PhD course Causal Inference in Empirical Economics

Contents

We, as human beings, tend to attribute cause and effect to observations quite quickly, even if such a causal relationship does not really exist. Causal inference is the science of the study of causal relationships and gives us tools to study rigorously if an intervention, action, or treatment actually casually determines a certain outcome. Causal inference is required to answer questions such as "What is the impact of social distancing on the spread of COVID-19?", "What is the effect of minimum wages on employment?", or "To what extent do increases in food prices increase conflict?" In this "Causal Inference in Empirical Economics" course five development economists from both Wageningen University (WUR) and Utrecht University (UU), will teach state-of-the-art causal inference methods for both experimental and quasi-experimental designs, and help students to apply these to their own research designs.

Learning objectives

After successful completion of this course students are expected to be able to:

1. Use economic theory to design a (quasi) experiment
2. Apply and evaluate statistical techniques in terms of valid causal inference
3. Appraise various experimental design choices
4. Appraise various quasi-experimental methods
5. Write a pre-analysis plan including power analysis

Course entry requirements

- DEC-32806 Impact Assessment of Policies and Programmes at WUR or ECRMRS1 Econometric Methods 1 at UU or a similar course at another university, and
- YSS-34306 Advanced Econometrics at WUR or ECRMRS1 Econometric methods 2 + Research skills: Data handling at UU or a similar course at another university, and
- Being able to program in Stata.

Activities

- Lectures: The course material will be discussed in fourteen interactive lectures.
- Assignments: Students will replicate some empirical results from highly-cited papers by implementing estimation procedures in Stata.

Feedback

- Question hours to discuss progress with Stata assignments.
- Each Friday, Q&A to help students apply the material of the week in their own research design.
- Students will receive feedback on their research design from one of the teachers for further improvement after the course.

Examination

The student needs to pass each:

A. Three Stata assignments (pass/fail grading)
B. Written exam with open questions (minimum 5.5 to pass)

Evaluation grid

Learning objective	**A**	**B**
1. Design a (quasi) experiment based on economic theory		X
2. Judge whether statistical techniques provide valid inference	X	X
3. Appraise various experimental design choices		X
4. Appraise various quasi-experimental methods	X	X
5. Write a pre-analysis plan including power analysis	X	X

Time allocation

	Number	Hours	Total hours
Lectures	12	2	24
Readings	12	5	60
Assignments	3	6	18
Q&A	7	1	7
Exam	1	3	3
Total			112

Practical information

- Credits: 4 ECTS
- Language of instruction: English
- The course will be taught in hybrid form: each week there will be one physical lecture (either in Wageningen or in Utrecht) and the rest of the meetings will be online. Students that are staying abroad will be allowed to participate online if they participate actively. Of course if restrictions change, we may have to move the course online.

Staff

The course team consists of:

- Dr. Elena Fumagalli
- Dr. Karlijn Morsink
- Dr. Robert Sparrow
- Dr. Mark Treurniet
- Dr.ir. Maarten Voors (course coordinator)

Program

Date Time	**Topic**	**Literature (R=required, O=optional)**	**Person**
Week 1: From theory to design			
Mon 14-2 15:00	Lecture 1:	R: Cunningham (2021) §4.1 R: Angrist & Pischke (2008) Ch. 1 and 2 R: Imbens and Rubin (2015) Ch. 1 and 2	Karlijn
	Causal attribution: Rubin causal model and potential outcomes		
	Sample selection		
	Randomization		
	Spillovers		
Tue 16-2 15:00	Lecture 2:		Karlijn
	Estimands and estimators (ATE, ATT, ATU, ITT, LATE)	R: Gerber and Green (2012) Ch. 5 and Ch.6	
Thu 17-2 15:00	Q&A		Karlijn
Week 2: Causal inference in randomized experiments			
Mon 21-2 15:00	Lecture 3:		Mark
	Pros and cons of collecting baseline data	O: Zwane et al (2011) O: Treurniet (2021)	

		O: McKenzie (2012)	
	When to cluster How to cluster (Monte Carlo simulation)	R: Abadie et al (2017) O: Deeb and de Chaisemartin (2020) O: Cameron et al (2008)	
Tue 22-2 11:30	Question hour Stata assignment: Simulation		Mark
Wed 23-2 11:30	Lecture 4:		Mark
	Randomization inference	R: Cunningham (2021) §4.2 O: Young (2019)	
	Correlated outcomes (SUR)	O: Christensen et al (2020)	Maarten
	Multiple hypothesis testing (FDR, FWER, Bonferroni)	O: Anderson (2008)	
Thu 24-2 15:00	Q&A		Mark
Week 3: Advanced randomized designs			
Mon 28-2 15:00	Lecture 5:	R: Voors et al (2021)	Maarten
	Factorial designs	R: Muralidharan et al (2019)	
	Heterogeneous effects analysis		
	Mediation analysis		
Tue 2-3 15:00	Lecture 6:		Maarten
	Spillovers: design and analysis		
Thu 4-3 15:00	Q&A: Application to student's research design		Maarten
Week 4: Quasi-experimental methods I			
Mon 7-3	Deadline Stata Assignment 1: Simulation	Via Brightspace	

15:00			
Mon 7-3 15:00	Lecture 7:		Robert
	Propensity score matching vs. exact matching	R: Cunningham (2021) Ch. 5 O: Iacus et al (2012) O: King and Nielsen (2019)	
Wed 9-3 15:00	Lecture 8:		Robert
	Regression Discontinuity	R: Cunningham (2021) Ch. 6	
Thu 11-3 15:00	Q&A: Application to student's research design		Robert
Week 5: Quasi-experimental methods II			
Mon 14-3 15:00	Lecture 9:		Elena
	Instrumental Variables	R: Cunningham (2021) Ch. 7 O: Lee at al (2020)	
Tue 15-3 15:00	Question hour Stata assignment		Elena/ Robert
Wed 16-3 15:00	Lecture 10:		Elena
	Difference-in-Differences	R: Cunningham (2021) Ch. 9	
Thu 18-3 15:00	Q&A: Application to student's research design		Elena
Week 6: Power, ethics and pre-analysis plans			
Mon 21-3 15:00	Lecture 13:	R: Voors et al (2021)	Karlijn/ Maarten
	Power analysis and designing for sufficient power	O: McKenzie (2012) R: Muralidharan et al (2019)	
Tue 22-3 15:00	Question hour Stata Assignment: Power		Karlijn/ Maarten
Tue	Lecture 14:		Karlijn/

22-3 15:00	Ethics		Maarten
	Pre-registration and pre-analysis plans		
	Data management and open science		
Thu 24-3 15:00	Q&A: Application to student's research design		Maarten/ Karlijn
Week 7: Self study			
Mon 4-4 15:00	Deadline Stata Assignment 3: Power	Via Brightspace	
Thu 7-4 15:00	Q&A Optional	Via Brightspace	All
Fri 8-4 14:00	Written exam		

Literature

Abadie, A. (2020). Using Synthetic Controls: Feasibility, Data Requirements, and Methodological Aspects. *Journal of Economic Literature*, forthcoming.

Abadie, Alberto, Susan Athey, Guido W. Imbens, and Jeffrey Wooldridge. 2017. When Should You Adjust Standard Errors for Clustering? NBER Working Paper No. 24003.

Abadie, A., Diamond, A. and Hainmueller, J. 2015. Comparative Politics and the Synthetic Control Method. *American Journal of Political Science*, 59: 495-510.

Anderson, Michael L. 2008. Multiple Inference and Gender Differences in the Effects of Early Intervention: A Reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects, *Journal of the American Statistical Association*, 103(484): 1481-1495.

Angrist, J.D. and Pischke, J.S., 2008. Mostly harmless econometrics: An empiricist's companion. Princeton university press. Online version here.

Cameron, A. Colin, Jonah B. Gelbach, and Douglas L. Miller. 2008. Bootstrap-Based Improvements for Inference with Clustered Errors. *The Review of Economics and Statistics* 90(3): 414-427.

Christensen, Darin, Oeindrila Dube, Johannes Haushofer, Bilal Siddiqi, Maarten Voors. 2021. Building Resilient Health Systems: Experimental Evidence from Sierra Leone and the 2014 Ebola Outbreak. *The Quarterly Journal of Economics*, 136(2): 1145–1198

Cunningham, Scott. 2021. *Causal Inference: The Mixtape*.

Deeb, Antoine, and Clément de Chaisemartin. 2020. Clustering and External Validity in Randomized Controlled Trials. Working paper.

Iacus, S., King, G., & Porro, G. 2012. Causal Inference without Balance Checking: Coarsened Exact Matching. *Political Analysis*, 20(1): 1-24.

Imbens, G.W. and Rubin, D.B., 2015. Causal inference in statistics, social, and biomedical sciences. Cambridge University Press.

King, G., & Nielsen, R. 2019. Why Propensity Scores Should Not Be Used for Matching. *Political Analysis*, 27(4): 435-454.

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McKenzie, David. 2012. Beyond baseline and follow-up: The case for more T in experiments. *Journal of Development Economics*, 99(2): 210-221.

Muralidharan, Karthik, Mauricio Romero and Kaspar Wüthrich. 2019. Factorial Designs, Model Selection, and (Incorrect) Inference in Randomized Experiments. NBER Working Paper No. 26562.

Treurniet, Mark. 2021. The Impact of Being Surveyed on the Adoption of Agricultural Technology. *Economic Development and Cultural Change*, forthcoming.

Young, Alwyn. 2019. Channeling Fisher: Randomization Tests and the Statistical Insignificance of Seemingly Significant Experimental Results. *The Quarterly Journal of Economics*, 134(2): 557-598

Voors, Maarten, Jake Bowers, and Nahomi Ichino. 2021. *The Theory and Practice of Field Experiments: An Introduction from the EGAP Learning Days*.

Zwane, Alix Peterson, Jonathan Zinman, Eric Van Dusen, William Pariente, Clair Null, Edward Miguel, Michael Kremer, Dean S. Karlan, Richard Hornbeck, Xavier Giné, Esther Duflo,

Florencia Devoto, Bruno Crepon, and Abhijit Banerjee. 2011. Being surveyed can change later behavior and related parameter estimates. *PNAS*, 108(5): 1821-1826.