

M A T H 3 8 6 - 2
A c c e l e r a t e d M a t h e m a t i c s f o r M M S S :
E C O N O M E T R I C S I I
S P R I N G 2 0 2 6

Instruction:

Lecture: **M-W** 9:30AM – 10:50AM, in 555 Clark B01

Discussion: **F** 9:30AM – 10:50AM, in 555 Clark B01

Instructor: Ivan Canay

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Office Hours: **Tu** 1:00PM – 3:00PM in KGH 3353

Teaching Assistants: Benjamin Krueger & Kenneth Fu

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Kenneth's e-mail: kennethfu@u.northwestern.edu

Ben's Office Hours: **Th** 2:00 PM – 4:00PM in 555 Clark

Kenneth's Office Hours: **F** 3:00 PM – 5:00PM in 555 Clark

Course description: This is the second quarter of the MMSS econometrics sequence. The focus of this class will be on causal inference. Through a rigorous blend of theoretical frameworks and practical applications, we will explore a range of econometric techniques essential for drawing reliable causal conclusions from experimental and observational data. Topics covered include regression analysis, identification and estimation of treatment effects under a variety of assumptions, and instrumental variables in heterogeneous models. In addition, we will cover popular econometrics tools like panel data analysis, difference in differences, and regression discontinuity designs.

The course assumes that you are comfortable with the material covered in Math 386-1 and Math 385.

Grading: The class grade consists of problem sets (submitted via Canvas), two midterm exams on **Monday April 27 in class** and **Wednesday May 27 in class**, and a research proposal. The weighting scheme for the final grade will be as follows:

Problem Sets:	15%
Midterm Exam:	30% each exam
Research Proposal:	25%

- **Problem sets:** Problem sets will include both analytical and data analysis questions. They must be submitted via CANVAS by **9 AM** on the due date. Late submissions will not be accepted, and there are no make-up problem sets. Problem sets should be completed in **groups of 2 or 3** students. Collaboration with other groups is encouraged, but each group’s work must be independent. Copying, sharing assignments, or jointly writing answers across groups will result in a score of “0” for all involved. Additionally, dividing questions between students is strongly discouraged. Completing the entire problem set is essential for mastering the material and developing key skills. Each problem set will include questions designed to help you develop an original research question. At the end of the quarter, you will present a 10-minute research proposal to the class, also in pairs. We highly recommend taking the research proposal questions in the problem sets seriously throughout the quarter, as this will make preparing your presentation much easier.
- **Exams:** The two midterm exams will take place in class and will be closed-book. Any student who misses an evaluation without a good reason will receive no credit for it. Medical reasons require written confirmation from the University health services or your doctor. Non-medical reasons require a written excuse from some official of the University (e.g. an official from the Dean’s Office.) A makeup for the midterms will be permitted only if there is a good reason. The make-up exam will be an oral exam.

Research proposal: This project will guide students through the process of creating a research proposal, culminating in a 10-minute presentation. The expectations for this presentation are outlined below in the grading rubric. The problem sets will include questions related to your research proposal to ensure that students stay on track and don’t fall behind.

- **PS1: Propose a question.** Write a one-sentence research question, explain its relevance and interest, and begin searching for literature and data sources.
- **PS2-4: Analyze a suggested paper.** Summarize the paper’s main question, data sources, empirical challenges, and approach. Compare these elements with your own research question.
- **PS5: Refine your question.** Refine your research question, justify its novelty and relevance, explain its connection to the literature, and identify potential data sources.
- **PS6: Propose an empirical strategy.** Describe your ideal data source, model, and strategy. Discuss the merits and drawbacks of your approach and how it addresses empirical challenges in the literature.

Grading rubric: Your research proposal grade is based on both your presentation and the questions you ask during your classmates’ presentations. Attendance is expected on all class days. Presentations will take place on 5/29 (Friday), 6/1, 6/3, and during the final

exam (6/10, 12-2 PM). Presentation dates will be randomly assigned. If there are conflicts, respond to the survey in Canvas by April 29 to request a different date.

– **Presentation Grade (75%)**

- Clearly convey the setting and research question.
- Argue why it matters and link to the literature concisely (4 minutes max).
- Describe the estimation strategy and its assumptions.
- Justify the strategy's appropriateness and compare to literature.
- Discuss drawbacks of the approach.
- Finish within 10-minutes (presentations will be timed and capped at 10 mins).

– **Questions Grade (25%)**

- Submit questions during each presentation, graded as check or check plus.
- Your top three questions will be averaged with your presentation score.

Readings: I will provide lecture notes every week and my expectations are that you master the concepts contained in those notes. I will also make suggestions of supporting material that you may find useful and make sure to provide a link to the relevant papers or original sources in Canvas. There is no required textbook for this course.

Discussions: The TAs will conduct discussion sessions every Friday. The goal of these sessions is to review material covered during the lectures and help you prepare for the problem sets and midterm exams.

Software: The problem sets will require you to use R. R is free and is one of the most popular programming languages, widely used in academic and industry environments. This year we will provide minimal guidance on R during discussion sessions and office hours if needed. Next year all MMSS students entering sophomore year will be expected to complete an MMSS exclusive R camp that will take place a couple of days before the quarter starts. NUIT offers a variety of online resources to get you started with R.

AccessibleNU: Any student requesting accommodations related to a disability or other condition is required to register with AccessibleNU (847-467-5530) and provide professors with an accommodation notification from AccessibleNU, preferably within the first two weeks of class. All information will remain confidential.

Syllabus standards: All Northwestern University courses, including this one, follow the University Syllabus Standards. Students are responsible for familiarizing themselves with this information.

Tentative Course Schedule: Math 386-2 Spring 2026

Lecture	Date	Day	Topics	PS Deadline
Part I: Causality and Conditional Independence				
1	March 31	Tu	Causality and Potential Outcomes	–
2	April 1	W	Random Assignment	–
3	April 6	M	Linear Regression	1
4	April 8	W	Properties of LS	–
5	April 13	M	Linear Regression and the ATE	2
6	April 15	W	Covariate Adjustment	–
7	April 20	M	Selection on Observables I	3
8	April 22	W	Selection on Observables II	–
-	April 27	M	Midterm Exam I	–
Part II: Panel Data and RDD				
9	April 29	W	Panel Data	–
-	May 1	F	Discussion: feedback on research projects	–
10	May 4	M	Difference in Differences	–
11	May 6	W	Regression Discontinuity	4
Part III: Causality and Endogeneity				
12	May 11	M	Endogeneity	–
13	May 13	W	IV and Two Stages Least Squares	5
14	May 18	M	Properties of TSLS	–
15	May 20	W	Heterogeneous and Endogenous Treatments	–
-	May 22	F	Discussion: feedback on research projects	6
-	May 25	M	Memorial Day - No Class	–
-	May 27	W	Midterm Exam II	–
16	May 29	F	Student Presentations : I	–
17	June 1	M	Student Presentations : II	–
18	June 3	W	Student Presentations : III	–
19	June 10	W	Student Presentations : IV (12:00–2:00PM)	–