Research Design II

Prof. Natalia Lamberova

E-mail: Natalia.Lamberova@UTDallas.edu
Office Hours: Thursady 2pm-3.30pm
Office: GR 3.822

Web: natalialamberova.youcanbook.me
Class Hours: Thursday 4:00pm-6:45pm
Class Room: CB 1.210

Course Description and Goals

Often the goal of social science research is to figure out the causal effect of one phenomenon on another. This task is straightforward if one can perform an experiment, randomizing the "treatment" variable of interest. However, in social sciences such experimentation is often impossible - we cannot randomize treatments of interest, such as which countries get democracy, what policies are adopted by a state, or who is exposed to violence. This course covers both experimentation in social sciences, and clarification of the conditions under which estimates made using non-experimental data can be given a causal interpretation.

We will cover a variety of designs and methods, including experiments, matching, regression, panel methods, difference-in-differences, synthetic control methods, instrumental variable estimation, regression discontinuity designs, and sensitivity analyses. The toolkit you build during this course will apply to any discipline in which investigators seek to make causal statements even if full randomization of the treatment is not possible.

Course Policy

Grading Policy

Throughout this course, you will acquire coding skills in R (DataCamp), engage in active learning via worksheets, demonstrate your skills understanding the implicit assumptions behind causal inference methods and their validity via presentations and develop your own research project. Research projects can be done in groups of 3-4 people. You would formulate your (testable) hypothesis, find data, choose applicable method, perform the analysis and write up a draft of your research paper. Given the scope of the project, I recommend you to start thinking about it from week 1. I also highly recommend working in groups. The breakdown of your course scores in below.

1. ***DataCamp Courses:*** **(20%)**

- Introduction to R
- Reporting with R Markdown
- Foundations of inference in R
- Experimental Design in R
- Intermediate Regression in R

2. ***Worksheets* (40%)**

We will have 8 Worksheets, graded at 5% of the class each. They would test the understanding of different research designs. You are free to use any resources.

3. ***Paper Presentation* (10%)**

You will present 2 papers from the reading list, focusing on its research design (be prepared to discuss its assumptions and their validity) and interpretation of the results.

4. ***Project pre-registration workshop* (10%)**

On week 8 you will present your research idea for the final project. Pay attention to the exact hypothesis you'd like to test, describe the treatment, your control group and the sources of data you hope to obtain.

Be prepared to give helpful comments to your peers! (extra credit)

4. ***Final Project and presentation* (20%)**

On May 1 you'll have the opportunity to present your final project and receive feedback. The final project write-up is due on **May, 12**.

Resources for success

The best way to learn the material in this class is practice. On most weeks we will have our TA - Venki - hold a tutorial via Teams. In this tutorial, he will go over some practice questions with you. Tutorials would be recorded. I HIGHLY recommend you attend them (or watch them if you have a scheduling conflict). **Venki** will hold weekly workshops on **Fridays 1-2pm** and office hours on **Fridays 2-3pm**. Please do your best to follow the workshops!

UTD has a constellation of resources aimed at helping students. Please find them here: https://go.utdallas.edu/academic-support-resources

Attendance Policy

Attendance is mandatory and expected. We will record the lectures and the recordings will be available online. Graded worksheets are only available in class. We will have 2 make-up opportunities for missed worksheets during the semester. No other make-up opportunities would be granted.

Course Website

Course website will be the main source for all course materials, including possible syllabus changes and readings. In addition to lectures and office hours, all questions about lectures and other course materials should be posted to the discussion forums on the course website. This allows all students to benefit from the discussion, and to help each other understand the materials. If you have a question, chances are one of your colleagues does too. All non-personal questions should be posted to the discussion forum, and both students and instructors are encouraged to participate in the discussion.

Academic Dishonesty Policy

Cheating and plagiarism will not be tolerated. I strongly encourage you to review the University's policies regarding academic honesty, which you can read here: https://go.utdallas.edu/syllabus-policies. In general, if you have any question, please feel free to ask me.

Disabilities Policy

Please find disability policy here: https://go.utdallas.edu/syllabus-policies Students with disabilities enrolled in this course who may need disability-related classroom accommodations are encouraged to make an appointment to see Natalia Lamberova before the end of the second week of semester. Please also arrange to have the required documentation sent to me for any accommodations *as soon as possible*.

Generative AI

The use of generative AI is permitted and encouraged. You are allowed to use it for making your project more readable, for assisting you with presentation preparation, for helping you read the material. It's really good with LaTex and code debugging. Please refer to the pdf "Hints on efficient GPT use" on the course website. You are required to provide the link to the whole GPT dialog (or analogous LLM). Failure to do so constitutes a violation of Academic Dishonesty Policy.

You are responsible for the final output.

Asking for coding help

Feel free to ask for help coding up your projects. In your email, you **must** provide: zip-file containing: code in .Rmd (do) file, dataset that is used with this code, **Full dialogue with ChatGPT/Copilot/other LLM** where you try to solve the problem. Emails that don't provide all three will be responded with this message: "Please provide zip-file containing: code in .Rmd (do) file, dataset that is used with this code, **Full dialogue with ChatGPT/Copilot/other LLM** where you try to solve the problem."

Required readings:

We will be using the following book as a textbook:

Cunningham, Scott. "Causal inference." Causal Inference. Yale University Press, 2021.

Free online edition is available here:

https://mixtape.scunning.com/

We will also have a number of required papers to read. They will be available on the course website.

Recommended readings:

A classic text worth having:

Angrist, Joshua D., and Jörn-Steffen Pischke. Mostly harmless econometrics: An empiricist's companion. Princeton university press, 2009.

Class Schedule (With Extended Readings)

Materials in **bold** will be presented by me. Other papers are open for student presentations.

Week 01, 01/21 - 01/25: Syllabus and Introduction.

Topics:

- Syllabus

- GPT and friends and how (not) to use them
- Intro

Assignments:

DataCamp 1 is due: Introduction to R

Week 02, 01/28 - 02/01: Potential Outcomes

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

Readings:

- **Chapter 4 of Mixtape: https://mixtape.scunning.com/04-potential_outcomes**
- 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.

Assignments:

DataCamp 2 is due: Reporting with R Markdown

Week 03, 02/04 - 02/08: Experiments

Topics: - Identification of Causal Effects under Randomization - Implementation, Estimation, Diagnostics, Blocking - When do you have a "natural experiment"? - Threats to Validity - The sharp-null interpretation of randomization inference, Fisher's exact test

Readings: Some Famous Social Science 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. APSR 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.
- 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).

Assignments:

DataCamp 3 is due: Foundations of inference in R

Worksheet 1: POMs

Week 04, 02/11 - 02/15: Survey Experiments

Topics:

- Total Survey Error
- Errors of observation (measurement)
- Errors of non-observation (coverage, non-response, sampling)
- Design Linear Estimators
- Theorems for linear estimators with sampling
- Horvitz-Thompson and Hajek
- HT: General framework for different sampling designs
- Hajek has better MSE properties
- Conjoint experiments

Readings:

- **Bansak, K., Hainmueller, J., Hopkins, D., & Yamamoto, T. (2021). Conjoint Survey Experiments. In J. Druckman & D. Green (Eds.), Advances in Experimental Political Science (pp. 19-41). Cambridge: Cambridge University Press. doi:10.1017/9781108777919.004**
- **Hainmueller, J., Hangartner, D., & Yamamoto, T. (2015). Validating vignette and conjoint survey experiments against real-world behavior. Proceedings of the National Academy of Sciences, 112(8), 2395-2400.**
- Graham, M. H., & Svolik, M. W. (2020). Democracy in America? Partisanship, Polarization, and the Robustness of Support for Democracy in the United States. American Political Science Review, 114(2), 392-409.
- Abramson, Scott F., Korhan Koçak, and Asya Magazinnik. "What do we learn about voter preferences from conjoint experiments?." American Journal of Political Science 66.4 (2022): 1008-1020.
- Breitenstein, Sofia. "Choosing the crook: A conjoint experiment on voting for corrupt politicians." Research & Politics 6.1 (2019): 2053168019832230.
- Kirkland, Patricia A., and Alexander Coppock. "Candidate choice without party labels: New insights from conjoint survey experiments." Political Behavior 40 (2018): 571-591.

Assignments:

DataCamp 4: Experimental Design in R

Worksheet 2: Experiments

Week 05, 02/18 - 02/22: Conditioning on observables: regression

Topics:

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

Readings:

- **Mixtape Chapter 2: Probability and regression review**
- **Lin, Winston. "Agnostic notes on regression adjustments to experimental data: reexamining Freedmans critique." Annals of Applied Statistics 7.1 (2013): 295-318.**
- **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.**

Assignments:

DataCamp 5: Intermediate Regression in R

Week 06, 02/25 - 03/01: Directed Acyclic Graphs

Worksheet 3: Interpreting regression

Topics:

- Introduction to structural causal models
- Conditional independence and d-separation
- Backdoor criterion
- Use cases for DAGs, connection to CI/SOO, handling complaints Important things revealed by DAGs

Readings

- **Mixtape Chapter 3: https://mixtape.scunning.com/03-directed_acyclical_graphs**
- **Primer (Pearl, Glymour, Jewell), Chapters 1.4, 1.5, 2, 3.**

Some online materials:

- Causal Diagrams: Draw Your Assumptions Before Your Conclusions course by Miguel Hernan on EdX
- A Crash Course in Causality: Inferring Causal Effects from Observational Data course by Jason Roy on Coursera.
- Richard McElreath lecture on "Science before statistics: causal inference". https://www.youtube.com/watch?v=KNPYUVmY3NM&t=8565s

Week 07, 03/04 - 03/08: Matching and Weighting

Topics

- Matching, weightening, propensity scores

Worksheet 4 : DAGs

Readings:

Matching:

- **Mixtape Chapter 5: Matching and Subclassification**

- **Abadie, Alberto, and Guido W. Imbens. 2011 "Bias-Corrected Matching Estimators for Average Treatment Effects." Journal of Business & Economic Statistics 29(1): 1-11.**
- **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

Weighting:

- **Hazlett, Chad. Kernel Balancing: A flexible non-parametric weighting procedure for estimating causal effects .**

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.
- Roberts, Margaret E., Brandon M. Stewart, and Richard A. Nielsen. "Adjusting for confounding with text matching." American Journal of Political Science 64.4 (2020): 887-903.

Week 08, 03/11 - 03/15: Research Topic Presentations

Week 09, 03/18 - 03/22: Spring Break!

Have a great break!

Week 10, 03/25 - 03/29: Difference-in-Differences Estimators

Topics:

- Identification, Estimation, Falsification tests

Readings: DID Theory

- **Mixtape chapter 9: https://mixtape.scunning.com/09-difference_in_differences**
- 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. Topics: 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.**
- 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)
- 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.
- Atkinson, Jesse, et al. "Prompting microfinance borrowers to save: A field experiment from Guatemala." Economic Development and Cultural Change 62.1 (2013): 21-64.
- **Roth, Jonathan, et al. "What's Trending in Difference-in-Differences? A Synthesis of the Recent Econometrics Literature." arXiv preprint arXiv:2201.01194 (2022).**
- Xu, Yiqing, Anqi Zhao, and Peng Ding. "Factorial Difference-in-Differences." arXiv preprint arXiv:2407.11937 (2024).

Worksheet make-up opportunity

Week 11, 04/01 - 04/05: Synthetic Control Methods

- **Mixtape chapter 10: https://mixtape.scunning.com/10-synthetic_control**
- **Abadie, Diamond, and Hainmueller. 2010. Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program. JASA**
- Abadie, Alberto and Javier Gardeazabal. 2003. The Economic Costs of Conflict: a Case-Control Study for the Basque Country. American Economic Review 92 (1)
- Pieters, Hannah, et al. "Effect of democratic reforms on child mortality: a synthetic control analysis." The Lancet Global Health 4.9 (2016): e627-e632.
- Abadie, Alberto. "Using synthetic controls: Feasibility, data requirements, and methodological aspects." Journal of economic literature 59.2 (2021): 391-425.
- Ben-Michael, Eli, Avi Feller, and Jesse Rothstein. "The augmented synthetic control method." Journal of the American Statistical Association 116.536 (2021): 1789-1803.
- Donohue, John J., Abhay Aneja, and Kyle D. Weber. "Right-to-carry laws and violent crime: A comprehensive assessment using panel data and a state-level synthetic control analysis." Journal of Empirical Legal Studies 16.2 (2019): 198-247.

Worksheet 5 : DiDs

Week 12, 04/08 - 04/12: Guest Lecture by Dr. Brandt. Instrumental Variables - No Student presentations

Topics:

- Identification: exogenous influences on treatment taking

- Intent-to-treat, imperfect compliance, randomized encouragement
- Reduced form, Wald Estimator, Local Average Treatment Effects, 2SLS

Readings:

- **Mixtape chapter 7: https://mixtape.scunning.com/07-instrumental_variables**
- **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.**
- Deaton, Angus. 2010. Instruments, Randomization, and Learning About Development. Journal ofEconomic 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.
- Holger L. Kern and Jens Hainmueller Opium for the Masses: How Foreign Free Media Can Stabilize Authoritarian Regimes. Political Analysis (2009).
- 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.

Worksheet 6 : Synth

Week 13, 04/15 - 04/19: Discontinuity Designs

- **Mixtape chapter 6: https://mixtape.scunning.com/06-regression_discontinuity**

Topics:

- Identification: continuity of the potential outcomes
- Sharp and Fuzzy Designs, Estimation, Falsification Checks

Readings:

- **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 interesting.)**
- 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, Fowler, Anthony, Hainmueller, Jens, Hall, Andrew B. and Snyder, James M. 2014. 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
- Lee, David S. 2008. Randomized Experiments from Non-random Selection in U.S. House Elections. Journal of Econometrics 142 (2): 675-697.
- Eggers and Hainmueller: The Value of Political Power: Estimating Returns to Office in Post-War British Politics.
- Dell, Melissa. "The persistent effects of Peru's mining mita." Econometrica 78.6 (2010): 1863-1903.
- Santoleri, Pietro, et al. "The causal effects of R&D grants: Evidence from a regression discontinuity." Review of Economics and Statistics 106.6 (2024): 1495-1510.

Worksheet 7 : IV

Week 14, 04/22 - 04/26: Sensitivity Analysis for Selection on Observables

Readings:

- **Cinelli, Hazlett. Making Sense of Sensitivity: Extending omitted variable bias**
- **Go through these example in the sensemakr software: https://carloscinelli.com/sensemakr/articles/index.html**
- **Guido W. Imbens. 2003. Sensitivity to Exogeneity Assumptions in Program Evaluation. The American Economic Review 93 (2): 126–32**.
- **Cinelli, Carlos, and Chad Hazlett. "An omitted variable bias framework for sensitivity analysis of instrumental variables." Available at SSRN 4217915 (2022).**
- **Hazlett, Chad. "Angry or weary? How violence impacts attitudes toward peace among Darfurian refugees." Journal of Conflict Resolution 64.5 (2020): 844-870.**
- 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)
- Rosenbaum and Rubin. 1983. Assessing Sensitivity to an Unobserved Binary Covariate in an Observational Study with Binary Outcome. Journal of the Royal Statistical Society. Series B 45(2).
- Hazlett, Chad, and Francesca Parente. "From "Is It Unconfounded?" to "How Much Confounding Would It Take?": Applying the Sensitivity-Based Approach to Assess Causes of Support for Peace in Colombia." The Journal of Politics 85.3 (2023): 1145-1150.
- Lamberova, Natalia. "The paradox of government-funded innovation in weakly institutionalized environments." Journal of Innovation & Knowledge 9.4 (2024): 100536.

Worksheet 8 : RD

Week 15, 04/29 - 05/03: Group Presentations

Week 16, 05/06 - 05/10: Guest Lecture: IRB and Human Subjects Research

Laura Hamilton, OHSP Quality Improvement Specialist will touch on the following when conducting surveys/survey experiments/human subject research:

- Sensitive questions
- Debriefing
- Balancing/Mitigating risks and value
- Recruitment & Enrollment
- Working with vulnerable populations
- Compensating participants
- Best practices and deviations
- IRB Functions and Responsibilities

These topics are extremely important for everyone who might end up conducting a survey (all of you).