ECON 523 (M1)
Applied Econometrics: Causal Inference and Policy Evaluation
MSPE, Department of Economics
Fall 2025

Instructor:
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DKH 101-E
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Class meetings: Monday/Wednesday, 11:00am – 12:20pm in DKH 215

Office Hours:

- Individual office hours: Mon 3:30-5:00pm CT, Tues 1:30-4:00pm 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 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.

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.

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 7 mandatory assignments that together will count for 15% of the grade. I will drop your lowest assignment scores when computing this grade. The assignments will be due on:
    - Assignment 1: Sep 8
    - Assignment 2: Sep 22
    - Assignment 3: Oct 1
    - Assignment 4: Oct 13
    - Assignment 5: Nov 3
    - Assignment 6: Nov 17
    - Assignment 7: Dec 1
- ***Midterms:*** There will be 1 midterm that will count for 20% of the grade
    - Midterm, October 20
- **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 29 and Oct 1 (2.5% of grade)
    - First draft of proposal. Oct 8 (2.5% of grade)
    - Final Proposal: Oct 15 (5% of the grade)
    - Preliminary Analysis: Nov 19 (5% of the grade)
    - Final presentations and memos: December 3, 8 and 10 (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 30% of the grade. The final exam is scheduled for Wednesday, December 17 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.

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-preparedness/building-emergency-action-plans/

Course Schedule (tentative)

1	Aug 25	Course overview, logistics, and introduction to causality
	Aug 27	Introduction to causality: Potential Outcomes
2	*Sep 1*	*Labor Day (No Class)*
	Sep 3	Introduction to causality: Directed Acyclic graphs (DAGs)
3	Sep 8	Randomization Day #1
	Sep 10	Randomization Day #2
4	Sep 15	Regression and experiments
	Sep 17	Statistical programming in R
5	Sep 22	Statistical inference in experiments day #1
	Sep 24	Statistical inference in experiments day #2
6	Sep 29	Brainstorming presentations
	Oct 1	Finish brainstorming presentations and Power Day #1
7	Oct 6	Power Day #2
	Oct 8	Advanced randomization
8	Oct 13	Noncompliance and Instrument Variables
	Oct 15	Heterogenous Treatment Effects Day # 1
9	***Oct 20***	**Midterm**
	Oct 22	Heterogeneous treatment effects Day # 2
10	Oct 27	When experiments go wrong: i) bad control, ii) SUTVA violations, iii) p-hacking
	Oct 29	Introduction to observational studies: basics of matching
11	Nov 3	Class Activity on Interpreting Study Results
	Nov 5	Conditional Independence Assumption/Back-Door Criterion
12	Nov 10	Regression discontinuity
	Nov 12	Differences-in-differences
13	Nov 17	Difference-in-differences continued
	Nov 19	Class Activity on Conducting Monte-Carlos
14	*Nov 24*	*Thanksgiving Break*
	Nov 26	*Thanksgiving Break*
15	Dec 1	Instrumental variables in observational settings
	Dec 3	Final presentations: Day 1
16	Dec 8	Final presentations: Day 2

Dec 10	Final presentations: Day 3