

Syllabus

POLI 273: Causal Inference, Spring 2020

Professor: Kirk Bansak
Teaching Assistant: Mackenzie Lockhart

Time & Room

Class: Thursday, 3:00 - 5:50pm Pacific Time
Section: TBD

Professor: Kirk Bansak

Contact: kbansak@ucsd.edu
Office Hours: Wednesday, 9:00am - 12:00pm (sign-up details below)

TA: Mackenzie Lockhart

Contact: mwlockha@ucsd.edu
Office Hours: Tuesday, 9:00am - 11:00am (or by appointment)

1 Overview

This is part of the course sequence on quantitative political methodology—the application of statistical methods to problems in political science and public policy. The goal of the course sequence is to teach you (1) to understand and (2) to confidently apply a variety of statistical methods and research designs that are essential for political science and public policy research.

Building on the previous courses, which covered math, probability, linear regression, and other statistical models, this class provides a survey of more advanced empirical tools for political science research. The focus is on statistical methods for causal inference, i.e. methods designed to address research questions that concern the impact of some potential cause (e.g. an intervention, a change in institutions, economic conditions, government policies) on some outcome (e.g. vote choice, income, election results, levels of violence).

We cover a variety of causal inference designs and methods. These include experiments, matching, regression, difference-in-differences, panel methods, synthetic control methods, instrumental variable estimation, regression discontinuity designs, power analysis, and sensitivity analysis.

We will analyze the strengths and weaknesses of these methods, and throughout the course we will illustrate the methods with applications drawn from various fields, including political science, public policy, economics, public health, and sociology. The ultimate goal of this course is to provide students with adequate methodological skills for conducting causal empirical research in their own fields of substantive interest.

1.1 Prerequisites

A willingness to work hard on possibly unfamiliar material is key. In addition to introductory statistics and probability, we assume that you have a reasonably good knowledge of linear regression (meaning that you probably should have taken at least one graduate class on this subject, such as POLI 204B). Knowledge of the maximum likelihood method is useful, but not required.

Students are also expected to be reasonably proficient in the statistical software R. We will allow the use of other software packages that you may be more familiar with. However, the teaching staff will only provide

support in R, all in-class coding examples/exercises will be in R, and there will be questions on problem sets and exams that require coding up functions, running simulations, and performing other tasks for which other software may not necessarily be well-suited.

1.2 Class Requirements

Readings

The syllabus lists the required readings. This required reading should be completed prior to lecture in a given week. Students are expected to read the material very carefully. You may even find it helpful to read the material multiple times.

Problem Sets

This is a methodological course in which you will develop skills in understanding and applying statistical methods. You can only learn statistics by doing statistics, and therefore you will be required to complete weekly problem sets. The problem sets are intensive and consist of analytical problems, computer simulations, and data analysis. Problem sets will be graded on a (+,√,-) scale.

Problem sets should be completed and submitted using **R Markdown**, a markup language for producing well-formatted HTML documents with embedded R code and text (including \LaTeX outputs). **R Markdown** requires installation of the `knitr` package. We recommend using **RStudio**, an IDE for R, which is set up well for the creation of **R Markdown** documents.

More about **RStudio** can be found here:
<http://www.rstudio.com/>

R Markdown can be found here:
<http://rmarkdown.rstudio.com/>

We encourage students to work together on the assignments, but you always need to write your own solutions, and we ask that you make a solo effort at all the problems before consulting others. In particular, you should not copy someone else's answers or computer code. We also ask that you write the names of your co-workers on your assignments. For analytical questions, you should include your intermediate steps, as well as comments on those steps when appropriate. For data analysis questions, include annotated code as part of your answers. All results should be presented so that they can be easily understood.

Exams

There will be a final exam and a midterm exam. You are required to work on both exams alone.

The midterm exam is a timed take-home exam. You will have flexibility in terms of when you begin the exam. However, once you begin, you will have a pre-specified amount of time to complete the exam.

The final exam will consist of a week-long take-home exam that is similar to a more extensive problem set.

Grading

Grades will be based on:

- Homework assignments (35% of final grade)
- Midterm exam (30% of final grade)
- Final exam (35% of final grade)

2 Logistics

2.1 Class Meetings

All class meetings will be conducted online at our scheduled class time (Thursday 3:00pm - 5:50pm Pacific Time) via the video-conferencing platform Zoom. It is recommended that everyone tries to connect through our Zoom link in advance of our first class meeting to ensure the software is working properly.

In addition, all class meetings will be recorded and posted on our `canvas.ucsd.edu` page. However, students are highly encouraged to attend class at the scheduled meeting time in order to have the opportunity to participate and ask questions in real time. Individuals who do not want to have their surroundings visible are encouraged to use Zoom's virtual background feature, if feasible, or to participate without video. Please also be mindful of others who may not wish to be visible or recorded in the background.

2.2 Recitation Sections

Weekly recitation sections will be held. The section will cover a review of the theoretical material and also provide help with computing issues. The TA will run the sections and can give more detail.

2.3 Office Hours

I will hold office hours from 9:00am to 12:00pm Pacific Time on Wednesdays via Zoom. Please make sure to sign up for office hours in advance using the following Cal-endly link. If you would like to meet but have class during my office hours, please email me to arrange an alternative time.

2.4 Teaching Assistant

Mackenzie Lockhart (mwlockha@ucsd.edu) will be the teaching assistant for this course. He will be holding office hours on Tuesdays from 9:00am to 11:00am Pacific Time via Zoom. Mac's office hours will be on a first-come, first-served basis. If you cannot make this time, please contact him by email to coordinate a different time.

2.5 Course Website

As our primary course website, we will use Piazza.

You can sign up on the Piazza course page directly from the above address. There are also free Piazza apps for mobile devices.

We will distribute course materials, including lecture slides and problem sets on our Piazza website. There is also a question-and-answer platform that is easy to use and designed to get you answers to questions quickly. It supports code formatting, embedding of images, and attaching of files.

If you have non-personal questions related to course material or logistics, we encourage you to post these questions on Piazza rather than emailing the course instructors. Using Piazza will allow students to see and

learn from other students' questions. Course instructors will regularly check the board and answer questions posted, although everyone else is also encouraged to contribute to the discussion and help answer questions. Participating on the Piazza forum, in addition to attending recitation sections and office hours, is a valuable way to supplement your own learning of the course material. Please be respectful and constructive in your participation on the forum.

In addition, we will also use our `canvas.ucsd.edu` page for a few select functions, including to record/access grades and post lecture recordings.

2.6 Computation

In this course we will exclusively use [R](#).

2.7 Required Books

- *Most required readings are from the following two textbooks:*
 - Angrist, Joshua D. and Jörn-Steffen Pischke. 2009. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press. (A standard reference for applied researchers for most topics covered in the first part of the course.)
 - Morgan, Stephen L. and Christopher Winship. 2015. *Counterfactuals and Causal Inference: Methods and Principles for Social Research*, **Second Edition**. Cambridge University Press. (This is the second edition of a standard reference for applied researchers for most topics covered in the first part of the course. There are considerable differences between the first and second edition. The assigned readings correspond to the second edition.)

Useful Summary Articles

- *The following papers summarize the main methods learned in this course. They are dense and detailed, and you might not understand all of the details the first time you read through them. However, if you plan to conduct applied empirical work that involves causal inference, you should revisit these again and again as reference.*
 - Guido W. Imbens and Jeffrey Wooldridge. 2008. [Recent Developments in the Econometrics of Program Evaluation](#). NBER Working Paper No. 14251.
 - Joshua D. Angrist and Alan B. Krueger. 1999. [Empirical Strategies in Labor Economics](#). In Handbook of Labor Economics, ed. O. Ashenfelter and D. Card: Elsevier Science.
 - Susan Athey and Guido W. Imbens. 2017. [The State of Applied Econometrics: Causality and Policy Evaluation](#). *Journal of Economic Perspectives* 31(2): 3–32.

Optional Books

- *The following books are optional but may prove useful for additional coverage of some of the course topics.*
- *Causal Inference*
 - Imbens, Guido and Donald B. Rubin. 2015. *Causal Inference for Statistics, Social, and Biomedical Sciences: An Introduction*. 1st Edition. Cambridge University Press.
 - Rosenbaum, Paul R. 2009. *Design of Observational Studies*. Springer Series in Statistics.
 - Rosenbaum, Paul R. 2002. *Observational Studies*. Springer-Verlag. 2nd edition.
 - Pearl, Judea. 2009. *Causality: Models, Reasoning, and Inference*. New York: Cambridge University Press. 2nd edition.

- Manski, Charles F. 1995. *Identification Problems in the Social Sciences*. Cambridge: Harvard University Press.
- *Experiments*
 - Gerber, Alan S., and Donald P. Green. 2012. *Field Experiments*. W. W. Norton.
- *Matching*
 - Rubin, Donald. 2006. *Matched Sampling for Causal Effects*. Cambridge University Press.
- *Panel Methods*
 - Wooldridge, Jeffrey. 2010. *Econometric Analysis of Cross Section and Panel Data*, 2nd ed. MIT Press.

3 Tentative Course Schedule

The following is a preliminary schedule of the assignments and topics we will cover in this course. More details on each topic and the associated readings can be found in the Course Outline section.

| | | |
|---------|---|-------------------------|
| Week 1 | Introduction and Potential Outcomes Model | PS1 out |
| Week 2 | Randomized Experiments | PS1 in; PS2 out |
| Week 3 | Randomized Experiments | PS2 in; PS3 out |
| Week 4 | Causal Effects under Selection on Observables <i>Subclassification, Matching</i> | PS3 in; PS4 out |
| Week 5 | Causal Effects under Selection on Observables <i>Propensity Scores, Regression</i> | PS4 in |
| Week 6 | Causal Effects under Selection on Time-Invariant Unobservables <i>Difference-in-Differences</i> | Midterm; PS5 out |
| Week 7 | Causal Effects under Selection on Time-Invariant Unobservables <i>Panel Methods, Synthetic Control Methods</i> | PS5 in; PS6 out |
| Week 8 | Additional Designs and Methods <i>Instrumental Variables</i> | PS6 in; PS7 out |
| Week 9 | Additional Designs and Methods <i>Regression Discontinuity Design</i> | PS7 in; PS8 out |
| Week 10 | Distributional Effects | PS8 in |
| Week 11 | Final Exam Week | Final |

4 Course Outline

The following is an outline of course topics. Notice that required readings are marked with a (★).

4.1 Introduction

- Overview, Course Requirements, Course Outline

4.2 The Potential Outcome Model

- Counterfactual Responses and the Fundamental Identification Problem
- Estimands and Assignment Mechanisms
- Heterogeneity and Selection

Readings

- Morgan and Winship: Chapter 1-2. (★)
- Angrist and Pischke: Chapter 1. (★)
- Holland, Paul W. 1986. *Statistics and Causal Inference*. *Journal of the American Statistical Association* 81(396): 945-960. (★)
- Sekhon, Jasjeet S. 2004. *Quality Meets Quantity: Case Studies, Conditional Probability and Counterfactuals*. *Perspectives on Politics* 2 (2): 281-293.

4.3 Randomized Experiments

4.3.1 Theory

- Identification of Causal Effects under Randomization
- Implementation, Estimation, Diagnostics, Blocking
- Threats to Validity

4.3.2 Statistical Inference

- Variance Estimation under the Neyman Model
- Inference for Clustered Designs
- Randomization Inference
- The Bootstrap
- Power Analysis

Readings: Theory and Inference in Experiments

- Angrist and Pischke: Chapter 2. (★)
- Angrist and Pischke: Chapter 8. (★)
- Athey, Susan, and Guido W. Imbens. 2016. *The Econometrics of Randomized Experiments*.
- Rosenbaum, Paul R. 2002. *Observational Studies*. Springer-Verlag. 2nd edition. Chapter 2.
- Gerber, Alan S., and Donald P. Green. 2012. *Field Experiments*. W. W. Norton. Chapters 2 - 4.

- Neyman, Jerzy. 1923 [1990]. **On the Application of Probability Theory to Agricultural Experiments. Essay on Principles. Section 9.** *Statistical Science* 5 (4): 465-472. Trans. Dorota M. Dabrowska and Terence P. Speed.
- Lin, Winston. 2013. **Agnostic Notes on Regression Adjustments to Experimental Data: Reexamining Freedman's Critique.** *The Annals of Applied Statistics* 7(1): 295-318.
- Cameron, A. C., Gelbach, J. B., and Miller, D. L. 2008. **Bootstrap-Based Improvements for Inference with Clustered Errors.** *Review of Economics and Statistics*, 90(3), 414-427.

Readings: Application of Experiments

- Olken, Benjamin. 2007. **Monitoring corruption : Evidence from a field experiment in Indonesia.** *Journal of Political Economy* 115 (2): 200-249.
- Gerber, Alan S., Donald P. Green and Christopher W. Larimer. 2008. **Social Pressure and Voter Turnout: Evidence from a Largescale Field Experiment.** *American Political Science Review* 102 (1): 1-48. (★)
- Wantchekon, Leonard. 2003. **Clientelism and Voting Behavior: Evidence from a Field Experiment in Benin** *World Politics* 55 (3), April: 399-422.
- Chattopadhyay, Raghavendra and Esther Dufo. 2004. **Women as Policy Makers: Evidence from a Randomized Policy Experiment in India.** *Econometrica*, 72 (5): 1409-1443.
- Bansak, Kirk, Jens Hainmueller, and Dominik Hangartner. 2016. **How Economic, Humanitarian, and Religious Concerns Shape European Attitudes Toward Asylum Seekers.** *Science* 354 (6309): 217-222.

Readings: Application of Natural Experiments

- Hyde, Susan D. 2007. **The Observer Effect in International Politics: Evidence from a Natural Experiment.** *World Politics* 60(1): 37-63. (★)
- Ferraz, Claudio, and Federico Finan. 2008. **Exposing Corrupt Politicians: The Effects of Brazil's Publicly Released Audits on Electoral Outcomes.** *Quarterly Journal of Economics* 123(2): 703-45.
- Ho, Daniel E., and Kosuke Imai. 2008. **Estimating Causal Effects of Ballot Order from a Randomized Natural Experiment: The California Alphabet Lottery, 1978-2002.** *Public Opinion Quarterly* 72(2): 216-40.
- Dunning, Thad. 2012. *Natural Experiments in the Social Sciences: A Design-Based Approach.* New York: Cambridge University Press.

Readings: Review Articles

- Palfrey, Thomas. 2009. **Laboratory Experiments in Political Economy.** *Annual Review of Political Science* 12: 379-388.
- Druckman, James N., Donald P. Green, James H. Kuklinski, and Arthur Lupia. 2006. **The Growth and Development of Experimental Research in Political Science.** *American Political Science Review* 100(4): 627-635.
- Green, Donald P., Peter M. Aronow, and Mary C. McGrath. 2012. **Field Experiments and the Study of Voter Turnout.** *Journal of Elections, Public Opinion & Parties*: 1-22.
- Humphreys, Macartan, and Jeremy Weinstein. 2009. **Field Experiments and the Political Economy of Development.** *Annual Review of Political Science* 12: 367-378.
- Harrison, Glenn and John A. List. 2004. **Field Experiments.** *Journal of Economic Literature*, XLII: 1013-1059.

- List, John A., and Steven Levitt. 2006. [What Do Laboratory Experiments Tell Us About the Real World?](#) University of Chicago and NBER.
- Gaines, Brian J., and James H. Kuklinski. 2007. [The Logic of the Survey Experiment Reexamined.](#) *Political Analysis* 15: 1-20.

Readings: Methodological Guides

- Duflo, Esther, Abhijit Banerjee, Rachel Glennerster, and Michael Kremer. 2006. [Using Randomization in Development Economics: A Toolkit.](#) *Handbook of Development Economics*.
- Bloom, Howard S. 2008. “The Core Analytics of Randomized Experiments for Social Research.” In *The SAGE Handbook of Social Research Methods*, eds. Pertti Alasuutar, Leonard Bickman, and Julia Brannen. London: SAGE.
- Bruhn, Miriam, and David McKenzie. 2009. [In Pursuit of Balance: Randomization in Practice in Development Field Experiments.](#) *American Economic Journal: Applied Economics* 1(4): 200-232.
- Glennerster, Rachel and Kudzai Takavarasha. 2013. *Running Randomized Experiments: A Practical Guide.* Princeton University Press.
- Abadie, Alberto, Athey, Susan, Imbens, Guido, and Jeffrey Wooldridge. 2017. [When Should You Adjust Standard Errors for Clustering?.](#) *arXiv:1710.02926*

4.4 Causal Effects under Selection on Observables

4.4.1 Theory

- Identification under Selection on Observables
- Subclassification

Readings

- Morgan and Winship: Chapters 3-4. (★)
- Rubin, Donald B. 2008. [For Objective Causal Inference, Design Trumps Analysis.](#) *Annals of Applied Statistics* 2(3): 808-840.
- Rosenbaum, Paul R. 2002. *Observational Studies.* Springer-Verlag. 2nd edition. Chapter 3.
- Rosenbaum, Paul R. 2005. [Heterogeneity and Causality: Unit Heterogeneity and Design Sensitivity in Observational Studies.](#) *The American Statistician* 59: 147-152.
- Acemoglu, Daron. 2005. [Constitutions, Politics, and Economics: A Review Essay on Persson and Tabellini’s The Economic Effects of Constitutions.](#) *Journal of Economic Literature* XLIII: 1025-1048.
- Athey, Susan, and Guido W. Imbens. 2015. [A Measure of Robustness to Misspecification.](#) *American Economic Review* 105(5): 476–480.

4.4.2 Matching Methods

- Covariate Matching
- Balance Checks
- Properties of Matching Estimators

Readings: Matching Theory

- Morgan and Winship: Chapter 5. (★)

- Imbens, Guido. 2014. **Matching Methods in Practice: Three Examples**. *NBER Working Paper 19959*.
- Sekhon, Jasjeet S. 2009. **Opiates for the Matches: Matching Methods for Causal Inference**. *Annual Review of Political Science* 12: 487-508.(★)
- Ho, Daniel E., Kosuke Imai, Gary King, and Elizabeth A. Stuart. 2007. **Matching as Nonparametric Preprocessing for Reducing Model Dependence in Parametric Causal Inference**. *Political Analysis* 15: 199-236.
- Stuart, Elizabeth A. 2009. **Matching methods for causal inference: A review and a look forward**
- Rubin: Chapters 3 to 5.
- Rosenbaum, Paul R., 1995. *Observational Studies*. New York: Springer-Verlag. Chapter 3.
- Abadie, Alberto and Guido W. Imbens. 2006. **Large Sample Properties of Matching Estimators for Average Treatment Effects**, *Econometrica* 74: 235-267.
- Abadie, Alberto, and Guido W. Imbens. 2011. **Bias-Corrected Matching Estimators for Average Treatment Effects**. *Journal of Business & Economic Statistics* 29(1): 1-11.
- Imbens, Guido W. 2004. **Nonparametric Estimation of Average Treatment Effects under Exogeneity: A Review**. *Review of Economics and Statistics* 86 (1): 4-29.

Readings: Matching Applications

- Lyall, Jason. 2010. **Are Co-Ethnics More Effective Counter-Insurgents? Evidence from the Second Chechen War**. *American Political Science Review*, 104:1 (February 2010): 1-20.
- Gordon, Sanford and Gregory Huber. 2007. **The Effect of Electoral Competitiveness on Incumbent Behavior**. *Quarterly Journal of Political Science* 2(2): 107-138.
- Eggers, Andrew and Jens Hainmueller. 2009. **MPs for Sale? Estimating Returns to Office in Post-War British Politics**. *American Political Science Review*. 103 (4): 513-533.
- Gilligan, Michael J. and Ernest J. Sergenti. 2008. **Do UN Interventions Cause Peace? Using Matching to Improve Causal Inference**. *Quarterly Journal of Political Science* 3 (2): 89-122.
- Sekhon, J., and R. Titiunik. 2012. **When Natural Experiments Are Neither Natural nor Experiments**. *American Political Science Review* 106(1): 35-57.
- Sen, Maya. 2014. **How Judicial Qualification Ratings May Disadvantage Minority and Female Candidates**. *Journal of Law and Courts*. 2 (1): 33-65.

4.4.3 Propensity Score Methods

- Identification, Propensity Score Estimation, Matching on the Propensity Score, Weighting on the Propensity Score, Reweighting methods

Readings: Propensity Score Methods Theory

- Morgan and Winship: Chapter 5. (★)
- Rubin: Chapters 10, 11 and 14 (all with Paul R. Rosenbaum).
- Imbens, Guido W. 2004. **Nonparametric Estimation of Average Treatment Effects under Exogeneity: A Review**. *Review of Economics and Statistics* 86 (1): 4-29.
- Hainmueller, Jens. 2012. **Entropy Balancing for Causal Effects: A Multivariate Reweighting Method to Produce Balanced Samples in Observational Studies**. *Political Analysis* 20 (1): 25-46.

- Glynn, Adam, and Kevin Quinn. 2010. **An Introduction to the Augmented Inverse Propensity Weighted Estimator**. *Political Analysis* 18(1): 36-56.
- King, Gary and Richard Nielsen. 2019. **Why Propensity Scores Should Not Be Used for Matching**. *Political Analysis* 27(4): 435-454.

Readings: Propensity Score Methods Applications

- Rubin, Donald B. 2001. **Using Propensity Scores to Help Design Observational Studies: Application to the Tobacco Litigation**. *Health Services and Outcomes Research Methodology* 2 (3-4): 169-188.
- Blattman, Christopher. 2009. **From Violence to Voting: War and Political Participation in Uganda**. *American Political Science Review* 103 (2): 231-247.

4.4.4 Regression

- Agnostic Regression framework, Non-parametric Regression, Identification with Regression

Readings

- Angrist and Pischke: Chapter 3. (★)
- Morgan and Winship: Chapters 6-7. (★)
- Härdle, W and Linton, O. 1994. **Applied Nonparametric Methods**, in R. F. Engle and D. L. McFadden eds. *Handbook of Econometrics*, vol. 4. New York: Elsevier Science.
- White, H. 1980. **Using Least Squares to Approximate Unknown Regression Functions**. *International Economic Review* 21: 149-170.
- Hainmueller, J. and Hazlett, C. 2014. **Kernel Regularized Least Squares: Reducing Misspecification Bias with a Flexible and Interpretable Machine Learning Approach**. *Political Analysis* 22(2): 143-168. 2014.
- Abadie, Alberto, Athey, Susan, Imbens, Guido, and Jeffrey Wooldridge. 2020. **Sampling-based vs. Design-based Uncertainty in Regression Analysis**. *Econometrica* 88(1): 265-296.

4.4.5 Conclusion: Selection on Observables

- Can Non-Experimental Methods Recover Causal Effects?

Readings: Comparison of Experimental and Non-experimental Methods

- Dehejia, Rajeev H. and Sadek Wahba. 1999. **Causal Effects in Non-Experimental Studies: Re-Evaluating the Evaluation of Training Programs**, *Journal of the American Statistical Association* 94 (448): 1053-1062.
- Heckman, James J., Hidehiko Ichimura and Petra Todd. 1998. **Matching as an Econometric Evaluation Estimator**, *Review of Economic Studies* 65: 261-294.
- Heckman, J., Ichimura, H., Smith, J., and Todd, P. 1998. **Characterizing Selection Bias Using Experimental Data**. *Econometrica* 66(5): 1017-1098.
- Shadish, William R., M.H. Clark, and Peter M. Steiner. 2008. **Can Nonrandomized Experiments Yield Accurate Answers? A Randomized Experiment Comparing Random and Nonrandom Assignments**. *Journal of the American Statistical Association* 103 (484): 1334-1344. (★)
- Arceneaux, Kevin, Alan S. Gerber, and Donald P. Green. 2006. **Comparing Experimental and Matching Methods using a Large-Scale Voter Mobilization Experiment**. *Political Analysis* 14 (1): 1-36.
- John Concato, Nirav Shah, and Ralph Horwitz. 2000. **Randomized, Controlled Trials, Observational Studies, and the Hierarchy of Research Designs**. *New England Journal of Medicine* 342 (25): 1887-92.
- Benson, Kjell and Arthur J. Hartz. 2000. **A Comparison of Observational Studies and Randomized, Controlled Trials**. *New England Journal of Medicine* 342(25): 1878-86.

4.4.6 Sensitivity Analysis

- Nonparametric Bounds
- Formal Sensitivity Tests

Readings

- Guido W. Imbens. 2003. [Sensitivity to Exogeneity Assumptions in Program Evaluation](#). *The American Economic Review* 93 (2): 126–32.
- Morgan and Winship: Chapter 12 (★)
- Rosenbaum, Paul R. 2002. *Observational Studies*. Springer-Verlag. 2nd edition. Chapter 4.
- Manski, Charles F. 1995. *Identification Problems in the Social Sciences*. Cambridge: Harvard University Press. Chapter 2.
- VanderWeele, Tyler J. , and Onyebuchi A. Arah. 2011. [Bias Formulas for Sensitivity Analysis of Unmeasured Confounding for General Outcomes, Treatments, and Confounders](#). *Epidemiology* 22 (1): 42.
- Rosenbaum, Paul R. 2009. [Amplification of Sensitivity Analysis in Matched Observational Studies](#). *Journal of the American Statistical Association* 104 (488): 1398-1405.
- Rosenbaum, Paul R. and Donald Rubin. 1983. [Assessing Sensitivity to an Unobserved Binary Covariate in an Observational Study with Binary Outcome](#). *Journal of the Royal Statistical Society. Series B (Methodological)* 45(2): 212-18.

4.5 Causal Effects under Selection on Time-Invariant Unobservables

4.5.1 Difference-in-Differences Estimators

- Identification, Estimation, Falsification tests

Readings: DID Theory

- Angrist and Pischke: Chapter 5.2-5.4 (★)
- Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan. 2004. [How Much Should We Trust Differences-in-Differences Estimates?](#) *Quarterly Journal of Economics* 119 (1): 249-275.

Readings: DID Applications

- Lyall, Jason. 2009. [Does Indiscriminate Violence Incite Insurgent Attacks? Evidence from Chechnya](#). *Journal of Conflict Resolution* 53 (3): 331-62.
- Card, David. 1990. [The Impact of the Mariel Boatlift on the Miami Labor Market](#), *Industrial and Labor Relations Review* 44 (2): 245-257.
- Card, David. and Alan B. Krueger. 1994. [Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania,](#) *American Economic Review* 84 (4): 772-793.
- Bechtel, Michael M. and Jens Hainmueller. 2011. [How Lasting Is Voter Gratitude? An Analysis of the Short- and Long-Term Electoral Returns to Beneficial Policy](#). *American Journal of Political Science* 55 (4): 852-868.

4.5.2 Panel Data Methods

- Fixed Effects and Random Effects Estimation

Readings: Panel Methods Theory

- Angrist and Pischke: Chapter 5.1 (★)
- Angrist and Pischke: Chapter 8 (★)
- Goodman-Bacon, Andrew. 2018. [Difference-in-Differences with Variation in Treatment Timing](#). NBER Working Paper 25018. [Summary Guidance](#).
- Bai, Jushan. 2009. [Panel data models with interactive fixed effects](#). *Econometrica* 77(4): 1229-1279.
- Imai, Kosuke and In Song Kim. 2020. [On the Use of Two-way Fixed Effects Regression Models for Causal Inference with Panel Data](#). Working Paper.

Readings: Panel Methods Applications

- Ladd, Jonathan McDonald, and Gabriel S. Lenz. 2009. [Exploiting a Rare Communication Shift to Document the Persuasive Power of the News Media](#). *American Journal of Political Science* 53 (2): 394-410. (★)
- Berrebi, Claude. and Esteban F. Klor. 2008. [Are Voters Sensitive to Terrorism? Direct Evidence from the Israeli Electorate](#). *American Political Science Review* 102 (3): 279-301.
- Acemoglu, Daron, Simon Johnson, James A. Robinson, and Pierre Yared. 2008. [Income and Democracy](#). *American Economic Review* 98 (3): 808-842.
- Hainmueller, Jens and Dominik Hangartner. 2016. [Does Direct Democracy Hurt Immigrant Minorities? Evidence from Naturalization Decisions in Switzerland](#). *American Journal of Political Science*.

4.5.3 Synthetic Control Methods

Readings

- Abadie, Diamond, and Hainmueller. 2010. [Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program](#). *Journal of the American Statistical Association* 105(490): 493-505.
- Abadie, Diamond, and Hainmueller. 2014. [Comparative Politics and the Synthetic Control Method](#). *American Journal of Political Science*. 59(2): 495-510.
- Doudchenko, Nikolay and Guido W. Imbens. 2016. [Balancing, Regression, Difference-In-Differences and Synthetic Control Methods: A Synthesis](#).
- Abadie, Alberto and Javier Gardeazabal. 2003. [The Economic Costs of Conflict: A Case Study of the Basque Country](#). *American Economic Review* 92 (1). 113-132.
- Xu, Yiqing. 2017. [Generalized Synthetic Control Method: Causal Inference with Interactive Fixed Effects Models](#). *Political Analysis* 25(1): 57-76.
- Arkhangelsky, Dmitry, Susan Athey, David A. Hirshberg, Guido W. Imbens, and Stefan Wager. 2019. [Synthetic Difference In Differences](#). NBER Working Paper No. 25532.

4.6 Additional Designs and Methods

4.6.1 Instrumental Variables

- Identification: Using Exogenous Variation in Treatment Intake Given by Instruments
- Imperfect Compliance in Randomized Studies
- Wald Estimator, Local Average Treatment Effects, 2SLS

Readings: Instrumental Variable Theory and Methods

- Angrist and Pischke: Chapter 4 (★)
- Morgan and Winship: Chapter 8
- Morgan and Winship: Chapter 9 (★)
- Angrist, Joshua D., Guido W. Imbens, and Donald B. Rubin. 1996. [Identification of Causal Effects Using Instrumental Variables](#). *Journal of the American Statistical Association* 91(434): 444-455.
- Abadie, Alberto 2003. [Semiparametric instrumental variable estimation of treatment response models](#). *Journal of Econometrics* 113 (2003) 231-263.
- Gerber, Alan S., and Donald P. Green. 2012. *Field Experiments*. W. W. Norton. Chapters 5-6.
- Sovey, Allison J. and Donald P. Green. 2011. [Instrumental Variables Estimation in Political Science: A Readers' Guide](#). *American Journal of Political Science* 55 (1): 188-200.
- Bansak, Kirk. Forthcoming. [A Generalized Approach to Power Analysis for Local Average Treatment Effects](#). *Statistical Science*.

Readings: Instrumental Variable Critique

- Deaton, Angus. 2010. [Instruments, Randomization, and Learning About Development](#). *Journal of Economic Literature* 48(2): 424-455.
- Hernan, Miguel A., and James M. Robins. 2006. [Instruments for Causal Inference: An Epidemiologist's Dream?](#) *Epidemiology* 17(4): 360-72.
- Imbens, Guido W. 2010. [Better LATE Than Nothing: Some Comments on Deaton \(2009\) and Heckman and Urzua \(2009\)](#). *Journal of Economic Literature* 48(2): 399-423.

Readings: Instrumental Variable Applications

- Kern, Holger L., and Jens Hainmueller. 2009 [Opium for the Masses: How Foreign Free Media Can Stabilize Authoritarian Regimes](#). *Political Analysis*.
- Angrist, Joshua D., and Alan B. Krueger. 2001. [Instrumental Variables and the Search for Identification: From Supply and Demand to Natural Experiments](#). *Journal of Economic Perspectives* 15(4): 69-85.
- Acemoglu, Daron, Simon Johnson, and James A. Robinson. 2001. [The Colonial Origins of Comparative Development: An Empirical Investigation](#). *American Economic Review* 91(5): 1369-1401.
- Clingingsmith, David, Asim Ijaz Khwaja, and Michael Kremer. 2009. [Estimating the Impact of the Hajj: Religion and Tolerance in Islam's Global Gathering](#). *Quarterly Journal of Economics* 124(3): 1133-1170.
- Hidalgo, F. Daniel, Suresh Naidu, Simeon Nichter, and Neal Richardson. 2010. [Economic Determinants of Land Invasions](#). *Review of Economics and Statistics* 92(3): 505-523.
- Angrist, Joshua D. 1990. [Lifetime Earnings and the Vietnam Era Draft Lottery: Evidence from Social Security Administrative Records](#). *American Economic Review* 80(3): 313-336.

4.6.2 The Regression Discontinuity Design

- Sharp and Fuzzy Designs, Identification, Estimation, Falsification Checks

Readings: *RDD Theory*

- Imbens, Guido W., and Thomas Lemieux. 2008. [Regression Discontinuity Designs: A Guide to Practice](#). *Journal of Econometrics* 142 (2): 615-35. (Part of special issue on RDD, all of which is of interest.) (★)
- Angrist and Pischke: Chapter 6 (★)
- Hahn, Jinyong, Petra Todd and Wilbert Van der Klaauw. 2001. [Identification and Estimation of Treatment Effects with a Regression Discontinuity Design](#). *Econometrica* 69 (1): 201-209.
- Calonico, Sebastian, Matias Cattaneo, and Rocio Titiunik. 2014. [Robust Nonparametric Confidence Intervals for Regression-Discontinuity Designs](#). *Econometrica* 82(6): 2295-2326.
- Keele, Luke J. and Rocio Titiunik. 2015. [Geographic Boundaries as Regression Discontinuities](#). *Political Analysis* 23(1): 127-155.

Readings: *RDD Applications*

- Eggers, Andrew, Fowler, Anthony, Hainmueller, Jens, Hall, Andrew B. and Snyder, James M. 2015. [On the Validity of the Regression Discontinuity Design for Estimating Electoral Effects: New Evidence from over 40,000 Close Races](#). *American Journal of Political Science* 59(1): 259-274 (★).
- Hidalgo, F. Daniel. 2012. [Fraud or Enfranchisement? The Consequences of Electronic Voting for Political Representation in Brazil](#). Working Paper.
- Lee, David S. 2008. [Randomized Experiments from Non-random Selection in U.S. House Elections](#). *Journal of Econometrics* 142 (2): 675-697. (★)
- Hainmueller, Jens, and Holger Lutz Kern. 2008. [Incumbency as a Source of Spillover Effects in Mixed Electoral Systems: Evidence from a Regression- Discontinuity Design](#). *Electoral Studies* 27: 213-27.
- Caughey, Devin, and Jasjeet Sekhon. 2011. [Elections and the Regression Discontinuity Design: Lessons From Close U.S. House Races, 1942-2008](#). *Political Analysis* 19 (4): 385-408.
- Eggers, Andrew, Ronny Freier, Veronica Grembi, and Nannicini, Tommaso. 2016. [Regression Discontinuity Designs Based on Population Thresholds: Pitfalls and Solutions](#).
- Hainmueller, Jens, Andrew B. Hall, and James Snyder. 2015. [Assessing the External Validity of Election RD Estimates: An Investigation of the Incumbency Advantage](#) *Journal of Politics*. 77(3): 707-720.
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- Bertanha, Marinho and Guido Imbens. [External Validity in Fuzzy Regression Discontinuity Designs](#). 2019. *Journal of Business & Economic Statistics*: 1-39.

4.7 Distributional Effects

4.7.1 Quantile Regression

Readings

- Angrist and Pischke: Chapter 7 (★)

- Koenker, Roger and Kevin F. Hallock. 2001. **Quantile Regression**. *Journal of Economic Perspectives* 15 (4): 143-156(★)
- Bruenig, Christian and Brian D. Jones. 2011. **Stochastic Process Methods with an Application to Budgetary Data**. *Political Analysis* 19 (1): 103-117

4.7.2 Distributional Effects in Difference-in-Differences

Readings

- Athey, Susan and Guido W. Imbens. 2006. **Identification and Inference in Nonlinear Difference-in-Differences Models**. *Econometrica* 74 (2): 431-497.(★)

4.7.3 Instrumental Variables for Quantile Effects

Readings

- Abadie, Alberto, Joshua Angrist, and Guido Imbens. 2002. **Instrumental Variables Estimates of the Effect of Subsidized Training on the Quantiles of Trainee Earnings**. *Econometrica* 70 (1): 91-117.

4.8 Possible Additional Topics

4.8.1 Attrition

4.8.2 Causal Mediation

4.8.3 Machine Learning for Causal Inference

5 Policies

5.1 Students with Disabilities

Students requesting accommodations for this course due to a disability must provide a current Authorization for Accommodation (AFA) letter issued by the Office for Students with Disabilities (<https://osd.ucsd.edu/>). Students are required to discuss accommodation arrangements with instructors and OSD liaisons in the department well in advance of any exams or assignments. The OSD Liaison for the Department of Political Science is Joanna Peralta; please connect with her via the Virtual Advising Center (<https://stark.ucsd.edu/students/vac/>) as soon as possible.

5.2 Academic Advising

Students who have questions pertaining to Political Science academic advising are asked to reach out the Department's Graduate Advisor, Julie Choi, who can be reached via the Virtual Advising Center (<https://stark.ucsd.edu/students/vac/>). Academic advising questions often include (but not limited to): add/drop deadlines, course enrollment policies, planning major and minor requirements, quarter-by-quarter plans, department petitions and paperwork, and referrals to campus and student support services.

5.3 UC San Diego Principles of Community

The University of California, San Diego is dedicated to learning, teaching, and serving society through education, research, and public service. Our international reputation for excellence is due in large part to the cooperative and entrepreneurial nature of the UC San Diego community. UC San Diego faculty, staff, and students are encouraged to be creative and are rewarded for individual as well as collaborative achievements.

To foster the best possible working and learning environment, UC San Diego strives to maintain a climate of fairness, cooperation, and professionalism. These principles of community are vital to the success of the University and the well being of its constituents. UC San Diego faculty, staff, and students are expected to practice these basic principles as individuals and in groups.

For the complete UC San Diego Principles of Community, see:

<https://ucsd.edu/about/principles.html>

6 Resources

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|----------------------------------|---|
| Library Help and Research Tools: | https://library.ucsd.edu/ask-us/triton-ed.html |
| Writing Hub: | https://commons.ucsd.edu/students/writing/index.html |
| Supplemental Instruction: | https://commons.ucsd.edu/academic-support/supplemental-instruction/si-students.html |
| Tutoring: | https://commons.ucsd.edu/academic-support/content-tutoring/index.html |
| Mental Health Services: | https://caps.ucsd.edu |
| Community Centers: | Learn about the different ways UC San Diego explores, supports, and celebrates the many cultures in our diverse community. https://students.ucsd.edu/student-life/diversity/index.html |
| Accessibility: | https://disabilities.ucsd.edu/ |
| Basic Needs: | Any student who has difficulty accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in this course, is encouraged to contact: foodpantry@ucsd.edu and basicneeds@ucsd.edu |