

ECON 523 (M1)
Applied Econometrics: Causal Inference and Policy Evaluation
MSPE, Department of Economics
Fall 2026

Instructor:

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DKH 101-E
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Class meetings: Monday/Wednesday, 9:30am – 10:50am in DKH 215

Office Hours:

- Individual office hours: Mon 3:30-5:00pm CT, Tues 2:30-4:00pm CT. Schedule time [here](#). Can also schedule alternative appointment if necessary. Office hours are an opportunity to discuss questions you have about the class, problems with the assignments, or broader topics related to the course material and economics/econometrics more broadly. Office hours are available in DKH 101-E or on zoom. The zoom room link will be sent to you when you schedule a meeting through my website.
- Group office hours: 4:00-5:00pm CT Tuesdays in DKH 101E. No appointment necessary.

Course Description: This course will cover modern econometric techniques for estimating causal effects including experiments, regression and matching, instrumental variables, difference-in-differences, synthetic control, and regression-discontinuity designs. We will discuss the properties of each of these techniques and illustrate them using examples from health policy, education policy, workforce development programs, environmental and labor market regulations, and economic development programs. Students will be introduced to both the potential outcomes (PO) and directed acyclic graph (DAG) frameworks for thinking about causal questions. Students will also gain experience applying the techniques to study policies in real-data sets using the statistical programming language R. Emphasis will be placed on following good coding and data practices and using LLMs to improve productivity.

Course Goals: At the end of this course, students should be able to:

- 1) Be informed consumers of research & news regarding causal effects of public /private policies.
- 2) Describe advantages and limitations of different techniques for estimating causal effects.
- 3) Implement a variety of strategies for estimating causal effects using R programming language.
- 4) Present and interpret research results and discuss strengths and limitations of the evidence.

Prerequisites: Econ 502 and 503 are strongly recommended for individuals taking this course. Please schedule a meeting with me if you have not completed these courses. The course assumes that students have knowledge of calculus, linear algebra, and basic statistics and econometrics. In particular, students should be familiar with basic multivariate calculus (first and second derivatives and how to obtain them), matrix operations, basic properties of random variables, calculating expectations, variances, correlations, conditional expectations and variances, and multiple linear regression.

Credits: 4 credits

Learning Resources:

The three textbooks for this course are below:

- *Mastering 'Metrics: The Path from Cause to Effect* by Josh Angrist and Jorn-Steffen Pischke (2014)

- *Foundations of Agnostic Statistics* by Peter Aronow and Benjamin Miller (2019)
- *Counterfactuals and Causal Inference, 2nd Edition* by Morgan and Winship (2015)

Additional materials, as well as assignments and practice materials will be available on Illinois Canvas (<http://canvas.illinois.edu>). Announcements about assignments, readings, and other course items will be posted on Canvas.

This course will use R, which is a free statistical computing language. R can be downloaded at <http://www.r-project.org>. Additional background materials on R will be provided throughout the course. Students are strongly encouraged to take the introduction to R class offered by the economics department the first two weeks of the semester.

Requirements:

- **Assignments:** There will be 6 mandatory assignments that together will count for 10% of the grade. I will drop your lowest assignment scores when computing this grade. The assignments will be due on:
 - Assignment 1: Sep 18
 - Assignment 2: Sep 23
 - Assignment 3: Oct 14
 - Assignment 4: Nov 4
 - Assignment 5: Nov 16
 - Assignment 6: Dec 2
- **Midterms:** There will be 1 midterm that will count for 20% of the grade
 - Midterm, October 21
- **Research Project:** Students will complete a research project worth a total of 35% of the grade. This project will be done in **groups of two**.
 - Topic brainstorming presentations: Sep 28 and Sept 30 (2.5% of grade)
 - First draft of proposal. Oct 12 (2.5% of grade)
 - Final Proposal: Oct 19 (5% of the grade)
 - Preliminary Analysis: Nov 18 (10% of the grade)
 - Final presentations and memos: December 2, 7, and 9 (15% of the grade)
- **Final Exam:** There will be a 3-hour exam during finals week which will cover the entire course material and be worth 35% of the grade. The final exam is scheduled for Monday, December 14 from 8-11am.

Assignments: Will be mixture of problem sets and other assignments.

Research Project: Students will propose their own program evaluation or other piece of policy analysis. There will be a series of deadlines to help students put together these projects, which are outlined in the course deadline list above. More details will be discussed during class.

Grading: Overall Grades will be on a +/- scale and may follow a light curve.

Assessment Policies:

Assignment Policies:

Student grades on their lowest three assignments will be dropped. All assignments are to be turned on canvas by 10:30am on the day that they're due. Late assignments receive *no* credit without an instructor approved excuse. Acceptable excuses include physical and mental illness, and personal or family emergencies. A written request for an extension must be submitted at least 48 hours in advance.

Assignments can be turned in early at your instructor's office or via email. You are encouraged to work as a group with your classmates on problems sets, although you have to hand in your own solutions. On assignments, I will specify questions that I think it would be good for you to try on your own and those with which you should start by trying with an LLM. This is for your own education. I will grade the problem sets based on the quality of the output alone.

Note that we cannot grade assignments that we cannot read. Consequently, please be careful to make all assignments legible.

Exam Policy:

In the event that a student misses one of the exams, the instructor reserves the right to give the student a zero on that exam. There are no make-up exams without an instructor approved excuse. Instructor approved excuses include 1) medical reasons, in which case you should bring a letter from a medical professional describing your reason for missing the exam, 2) death or serious illness of an immediate family member or close friend (documentation required), or 3) conflict with a religious holiday. Requests for exam make-ups should be made as far in advance as possible.

We will follow the University guidelines on student conflicts with final exams. For this year's student code, see http://admin.illinois.edu/policy/code/article3_part2_3-201.html.

Regrades:

All regrade requests must be submitted in writing no more than one week after the assignment or exam is returned. The request must be written and include a detailed summary of why the student believes the grade they received was incorrect. I generally regrade the entire exam or assignment, so the grade may go up or down. Consequently, students should only request a regrade if they are very confident that the original grade they received was incorrect.

Statement on Academic Integrity

We will follow Articles 1-401 through 1-406 of the *Student Code* (beginning at http://studentcode.illinois.edu/article1_part4_1-401.html). This rule defines infractions of academic integrity, which include, but are not limited to, cheating, fabrication, and plagiarism. You are responsible for following these guidelines (ignorance is no excuse). If you have any questions about whether something would be an infraction, consult with the instructor before proceeding.

Requests for Special Accommodations:

To obtain disability-related adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, call (217)-333-4603, email disability@illinois.edu or go to the DRES website.

Please also schedule a private meeting with the course instructor to discuss your needs and requirements. The instructor will attempt to meet all reasonable course accommodations once the student self-identifies. Please note that accommodations are not retroactive to the beginning of the semester, but begin the day you contact the instructor with a current letter of accommodation from DRES.

Emergency Response Recommendations:

The university maintains guidelines for emergency responses. A list of recommendations when to evacuate and when to find shelter are available at:

http://illinois.edu/cms/2251/general_emergency_response_recommendations_8_16_13_final.docx

Floor plans for specific buildings are available at: <http://police.illinois.edu/emergency->

Course Schedule (tentative)

1	Aug 24	Course overview, logistics, and introduction to causality
	Aug 26	Introduction to causality: Potential Outcomes
2	Aug 31	Introduction to causality: Directed Acyclic graphs (DAGs)
	Sept 2	Randomization Day #1
3	Sept 7	<i>Labor Day (No Class)</i>
	Sept 9	Randomization Day #2 and using regression to analyze experiments
4	Sept 14	Statistical programming in R
	Sept 16	Using VScode and LLMs for programming
5	Sept 21	Statistical inference in experiments day #1
	Sept 23	<u>Brainstorming presentations</u>
6	Sept 28	<u>Finish brainstorming presentations</u> and Statistical inference in experiments day #2
	Sept 30	Power Day #1
7	Oct 5	Power Day #2
	Oct 7	Advanced randomization
8	Oct 12	Noncompliance and Instrument Variables
	Oct 14	Heterogenous Treatment Effects Day #1
9	Oct 19	Midterm
	Oct 21	Heterogeneous treatment effects Day #2
10	Oct 26	When experiments go wrong: i) bad control, ii) SUTVA violations, iii) p-hacking
	Oct 28	Selection on observables/matching Day #1
11	Nov 2	Selection on observables/matching Day #2
	Nov 4	Regression discontinuity
12	Nov 9	Differences-in-differences, synthetic control, and related strategies 1
	Nov 11	Difference-in-differences, synthetic control, and related strategies 2
13	Nov 16	Difference-in-differences, synthetic control, and related strategies 3
	Nov 18	Instrumental variables in observational settings day 1
14	Nov 23	<i>Thanksgiving Break</i>

	Nov 25	<i>Thanksgiving Break</i>
15	Nov 30	Instrumental variables in observational settings day 2 (shift shares)
	Dec 2	<u>Final presentations: Day 1</u>
16	Dec 7	<u>Final presentations: Day 2</u>
	Dec 9	<u>Final presentations: Day 3</u>