ECON 21020: Econometrics
The University of Chicago, Spring 2022
Lectures: Monday and Wednesday, 1:30-2:50pm in SHFE 203
TA sessions: Friday, 1:30-2:50pm in Pick Hall 022

Instructor:
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Office hours: Friday, 9-10am in SHFE 201

Teaching assistant:
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Office hours: Wednesday, 3-4pm in SHFE 201

Course description:
This course provides students with a rigorous introduction to econometrics and two of its most common statistical tools: linear regression and linear instrumental variables.

Upon successful completion, students are equipped to distinguish between the causal and descriptive uses of linear regression, evaluate applications of instrumental variables, and characterize key statistical properties of the corresponding estimators. Students are further able to apply these methods to draw insights from data.

Prerequisites:
The prerequisites for this course are [(ECON 20100 or 20110) & (ECON 21010)], or [(STAT 23400, 24400 or 24410) & (MATH 19620, 20000, 20250, or 18500 or STAT 24300)]. In particular, we will make use of calculus, basic probability and statistics, and matrix algebra.

Course websites:
Lecture material and problem sets will be shared via Canvas. Solutions to programming exercises and supplementary code will be shared via GitHub, a free hosting website for the widely used version control system Git. We will also use Slack to facilitate discussions on lecture material, problem sets, and coding questions. Students should sign up using this link.

Software:
This course requires using R, a high-level statistical programming language. Students should install R along with a suitable IDE (e.g., R Studio). Albeit not mandatory, it is highly encouraged to use the version control system Git when working on the programming exercises. The GitHub desktop app provides an accessible interface for getting started with Git. An introduction to statistical programming with R and Git is provided in the first TA session.

Textbook:
There is no required textbook as the course material is meant to be self-contained. Students interested in supplementary readings may want to consider "Introduction to Econometrics" by James Stock and Mark Watson, or "Introductory Econometrics: A Modern Approach" by Jeffrey Wooldridge.

Grading:
There will be six problem sets, a midterm, and a final exam. The course score is a weighted average of the three calculated as follows:

Course Score

Component	Weight
Problem sets	30%
Midterm	20%
Final exam	50%

All problem set and exam scores are final except for correcting obvious grading mistakes. For example, points are added up incorrectly. Students should bring these to the attention of the teaching assistant within three working days. Note that partial credit is systematically awarded. Therefore, partial credit cannot be revised for one student without implicitly penalizing his or her classmates.

Letter grades are determined on a curve at the end of the quarter.

Problem sets:
Problem sets need to be submitted on Canvas prior to their deadline (see the course schedule below). If you have issues with Canvas, send the problem set to the teaching assistant via email. Late problem sets will not be accepted. The lowest problem set grade will be dropped when calculating final course scores.

Students are encouraged to work together on problem sets, but each student must submit his or her own set of solutions. Write-ups must include the names of the other students with whom they worked.

Students should consider typesetting their problem sets using LaTeX. Overleaf is an excellent online editor for getting started. A simple LaTeX template for problem set submissions will be shared on Canvas.

The teaching assistant and I will gladly answer questions on problem sets in our office hours.

Extra credit opportunities:
There are two – entirely optional – extra credit opportunities. They are meant as encouragement for good coding practice and to deepen students' understanding of the statistical methods discussed in class.

(1) Students who track their code using Git and upload their solutions to the programming exercises to a public GitHub repository will receive a 5 percentage point bonus on the corresponding problem set. To receive the bonus, the link to the GitHub repository must be included in the problem set submission.

(2) Some problem sets will include optional programming exercises that ask students to implement statistical estimators using low-level commands. For example, students may implement linear regression using arithmetic operations rather than the `lm`-command in R. Successful implementations are rewarded with a bonus of up to 20 percentage points on the corresponding problem set.

To ensure that extra credit awarded to one student does not negatively impact his or her peers, extra credit is awarded after determining thresholds for the letter grades.

Academic integrity:
Cheating on any assignment in any way will be dealt with severely. In particular, anyone caught cheating on any exam will fail the course and be reported to the Dean's office for further disciplinary action.

Course schedule:

The below is a rough outline of the topics covered in class.

Course Schedule

	Date	Topic	PSet Out	PSet Due
1	Mar 28	Logistics & Motivation	1	–
2	Mar 30	Review of Probability Theory	–	–
3	Apr 4	Review of Probability Theory	–	–
4	Apr 6	Review of Statistics	2	1
5	Apr 11	Review of Statistics	–	–
6	Apr 13	Introduction to Causal Inference	3	2
7	Apr 18	Random Assignment	–	–
8	Apr 20	Simple Linear Regression	4	3
9	Apr 25	Simple Linear Regression	–	–
10	Apr 27	Simple Linear Regression	–	–
–	May 2	Midterm	–	–
11	May 4	Selection on Observables	5	4
12	May 9	Multivariate Linear Regression	–	–
13	May 11	Multivariate Linear Regression	–	–
14	May 16	Multivariate Linear Regression	6	5
15	May 18	Instrumental Variables	–	–
16	May 23	Instrumental Variables	–	–
17	May 25	Instrumental Variables	–	6
–	TBD	Final Exam	–	–

Notes. Problem sets are due at noon.