

Spring 2020 | TR 9-10:15 | Classroom: Stone 345

SOC 681: Casual Analysis

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Course Description

Social science research questions often involve identifying the causal effect of a particular social factor. To give just a few examples, we might be interested in the estimating the effect of education on health, the effect of divorce on children's outcomes, or the effect of teenage pregnancy on adult socioeconomic resources. In these examples and many others, it is either difficult or unethical to conduct social experiments and we generally rely on observational data to obtain causal estimates. This course provides an introduction to a contemporary framework for causal inference as well as a range of methods that can be used within that framework.

As we will learn, research designs and statistical models alone are insufficient for causal inference. There are no simple algorithms to generate causal estimates. Interpreting an estimate as a causal effect rests on assumptions. As such, although we will cover some technical material, much of the course will be devoted to honing your intuition around causal reasoning in an observational setting.

For the models we will learn in the course, knowledge of linear regression and regression models for categorical data (particularly logit or probit models) will be quite beneficial. If you lack this background, you may find that some components of the course require additional work to be able to understand the material.

Learning Outcomes

1. Obtain an understanding of causal graphs and the potential outcomes framework for causal inference
2. Learn how to implement and interpret tools for causal analysis including regression, matching, weighting, instrumental variables, fixed-effects, and difference-in-difference models
3. Develop the ability to assess causal claims in empirical research

Course Details

Texts

The following, referenced in the course outline as MW, is the primary text.

- Morgan, Stephen L. and Christopher Winship. 2015. *Counterfactuals and Causal Inference: Methods and Principles for Social Research* (2nd ed.). New York: Cambridge University Press.

The following are also good texts if you'd like additional resources.

- Angrist, Joshua D. and Jörn-Steffen Pischke. 2015. *Mastering 'Metrics: The Path from Cause to Effect*. Princeton: Princeton University Press.
- Pearl, Judea, Madelyn Glymour, and Nicholas P. Jewell. 2016. *Causal Inference in Statistics: A Primer*. West Sussex, UK: John Wiley & Sons.
- Rosenbaum, Paul R. 2017. *Observation and Experiment: An Introduction to Causal Inference*. Cambridge: Harvard University Press.

Statistical Software

The statistical models we cover in this course can be fit using a variety of statistical software packages. I will provide instruction for fitting the models in R and Stata. R is available for free download and I recommend using the RStudio interface. Stata is available for free to Purdue students at OnTheHub. If you are already familiar with another statistical software package, then you are welcome to use it.

Grades

Your grade for the course will be based on three components: (1) three assignments, (2) two reading presentations, and (3) one reading response paper.

Assignments (60 points)

During the semester there will be a series of assignments related to the models we've covered in class that will typically involve some form of analysis and interpretation. I will provide information about how to obtain the data (either via Blackboard or downloading from an online source) in the assignment. The assignments should be prepared as Word documents (or some other word processing program) and should not consist of raw output or code. The assignments should be submitted on Blackboard. You are welcome to work collaboratively on the assignments, but I expect that everyone will submit their own assignment. (20 points per assignment)

<u>Assignment Due Dates</u>	
Assignment 1	Mar 13
Assignment 2	Apr 10
Assignment 3	May 1

Reading Presentations (20 points)

Throughout the semester we will dissect examples of empirical research published in leading journals that involve various forms of causal analysis (see list below). Most weeks I will assign one article and a few reading questions to guide our examination. Everyone should prepare notes on the questions and two volunteers will lead our discussion with a short presentation (5-10 minutes). The presentation should provide a brief summary of the research question(s) and then offer thoughts on the reading questions. (10 points per presentation)

Reading Response Paper (20 points)

Reading response: At the end of the semester you will need to complete a short response paper (500-1000 words) that provides an assessment of one of the empirical articles. The response paper should include the following: (1) a brief summary of the research question(s), (2) a precise statement of the potential outcomes or counterfactuals involved in the analysis, (3) a discussion of the strategy used for obtaining a causal estimate, and (4) your assessment of the strengths and limitations of the analysis.

Empirical Examples

- Aksoy, Ozan and Francesco C. Billari. 2018. "Political Islam, Marriage, and Fertility: Evidence from a Natural Experiment." *American Journal of Sociology* 123:1296-1340.
- Brand, Jennie E. and Juli Simon Thomas. 2014. "Job Displacement among Single Mothers: Effects on Children's Outcomes in Young Adulthood." *American Journal of Sociology* 119:955-1001.
- Budig, Michelle J. and Paula England. 2001. "The Wage Penalty for Motherhood." *American Sociological Review* 66:204-225.
- Diaz, Christina J. and Jeremy E. Fiel. 2016. "The Effect(s) of Teen Pregnancy: Reconciling Theory, Methods, and Findings." *Demography* 53:85-116.
- Harding, David J. 2003. "Counterfactual Models of Neighborhood Effects: The Effect of Neighborhood Poverty on Dropping Out and Teenage Pregnancy." *American Journal of Sociology* 109:676-719.
- Harding, David J., Shawn D. Bushway, Jeffrey D. Morenoff, and Anh P. Nguyen. 2018. "Imprisonment and Labor Market Outcomes: Evidence from a Natural Experiment." *American Journal of Sociology* 124:49-110.
- Legewie, Joscha. 2013. "Terrorist Events and Attitudes Toward Immigrants: A Natural Experiment." *American Journal of Sociology* 118:1199-1245.
- Sharkey, Patrick, Gerard Torrats-Espinosa, and Delaram Takyar. 2017. "Community and the Crime Decline: The Causal Effect of Local Nonprofits on Violent Crime." *American Sociological Review* 82:1214-1240.
- Wodtke, Geoffrey T., David J. Harding, and Felix Elwert. 2011. "Neighborhood Effects in Temporal Perspective: The Impact of Long-Term Exposure to Concentrated Disadvantage on High School Graduation." *American Sociological Review* 76:713-736.

Grade Distribution

Your final grade will be calculated as the average of the three assignments and two reading responses. I will use the following standard grading scale for this course.

Grade	Percent	Grade	Percent
A+	96.5% - 100%	C+	76.5% - 79%
A	92.5% - 96%	C	72.5% - 76%
A-	89.5% - 92%	C-	69.5% - 72%
B+	86.5% - 89%	D+	66.5% - 69%
B	82.5% - 85%	D	62.5% - 65%
B-	79.5% - 82%	D-	59.5% - 62%

Accommodations

If you are student with a disability or ongoing medical condition, we can discuss appropriate accommodations. For additional information and resources please visit the [Disability Resource Center](#).

Course Readings Outline

Week 1: Introduction

- MW. Chapter 1.
- Pearl, Judea and Dana Mackenzie. 2018. "The Ladder of Causation." Pp. 23-52 in *The Book of Why: The New Science of Cause and Effect*. New York: Basic Books.
- Optional: Abbott, Andrew. 1998. "The Causal Devolution." *Sociological Methods & Research* 27:148-181.
- Optional: Berk, Richard A. 2005. "Randomized Experiments as the Bronze Standard." *Journal of Experimental Criminology* 1:417-433.

Week 2: Counterfactuals and Potential Outcomes

- MW. Chapter 2.
- Greenland, Sander. 2017. "For and Against Methodologies: Some Perspectives on Recent Causal and Statistical Inference Debates." *European Journal of Epidemiology* 32:3-20.

- Optional: Gangl, Markus. 2010. “Causal Inference in Sociological Research.” *Annual Review of Sociology* 36:21-47.
- Optional: Holland, Paul W. 1985. “Statistics and Causal Inference.” *Journal of the American Statistical Association* 81:945-960.

Week 3: Causal Graphs

- MW. Chapter 3.
- Rohrer, Julia M. 2018. “Thinking Clearly About Correlations and Causation: Graphical Causal Models for Observational Data.” *Advances in Methods and Practices in Psychological Science* 1: 27-42.
- Optional: Greenland, Sander, Judea Pearl, and James M. Robins. 1999. “Causal Diagrams for Epidemiologic Research.” *Epidemiology* 10:37-48.

Week 4: Causal Identification with Conditioning Estimators

- MW. Chapter 4.
- Elwert, Felix and Christopher Winship. 2014. “Endogenous Selection Bias: The Problem of Conditioning on a Collider Variable.” *Annual Review of Sociology* 40:31-53.

Week 5: Regression Estimators

- *Class Canceled on Tue (Feb 11)*
- MW. Chapter 6.
- Optional: Elwert, Felix and Christopher Winship. 2010. “Effect Heterogeneity and Bias in Main-Effects-Only Regression Models.” Pp. 327-336 in *Heuristics, Probability, and Causality: A Tribute to Judea Pearl* edited by R Dechter, H Geffner, a J Halpern. UK: College Publications.

Week 6: Matching Estimators I

- MW. Chapter 5.

- Optional: Morgan, Stephen L. and David J. Harding. 2006. “Matching Estimators of Causal Effects: Prospects and Pitfalls in Theory and Practice.” *Sociological Methods & Research* 35:3-60.

Week 7: Matching Estimators II

- MW. Chapter 5. [review]

Week 8: Weighted Regression Estimators

- MW. Chapter 7.

Week 9: Instrumental Variable Estimators I

- MW. Chapter 9.
- Bollen, Kenneth A. 2012. “Instrumental Variables in Sociology and the Social Sciences.” *Annual Review of Sociology* 38:37-72.
- Optional: 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: 69-85.
- Optional: Angrist, Joshua D., Guido W. Imbens, and Donald B. Rubin. 1996. “Identification of Causal Effects Using Instrumental Variables.” *Journal of the American Statistical Association* 91:444-455.

Week 10: Spring Break

Week 11: Instrumental Variable Estimators II

- MW. Chapter 9. [review]

Week 12: Repeated Observations and Causal Effects I

- *Class Canceled on Thr (Apr 2)*
- MW. Chapter 11.

- Optional: Halaby, Charles. 2004. “Panel Models in Sociological Research.” *Annual Review of Sociology* 30:507-544.

Week 13: Repeated Observations and Causal Effects II

- MW. Chapter 11. [review]

Week 14: Mechanisms and Causal Effects I

- MW. Chapter 10.
- Pearl, Judea and Dana Mackenzie. 2018. “Mediation: The Search for a Mechanism.” Pp. 299-348 in *The Book of Why: The New Science of Cause and Effect*. New York: Basic Books.
- Optional: Baron, Reuben M. and David A. Kenny. 1986. “The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations.” *Journal of Personality and Social Psychology* 51:1173-1182.

Week 15: Mechanisms and Causal Effects II

- *Class Canceled on Thr (Apr 23)*
- Imai, Kosuke, Luke Keele, Dustin Tingley, and Teppei Yamamoto. 2011. “Unpacking the Black Box of Causality: Learning about Causal Mechanisms from Experimental and Observational Studies.” *American Political Science Review* 105:765-789.

Week 16: Conclusion

- MW. Chapter 13.