

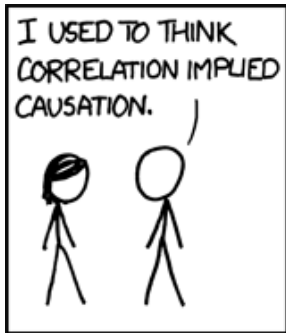
MY457/557: Causal Inference for Observational and Experimental Studies

Introduction

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LSE

Winter Term 2024



Causal Questions are Everywhere

- Class size on test scores
- Minimum wage on employment
- West-German TV and attitudes towards Leninism/Marxism in GDR
- Number of children on divorce rates
- Medical interventions on health outcomes
- 'Get out the vote'-campaigns on turnout
- New product launches on consumption
- ... and so on, and so on...

About GiveWell

GiveWell is a nonprofit dedicated to finding outstanding giving opportunities and publishing the full details of our analysis to help donors decide where to give.

We recommend a list of **top charities** to donors. We also offer donors the option to give to **our giving funds**. GiveWell is focused on finding a small number of outstanding giving opportunities, not on reviewing as many charities—or as many causes—as possible.

We don't focus solely on financials, such as assessing administrative or fundraising costs. Instead, we conduct in-depth research to determine how much good a given program accomplishes (in terms of lives saved, lives improved, etc.) per dollar spent.





AMAZON ORIGINAL

THE LORD OF THE RINGS

THE

RINGS OF POWER



MY457

Week 1

Introduction

6 / 14

Goals of this Course

At the end of the class you should know the following about **causal inference**:

- Concepts, definitions, and theoretical foundations
- Canonical research designs and examples
- Basic implementation of these designs using real data in \mathbb{R}

Formal technical presentation, but that is not the main point

Only study cases where measurement is numerical (though not necessarily quantitative!)

What this course does **not** (primarily) cover:

- Measurement
- Description and prediction
- Programming/coding

What Kinds of Causal Research Questions?

This course is primarily about **effects of causes**: $D \rightarrow Y$

- How do the values of an **outcome** variable (Y) change when a **causal** variable (D) takes on different values?
- For simplicity we can most of the time focus on the case where the causal variable has two values, **treatment** ($D = 1$) and **control** ($D = 0$).

What we **don't** really consider too closely:

- 'Causes of effects' (or, as LSE students say: *rerum cognoscere causas*)
- Substantive explanations of causal mechanisms: *Why* a treatment has the effect it does
- Generalization and meta-learning

Course Roadmap

- **Week 1:** Causal frameworks
- **Week 2:** Randomization
- **Week 3:** Selection on observables I
- **Week 4:** Selection on observables II
- **Week 5:** Selection on observables III
- **Week 6:** *Reading week*
- **Week 7:** Difference-in-differences I
- **Week 8:** Difference-in-differences II
- **Week 9:** Synthetic control methods
- **Week 10:** Instrumental variables
- **Week 11:** Regression discontinuity designs

Is This Class Right for You?

Prerequisites:

1. Probability and linear regression, to the level of MY452 or equivalent.
2. Familiarity with notions of research design, to the level of MY400 or equivalent, is helpful.
3. The computer classes use **R**. No prior experience with **R** is required (although it helps), but we are not able to offer extensive support on programming as this is not a programming class. Please see the Moodle page for some start-up information about **R**. The Digital Skills Lab offers a 3 week introduction to **R** which you could take. You will need your own laptop/computer.

Auditors are welcome, so long as there is room (lectures and classes). See <https://www.lse.ac.uk/Methodology/Auditing/Auditing> to register.

Teaching

Ten two-hour lectures, Wed 12:00–14:00

- Taught by yours truly.
- Focus on intuition, theory, and real examples. Some practical content, but not much.

Five two-hour seminars (two groups), Thu 12:00–14:00 and 14:00–16:00

- Led by Dr Michael Ganslmeier, along with me.
- Combination of recap/reinforcement and practical exercises including some programming.
- Please bring your own laptop to the computer classes, with R and RStudio/VScode installed.

See **LSE timetables** for room information.

Office hours for both me and Dr Ganslmeier can be booked on Studenthub.

Assessment

Summative assessment:

- Assessment for MY457 (MSc) will be a two-hour written examination in the Summer Term (100%)
- Assessment for MY557 (PhD) will be a paper applying methods from the course to a research question (100%, due 4pm on May 17th 2024)
 - If you plan to take MY557 for credit, please discuss your proposed topic with me **early** in Winter Term.

Formative assessment:

- Five problem sets – mix of theory, simulation, and real-world data
- Use the provided `Rmarkdown` and submit on time through Moodle
- Your learning will be **strongly enhanced** by completing these psets
- You are welcome to use ChatGPT and other Generative AIs

Online Learning Platforms

Moodle:

- Forum for questions (please use this!)
- Lecture recordings (after lectures)
- Formative homework assignments: Submission and feedback

Github (<https://lse-my457.github.io/>):

- Weekly reading lists (to be read before lecture)
- Lecture slides (before lectures)
- Seminar materials
- Formative homework assignments: Instructions and data

Core Books

- We will use three core textbooks throughout the term:
 - **MHE**: Angrist and Pischke, *Mostly Harmless Econometrics: An Empiricist's Companion*, 2009, Princeton University Press.
 - **CIS**: Imbens and Rubin, *Causal Inference for Statistics, Social, and Biomedical Sciences*, 2015, Cambridge University Press.
 - **TE**: Huntington-Klein, *The Effect: An Introduction to Research Design and Causality*, 2022, CRC Press.
- For those very interested in the material, we also recommend:
 - **CMRI**: Pearl, *Causality: Models Reasoning and Inference* (2nd Ed), 2009, Cambridge University Press.
 - **CISAP**: Pearl, Glymour, and Jewell, *Causal Inference in Statistics: A Primer*, 2016, Wiley.
 - **CIWI**: Hernan and Robins, *Causal Inference: What If*, 2020, Routledge.

All should be available as electronic copies.