

CAUSAL INFERENCE

Course Number
University Name, Course Term

Instructor: Julian Gerez

Email:

Office location:

Office/Student hours times:

Office/Student hours sign-up:

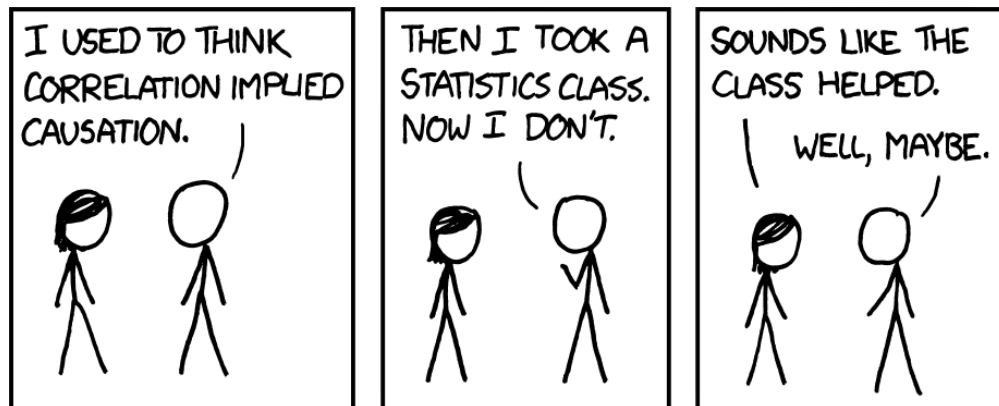
Class meeting times:

Class meeting location:

Course Overview

Do personal text messages increase voter registration? Does watching the FIFA Women's World Cup improve attitudes toward gender norms? Does higher education increase lifetime earnings? This course provides an introduction to causal inference in the social sciences. Causal inference is the study of cause and effect. In the natural sciences, the units of analysis—atoms, microorganisms, etc.—are all relatively homogenous (similar to each other), which allows for controlled experiments. Social scientists do not have this luxury, but this does not mean that we cannot answer interesting causal questions, and this course will show students how to do so. Students in this class will learn about how to answer causal questions in the social sciences, about existing social science research, and statistical inference.

This course is housed the political science department but is well suited for students interested in research in all social science disciplines, such as as sociology, psychology, economics, among others. Students in their early years of their degree program will be particularly well-suited to take this course in case they are interested in taking further advanced research classes. There are no prerequisites, but this will be a challenging course that requires a willingness to learn new skills!



Source: <https://xkcd.com/552/>

Learning Objectives

The main purpose of this course is to promote the understanding of introductory statistical concepts and how they can be used to explain aspects of our social environment. Using class lectures, applied exercises, and discussions, students will be able to:

- Describe the difference between correlation and causation, and understand confounding—they will be able to explain the joke of the above comic strip!

- Use the potential outcomes framework to identify and explain causal quantities of interest.
- Understand the role randomization plays in helping to establish causality, and decide between possible alternative options when randomization is not possible.
- Read scientific writing and critically evaluate research designs.
- Interpret results from statistical models, including uncertainty associated with quantifiable outcomes.

Assignments and Evaluation

Grades will be assigned according to the following components of the course. No extra credit will be granted.

- **Participation (20%)**: Class time will be divided between lectures and in-class activities including discussions and in-class surveys. Active involvement in these activities will help you succeed in this class beyond just your participation grade, but to receive full credit for participation you must attend class, actively participate in discussions, group work, and other class activities. Come to class prepared, having completed all assigned readings prior to each class. This way you will be ready to contribute to discussions. If you know you will be absent for an excused reason, email me before class and provide any necessary documentation. You can also receive participation credit for coming to office hours or by attending and outside seminar or lecture related to course material and writing a short-reflection on it.
- **Problem sets (5 × 10%)**: There will be five non-cumulative problem sets covering the lectures and assigned readings for corresponding weeks. The problem sets will consist of short answer questions and coding exercises.
- **Practicum experiment (15%)**: You will design an execute a simple experiment **on NON-HUMAN subjects** (e.g., cooking, growing or harvesting of plants, product testing, animal training) and write an essay between 1,500 and 2,000 words describing the design and results of the experiment. The essay should include the motivation for the study, the central hypothesis to be tested, a description of the subjects, randomization procedure, treatments, settings, and outcome measures, a discussion of whether the assumptions necessary to interpret the results causally are fulfilled, a figure and a table of results, along with statistical analysis, and a conclusion.
- **Observational study assignment (15%)**: Students have two options for this assignment:
 1. *Proposed study assignment*: You will propose, but not execute a study on a causal question using observational data. In an essay between 1,500 and 2,000 words in length, describe your motivation for the study, the central hypothesis to be tested, why an experiment is not appropriate or feasible, a description of the research design, and a discussion of what assumptions would be necessary to interpret hypothetical results causally, and a conclusion. You must clear the idea for your experiment with the instructor at least 2 weeks before the submission deadline.
 2. *Analyze study assignment*: You critically read a paper using one of the observational causal inference designs from the latter third of the course (instrumental variables, regression discontinuity, or difference-in-differences). In an essay between 1,500 and 2,000 words in length, describe researchers' motivation for the study, the central hypothesis tested, why an experiment was not appropriate or feasible (you can also argue an experiment may have been feasible), a description of the research design, and a discussion of their results and what assumptions are necessary to interpret the results causally. Are those assumptions met? Finally, please also add a conclusion. You must clear the paper you have chosen with the instructor at least 2 weeks before the submission deadline.

Course Policies

Academic integrity: [Institution name] does not tolerate cheating or plagiarism in any form. Students violating the code of academic and professional conduct will be subject to disciplinary procedures. Guidelines on academic integrity are available at this link: [link]. All students are expected to be familiar with and abide by these guidelines.

Accommodations: Students with disabilities who require accommodations for this class should come to my office hours as soon as possible to confirm their accommodation needs. If you believe you might have a disability requiring

accommodation, contact [disability services office] at [phone number] and [email address].

Contacting me and office/student hours: Questions about logistics or small conceptual issues would be appropriate for an email. Deeper conceptual questions or other concerns would be better to bring to my office hours. Office hours are dedicated times when I will be available to meet with you to discuss course material, answer questions, provide feedback, or assist with any other academic concerns you might have, including internships or academic opportunities, career aspirations, etc. Office hour times, location, and sign-up sheets can be found in the header of the first page of this syllabus.

Technology in the Classroom: You may use laptops or tablets in class for note taking purposes only. Refrain from using these devices for checking on social media, instant messenger, e-mail checking, or anything else that may distract you, your fellow students, or me. It is obvious when someone is using their laptop for non-class related activities, and I reserve the right to discontinue the use of laptops (unless you contact me about an exception) if they become a distraction. Texting is not permitted during class.

Contested Grades: If you wish to contest a grade you must submit a written explanation me of maximum one page length on why you believe the grade is inaccurate within two weeks of getting the assignment back. However, you must wait 48 hours from the time the assignment is returned before you submit the written explanation. I will not discuss grades until 48 hours after the assignment is passed back. If you ask for a reevaluation of your grade then I reserve the right to either raise or lower your grade based on my reevaluation. This policy is meant to address disagreements with our assessment of your work. It does not pertain to calculation errors. If you believe I have made a mistake adding up points, converting your points to a percentage, etc. you can let me know immediately, and I will be happy to correct any mistakes.

Course Outline and Readings

There are two textbooks for the course: Llaudet, Elena, and Kosuke Imai. *Data Analysis for Social Science: A Friendly and Practical Introduction*. Princeton University Press, 2022 and Angrist, Joshua D., and Jörn-Steffen Pischke. *Mastering 'Metrics: The Path from Cause to Effect*. Princeton University Press, 2014. Additional readings will be available online for students.

This class will be conducted using R software for statistical analysis in the R Studio environment. R is the only package for which we will provide instructional support. R and R Studio are free and can be downloaded for any common operating system.

1. Introduction: what is causal inference?
 - *Mastering 'Metrics*, Introduction (pp. xi-xv).
2. Confounding confounding and an introduction to R
 - *Data Analysis for Social Science: A Friendly and Practical Introduction*, Chapter 1.
3. The potential outcomes framework
 - Introduction to the Potential Outcomes Framework (<https://www.causalconversations.com/post/po-introduction/>).
 - Problem set #1 due.
4. Math vs. statistics: quantifying uncertainty
 - *Data Analysis for Social Science: A Friendly and Practical Introduction*, Chapter 3.
5. Measurement

- Kellstedt, Paul M., Guy D. Whitten and Steven A. Tuch. *The Fundamentals of Social Research*. Cambridge University Press, 2022. Chapter 6.
 - Problem set #2 due.
6. Randomization and experiments
- *Data Analysis for Social Science: A Friendly and Practical Introduction*, Chapter 2.
7. Interpreting experimental research
- Select one of:
 - Balcells, Laia, Valeria Palanza, and Elsa Voytas. "Do Transitional Justice Museums Persuade Visitors? Evidence from a Field Experiment." *The Journal of Politics* 84.1 (2022): 496-510.
 - Chattopadhyay, Raghendra, and Esther Duflo. "Women as Policy Makers: Evidence from a Randomized Policy Experiment in India." *Econometrica* 72.5 (2004): 1409-1443.
 - Gerber, Alan S., and Donald P. Green. "Does Canvassing Increase Voter Turnout? A Field Experiment." *Proceedings of the National Academy of Sciences* 96.19 (1999): 10939-10942.
 - Problem set #3 due.
8. Designing experiments
- *Mastering 'Metrics*, Chapter 2.
9. Analyzing experiments
- *Data Analysis for Social Science: A Friendly and Practical Introduction*, Chapter 7.
 - Practicum experiment assignment due.
10. Univariate regression
- *Data Analysis for Social Science: A Friendly and Practical Introduction*, Chapter 4.
11. Multivariate regression
- *Data Analysis for Social Science: A Friendly and Practical Introduction*, Chapter 5.
 - Problem set #4 due.
12. Instrumental variables
- *Mastering 'Metrics*, Chapter 3.
13. Regression discontinuity designs
- *Mastering 'Metrics*, Chapter 4.
14. Difference-in-differences
- *Mastering 'Metrics*, Chapter 5.
 - Problem set #5 due.
15. In-class workshoping observational study final assignment.
- Observational study assignment due.