Theory Building and Causal Inference

CDSS, University of Mannheim, Fall 2021

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Logistics

Time: Thu, 10:15-11:45
Location: Zoom [Link]

Instructor

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Course Description

Questions of cause and effect are at the heart of social science. And yet, establishing credible causal effects in empirical analyses is a difficult enterprise. This course will introduce some of the key conceptual and methodological approaches to tackle the causal inference problem: the potential outcomes model of causal inference, experimental designs, matching and regression, instrumental variables, regression discontinuity designs as well as difference-in-differences and fixed effects.

Textbooks

The primary readings are draft chapters from *Applied Causal Analysis (with R)*, a textbook I am currently writing together with Paul C. Bauer (under contract with Chapman & Hall/CRC; abbreviated [BC]). You can find Paul's course script here. Please do not share chapter drafts with others.

Background readings include:

- Joshua D Angrist and Jörn-Steffen Pischke. 2008. *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton, NJ: Princeton University Press. Abbreviated [AP].
- Alan S Gerber and Donald P Green. 2012. *Field Experiments. Design, Analysis, and Interpretation.* New York, London: W.W. Norton & Company. Abbreviated [GG].
- Guido W. Imbens and Donald B. Rubin. 2015. *Causal Inference for Statistics, Social, and Biomedical Sciences.* New York: Cambridge University Press. Abbreviated [IR].
- Stephen L Morgan and Christopher Winship. 2015. *Counterfactuals and causal inference.* 2nd. Cambridge: Cambridge University Press. Abbreviated [MW].

Course Structure

The course consists of seven topics, taught in paired sessions. Odd sessions are for *lectures.* Even weeks are for *lab sessions.* Please read the readings in advance of the lectures. I will upload a technical exercise after each lecture. You should work on the exercise before the corresponding lab session. We will then work through the solutions in the lab session.

Schedule

Session	Dates	Topic	Background Readings
1 + 2	09/09 + 09/16	Potential Outcomes	[IR] 1
3 + 4	09/23 + 09/30	Random Assignment: Experiments	[GG] 2-4
5 + 6	10/07 + 10/14	Matching	[MW] 5, [IR] 9
7 + 8	10/21 + 10/28	Regression	[AP] 3.2-3.3, [MW] 6
9 + 10	11/04 + 11/11	Instrumental Variables	[AP] 4, [MW] 9
11 + 12	11/18 + 11/25	Regression Discontinuity Designs	[AP] 6
13 + 14	12/02 + 12/09	Diff-in-Diff and Fixed Effects	[AP] 5

Course Requirements & Deadlines

Participation Requirements

I: Attendance, Readings, and Participation

Please attend the weekly sessions and read the assigned readings prior to class. Use the Discussion Forum on ILIAS to post questions of any sort (clarification or discussion) in advance of the sessions.

II: Technical Exercises

En lieu of the pre-pandemic in-class computer labs, you will have one week (between lecture and lab) to work on technical exercises in groups of two. Groups will be randomly assigned. We will then jointly discuss the solutions in the lab. You should come prepared with notes and/or some code that allows you to contribute to the lab sessions.

Final Paper

The main requirement of this class is a final paper. Your final paper may be a solo effort or a collaborative effort of max. two students. In case of collaborative work, both co-authors will receive the same grade. For the final paper, you may choose one of three formats, discussed below.

Note: You can opt into a peer review process for your final paper, which involves submitting an *outline* and both providing and receiving *reviewer comments*. The peer review process will only involve those students who choose to opt-in. It is the primary avenue for receiving feedback on your ideas for the final paper.

III: *Optional:* Outline

In preparation for the final (your "expected examination performance"), you should draft a *outline* of no more than 750 words (featuring short outlines of research question, theoretical argument, initial hypothesis, as well as proposed research design, data, and methods).

Deadline: Session 11 (November 18)

IV: *Optional:* Peer Review

I will then distribute your research proposals for peer review. You should prepare and submit a review of about *450 words* for the proposal you received. The review should entail constructive feedback, i.e., it should specify which aspects of the proposed research you found convincing, apply criticism where necessary, and include a list of suggestions for improvement. I will direct all reviews, along with my own feedback, back to the initial authors.

Deadline: Session 13 (December 2)

V: Final Paper

The final paper will give you the chance to explore a substantive problem of your choosing from an applied causal inference perspective. It should be brief, i.e., no longer than 5,000 words (excluding references and appendices).

Deadline: January 23, 2022, 23:59

Option A: Analysis plan/First-stage manuscript

This option gives you the chance to write a paper akin to the first stage of a registered report. This means that your write-up should include introduction, theory, and a detailed analysis plan. Next to (a) developing an argument by deductively theorizing _one_ theoretical mechanism directed at explaining an outcome and (b) briefly motivating and situating your argument against the background of the extant literature, you should present (c) detailed strategies for data collection/acquisition, causal identification, and empirical analysis. Feasibility is key: You should only propose an analysis plan that you can realistically implement during your PhD (e.g., a small online experiment that can be funded using CDSS research grants). Please also include (d) a critical assessment of the limitations of the proposed strategy.

Option B: Replication Paper

A replication paper builds up on somebody else's work but extends their argument as well as their analysis. Start with (a) an existing argument from published work and deductively theorize _one_ theoretical mechanism that extends the existing argument (e.g., did the authors miss important scope conditions under which the argument does not plausibly hold? Did they miss a theoretical mechanism through which the effect of the treatment on

the outcome unfolds?). You should then (b) extend the data and/or analysis to test your extended argument (e.g., using additional covariates included in replication materials for experimental studies, or joining additional data to published observational data). After applying and scrutinizing your identification and estimation strategy, conclude with (c) a critical assessment of the limitations of the implemented strategy.

Option C: Research Paper

The research paper will give you the chance to explore a substantive problem of your choosing from an applied causal inference perspective using an original identification and analytical strategy using experimental or observational data. It should focus on a concise connection of (a) developing an argument by deductively theorizing <u>one</u> theoretical mechanism directed at explaining an outcome, (b) briefly motivating and situating your argument against the background of the extant literature, (c) the development, application, and scrutinization of a corresponding identification and estimation strategy, and (d) a critical assessment of the limitations of the implemented strategy.

Grading & Accreditation

You will receive a course grade, which will be determined by your performance in the final examination (in this case, the final paper).

Submissions

All written assignments should be submitted through the corresponding upload modules on ILIAS. Please keep track of your schedules to ensure submissions without delay. Late submission of the final paper will result in deductions of 1/3 of a grade point per day.

Academic Integrity

You must adhere to the University Code of Academic Integrity (*Richtlinie zur guten wissenschaftlichen Praxis*). You are expected to be familiar with the Code and must understand the meaning and consequences of cheating, plagiarism, and other forms of academic misconduct. For further information, see `https://www.uni-mannheim.de/media/Universitaet/Dokumente/Richtlinie_gute_wissenschaftliche_Praxis_en.pdf`.