Syllabus

POLI 273 Causal Inference (Winter 2018)

Instructor: Professor Yiqing Xu

Time & Room
Class: Wednesday 3:00–5:50PM
Recitation: Friday 10:00–11:00AM

Room: SSB 104

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Course Description

This is the second course in the quantitative political methodology sequence at the Political Science Department at UCSD. The goal of the course is to provide a survey of most commonly used empirical tools for political science and public policy research. Our focus is design-based causal inference, that is, to use statistical methods to answer research questions that concern the impact of some cause (e.g., an intervention, a change in institutions, passage of a law, changes in economic conditions, or policies) on certain outcome (e.g., vote choice, income, election results, levels of violence, political attitudes).

We cover a variety of causal inference designs and methods, including experiments, matching, regression, fixed effects models, difference-in-differences, synthetic control methods, instrumental variable estimation, regression discontinuity designs, simple machine learning tools, and, if time permits, quantile regressions and sensitivity analysis. We will analyze the strengths and weaknesses of these methods using applications from various social sciences with a special focus on political science.

The class is open to qualified students from other departments and undergraduates, but priority will be given to graduate students in the Political Science Department.

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 POLI204B). Knowledge of the maximum likelihood method is useful, but not required—in fact, we are thinking about teaching POLI 273 prior to POLI 271 in the near future.

Students are also expected to be reasonably proficient in the statistical software `R` (you may use other software packages that you are very familiar with, but we can only support `R`). If you have some background in other programming languages, you can `R` fairly quickly. We will give you a chance to get familiar with `R` in the first few weeks.

Class Requirements

Grades will be based on a weighted average of your weekly assignments, the midterm and final projects, as well as your participation.

Reading (for your own intellectual satisfactory)

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

5 Problem Sets (50%)

This is a methodological course, developing skills in understanding and applying statistical methods. You can only learn statistics by doing statistics and therefore homework for this course is extensive, including five assignments. The assignments consist of analytical problems, computer simulations, and data analysis.

- They will usually be assigned on **Wednesday** and due the following **Wednesday**, prior to lecture.
- No late homework will be accepted.
- All sufficiently attempted homework (ie. a typed and well organized write-up with all problems attempted) will be graded on a ($\checkmark-$, $\checkmark$, $\checkmark+$) scale.

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. We also ask that you write the names of your co-workers on your assignments [this rule will be strictly enforced and we will keep a record].

Midterm (20%)

The in-class, closed-book midterm will take place on May 9 (Tuesday) during the regular class time. There will be no assignment in the week before the midterm.

Student Project (30%)

A students project should be short empirical paper (in the form of a blog post) that applies methods learned in this class to a research question of their choice. It needs to meet the following requirements:

I. Data and methods (15%)

- Students can either collect their own data related to an empirical problem of their own interest, or use replication data from a published paper.
- Replication works are strongly encouraged: students are expected go beyond the original analysis in some significant way both substantively and methodologically, for examples, by either (1) collecting additional data or (2) applying techniques learned in the course to make significant improvements on the original paper.
- At least one method taught in the class should be used.

III. Presentation (5%)

- You will be presenting your work on June 8.
- Bonus points will be given to best projects based on a secret polling among class members

II. "Paper" (Blog Post) (10%) – No more than 1500 words. It's a blog post, so you don't really have to follow any particular order. But if you don't have much experience writing a blog, there's some hint:

- An interesting title
- Two sentence gist

- Introduction or some background information (no more than 300 words).
  - (a) The problem/puzzle to be solved
  - (b) Explain why previous work and methods leave the problem unresolved
- Data and findings
- Figures and tables with informative captions (no more than 5 tables *or* figures in total — figures are strongly encouraged)
- A brief summary

Bonus points will be given to best projects based on votes by faculty members

Collaboration: We encourage you to collaborate with another student (a group should not consist of more than 2 students). Note that most cutting-edge research is collaborative (see any recent issue of *APSR* or *AJPS*), and collaboration is more likely result in a good, potentially publishable paper (multiple brains are usually better than one). We expect higher quality with a coauthored paper. Same page limit applies.

Deadlines: Please be aware of the following deadlines. Late submission will be penalized (1% for each day).

- **Week 3, Jan 24 (Project description):** By this date, you should email the instructor and TA what topic you plan to work on and how you plan to collect/obtain data (1 page).

- **Weeks 9–10, Mar 7, 14 (Project presentation):** Present your work in class.

- **Week 11, Mar 21 (Blog post due)**: By this date, you should email the instructor and TA your blog post. It should summarize the theoretical/empirical contributions, methods, and main results (figures and tables). The blog post should be sent to TA by midnight.

Recitation Sections

Weekly recitation sections will be held on Friday. 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.

Course Website

Throughout this class we will use the Piazza online discussion board. This is a question-and-answer platform that is easy to use and designed to get you answers to questions quickly. It supports LaTeX, code formatting, embedding of images, and attaching of files. We encourage you to ask questions on the Piazza forum for clarifications, questions about concepts, or about your projects in addition to attending recitation sessions and office hours. You can sign up to the Piazza course page either directly from the below address (there are also free Piazza apps for the iPhone and iPad):

https://piazza.com/ucsd/winter2018/poli273

Using Piazza will allow students to see and learn from other students' questions. Both the TA and the instructor will regularly check the board and answer questions posted, although everyone else is also encouraged to contribute to the discussion. A student's respectful and constructive participation on the forum will count toward his/her class participation grade. *Do not email your questions directly to the instructors or TAs* (unless they are of personal nature) — we will not be answering your questions regarding course materials or problem sets through email.

Computation

We teach the course in R, which is an open-source computing language that is very widely used in statistics. You can download it for free from www.r-project.org. The web provides many great tutorials and resources to learn R. A list of these is provided at http://wiki.math.yorku.ca/index.php/R:_Getting_started. A nice way to start you off are the two video tutorials provided by Dan Goldstein here and also here. Another good resource is the set of tutorials provided by DataCamp. R runs on a wide variety of UNIX platforms, Windows and MacOS. R makes programming very easy, has strong graphical capabilities, and also contains canned functions for most commonly used estimators.

To refresh your knowledge about R, you can check out one of the following free tutorials. All three tutorials cover similar material, just pick the one you like best:

1. W. J. Owen. *The R Guide*.
2. W. N. Venables and D. M. Smith. *An Introduction to R*.
3. J. Verzani. *Simple R*.

For advanced R programmers, *The R Inferno* is highly recommended (it's hilarious).

If you are very familiar with another statistical software package you may use that for the course at your own risk. We can only support R. Political science graduate students are strongly recommended to use R.

Office Hours and Availability

My office hours are by appointment and John will hold office hours at the listed times.

Books

Required Books

We will read chapters from the following textbooks:

- Angrist, Joshua D. and Jörn-Steffen Pischke. 2008. *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton University Press.

- Morgan, Stephen L. and Christopher Winship. 2007. *Counterfactuals and Causal Inference: Methods and Principles for Social Research.* Cambridge University Press.

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.

Optional Books for Your Future Reference

The following books are optional but may be useful for deeper understanding for some of the course topics and for your future reference.

- *Causal Inference*

    - 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 Data*

    - Wooldridge, Jeffrey M. 2002. Econometric Analysis of Cross Section and Panel Data. MIT Press.

Tentative Course Outline

Below is a preliminary schedule of course topics. Notice that required readings are marked with a ($\star$).

1 Introduction and Review (Week 1)

- Overview, Course Requirements, Course Outline
- Review of Statistical Concepts Useful for Causal Inference
    - Inference and Properties of Estimators
    - Conditional Mean Function

2 The Potential Outcome Framework (Week 2)

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

Readings

- Angrist and Pischke: Chapter 1. ($\star$)

- Morgan and Winship: Chapter 1-2. ($\star$)

- 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.

3 Randomized Experiments (Weeks 3–4)

3.1 Theory

- Identification of Causal Effects under Randomization

- Implementation, Estimation, Diagnostics, Blocking

- Attrition and Other Threats to Validity

Readings

- Angrist and Pischke: Chapter 2. (⋆)

- 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*, Vol. 7, No. 1, 295-318.

3.2 Statistical Inference

- Variance estimation under the Neyman model.

- Inference for clustered designs.

- Randomization inference.

- The bootstrap.

- Power analysis.

Readings

- Angrist and Pischke: Chapter 8. (⋆)

- Gerber, Alan S., and Donald P. Green. 2012. *Field Experiments*. W. W. Norton. Chapter 3.

- Rosenbaum, Paul R. 2009. *Design of Observational Studies*: pgs. 29-49

- Bowers, Jake and Costas Panagopoulos. 2011. Fisher's Randomization Mode of Statistical Inference, Then and Now. *Working Paper.*

- 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), 414C427.

3.3 Applications

Readings: 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 Large Scale 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, Raghabendra and Esther Duflo. 2004. Women as Policy Makers: Evidence from a Randomized Policy Experiment in India. *Econometrica*, 72 (5): 1409-1443.

Readings: 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.

- Washington, E. L. (2008). Female Socialization: How Daughters Affect Their Legislator Fathers Voting on Women's Issues. *The American Economic Review*, 98(1), 311-332.

- 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.

4 Selection on Observables (Weeks 5)

4.1 Theory

- Identification under Selection on Observables

- Subclassification

Readings

- Morgan and Winship: Chapter 3. ($\star$)

- 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, P. R. 1984. The Consquences of Adjustment for a Concomitant Variable That Has Been Affected by the Treatment. *Journal of the Royal Statistical Society.* Series a (General), 147(5), 656-666.

4.2 Regression Recap

- Identification with Regression

- Non-parametric Regression

Readings

- Angrist and Pischke: Chapter 3. ($\star$)

- Morgan and Winship: Chapter 5. ($\star$)

- 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.

4.3   Matching Methods

- Covariate Matching, Balance Checks

- Properties of Matching Estimators

- Inference

Readings: Theory

- Morgan and Winship: Chapter 4. ($\star$)

- Sekhon, Jasjeet S. 2009. Opiates for the Matches: Matching Methods for Causal Inference. *Annual Review of Political Science* 12: 487-508.($\star$)

- 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.

- Rubin: Chapters 3 to 5.

- Imbens, Guido W. 2004. Nonparametric Estimation of Average Treatment Effects under Exogeneity: A Review. *Review of Economics and Statistics* 86 (1): 4-29.

- 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.

- Imai, K., and D. A. van Dyk. 2004. Causal Inference With General Treatment Regimes. *Journal of the American Statistical Association*, 99(467), 854C866.

Readings: 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, Jasjeet, and Roco Titiunik. 2012. When Natural Experiments Are Neither Natural nor Experiments. *American Political Science Review* 106(1): 35-57.

4.4   Propensity Score and Weighting 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 3. (⋆)

- Rubin: Chapters 10, 11 and 14 (all with Paul R. Rosenbaum).

- Hirano, K., Imbens, G. W., and Ridder, G. 2003. Efficient Estimation of Average Treatment Effects Using the Estimated Propensity Score. *Econometrica*, 71(4), 1161-1189.

- 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.

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.

- King, Gary and Richard Nielsen. Working Paper. "Why Propensity Scores Should Not Be Used for Matching." Copy at `http://j.mp/1sexgVw`.

4.5 Summary

- Can Non-Experimental Method 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.

5 Cross-Sectional Research Designs (Weeks 6–7)

5.1 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

- Angrist and Pischke: Chapter 4 ($\star$)

- Morgan and Winship: Chapter 7

- 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.

- 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.

Readings: Instrumental Variable Critiques

- 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

- Iyer, L. (2010). Direct versus Indirect Colonial Rule in India: Long-Term Consequences. *The Review of Economics and Statistics*, 92(4), 693C713.

- Angrist and Krueger. 2001 Instrumental Variables and the Search for Identification: From Supply and Demand to Natural Experiments

- 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'ss 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.

5.2 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.) ($\star$)

- 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.

- Keele, Luke and Rocio Titiunik. Geographic Boundaries as Regression Discontinuities. *Working Paper*

Readings: RDD Applications

- Hidalgo, F. Daniel. 2012. Digital Democratization: Expanding the Electorate Through Voting Technology. *Working Paper*.

- Lee, David S. 2008. Randomized Experiments from Non-random Selection in U.S. House Elections. *Journal of Econometrics* 142 (2): 675-697. (⋆)

- 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, Olle Folke, Anthony Fowler, Jens Hainmueller, Andrew Hall, and James Snyder, 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*, Vol. 59, Iss. 1, ppg. 259–274.

6 Longitudinal Research Designs (Week 9)

6.1 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. 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.

- Jia, Ruixue, and Ying Bai, 2016. Elite Recruitment and Political Stability: The Impact of the Abolition of China's Civil Service Exam. *Econometrica*, Vol. 84 (2), 677C733,

6.2 Fixed Effects and Random Effects Models

- Fixed Effects and Random Effects Estimation

Readings: Panel Methods Theory

- Angrist and Pischke: Chapter 5.1 (⋆)

- Kim, In Song and Kosuke Imai. On the Use of Linear Fixed Effects Regression Estimators for Causal Inference. *Working Paper.*

Readings: Panel Methods Applications

- La Ferrara, Eliana, Albert Chong, and Suzanne Duryea. 2012. Soap Operas and Fertility: Evidence from Brazil. *American Economic Journal: Applied Econometrics* 4(4): 10-1. (⋆)

- 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.

- Sances, Michael. 2013. The Effects of Direct Elections When Voters are Unwise: Evidence from Tax Assessors. *MIT Working Paper.* (⋆)

- 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.

6.3 Synthetic Control Methods

Readings

- Abadie, A., A. Diamond, J. Hainmueller. Comparative Politics and the Synthetic Control Method. *American Journal of Political Science.* Forthcoming. (⋆)

- 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.*

- Bohn, S., M. Lofstrom and S. Raphael. Did the 2007 Legal Arizona Workers Act Reduce the State's Unauthorized Immigrant Population? *Review of Economics and Statistics.* Forthcoming.

- Acemoglu, D., Simon, J., Kermani, A, Kwak, J. and T. Mitton. 2013. The Value of Connections In Turbulent Times: Evidence from the United States. NBER Working Paper.

7 Additional Topics

7.1 Machine Learning for Causal Inference

- Double Selection

- Heterogeneous Treatment Effects

- Predictive Models and Causal Inference

Readings

- Varian, Hal R. "Big Data: New Tricks for Econometrics" *Journal of Economic Perspectives*, Vol. 28, No. 2, Spring 2014, pp.3–27. (⋆)

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

- Bloniarz et al. 2016. "Lasso Adjustments of Treatment Effect Estimates in Randomized Experiments" Proceedings of the National Academy of Sciences, Vol. 113, No. 27. 2016.

- Athey, Susan and Imbens, Guido W. "Recursive Partitioning for Heterogeneous Causal Effects." Working Paper.

- Van der Laan, Mark J., and Sherri Rose. *Targeted Learning: Causal Inference for Observational and Experimental Data.* Springer Science & Business Media, 2011.

7.2   Sensitivity Analysis

- Nonparametric Bounds, Formal sensitivity tests

Readings

- Morgan and Winship: Chapter 6 ($\star$)

- Guido W. Imbens. 2003. Sensitivity to Exogeneity Assumptions in Program Evaluation. *The American Economic Review* 93 (2): 126–32. ($\star$)

- Blackwell, M. (2013). A Selection Bias Approach to Sensitivity Analysis for Causal Effects. *Political Analysis.*

- 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.

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

- 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.

7.3   External Validity

- Sample Selection, Generalizability, Randomization Bias

Readings

- Hartman, Erin and Richard Grieve and Roland Ramasahai, and Jasjeet Sekhon. 2015. From SATE to PATT: Combining Experimental with Observational Studies to Estimate Population Treatment Effects. *Journal of the Royal Statistical Society, Series A.* ($\star$)

- Bold, T, M. Kimenyi, G. Mwabu, A. Ng'ang'a, and J. Sandefur. 2013. Scaling-up What Works: Experimental Evidence on External Validity in Kenyan Education. *Working Paper.*

- Allcott, H. and S. Mullainathan. 2012. External Validity and Partner Selection Bias. *NBER Working Paper 18373.*

- Stuart, E. A., Cole, S. R., Bradshaw, C. P., and Leaf, P. J. (2010). The use of propensity scores to assess the generalizability of results from randomized trials. *Journal of the Royal Statistical Society: Series A*, 174(2), 369C386.

- Aronow, P. M., and A. Carnegie. 2013. Beyond LATE: Estimation of the Average Treatment Effect with an Instrumental Variable. *Political Analysis*, 21(4), 492C506. doi:10.1093/pan/mpt013

7.4　Attrition

- Missing Data, Attrition, Sample Selection, Truncation by Death

Readings

- Gerber, Alan S., and Donald P. Green. 2012. *Field Experiments*. W. W. Norton. Chapter 7. (⋆)

- Zhang, J. L., and Rubin, D. B. 2003. Estimation of Causal Effects via Principal Stratification When Some Outcomes are Truncated by "Death". *Journal of Educational and Behavioral Statistics*, 28(4), 353-368.

7.5　Distributional Effects

- Quantile Regression
- Nonlinear difference-in-difference

Readings

- Angrist and Pischke: Chapter 7 (⋆)

- Koenker, Roger and Kevin F. Hallock. 2001. Quantile Regression. *Journal of Economic Perspectives* 15 (4): 143-156

- Bitler, M. P., Gelbach, J. B., and Hoynes, H. W. 2006. What Mean Impacts Miss: Distributional Effects of Welfare Reform Experiments. *The American Economic Review*, 96(4), 988C1012.

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

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