ECON 21020 3: Econometrics

University of Chicago, Fall 2021

Lecture: Monday & Wednesday 2:00pm—3:20pm, Saieh Hall 203

TA Session: Tuesday 4:30pm—5:20pm, Saieh Hall 203

Instructor: Oscar Volpe
Office Hours: Friday 1:00pm—3:00pm via Zoom
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Teaching Assistant: Camilla Schneier
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Course Description: This course introduces the single and multiple linear regression model, the associated distribution theory, and testing procedures; corrections for heteroskedasticity, autocorrelation, and simultaneous equations; interpretation of linear regression under heterogeneous treatment effects; and maximum likelihood estimators. An emphasis will be placed on the mastery of theoretical concepts related to causal inference and estimation. Students also apply the techniques they learn to a variety of data sets using statistical softwares on their personal computers.

Required Reading: No textbook is required for this course. Students are expected to read the lecture notes and to review any other supporting materials that will be posted on Canvas.

Supplemental Reading: The following textbooks may be useful references for this course.

- *Mathematical Statistics and Data Analysis (3rd Ed.)* by John A. Rice.

  This book gives a thorough introduction to probability theory and statistical methods. It is an accessible text for upper-level undergraduate students, with an assortment of computational exercises. For anyone seeking to further their knowledge of data analysis, I suggest reading it.

- *Introduction to Econometrics (3rd/4th Ed.)* by James H. Stock & Mark W. Watson.

  This book is a popular econometrics text, which emphasizes real-world applications of linear regression and instrumental variables. It contains many graphical examples, along with theoretical and computational exercises. I recommend it as an accessible, introductory text.

- *Introductory Econometrics: A Modern Approach (5th/6th/7th Ed.)* by Jeffrey Wooldridge.

  Wooldridge's book offers a good introduction to probability and statistics with econometric applications. Chapters *1-9* and sections *A-E* of the appendix are most relevant to this course.

Grading: Your final grade will be determined by your performance on five homework assignments, one short presentation, and two exams. These assessments will be weighted in the following way:

Component	Weight
Assignments	20%
Presentation	10%
Exams	70%

The *Assignments* grade equals the average score among your four best homework assignments. Note that your lowest homework score will be excluded when calculating the final grade. For the *Presentation* grade, you will be evaluated on the quality of a group project that you present to the rest of your classmates. The *Exams* grade is calculated as a weighted average of your two exam scores. If you perform better on the midterm, both exams will be weighted equally: 1/2 weight on the midterm and 1/2 weight on the final. If you perform better on the final, that exam will hold more weight: 2/7 weight on the midterm and 5/7 weight on the final. The intention of this grading scheme is to benefit students who demonstrate improvement throughout the course. *Note:* this course will not be curved.

Assignments: There will be five homework assignments in this course, and each one will cover a different set of topics. I strongly encourage you to start working on your homework early, to discuss the problems with your classmates, and to come to office hours if you have questions. The due dates and guidelines for these assignments are listed below:

Homework Due Dates

Number	Date	Assignment Topic
1	Tues, Oct. 12	Probability & Statistics
2	Thurs, Oct. 21	Linear Regression (1)
3	Tues, Nov. 2	Linear Regression (2)
4	Tues, Nov. 16	Instrumental Variables
5	Thurs, Dec. 2	Treatment Effects & MLE

Homework Guidelines

- All assignments must be submitted on time by **11:59pm CST** on the specified due date. Late submissions will not be accepted under any circumstance. No extensions will be granted.
- Assignments should be submitted digitally via Canvas. If there are any technical issues, you may email your submission to the TA. As long as it is sent before the deadline, it will be counted.
- Submissions must be clearly legible. No credit is awarded for responses that the TA cannot read.
- Students must print their own names clearly at the top of every submission.
- Assignments are intended to be worked on individually. There are no group submissions. While students are allowed—in fact, encouraged—to talk to their classmates about homework problems, everyone must write down their own answers and submit them independently. No credit will be awarded in instances where multiple students submit identical solutions or code.
- All computational problems are intended to be completed in *R*. If students prefer to use other languages (e.g. *Python*, *Julia*) for their homework, please ask the TA for approval beforehand.
- Your lowest homework score will be dropped from the final grade.

Presentations: Students are expected to work together, in teams of three, on a small computational project. This project will come in the form of an econometrics problem, chosen by the instructor, that relates to one of the topics taught in the course. Each group will be assigned a different problem to solve. After preparing a solution, groups will create slides and present their work to the rest of their classmates. Presentations will take place on Wednesdays, at the beginning of class, over four weeks. Each week, two or three groups will present. The schedule of these presentations is provided below:

Presentation Dates

# Groups	Date	Topics Presented
3	Wed, Oct. 20	Statistics / Probability Theory
2	Wed, Nov. 3	Linear Regression
2	Wed, Nov. 17	Treatment Effects
2	Wed, Dec. 1	Maximum Likelihood

The presentations are intended to encourage collaboration and to allow students to learn from each other. Teams will be assigned problems that highlight some real-world applications of econometrics, and the presentations are meant to complement the material taught in lectures. Note that the problems groups receive may involve both theory and data analysis. They are written so as to take about a week to complete. Teams are *strongly* encouraged to meet—either in person or virtually—at least once about their projects. They should also rehearse their presentations and time themselves while doing so. Effective communication is an important skill, and the ability to explain difficult concepts to your peers will signal that you fully grasp the material. Please take note of the following guidelines:

Presentation Guidelines

- Teams have *10 minutes to present* their projects, and *all team members are expected to participate* in the presentations. Make sure to plan accordingly, as this time limit will be strictly enforced.
- Every team must prepare slides for their presentation. Teams must email a draft of their slides to the instructor and TA on the Monday before their presentations. After the slides have been approved, they should send the final draft to the instructor sometime before they present.
- Students will be assessed on *(1)* the quality/accuracy of their slides and *(2)* the effectiveness of their presentation. Not all team members may receive the same grade. While there will likely be some overlap in scores, each student will be evaluated based on his/her individual contribution to the project. Concerns about unequal distributions of tasks can be brought up to the TA.
- Students who are not presenting are expected to attend the presentations. Audience members are strongly encouraged to ask questions and to offer constructive feedback.
- Teams may always come to office hours for guidance about their projects. They are encouraged to ask for help from their peers, the TA, and the instructor. Their slides will also be checked for accuracy by the TA before they present, and no points will be deducted for inaccurate first drafts. The goal of the presentations is not to test or trip up students, but rather to promote collaboration and to encourage a deeper understanding of particular topics in econometrics.

Exams: There are two exams in this course: a midterm and a final. The midterm is scheduled to be held on Monday, November 8, during class time. Students will be given the entire lecture period (exactly 80 minutes) to finish the exam, and they may not work past the allotted time. The date of the final exam will be set by the University Registrar. As soon as it is set, it will be announced to the class. Both exams are closed-book, and they must be completed individually. Adherence to academic integrity rules will be strictly enforced. Regrade requests must be submitted in writing with an explanation of the alleged error. They must be submitted in the three days after the exam scores are posted on Canvas. If a regrade request is accepted, then the entire exam will be regraded.

Academic Integrity: Students must abide by the University's policy on academic honesty. Instances of academic dishonesty will be reported to the Office of the Provost for adjudication. Policies specific to assignments and examinations in this class are outlined here.

Title IX: Faculty, staff, lecturers, teaching assistants, postdoctoral fellows, and all others who have teaching responsibilities in the classroom and/or lab are considered *Individuals with Title IX Reporting Responsibilities*, and they must report on gender-based discrimination, sexual harassment, sexual abuse, sexual assault, dating violence, domestic violence, or stalking to the University Title IX Coordinators. For more information, you can consult this website. In addition, you can review this website for an overview of confidentiality options and University resources.

Diversity and Inclusion: The University of Chicago believes that a culture of rigorous inquiry demands an environment where diverse perspectives, experiences, individuals, and ideas inform intellectual exchange and engagement. I concur with that commitment and expect to maintain a productive learning environment based upon open communication, mutual respect, and nondiscrimination. All students enrolled this class are and will always be equally welcome. I cannot overstate the value that each individual's contribution brings to lectures, sections, office hours, online discussion boards and the overall quality of this class. Any student who feels unable to participate fully in any class section for any reason should not hesitate to reach out to me. The University does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender identity, national or ethnic origin, age, status as an individual with a disability, protected veteran status, genetic information, or other protected classes as required by law.

Accessibility: The University of Chicago is committed to ensuring equitable access to our academic programs and services. Students with disabilities who have been approved for the use of academic accommodations by Student Disability Services (SDS)—linked here—and need a reasonable accommodation(s) to participate fully in this course should follow the procedures established by SDS for using accommodations. Timely notifications are required in order to ensure that your accommodations can be implemented. Please meet with me to discuss your access needs in this class after you have completed the SDS procedures for requesting accommodations.

Phone: (773) 702-6000
Email: disabilities@uchicago.edu

Lecture and Exam Schedule

Lecture	Date	Topic
1	Mon, Sept. 27	Probability Theory
2	Wed, Sept. 29	Probability Theory
3	Mon, Oct. 4	Statistics
4	Wed, Oct. 6	Statistics
5	Mon, Oct. 11	Hypothesis Testing
6	Wed, Oct. 13	Linear Regression
7	Mon, Oct. 18	Linear Regression
8	Wed, Oct. 20	Linear Regression
9	Mon, Oct. 25	Linear Regression
10	Wed, Oct. 27	Linear Regression
11	Mon, Nov. 1	Instrumental Variables
12	Wed, Nov. 3	Instrumental Variables
—	Mon, Nov. 8	**Midterm Exam**
13	Wed, Nov. 10	Instrumental Variables
14	Mon, Nov. 15	Heterogeneous Treatment Effects
15	Wed, Nov. 17	Heterogeneous Treatment Effects
16	Mon, Nov. 29	Maximum Likelihood Estimation
17	Wed, Dec. 1	Maximum Likelihood Estimation
—	TBD	**Final Exam**