkins. When Mayors Matter: Estimating the Impact of Mayoral Partisanship on City Policy. *American Journal of Political Science*, 55(2):326–339, April 2011 [[Link](#)]

7 *Difference-in-Differences* (2 Classes)

7.1 *Difference-in-Differences: Logic* (5/15)

- ★ Ch. 7, “Difference-in-Differences.” Gertler et al. (2016)
- ★ Ch. 5, “Difference-in-Differences.” Angrist and Pischke (2015)

- Marianne Bertrand, Esther Duflo, and Sendhil Mullainathan. How Much Should We Trust Differences-In-Differences Estimates? *The Quarterly Journal of Economics*, 119(1):249–275, February 2004 [[Link](#)]

7.2 Difference-in-Differences: Applications (5/17)

- ★ David Card and Alan Krueger. Minimum Wages and Employment: A Case Study of the Fast Food Industry in New Jersey and Pennsylvania. *American Economic Review*, 84(4), September 1994 [\[Link\]](#)
- † Arindrajit Dube, Oeindrila Dube, and Omar Garcia-Ponce. Cross-Border Spillover: U.S. Gun Laws and Violence in Mexico. *American Political Science Review*, 107(3):397–417, August 2013 [\[Link\]](#)
- † Jason Lyall. Does Indiscriminate Violence Incite Insurgent Attacks? Evidence from Chechnya. *Journal of Conflict Resolution*, 53(3):331–362, June 2009 [\[Link\]](#)

- Darin Christensen. Concession Stands: How Mining Investments Incite Protest in Africa. *International Organization*, 2018 [\[Link\]](#)

8 Instrumental Variables (2 Classes)

8.1 Instrumental Variables: Logic (5/22)

- ★ Ch. 5, “Instrumental Variables.” Gertler et al. (2016)
- ★ Ch. 3, “Instrumental Variables.” Angrist and Pischke (2015)

- Angus Deaton. Instruments, Randomization, and Learning about Development. *Journal Economic Literature*, 48:424–455, June 2010 [\[Link\]](#)
- Guido W Imbens. Better LATE Than Nothing: Some Comments on Deaton (2009) and Heckman and Urzua (2009). *Journal of Economic Literature*, 48(2):399–423, June 2010 [\[Link\]](#)

8.2 Instrumental Variables: Applications (5/24)

- ★ (Famous Paper) Daron Acemoglu, Simon Johnson, and James A Robinson. The Colonial Origins of Comparative Development: An Empirical Investigation. *The American Economic Review*, 91(5): 1369–1401, December 2001 [\[Link\]](#)
- † Holger L Kern and Jens Hainmueller. Opium for the Masses: How Foreign Media Can Stabilize Authoritarian Regimes. *Political Analysis*, 17(4):377–399, October 2009 [\[Link\]](#)
- † Emiliano Huet-Vaughn. Quiet Riot: Estimating a Causal Effect of Protest Violence. *Working Paper*, pages 1–41, August 2015 [\[Link\]](#)

- (Critique of Data Used in Famous Paper) David Y Albouy. The Colonial Origins of Comparative Development: An Empirical Investigation: Comment. *American Economic Review*, 102(6):3059–3076, October 2012 [\[Link\]](#)

9 *Common Problems* (5/29)

- * Ch. 9, "Addressing Methodological Challenges." Gertler et al. (2016)
- * Ch. 7, "Threats." Rachel Glennerster and Kudzai Takavarasha. *Running Randomized Evaluations: A Practical Guide*. Princeton University Press, 2013

† Tessa Bold, Mwangi Kimenyi, Germano Mwabu, Alice Nganga, and Justin Sandefur. Scaling Up What Works: Experimental Evidence on External Validity in Kenyan Education. *CGD Working Paper*, March 2013 [[Link](#)]

10 *TBD* (5/31)

11 *Review* (6/5)

12 *Final Exam* (6/7)