



NYU | WAGNER

PADM-GP 2172.001

Advanced Empirical Methods
Wednesday 4:55 pm – 6:35 pm
Location: 12 Waverly Place, Room L113

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Office Hours

Wednesday 3:45 pm-4:45 pm
By appointment: <https://tinyurl.com/y4rsjqfp>

Course Modality

This course will be run as a **flipped class**. Lecture content is available online along with the slides and Stata examples. Students will be required to view the lectures, respond to discussion questions, and complete Stata exercises online **before** the live session. In-person class time will be spent focusing on those questions and issues that students flagged as unclear or benefitting from more discussion. After class, you will have a lab with our TA and have another chance to over any questions.

Course Description and Objectives

This course is an introduction to the empirical toolkit widely used to estimate causal effects in wide range of settings -- from program evaluation, medical trials, public health interventions, and labor training programs to management HR interventions to policies implemented at the local, state, and national level. More generally, the methods we will discuss are part of the advanced toolkit of any data analyst -- they are the next step beyond multiple regression, although as we will see regression remains a bedrock tool that we will use often.

Another way to think about this course is that it primarily about understanding how to use variation in the data to estimate policy and causal effects, and having understood that how to seek out or create such variation to evaluate policies of interest.

We begin by discussing the strengths and limitations of multiple regression analysis and the relationship between regression and causal modeling. We then develop a sequence of extensions and alternatives, including: randomized trials, regression discontinuity, matching methods, difference-in-differences and panel data, and instrumental variables.

Having learned the methods, we will also learn how to implement them on large-scale data from real policy settings. This will entail expanding your comfort and expertise with advanced use of Stata, and learning how to conceptualize, clean, and handle large data sets in an abstract manner -- essential when dealing with data sets that are sufficiently large that you cannot eyeball and hand code data.

After taking this course, you will:

1. Understand the concept of causality and how it applies to policy research;
2. Understand the limitation of using direct comparisons of sample data to estimate policy effects (also known as sample selection bias);
3. Understand the importance of variation in policy exposure, in defining causal effects, in interpreting them, and in seeking out or even creating variation to evaluate policies of interest to you;
4. Understand (even better) the multiple regression model;
5. Understand at an advanced level the toolkit of methods we discuss
 - o randomized controlled trials - both analyzing and designing
 - o instrumental variable methods - what is valid instrument, how to find one, how to test for one, and how to estimate and interpret
 - o regression discontinuity methods - how to look for RD's, how to analyze them, and how to test the key assumptions
 - o matching methods - understand the key assumptions and when they are plausible, understand their use as a data descriptive tool, and implement both direct and propensity score matching;
 - o difference in differences estimation - understand why this is the most widely applied method, learn to test its assumptions, and estimate effects
6. Develop your advanced Stata skills - both for the sake of understanding a widely used package and also to get a bit of the coder's mindset;
7. Learn how to obtain a large data set, look at the codebook, clean and organize the data, and estimate the results;
8. Learn how to conceptualize, propose, and implement a strategy to estimate a policy or treatment effect of interest;
9. Become a proficient producer of empirical research; and
10. Become an advanced, critical, and thoughtful consumer of empirical research.

Grading

The course will be evaluated through five problem sets (10 points each), a semester-long replication exercise (30%), an in-class quiz (15%), and class participation (completing online asynchronous material, attending and participating in live sessions) (5%). All problem sets will make use of Stata, so please ensure you are familiar with how to access this program at NYU.

Late Policy

Assignments are due prior to 6.45 pm on the dates indicated below on NYU classes. Late submission of problem sets will lead to a two-point reduction for missing the deadline, another one-point reduction for a one-week delay, and zero thereafter. Late submission of the replication exercise will lead to a three-point reduction for missing the deadline, two additional points for a one-week delay, and zero thereafter. Any waivers due to emergencies must be discussed with Student Affairs, who will then communicate with all relevant faculty.

Course Structure

The class includes lectures, readings, and independent computer lab work. You are strongly encouraged to relate the general material of the course to your specific policy interests throughout the course. Class attendance is critical as interaction within the classroom is an essential aspect of this course and the learning process associated with it.

Expectations

Reading e-mail: I will communicate to you through your NYU e-mail. I'm assuming you read it at least once a day.

Preparation before class: come prepared for each class having read the required material carefully, viewed the online lecture content, and completed the discussion questions and Stata exercises. Given the nature of the material, you may find your first pass at a required article challenging; the first time through focus on the concepts and intuition (often found in the introduction).

Classroom Norms and netiquette: You are expected join each class on time. We will often use computers for Stata exercises in class. Please do not multitask. Please keep other windows, including social media and e-mail, closed, and remember that class participation is part of your grade.

Academic Integrity

Academic integrity is a vital component of Wagner and NYU. All students enrolled in this class are required to read and abide by Wagner's Academic Code. All Wagner students have already read and signed the Wagner Academic Oath. Plagiarism of any form will not be tolerated and students in this class are expected to report violations to me. If any student in this class is unsure about what is expected of you and how to abide by the academic code, you should consult me.

Use of Aids and Working Together

It can be very helpful to discuss course material with others. I would encourage working in small groups (e.g., 3 people). If you work in a group, do discuss concepts, ideas, and solutions. But do not share actual code or written solutions. Each person is responsible for typing in and understanding their own code and any written responses.

Use of ChatGPT and other generative AI is not permitted in this course. The only way you will learn in this course is to work at it yourself.

Henry and Lucy Moses Center for Students with Disabilities at NYU

Academic accommodations are available for students with disabilities. Please visit the Moses Center for Students with Disabilities (CSD) website and click the "Get Started" button. You can also call or email CSD (212-998-4980 or mosescsd@nyu.edu) for information. Students who are requesting academic accommodations are strongly advised to reach out to the Moses Center as early as possible in the semester for assistance.

Technology Support

You have 24/7 support via NYU's IT services. Explore the [NYU servicelink knowledgebase](#) for troubleshooting and student guides for all NYU-supported tools (NYU Classes, Zoom, etc). Contact askIT@nyu.edu or 1-212-998-3333 (24/7) for technology assistance, or contact [Zoom's 24/7 technical support](#) (includes a chat function), or review [Zoom's support resources](#). Your peers are another source of support, so you could ask a friend or classmate for help or tips.

If you do not have the appropriate hardware technology nor financial resources to purchase the technology, consider applying for the NYU [Emergency Relief Grant](#).

NYU's Calendar Policy of Religious Holidays

NYU's Calendar Policy of Religious Holidays states that members of any religious group may, without penalty, absent themselves when required in compliance with their religious obligations. Please notify me in advance of religious holidays that might coincide with exams to schedule mutually acceptable alternatives.

Books

There is no textbook for this course. The assigned readings (mainly articles) and lecture notes together will provide a self-contained treatment.

An introductory level book that covers similar material is:

Joshua Angrist and Jörn-Steffan Pischke, *Mastering Metrics* (MM below). Princeton: Princeton University Press, 2015.

This book blends an introduction to econometrics with the basic tools of causal inference we discuss in this course.

A useful supplemental reference is *Causal Inference: The Mix Tape* (MT), either the book or the very useful web site (<https://mixtape.scunning.com/>). The content, as you will see, parallels what we do in class, so this is useful if you want a second take on the same topic or if you are eventually interested in trying some of the methods we discuss in R (the web site provides parallel Stata and R code for many procedures).

Two more technical references are:

Guido Imbens and Donald Rubin, *Causal Inference for Statistics, Social and Biomedical Sciences: An Introduction*. Cambridge: Cambridge University Press 2015. Some chapters will be assigned as supplemental reading. This is a doctoral level treatment, so often too advanced for our purposes. Some sections are nonetheless useful.

Joshua Angrist and Jörn-Steffan Pischke, *Mostly Harmless Econometrics*. Princeton: Princeton University Press, 2009.

These books are more technically advanced than the material our course, so are useful for students who wish to get a flavor of more advanced material or have an advanced reference at hand.

Schedule

- 4 September, Lecture 1: Preliminaries and review
- 11 September, Lecture 2: Introduction to causality
- 18 September, Lecture 3: Randomized controlled trials: basics
- 25 September, Lecture 4: Randomized controlled trials: advanced
- 2 October, Lecture 5: Introduction to Stata and discussion of PS 1
- 9 October, Lecture 6: Instrumental variables, a (re-) introduction, and **problem set 1 due + replication data**
- 16 October, Lecture 7: Instrumental variables: advanced
- 23 October, Lecture 8: **In-class quiz**, class discussion and tutorial for replication exercise, PS 2 discussion
- 30 October, Lecture 9: Regression discontinuity, introduction, and **problem set 2 due**
- 6 November, Lecture 10: Regression discontinuity, advanced
- 13 November, Lecture 11: Matching, basics, and **problem set 3 due**
- 20 November, Lecture 12: Matching, advanced
- 27 November, Lecture 13: Difference-in-differences, **problem set 4 due**
- 4 December, Lecture 14: Replication exercise
- 13 December: No class: **Problem set 5 and replication assignments due.**

Note: These due dates are tentative; they will be postponed if we have not covered the necessary material.

Readings

* denotes required, # denotes an advanced reading where you should only skim the non-technical portions. IR denotes chapters from Imbens-Rubin. MM denotes chapters from Angrist-Pischke's *Mastering Metrics*. Articles (not books) will be available on our Brightspace site.

Topic 1: Preliminaries and review

No required reading. A useful supplement and review can be found in MT, Chapter 2. This chapter is a bit more advanced on Bayes' Rule than needed for our course.

Topic 2: Causality and the Treatment Effect

*Holland, P. (1986), "Statistics and Causal Inference" (with discussion), *Journal of the American Statistical Association*, 81, 945-970.

MT, chapter 4.

IR, chapter 1.

MT, [chapter 3](https://mixtape.scunning.com/03-directed_acyclical_graphs) (https://mixtape.scunning.com/03-directed_acyclical_graphs) offers a useful introduction to directed acyclic graphs (DAGs), an alternative framework for thinking through causal models, proposed by Judea Pearl. We don't use DAG's in our course, but you might see them around, and this is a useful non-technical introduction.

James Heckman, "Causal Parameters and Policy Analysis in Economics: A Twentieth Century Perspective," *Quarterly Journal of Economics*, February 2000.

Topic 3: Introduction to Randomized Controlled Trials

* Joshua Angrist and Victor Lavy, "The Effect of High School Matriculation: Evidence from Randomized Trials," NBER Working Paper No. 9389.

* Esther Duflo and Emmanuel Saez, "The Role of Information and Social Interactions in Retirement Savings Decisions: Evidence from a Randomized Experiment," *Quarterly Journal of Economics*, August 2003

* MM, chapter 1.

Marianne Bertrand and Sendhil Mullainathan, "Are Emily and Greg More Employable than Lakisha and Jamal? A Field Experiment on Labor Market Discrimination," *American Economic Review*, Vol. 94 (4), pp. 991-1013.

MT, chapter 4, blends an introduction to the Rubin Causal Model and randomization.

Marianne Bertrand, Dean Karlan, Sendhil Mullainathan, Eldar Shafir, and Jonathan Zinman, "What's Psychology Worth?"

Philip Oreopoulos, Richard Patterson, Uros Petronijevic, and Nolan Pope, "Lack of Study Time

is the Problem but What is the Solution? Unsuccessful Attempts to Help Traditional and Online College Students,” NBER Working Paper No. 25036.

Cox, The Planning of Experiments, selected chapters (currently unavailable online; check the library if you are interested in this topic).

Topic 4: Randomized Experiments, Advanced Issues

IR, Chapters 4-7 and 9-11.

Cornish, Rosie (2006), “Statistics: An Introduction to Sample Size Calculations,” manuscript.

Jones, S.R., S. Carley, and M. Harrison, “An Introduction to Power and Sample Size Estimation,”

Emergency Medicine Journal, Volume 21, Number 126, pp. 453-458.

Fred Dolittle, et al, *A Summary of the Design and Implementation of the National JTPA Study*.

Edward Miguel and Michael Kremer (2004), “Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities,” *Econometrica*, 72(1): 159-217

Marianne P. Bitler, Jonah B. Gelbach and Hilary W. Hoynes, “What Mean Impacts Miss: Distributional Effects of Welfare Reform Experiments,” *American Economic Review*, Vol. 96(4): 988-1012.

Topic 5: Introduction to Stata and PS1

Topic 6: Instrumental Variables, A Re-Introduction

[#] Angrist, J., G. Imbens, and D. Rubin, “Identification of Causal Effects Using Instrumental Variables” (with discussion), *Journal of the American Statistical Association*, 91, 444-72.

* Acemoglu, Daron, Simon Johnson, and James Robinson, “The Colonial Origins of Comparative Development: An Empirical Investigation,” *American Economic Review*, Vol. 91(5), pp. 1369-1401

* Angrist, J., and William Evans, “Children and Their Parents’ Labor Supply: Evidence from Exogenous Variation in Family Size,” *American Economic Review* 88 (3), June 1998, pp. 450-77.

* Sherman, Lawrence, and Richard Berk, The Specific Deterrent Effects of Arrest for Domestic Assault Author(s): Lawrence W. Sherman and Richard A. Berk Source: *American Sociological Review*, Apr., 1984, Vol. 49, No. 2 (Apr., 1984), pp. 261- 272

* Davis, Donald, and David Weinstein, “Bones, Bombs, and Break Points: The Geography of Economic Activity,” *American Economic Review*, December 2002.

* Miguel, Edward, and Gerard Roland, “The Long-Run Impact of Bombing in Vietnam,” *Journal of Development Economics*, Vol. 96 (2011), pp. 1-15.

MT, Chapter 7, 7.1-7.2

Joshua Angrist, “Instrumental Variable Methods in Experimental Criminology Research: What, Why, and How,” *Journal of Experimental Criminology*, Volume 2, pp. 23-44, 2006.

Jens Ludwig, Greg Duncan, Lisa Gennetian, Lawrence Katz, Ronald Kessler, Jeffrey Kling, and Lisa Sanbonmatsu, “Long-Term Neighborhood Effects of Low-Income Families: Evidence from Moving to Opportunity” February 2013

MM, Chapter 3.

Pitt, Mark, Mark Rosenzweig, and Nazmul Hassan, “Identifying the Hidden Costs of a Public Health Success: Arsenic Well Water Contamination and Productivity in Bangladesh”

Topic 7: Instrumental Variables, Advanced Topics

MT, chapter 7 7.3-7.9.

Joshua Angrist and Alan Krueger, “Does Compulsory School Attendance Affect Schooling and Earnings?” *Quarterly Journal of Economics*, Vol. 106(4): 979-1014.

Kasey Buckles and Daniel Hungerman, “Season of Birth and Later Outcomes: Old Questions, New Answers,” December 2008.

Imbens, Guido, and Jeffrey Wooldridge (2009), “Instrumental Variables with Treatment Effect Heterogeneity: Local Average Treatment Effects,” manuscript.

AR, Chapters 23-25.

Topic 8: Class discussion and tutorial for replication exercise, PS 2 discussion

Topic 9: Regression Discontinuity, Introduction

*Trochim, William, “The Regression-Discontinuity Design: An Introduction”, manuscript. MM, Chapter 4.

Thistlewaite, Donald, and Donald Campbell, “Regression-Discontinuity Analysis: An Alternative to the Ex Post Facto Experiment,” *Journal of Experimental Psychology*, Volume 51, Number 6 (1960).

Berk, Richard (2008), “Recent Perspectives on the Regression Discontinuity Design,” manuscript, Department of Statistics, University of Pennsylvania.

van der Klaauw W. (2002) ‘Estimating the Effect of Financial Aid Offers on College Enrollment: A Regression–Discontinuity Approach’, *International Economic Review* 43(4):1249–1287.

David S. Lee, Enrico Moretti and Matthew J. Butler, “Do Voters Affect or Elect Policies? Evidence from the U. S. House”, *Quarterly Journal of Economics*, Vol. 119(3): 807-859.

Andriana Camacho and Emily Conover, “Manipulation of Social Program Eligibility,” *American Economic Journal: Economic Policy*, Vol. 3, 41-65.

John DiNardo and David Lee, “Economic Impacts of New Unionization on Private Sector Employers: 1984-2001,” *Quarterly Journal of Economics*, Vol. 119(4): 1383-1441.

Olivier Marie, “Early Release from Prison and Recidivism: A Regression Discontinuity Approach”, 2008.

Topic 10: Regression Discontinuity, Advanced Topics

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

Imbens, Guido, and Thomas Lemieux (2007), “Regression Discontinuity Designs: A Guide to Practice,” National Bureau of Economic Research, Technical Working Paper No. 337.

Catherine Hausman and David Rapson (2017), “Regression Discontinuity in Time: Consideration for Empirical Analysis,” NBER Working Paper 23602.

Devin Caughey and Jasjeet Sekhon, “Elections and the Regression Discontinuity Design: Lessons from Close U.S. House Races: 1942-2008,” *Political Analysis*, Vol. 19 (2011), pp. 385-408.

Alan Barreca, Melanie Guldi, Jason Lindo, and Glen Waddell, “Saving Babies? Revisiting the Effect of Very Low Birthweight Classification,” *Quarterly Journal of Economics*, Vol. 126 (2011), pp. 2117-2123.

McCrary, Justin, “Manipulation of the Running Variable in the Regression Discontinuity Design: A Density Test,” December 2006.

Card, David, “Regression Kink Design: Theory and Practice,” October 2016.

Topic 11: Matching, Introduction

* Stuart, Elizabeth (2009), “Matching Methods for Causal Inference: A Review and a Look Forward,” manuscript, Department of Biostatistics, Johns Hopkins University

#Abadie, Alberto, David Drukker, Jane Leber Herr, and Guido Imbens (2001), “Implementing Matching Estimators for Average Treatment Effects in Stata,” *The Stata Journal*, Volume 1, Number 1, pp. 1-18.

MT, Chapter 5, 5.1-5.3.2

W.G. Cochran, “The Effectiveness of Adjustment by Subclassification in Removing Bias in Observational Studies,” *Biometrics*, Vol. 24(2), 295-313.

Alberto Abadie and Guido Imbens, “Bias-Corrected Matching Estimators for Average Treatment Effects,” *Journal of Business and Economic Statistics*, Vol. 29(1), 1-11.

IR, Chapter 18.

Topic 12: Matching, Advanced Topics

* Dehejia, Rajeev, and Sadek Wahba, "Causal Effects in Non-Experimental Studies: Reevaluating the Evaluation of Training Programs," *Journal of the American Statistical Association*, Vol. 94(488), pp. 1053-1062.

* Dehejia, Rajeev, and Sadek Wahba, "Propensity Score Matching Methods for Nonexperimental Causal Studies," *Review of Economics and Statistics*, Vol. 84(1), pp. 151-161.

MT, Chapter 5, 5.3.3-5.4

Robert Lalonde, "Evaluating the Econometric Evaluation of Training Programs with Experimental Data," *American Economic Review*, Vol. 76(4), 604-620.

Abadie, Alberto, and Guido Imbens, "Large Sample Properties of Matching Estimators for Average Treatment Effects," *Econometrica*, Volume 74 (No. 1, January 2006), pp. 235-267.

Matias Busso, John DiNardo, and Justin McCrary, "New Evidence on the Finite Sample Properties of Propensity Score Reweighting and Matching Estimators," manuscript.

Crump, Richard, Joseph Hotz, Guido Imbens, and Oscar Mitnik, "Dealing with Limited Overlap in Estimation of Average Treatment Effects," *Biometrika*, Volume 96 (No. 1, January 2009), pp. 187-199.

IR, Chapters 12-17.

Topic 13: Difference-in-Differences

MT, chapter 9.

Thomas Coleman, "Causality in the Time of Cholera: John Snow as a Prototype for Causal Inference," March 2019

Meyer, Bruce, Kip Viscusi, and David Durbin (1995), "Workers' Compensation and Injury Duration: Evidence from a Natural Experiment," *American Economic Review*, Volume 85, Number 3, pp. 322-340.

Meyer, Bruce, "Natural and Quasi Experiments in Economics," December 1994

Rajeev Dehejia, Heather Montgomery, and Jonathan Morduch, "Do Interest Rates Matter? Credit Demand in the Dhaka Slums," *Journal of Development Economics*, Vol. 97, pp. 437-449.

Justine Hastings, "Vertical Relationships and Competition in Retail Gasoline Markets: Empirical Evidence from Contract Changes in Southern California," *American Economic Review*, Vol. 94(1), 317-328.

Orley Ashenfelter, "Estimating the Effect of Training Programs on Earnings," *Review of Economics and Statistics*. Vol. 60(1): 47-57.

Jonathan Gruber, "The Incidence of Mandated Maternity Benefits," *American Economic Review*, Vol. 84(3), 622-641.

MM, Chapter 5.

Topic 14: Replication exercise discussion