

# MY457/MY557

## CAUSAL INFERENCE FOR EXPERIMENTAL AND OBSERVATIONAL STUDIES

Seminars

Introduction

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# COURSE STRUCTURE

Week 1: Potential outcomes framework

Week 2: Randomized experiments

Week 3: Selection on observables I

Week 4: Selection on observables II

Week 5: Selection on observables III

Week 6: Reading week

Week 7: Differences in differences I

Week 8: Differences in differences II

Week 9: Synthetic Control Method

Week 10: Instrumental variables

Week 11: Regression discontinuity designs

seminar 1 (week 2)

seminar 2 (week 4)

seminar 3 (week 7)

seminar 4 (week 9)

seminar 5 (week 11)



# READING LIST

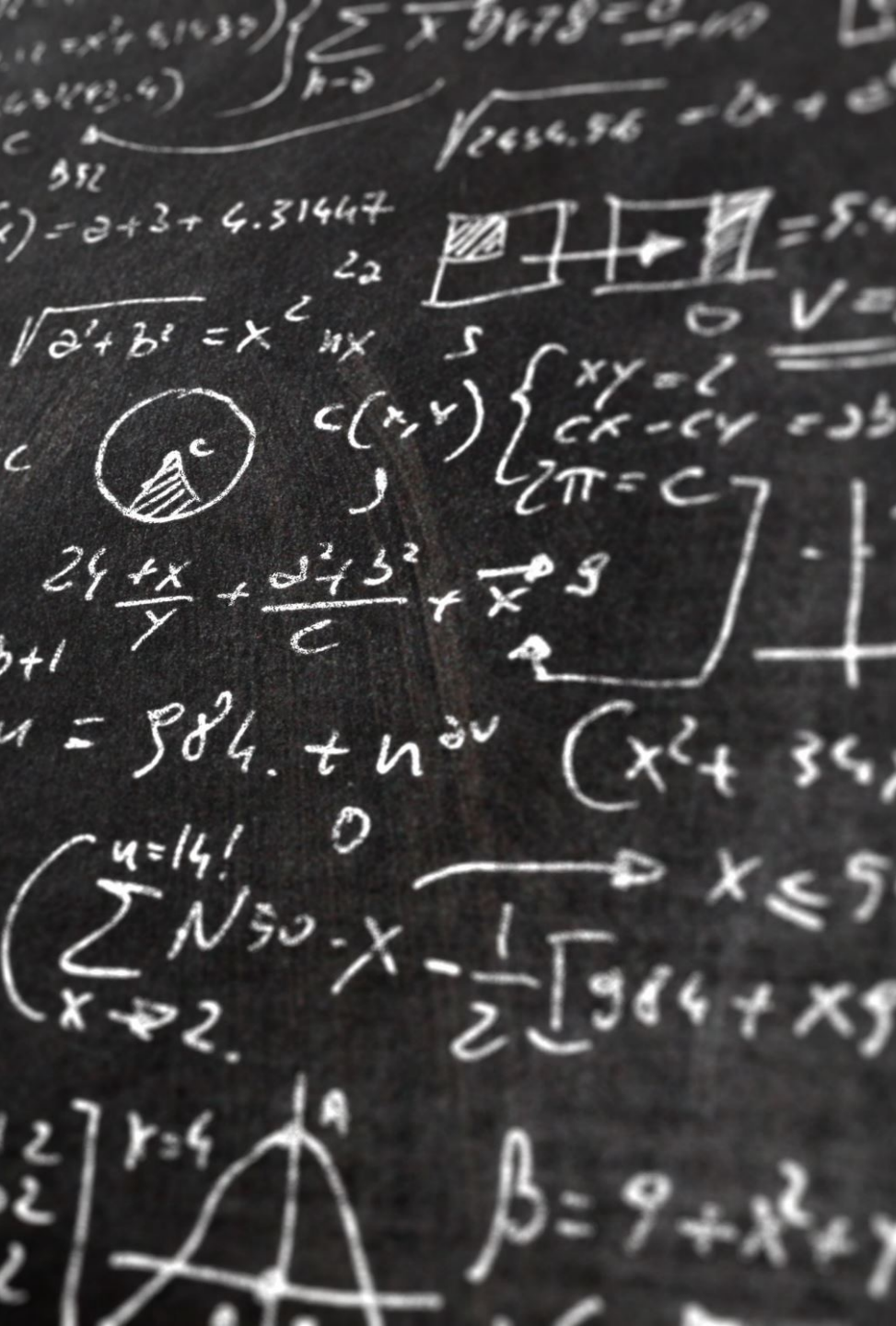
## Main textbooks:

- **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.

## Further readings:

- **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.





# PREREQUISITES

## Statistical knowledge:

- Linear regression and familiarity with generalized linear models (i.e. MY452)
- Familiarity with notions of research design (i.e. MY400)

## Coding knowledge:

- in-class exercises and homework uses R
- coding skills in R are not required but definitely helpful
- a good (free) introduction to R: “Hands-On Programming with R” by Garrett Golemund, see <https://rstudio-education.github.io/hopr/>

## Technical equipment:

- install R and RStudio on your laptop before the first computer class





# SEMINARS

- **Attendance:** we will check the attendance at the beginning of each seminar; if you cannot come to the seminar, please let me know beforehand via email
- **Structure of the seminars:**
  - **The application part (with observational data):** 1h 15min
    - Brief conceptual overview by seminar teacher: 5min
    - Teach-back exercise: 5min
    - Application exercise: 60-70min
      - group discussion
      - presentation of results
  - Break for 5-10min
  - **The coding part (with simulated data):** 30min





Each week, all students are required to read one paper in detail



The paper uses the method you covered in the lecture



Teach-back exercise



Reviewer-2 exercise



Grant-Proposal exercise

# THE APPLICATION PART

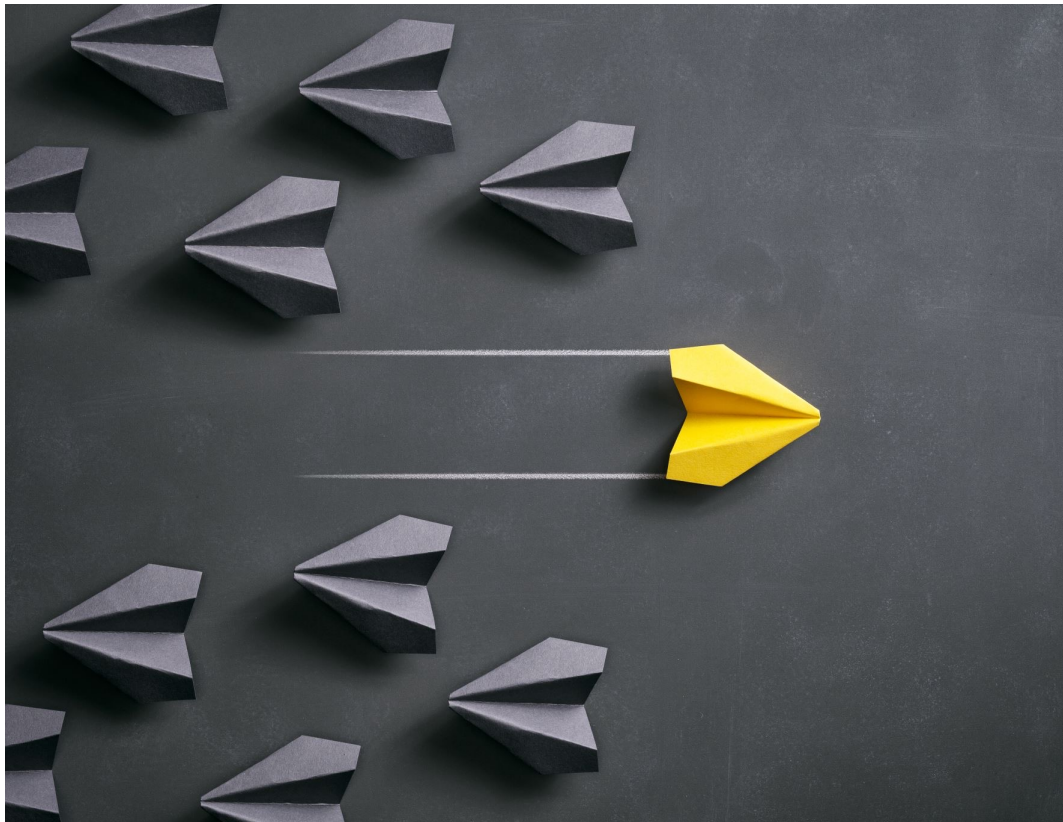


# THE TEACH-BACK EXERCISE

- At the beginning of each seminar, one group will provide a 5min overview and summary of the paper
- Duration: max 5min
- Example questions:
  - What is the research question? What is the estimand/estimator/cause-effect question?
  - Describe the population and the sample.
  - Which identification strategy has been used? What are they key identifying assumptions?
  - What are the main empirical results?



# THE REVIEWER-2 EXERCISE



- ❑ Group exercise: you work in a group consisting of up to five students
- ❑ Questions are given for guidance
- ❑ Task: review and discuss the paper from the perspective of “Reviewer 2”. In general, R2 is always very skeptical towards the research design of the paper. Try to be R2!
- ❑ Take notes by summarizing your thoughts.
- ❑ After 30 minutes, each group presents their findings and we will discuss them in the class





# THE GRANT-APPLICATION EXERCISE

- ❑ Task: assume now that you are not totally convinced of the findings of the paper. For this, you require research money from a research fund to validate/invalidate the results of the paper
- ❑ Brainstorm in your group how an alternative study setup can look like and how it can address the shortcomings of the paper we have discussed.
- ❑ Are other methods which you have learned in previous lectures more suitable to study the causal effect than the method from this seminar? If so, which ones and why? If not, why not?



# THE CODING PART

- After the application part, we do some hands-on coding.
- For this, we use simulated data and then walk through the single coding steps to implement a particular method.
- The script will be shared with you on the day of the lecture (Wednesdays), so you can download the RMarkdown file and execute each step on your own computer during the computer class.
- This part of the course will give you the opportunity to learn how to estimate the treatment effect using a particular method

