

E471/M504: ECONOMETRICS I

Fall 2023

Instructor:	Stefan Weiergraeber	Time:	TR 1:15pm – 2:30pm
Email:	sweiergr@iu.edu	Place:	Wylie Hall 329

Course Pages:

- Announcements and course materials will be posted on Canvas.

Office Hours: Thursday, 10:30am – noon, or by appointment (Wylie Hall 347). You are welcome to drop by my office hours without making an appointment. If you'd like to make sure we can talk at a specific time, please book a slot (or several) using this website: <https://sweiergr.youcanbook.me>. Appointments will be given priority over walk-ins. Also, you will have to make an appointment if you prefer a virtual office hour meeting via Zoom.

Objectives: This course introduces students to basic econometric concepts and their application. Compared to E371, we will put more emphasis on the mathematical and statistical foundations of econometric methods. Therefore, students are expected to have a strong background in Linear Algebra and Calculus on the level of M303 and M311 or equivalent. We will start with a short review of matrix algebra, probability theory and statistics. Afterwards, the course covers linear regression models in detail. We will discuss (and prove) finite-sample and asymptotic properties of the OLS estimator. We continue with a discussion of statistical testing and conclude with an outlook on generalizations of the OLS estimator that tackle many prevalent problems. All concepts are motivated with real-word applications. In several tutorial sessions, students will learn how to apply econometric methods to data using the statistical software R. Note that this course is cross-listed as E471 and M504. The former is an advanced undergraduate course targeted towards Economics majors and has 3 credit hours. The latter is the first semester Econometrics course for M.Sc. students in Economics and Data Science and has 4 credit hours.

Prerequisites: E370 or S370 or equivalent (Statistics) and M303 (Linear Algebra) and M311 (Calculus) or equivalent.

Main References: For this course, I will rely on material from Wooldridge's *Introductory Econometrics* for the applied topics and the more advanced text by Davidson and MacKinnon for the theory part. Both are excellent textbooks although written from very different perspectives. Stachurski's recent book *A Primer in Econometric Theory* is a good alternative to Davidson and MacKinnon. The book by Angrist & Pischke is an entertaining complementary read for a more applied perspective on econometric methods.

- Russell Davidson and James G. MacKinnon, *Econometric Theory and Methods*, Oxford University Press, 2004.
- Jeffery M. Wooldridge, *Introductory Econometrics - A Modern Approach*, Cengage Learning, 6th edition 2015.
- John Stachurski, *A Primer in Econometric Theory*, The MIT Press, 2016.

- Joshua A. Angrist and Joern-Steffen Pischke, *Mastering 'Metrics*, Princeton University Press, 2014.

Software: For the empirical exercises, I will mostly use R. However, you are free to choose whatever software you feel most comfortable with. If necessary, we can spend several tutorial sessions to introduce you to the fundamentals of R. Please install a recent version of [R](#) on your computer before the first class. In addition, I recommend using a good IDE, for example, [R Studio](#).

Tentative Course Outline:

Week 1: Introduction to regression models - What is Econometrics?	W Ch. 1
Week 2: Review of matrix algebra	W App. D
Week 3: Review of probability theory & statistics	W App. B-C
Week 4: The geometry of linear regressions	DMK Ch. 2
Week 5: Orthogonal projections (I)	DMK Ch. 2
Week 6: Orthogonal projections (II)	DMK Ch. 2
Week 7: The Frisch-Waugh Theorem	DMK Ch. 2
Week 8: Statistical properties of OLS (I): Unbiasedness	DMK Ch. 3
Week 9: Statistical properties of OLS (II): Consistency	DMK Ch. 3
Week 10: Statistical properties of OLS (III): Variance & Precision	DMK Ch. 3
Week 11: Running & interpreting linear regression models	
Week 12: Testing: Basic concepts	DMK Ch. 4
Week 13: Testing single restrictions: t-tests	DMK Ch. 4
Week 14: Testing multiple restrictions: F-tests	DMK Ch. 4
Week 15: Outlook: Confidence intervals & asymptotics	DMK Ch. 4-5
(Week 15: Review session)

Grading Policy: Homeworks (20%), Midterm 1 (20%), Midterm 2 (20%), Final (40%).

There will be 6 problem sets. You are allowed and strongly encouraged to work and hand-in in groups of 2 or 3 students. Problem sets should be turned in at the beginning of class on the day that they are due. Late homeworks will not be accepted and there will be no extensions. Please note that if you are enrolled in M504, you will have to complete more extensive assignments to earn the additional credit hour. We will discuss the details of this at the beginning of the semester and I will try to take your specific background and interests into account.

Important Dates:

- Midterm #1: September 21, in class - closed book
- Midterm #2: November 9, in class - closed book
- Final Exam: TBA, in class - closed book

Policies:

- **Academic Integrity:** As a student at IU, you are expected to adhere to the standards and policies detailed in the [Code of Student Rights, Responsibilities, and Conduct](#). When you submit an assignment with your name on it, you are signifying that the work contained therein is yours, unless otherwise cited or referenced. Any ideas or materials taken from another source for either written or oral use must be fully acknowledged. If you are unsure about the expectations for completing an assignment or taking a test or exam, be sure to

seek clarification beforehand. All suspected violations of the Code will be handled according to University policies. Sanctions for academic misconduct may include a failing grade on the assignment, reduction in your final course grade, a failing grade in the course, among other possibilities, and must include a report to the Dean of Students, who may impose additional disciplinary sanctions.

- **Special circumstances:** Students requiring any type of special classroom/testing accommodation for a disability, religious belief, scheduling conflict, or other impairment that might affect his or her successful completion of this course must personally present the requested remedy or other adjustment in written form (signed and dated) to the instructor, i.e. supporting memorandum of accommodation from the Office of Disabilities Services for Students. Requests for accommodations must be received and authorized by the instructor in written form no less than two weeks in advance of need. No accommodation should be assumed unless so authorized. In the event of needs identified later in the course, or for which an adjustment cannot be made on a timely basis, a grade of “I”, Incomplete, for the course will be given to accommodate the unanticipated request.
- **Exam absences:** In the event of a catastrophic (and documented) occurrence which necessitates an absence from a scheduled exam, the student should immediately seek the instructor’s *permission to miss an exam*. If approval is granted, the weights of the student’s scores for the other exams will be re-adjusted proportionately, so as to make up for the missed exam. If completed documentation is not presented within one week after a missed exam, or if no *permission to miss a exam* has been obtained prior to the exam date, the missed exam will received a score of zero points.