University of Nevada, Reno ECON 741: Applied Econometrics

Fall 2025 (8/25 - 12/17)

Professor:	Pierce Donovan	pierce.donovan@unr.edu
Lectures:	TULL 408	TR 4:30 pm - 5:45 pm
Office Hours:	TULL 457	TF 1:00 pm - 3:00 pm
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Course Description

This class will demonstrate how economists conduct research to generate measurements of causal effects with direct policy implications. That work provides the rigorous evidence needed for informed policymaking, so we will study research design that gives rise to causal inference through a survey of popular and modern empirical methods in econometrics.

My Plan

We're going to learn how to publish in *AEJ*: *Applied Economics* and *AEJ*: *Economic Policy* (and similarly ranked general-interest journals). Even if you never want to do this yourself, I want to present examples of recent, relevant, and high quality empirical research and have you emulate them. This will help us understand the ingenuity required to be a successful practitioner of econometrics.

Objective

This class will provide a preview of post-comprehensive exam study. It is ultimately your job to learn what your field's literature prioritizes and values, recognize research opportunities, and generate your own questions that are answerable, interesting, and policy-relevant. With this class, I want you to begin this transition to full-fledged researcher as early as possible.

Student Learning Outcomes

Upon completion of this course, students should be able to

- 1. Identify, discuss implications of, and provide solutions to common challenges when using observational data to estimate causal effects.
- 2. Use statistical software to apply commonly used empirical methods for econometric analysis of data and initiate self-study when more complicated variants are desired.
- 3. Read a journal article and (1) determine the policy-relevant question of interest, (2) discuss the model and identification strategy used in the study, and (3) interpret empirical results.
- 4. Develop a research plan consisting of (1) a policy-relevant research question, (2) a model and hypothesis test, (3) a data collection and empirical strategy, and (4) key results of interest.
- 5. Create clear, informative, and engaging research presentations.

Expectations

This is a rigorous 700-level class geared towards 1st-year PhD students in economics and related fields that want to pursue policy-relevant research careers. Because of this emphasis, the class is not particularly difficult when it comes to mathematical proof or statistical technique, but it will require clear causal thinking, a challenging type of logic at which economists excel. I interpret enrollment in this class to be a signal that you are interested in developing this skill and that you will respect my other expectations, listed below.

Econometrics Background

I don't expect that every student will have the same background, but there is still a minimum understanding required to make further progress. To ensure that you all establish a shared baseline, I will conduct a rapid review during the first few lectures. I will also share my course notes from ECON 441: *Introduction to Econometrics* with you. It is ok if some of that content is not familiar, but you should at least find it relatively easy to digest. Regardless of your background, I strongly recommend studying these notes and frequently referencing the three textbooks listed below during the early phases of this class.

Attendance and Discussion

Learning is an active process. I've set aside a significant portion of our class time for journal article discussion, and preparation is crucial if you want to get anything out of this. If students have no questions or comments concerning the assigned readings, then I will simply end our class early.

The following is an excerpt from my ECON 441 syllabus that still applies here:

You're responsible for becoming a competent econometrician. I can't accomplish this for you. Consider my role: I am like your personal trainer. I provide you with your workout regimen (the lectures, assignments, readings, and my direction), and you choose how you want to follow that plan. If you play an active role in class, regularly review your notes, and keep up with office hours, then you're setting yourself up for success.

Autonomy and Assistance

Later in your careers, you should be able to conduct your research and solve most of your problems autonomously. As students, you should be working towards this ability, but you are also expected to ask for help when you need it. In these cases, it is important that you come to me or Urjaswi with your problem clearly identified so that we can help you most effectively. Please ask me questions involving theory or course materials, and ask Urjaswi for help about STATA and LATEX.

Large Language Models

The use of LLMs is prohibited in this class. I ask you to summarize journal articles and write your own analyses because important things happen in your brain when you do these tasks. In other words, learning and critical thinking are what I want, rather than some specific product. My ban is evidence-based, as LLM use has been demonstrated to reduce critical thinking ability and is therefore at odds with my objective. I would avoid this class if you do not want to learn anything, or if you do not aim to provide any value beyond that of insipid and mediocre LLM output.

Assessment

Your final grade composition is as follows:

40%	Reading Summaries and Class Discussion
30%	Replication Assignments
15%	Presentations
15%	Research Proposal

Reading Summaries and Class Discussion

This is a reading and writing-intensive course. There will be assigned readings for every lecture, and you must be prepared to discuss them in class. To make reading incentive compatible, reading summaries will be submitted at the beginning of each lecture with a discussion element.

To complete your reading summary, answer the following five questions for each journal article marked with an asterisk in the reading list:

- 1. What is the empirical objective of the paper (the hypothesis that the authors want to test)?
- 2. How can this study help *people*, i.e. what makes this study interesting and policy-relevant?
- 3. What is the *academic* contribution of the paper relative to existing literature?
- 4. How does the chosen empirical strategy justify a causal interpretation of the authors' results?
- 5. What are the authors' key empirical results—and the implications of their findings?

You'll notice that I am less concerned with you repeating the findings of the paper results and more interested in you discussing the validity of the empirical approach that the authors used to facilitate causal effect estimation. This is a short but challenging report; these summaries should only be around a page on average, but will require careful reading.

Comment: I've created a class for *practitioners* of econometrics. Given that our in-class emphasis is on discussing application, the class is sort of "flipped" when it comes to learning a theoretical foundation. I will support you with theory lectures so that you understand the basics of how and when to apply the empirical strategies that we discuss, but you should expect to generate additional questions in your head that deserve further study.

It takes years to learn econometrics. I can point you to places where you can learn all of the minutiae of each empirical strategy, but right now, I want you to focus on your foundational knowledge. To facilitate this, I will assign supplemental readings from the following three textbooks:

- Mostly Harmless Econometrics: An Empiricist's Companion, by Angrist and Pischke (2009)
- *Mastering 'Metrics: The Path From Cause to Effect*, by Angrist and Pischke (2014)
- Causal Inference: The Mixtape, by Cunningham (2021)

The first and last books are in-line with the level of understanding needed for this course, and the middle one is for developing an intuitive baseline. I highly recommend reading all three throughout the course. Please bring questions about these readings to class.

Replication Assignments

This class covers several methods that underlie most empirical research in economics today. There will be a replication assignment to go along with each method, and you will follow the work of a representative journal article. With these assignments, you will gain experience using statistical software (namely STATA, maybe R) to apply empirical methods to data. Furthermore, you will glean insight into the amount of work needed to put a high quality paper together.

Your work must be your own, and late assignments will not be accepted. Assignments should be written in LATEX and contain *curated* regression output/tables/figures with functional code submitted as an appendix. Your code should be well-documented (headings, ownership, comments, etc.) so that anyone with some coding experience could quickly read it and understand what it does.

Presentations

Any research career will require you to create clear, informative, and engaging research presentations with some regularity. This skill is just as important as being able to conduct research. In this class, you will present twice, with the first presentation discussing an existing published paper, and the second detailing a research proposal.

You will write your presentations with an *assertion-evidence* approach, which is a challenging but rewarding paradigm for scientific communication. Slides are formatted with a short assertion at the top, and a central figure, table, or picture that provides the evidence for that assertion to stand on. Ideally, you select exhibits that prompt the things you want to say, rather than reading lengthy text-filled slides out loud. Like your replication assignments, these presentations must use LATEX.

Research Proposal

The goal of this exercise is to prepare you to look for future research questions. Everyone in this class is just starting out on their research careers, so we aren't chasing after a fully developed dissertation topic in just half a semester. What I'm looking for is a workable plan for a paper that can be pursued after finishing this class.

Your research proposal consists of the following:

- 1. A policy-relevant research question related to a broad theme.
- 2. A literature review demonstrating where this paper fits and its novelty.
- 3. A proposed model and hypothesis test to answer your research question.
- 4. Details how on your data collection and empirical strategy can be implemented.
- 5. Key results of interest and discussion of potential implications.

You will complete this task in three stages. The first is an initial proposal idea, which should be no more than two pages excluding references. I will then provide feedback that you can use to refine your proposal and create a corresponding presentation. The presentation allows the class to discuss your paper idea together. After both rounds of feedback, your final proposal, which should be no longer than five pages excluding references, will be due during finals week.

Course Schedule and Reading List

(* Required Reading, + Recommended, × Replication)

Probability and Regression Review

Background Probability and [Frequentist] Statistics Tuesday, 8/26

Causal Inference Mixtape: Chapters 2.7–2.10 Mastering 'Metrics: Chapter 1 Appendix

ECON 441 Notes: Statistical Inference, Operators

Concepts: random variable, probability distribution, p-value, law of large numbers, consistency, unbiasedness, central limit theorem, t-statistics, hypothesis testing, statistical significance

Causal Inference Mixtape: Chapters 2.11–2.16, 2.24–2.27

Mostly Harmless: Chapters 3.0, 3.1

Mastering 'Metrics: Chapter 2 Appendix

ECON 441 Notes: Operators, Regression Anatomy

Concepts: curve fitting, optimization, least-squares estimator, omitted variable bias

How to Read a Paper Tuesday, 9/2

Causal Inference Mixtape: Introduction

Mostly Harmless: Chapter 1
Mastering 'Metrics: Introduction

Concepts: research questions, literature review, empirical strategy, identifying variation

Readings:

- * Englander, G. (2023). Information and Spillovers from Targeting Policy in Peru's Anchoveta Fishery. *American Economic Journal: Economic Policy*, 15(4):390–427.
- * Axbard, S. (2016). Income Opportunities and Sea Piracy in Indonesia: Evidence from Satellite Data. *American Economic Journal: Applied Economics*, 8(2):154–194.

Potential Outcomes and Randomized Controlled Trials

The Potential Outcomes Framework Thursday, 9/4

Causal Inference Mixtape: Chapters 4.0, 4.1

Mostly Harmless: Chapters 2.0, 2.1 Mastering 'Metrics: Chapter 1

ECON 441 Notes: Potential Outcomes

Concepts: treatment and control groups, dummy variables, counterfactuals, selection bias

STATA and Later Introduction (Urjaswi)
STATA Exercise (Urjaswi)
Randomized Controlled Trials: Theory
Causal Inference Mixtape: Chapters 4.2, 4.3
Mostly Harmless: Chapters 2.2, 2.3
ECON 441 Notes: Potential Outcomes

Concepts: random assignment, average treatment effects, preanalysis plans, power calculations, multiple hypothesis testing, clustering, the stable unit treatment value assumption

- * Hussam, R., Rabbani, A., Reggiani, G., and Rigol, N. (2022). Rational Habit Formation: Experimental Evidence from Handwashing in India. *American Economic Journal: Applied Economics*, 14(1):1–41.
- * Bailey, M. R., Brown, D. P., Shaffer, B., and Wolak, F. A. (2025). Show Me the Money! A Field Experiment on Electric Vehicle Charge Timing. *American Economic Journal: Economic Policy*, 17(2):259–284.

Other RCT Examples

Replication Assignment:

× Hanna, R., Duflo, E., and Greenstone, M. (2016). Up in Smoke: The Influence of Household Behavior on the Long-Run Impact of Improved Cooking Stoves. *American Economic Journal: Economic Policy*, 8(1):80–114.

- + Park, S. (2019). Socializing at Work: Evidence from a Field Experiment with Manufacturing Workers. *American Economic Journal: Applied Economics*, 11(3):424–455.
- + Dupas, P., Karlan, D., Robinson, J., and Ubfal, D. (2018). Banking the Unbanked? Evidence from Three Countries. *American Economic Journal: Applied Economics*, 10(2):257–297.
- + Edelman, B., Luca, M., and Svirsky, D. (2017). Racial Discrimination in the Sharing Economy: Evidence from a Field Experiment. *American Economic Journal: Applied Economics*, 9(2):1–22.

Econometrics in Practice

Directed Acyclic Graphs Tuesday, 9/23

- * Marcus, M. (2021). Going Beneath the Surface: Petroleum Pollution, Regulation, and Health. *American Economic Journal: Applied Economics*, 13(1):72–104.
- * Baylis, P. and Boomhower, J. (2023). The Economic Incidence of Wildfire Suppression in the United States. *American Economic Journal: Applied Economics*, 15(1):442–473.

Deeper into Regression Thursday, 10/2 Readings: Thursday, 10/2

- * Burke, M. and Emerick, K. (2016). Adaptation to Climate Change: Evidence from US Agriculture. *American Economic Journal: Economic Policy*, 8(3):106–140.
- * Alix-Garcia, J. M., Sims, K. R. E., and Yañez-Pagans, P. (2015). Only One Tree from Each Seed? Environmental Effectiveness and Poverty Alleviation in Mexico's Payments for Ecosystem Services Program. *American Economic Journal: Economic Policy*, 7(4):1–40.

Other Regression Examples

Replication Assignment:

× Kuruc, K., LoPalo, M., and O'Connor, S. (2025). The Willingness to Pay for a Cooler Day: Evidence from 50 Years of Major League Baseball Games. *American Economic Journal: Applied Economics*, 17(1):126–159.

Additional Readings:

- + He, G. and Tanaka, T. (2023). Energy Saving May Kill: Evidence from the Fukushima Nuclear Accident. *American Economic Journal: Applied Economics*, 15(2):377–414.
- + Baker, M., Halberstam, Y., Kroft, K., Mas, A., and Messacar, D. (2023). Pay Transparency and the Gender Gap. *American Economic Journal: Applied Economics*, 15(2):157–183.
- + Severen, C. and Van Benthem, A. A. (2022). Formative Experiences and the Price of Gasoline. *American Economic Journal: Applied Economics*, 14(2):256–284.
- + Hollingsworth, A. and Rudik, I. (2021). The Effect of Leaded Gasoline on Elderly Mortality: Evidence from Regulatory Exemptions. *American Economic Journal: Economic Policy*, 13(3):345–373.
- + Park, R. J., Goodman, J., Hurwitz, M., and Smith, J. (2020). Heat and Learning. *American Economic Journal: Economic Policy*, 12(2):306–339.
- + Gagliarducci, S., Onorato, M. G., Sobbrio, F., and Tabellini, G. (2020). War of the Waves: Radio and Resistance during World War II. *American Economic Journal: Applied Economics*, 12(4):1–38.
- + Myers, E. (2019). Are Home Buyers Inattentive? Evidence from Capitalization of Energy Costs. *American Economic Journal: Economic Policy*, 11(2):165–188.

Instrumental Variables

Replication #2 due.

Causal Inference Mixtape: Chapters 7.1–7.3, 7.5–7.9

Mostly Harmless: Chapters 4.0-4.2, 4.4-4.6

Mastering 'Metrics: Chapter 3, Chapter 3 Appendix

ECON 441 Notes: Instrumental Variables

Concepts: instrument vs proxy, two-stage least squares, exclusion restriction, relevance and independence of an instrument, weak instruments, heterogeneous treatment effects, intent-to-treat effect, local average treatment effect, internal and external validity

- * Blonz, J., Palmer, K., Wichman, C. J., and Wietelman, D. C. (2025). Smart Thermostats, Automation, and Time-Varying Prices. *American Economic Journal: Applied Economics*, 17(1):90–125.
- * Assunção, J., Gandour, C., and Rocha, R. (2023). DETER-ing Deforestation in the Amazon: Environmental Monitoring and Law Enforcement. *American Economic Journal: Applied Economics*, 15(2):125–156.

- * Ketel, N., Leuven, E., Oosterbeek, H., and Van Der Klaauw, B. (2016). The Returns to Medical School: Evidence from Admission Lotteries. *American Economic Journal: Applied Economics*, 8(2):225–254.
- * Hansen-Lewis, J. and Marcus, M. (2025). Uncharted Waters: Effects of Maritime Emission Regulation. *American Economic Journal: Economic Policy*, 17(1):37–69.

Other IV Examples

Replication Assignment:

× Busso, M. and Galiani, S. (2019). The Causal Effect of Competition on Prices and Quality: Evidence from a Field Experiment. *American Economic Journal: Applied Economics*, 11(1):33–56.

- + Cohen, E. (2024). Housing the Homeless: The Effect of Placing Single Adults Experiencing Homelessness in Housing Programs on Future Homelessness and Socioeconomic Outcomes. *American Economic Journal: Applied Economics*, 16(2):130–175.
- + Angrist, J. D., Caldwell, S., and Hall, J. V. (2021). Uber versus Taxi: A Driver's Eye View. *American Economic Journal: Applied Economics*, 13(3):272–308.
- + Fell, H., Kaffine, D. T., and Novan, K. (2021). Emissions, Transmission, and the Environmental Value of Renewable Energy. *American Economic Journal: Economic Policy*, 13(2):241–272.
- + Yang, J., Purevjav, A.-O., and Li, S. (2020). The Marginal Cost of Traffic Congestion and Road Pricing: Evidence from a Natural Experiment in Beijing. *American Economic Journal: Economic Policy*, 12(1):418–453.
- + Collinson, R. and Ganong, P. (2018). How Do Changes in Housing Voucher Design Affect Rent and Neighborhood Quality? *American Economic Journal: Economic Policy*, 10(2):62–89.

Regression Discontinuity

Replication #3 due.

Causal Inference Mixtape: Chapters 6.1-6.3, 6.6

Mostly Harmless: Chapters 6.0–6.2 Mastering 'Metrics: Chapter 4

ECON 441 Notes: Regression Discontinuity

Concepts: natural experiments, running variable, threshold, continuity, local randomization, extrapolation, bandwidth, local linear regression, sharp vs fuzzy RD, bunching and heaping, density and placebo tests

- * Rohlfs, C., Sullivan, R., and Kniesner, T. (2015). New Estimates of the Value of a Statistical Life Using Air Bag Regulations as a Quasi-Experiment. *American Economic Journal: Economic Policy*, 7(1):331–359.
- * Hoekstra, M., Puller, S. L., and West, J. (2017). Cash for Corollas: When Stimulus Reduces Spending. *American Economic Journal: Applied Economics*, 9(3):1–35.

- * Garg, T., Jagnani, M., and Pullabhotla, H. K. (2024). Rural Roads, Farm Labor Exits, and Crop Fires. *American Economic Journal: Economic Policy*, 16(3):420–450.
- * Ganguli, I. (2017). Saving Soviet Science: The Impact of Grants When Government R&D Funding Disappears. *American Economic Journal: Applied Economics*, 9(2):165–201.

Other RD Examples

Replication Assignment:

× Smith, A. C. (2016). Spring Forward at Your Own Risk: Daylight Saving Time and Fatal Vehicle Crashes. *American Economic Journal: Applied Economics*, 8(2):65–91.

- + Lalive, R., Magesan, A., and Staubli, S. (2023). How Social Security Reform Affects Retirement and Pension Claiming. *American Economic Journal: Economic Policy*, 15(3):115–150.
- + Lindner, A. and Reizer, B. (2020). Front-Loading the Unemployment Benefit: An Empirical Assessment. *American Economic Journal: Applied Economics*, 12(3):140–174.

- + Cantoni, E. (2020). A Precinct Too Far: Turnout and Voting Costs. *American Economic Journal: Applied Economics*, 12(1):61–85.
- + Ramnath, S. P. and Tong, P. K. (2017). The Persistent Reduction in Poverty from Filing a Tax Return. *American Economic Journal: Economic Policy*, 9(4):367–394.

Differences in Differences

Replication #4 due.

Causal Inference Mixtape: Chapters 9.1–9.7, 10

Mostly Harmless: Chapter 5.2

Mastering 'Metrics: Chapter 5, Chapter 5 Appendix

ECON 441 Notes: Differences in Differences

Concepts: common (parallel) trends, interaction variables, time-varying effects, panel data, fixed effects, staggered treatment, synthetic control

- * You, W. (2021). The Economics of Speed: The Electrification of the Streetcar System and the Decline of Mom-and-Pop Stores in Boston, 1885–1905. *American Economic Journal: Applied Economics*, 13(4):285–324.
- * Timm, L. M., Giuliodori, M., and Muller, P. (2025). Tax Incentives for Migrants with Midlevel Earnings: Evidence from the Netherlands[†]. *American Economic Journal: Applied Economics*, 17(3):42–79.

- * Jones, D. and Marinescu, I. (2022). The Labor Market Impacts of Universal and Permanent Cash Transfers: Evidence from the Alaska Permanent Fund. *American Economic Journal: Economic Policy*, 14(2):315–340.
- * Alpert, A., Dykstra, S., and Jacobson, M. (2024). Hassle Costs versus Information: How Do Prescription Drug Monitoring Programs Reduce Opioid Prescribing? *American Economic Journal: Economic Policy*, 16(1):87–123.

Other DiD Examples

Replication Assignment:

× Ouss, A. and Stevenson, M. (2023). Does Cash Bail Deter Misconduct? *American Economic Journal: Applied Economics*, 15(3):150–182.

- + Ito, K. and Zhang, S. (2025). Do Consumers Distinguish Fixed Cost from Variable Cost? "Schmeduling" in Two-Part Tariffs in Energy. *American Economic Journal: Economic Policy*, 17(2):194–223.
- + Nathan, B., Perez-Truglia, R., and Zentner, A. (2025). My Taxes Are Too Darn High: Why Do Households Protest Their Taxes? *American Economic Journal: Economic Policy*, 17(1):273–310.
- + Christensen, H. B., Maffett, M., and Rauter, T. (2024). Reversing the Resource Curse: Foreign Corruption Regulation and the Local Economic Benefits of Resource Extraction. *American Economic Journal: Applied Economics*, 16(1):90–120.
- + Andrews, M. J. (2023). How Do Institutions of Higher Education Affect Local Invention? Evidence from the Establishment of US Colleges. *American Economic Journal: Economic Policy*, 15(2):1–41.
- + Sanders, N. J. and Barreca, A. I. (2022). Adaptation to Environmental Change: Agriculture and the Unexpected Incidence of the Acid Rain Program. *American Economic Journal: Economic Policy*, 14(1):373–401.
- + Wagner, K. R. H. (2022). Adaptation and Adverse Selection in Markets for Natural Disaster Insurance. *American Economic Journal: Economic Policy*, 14(3):380–421.
- + Zuo, G. W. (2021). Wired and Hired: Employment Effects of Subsidized Broadband Internet for Low-Income Americans. *American Economic Journal: Economic Policy*, 13(3):447–482.
- + Gu, Y., Jiang, C., Zhang, J., and Zou, B. (2021). Subways and Road Congestion. *American Economic Journal: Applied Economics*, 13(2):83–115.
- + Cicala, S., Lieber, E. M. J., and Marone, V. (2019). Regulating Markups in US Health Insurance. *American Economic Journal: Applied Economics*, 11(4):71–104.
- + Machin, S., McNally, S., and Viarengo, M. (2018). Changing How Literacy Is Taught: Evidence on Synthetic Phonics. *American Economic Journal: Economic Policy*, 10(2):217–241.
- + Bauernschuster, S., Hener, T., and Rainer, H. (2017). When Labor Disputes Bring Cities to a Standstill: The Impact of Public Transit Strikes on Traffic, Accidents, Air Pollution, and Health. *American Economic Journal: Economic Policy*, 9(1):1–37.

Research Discussions

Random Filters
Replication #5 due. Concepts: mediation, mechanisms, effect support, seemingly unrelated regression
Readings:
* Donovan, P. (2025). Identifying Treatment Effects with a Random Filter. <i>Working Paper</i> .
Additional Readings:
+ Bellemare, M. F., Bloem, J. R., and Wexler, N. (2024). The Paper of How: Estimating Treatment Effects Using the Front-Door Criterion. <i>Oxford Bulletin of Economics and Statistics</i> , 86(4):951–993.
No class (Veteran's Day)
Paper Discussions (Students TBD) Thursday, 11/13
Research idea due.
Paper Discussions (Students TBD)
Paper Discussions (Students TBD) Thursday, 11/20
Paper Discussions (Students TBD)
No class (Thanksgiving Break) Thursday, 11/27
Research Brownbag (Students TBD)
Research Brownbag (Students TBD) Thursday, 12/4
Research Brownbag (Students TBD)
Beginning of Finals Week