

Causal Inference in Applied Econometrics

last update: September 27, 2023

Course description

Many of the big questions in the social sciences (and economics) deal with cause and effect. How does immigration affect pay and employment levels? How does a longer education affect someone's future income? These questions are difficult to answer because we have nothing to use as a comparison. We do not know what would have happened if there had been less immigration or if that person had not continued studying.

However, the Laureates of the Nobel Prize in Economics in 2021 - David Card, Joshua Angrist, and Guido Imbens - have shown that it is possible to answer these and similar questions using natural experiments. The key is to use situations in which chance events or policy changes result in groups of people being treated differently, in a way that resembles clinical trials in medicine.

If you are curious about how economists can draw plausible conclusions about cause and effect I invite you to join this course. The course covers core methods and seminal applications dealing with causal inference.

We will work through assumptions, diagnostics, practical examples and code in Stata (and/or R if available). Moreover, students will present and discuss applications or extensions of such designs with practical examples from recent papers.

Participation is possible for MAGKS and GGS members.

Syllabus

1. Introduction and Potential Outcome Framework
2. Randomized Controlled Trials
3. Matching
4. Linear Regression and Causality
5. Instrumental Variables
6. Regression Discontinuity Designs
7. Difference-in-Differences
8. Synthetic Control Method

Course Work

Active participation in the course

Presentation (approx. 10 minutes) and discussion of a research paper

Contact

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Material accessible via: <https://jlubox.uni-giessen.de/getlink/fiVLTs35pQS5CSocnsQn13r2/>

Registration via MAGKS <https://magks.de/courses/>

Maximum number of participants: 30 Registration deadline: September 24, 2023

Tentative Schedule

The course will take place from Monday, October 09 to Thursday, October 12; 09:30 to 17:00 at the Justus Liebig University Giessen, Licher Strasse 68, room 45.

	time	topic
Monday (Oct-09)	09:30 – 11:00	Intro; Potential Outcome Framework
	11:15 – 12:45	RCT
	14:00 – 17:00	Matching + Regression
Tuesday (Oct-10)	09:30 – 11:30	present + discuss (RCT, match)
	11:45 – 12:45	IV
	14:00 – 17:00	IV + RDD
Wednesday (Oct-11)	09:30 – 11:30	present + discuss (IV)
	11:45 – 12:45	RDD
	14:00 – 15:40	present + discuss (RDD)
Thursday (Oct-12)	15:50 – 17:00	DiD
	09:30 – 11:00	DiD
	11:15 – 11:45	SCM
	11:45 – 12:45	present + discuss (DiD)
	14:00 – 17:00	present + discuss (DiD, SCM)

Literature: what we will discuss in class (preliminary; to be updated)

Literature on Causal Inference in general:

- Angrist, J. D., and Pischke, J. S. (2014). *Mastering 'Metrics: The Path from Cause to Effect*. Princeton University Press.
(online material)
- Angrist, J. D., and Pischke, J. S. (2013). *Mostly Harmless Econometrics. An Empiricist's Companion*. Princeton University Press.
(MHE – online access)
- Cunningham, S. (2021). *Causal inference: The Mixtape*. Yale University Press.
(The Mixtape – online access)
- Huntington-Klein, N. (2021). *The Effect: An Introduction to Research Design and Causality*. CRC Press.
(The Effect – online access)
- Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data*. MIT press. (Chapter 18: Estimating Average Treatment Effects)
(Panel-Wooldridge – online access)

Potential Outcome Framework:

- Neyman, J. S. (1923). On the application of probability theory to agricultural experiments. Essay on principles. section 9.(translated and edited by D. M. Dabrowska and T.P. Speed, *Statistical Science* (1990), 5, 465-480). *Annals of Agricultural Sciences*, 10:1–51
- Fisher, R. A. (1935). *The Design of Experiments*. *Oliver and Boyd, Edinburgh*
- Roy, A. D. (1951). Some thoughts on the distribution of earnings. *Oxford economic papers*, 3(2):135–146
- Rubin, D. B. (1974). Estimating causal effects of treatments in randomized and nonrandomized studies. *Journal of educational Psychology*, 66(5):688

Randomized Controlled Trials:

- Baicker, K., Taubman, S. L., Allen, H. L., Bernstein, M., Gruber, J. H., Newhouse, J. P., Schneider, E. C., Wright, B. J., Zaslavsky, A. M., and Finkelstein, A. N. (2013). The oregon experiment-effects of medicaid on clinical outcomes. *New England Journal of Medicine*, 368(18):1713–1722
- Carter, S. P., Greenberg, K., and Walker, M. S. (2017). The impact of computer usage on academic performance: Evidence from a randomized trial at the united states military academy. *Economics of Education Review*, 56:118–132
- Finkelstein, A., Taubman, S., Wright, B., Bernstein, M., Gruber, J., Newhouse, J. P., Allen, H., Baicker, K., and Group, O. H. S. (2012). The oregon health insurance experiment: evidence from the first year. *The Quarterly journal of economics*, 127(3):1057–1106
- Krueger, A. B. (1999). Experimental estimates of education production functions. *The quarterly journal of economics*, 114(2):497–532
- Taubman, S. L., Allen, H. L., Wright, B. J., Baicker, K., and Finkelstein, A. N. (2014). Medicaid increases emergency-department use: evidence from oregon’s health insurance experiment. *Science*, 343(6168):263–268

Matching Methods:

- Abadie, A. and Imbens, G. W. (2006). Large sample properties of matching estimators for average treatment effects. *econometrica*, 74(1):235–267
- Cochran, W. G. (1968). The effectiveness of adjustment by subclassification in removing bias in observational studies. *Biometrics*, pages 295–313
- Crump, R. K., Hotz, V. J., Imbens, G. W., and Mitnik, O. A. (2009). Dealing with limited overlap in estimation of average treatment effects. *Biometrika*, 96(1):187–199
- Diamond, A. and Sekhon, J. S. (2013). Genetic matching for estimating causal effects: A general multivariate matching method for achieving balance in observational studies. *Review of Economics and Statistics*, 95(3):932–945

- Rosenbaum, P. R. and Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1):41–55
- Shonchoy, A. (2010). Seasonal migration and the effectiveness of micro-credit in the lean period: Evidence from bangladesh. *Institute of Developing Economies Discussion paper No*, 294

Regression and Causality:

- Angrist, J. D. and Pischke, J.-S. (2014). *Mastering 'Metrics: The Path from Cause to Effect*. Princeton university press
- Pei, Z., Pischke, J.-S., and Schwandt, H. (2019). Poorly measured confounders are more useful on the left than on the right. *Journal of Business & Economic Statistics*, 37(2):205–216

Instrumental Variables:

- Angrist, J. D. and Krueger, A. B. (1991). Does compulsory school attendance affect schooling and earnings? *The Quarterly Journal of Economics*, 106(4):979–1014
- Card, D. (1993). Using geographic variation in college proximity to estimate the return to schooling. working paper version available at: <http://www.nber.org/papers/w4483>
- Card, D. (2001). Estimating the return to schooling: Progress on some persistent econometric problems. *Econometrica*, 69(5):1127–1160
- Staiger, D. and Stock, J. (1997). Instrumental variables regression with weak instruments. *Econometrica*, 65(3):557–586
- Stock, J. H., Wright, J. H., and Yogo, M. (2002). A survey of weak instruments and weak identification in generalized method of moments. *Journal of Business & Economic Statistics*, 20(4):518–529
- Wald, A. (1940). The fitting of straight lines if both variables are subject to error. *The annals of mathematical statistics*, 11(3):284–300

Regression Discontinuity Designs:

- Almond, D., Doyle Jr, J. J., Kowalski, A. E., and Williams, H. (2010). Estimating marginal returns to medical care: Evidence from at-risk newborns. *The Quarterly Journal of Economics*, 125(2):591–634
- Angrist, J. D. and Lavy, V. (1999). Using maimonides' rule to estimate the effect of class size on scholastic achievement. *The Quarterly Journal of Economics*, 114(2):533–575
- Carpenter, C. and Dobkin, C. (2009). The effect of alcohol consumption on mortality: regression discontinuity evidence from the minimum drinking age. *American Economic Journal: Applied Economics*, 1(1):164–82

- Carpenter, C. and Dobkin, C. (2011). The minimum legal drinking age and public health. *Journal of Economic Perspectives*, 25(2):133–56
- Imbens, G. W. and Lemieux, T. (2008). Regression Discontinuity Designs: A Guide to Practice. *Journal of Econometrics*, 142(2):615–635
- McCrary, J. (2008). Manipulation of the running variable in the regression discontinuity design: A density test. *Journal of Econometrics*, 142(2):698–714

Difference-in-Differences:

- Snow, J. (1855). *On the mode of communication of cholera*. John Churchill
- Ashenfelter, O. and Krueger, A. (1994). Estimates of the economic return to schooling from a new sample of twins. *The American economic review*, pages 1157–1173
- Card, D. and Krueger, A. B. (1994). Minimum wages and employment: A case study of the fast-food industry in new jersey and pennsylvania. *American Economic Review*, 84(4):772–93
- Todd, P. E. and Wolpin, K. I. (2003). On the specification and estimation of the production function for cognitive achievement. *The Economic Journal*, 113(485):F3–F33
- Carpenter, C. and Dobkin, C. (2011). The minimum legal drinking age and public health. *Journal of Economic Perspectives*, 25(2):133–56
- Pfeifer, G. and Stockburger, M. (2023). The morning after: Prescription-free access to emergency contraceptive pills. *Journal of Health Economics*, page 102775

Synthetic Control Method:

- Abadie, A. and Gardeazabal, J. (2003). The economic costs of conflict: A case study of the basque country. *American economic review*, 93(1):113–132
- Abadie, A., Diamond, A., and Hainmueller, J. (2010). Synthetic control methods for comparative case studies: Estimating the effect of california’s tobacco control program. *Journal of the American statistical Association*, 105(490):493–505
- Abadie, A., Diamond, A., and Hainmueller, J. (2015). Comparative politics and the synthetic control method. *American Journal of Political Science*, 59(2):495–510
- Athey, S. and Imbens, G. W. (2017). The state of applied econometrics: Causality and policy evaluation. *Journal of Economic Perspectives*, 31(2):3–32

Literature: Paper suggestions for Presentations

RCT:

- Leibowitz, A. (1990). The response of births to changes in health care costs. *Journal of Human Resources*, pages 697–711
- Bruhn, M. and McKenzie, D. (2009). In pursuit of balance: Randomization in practice in development field experiments. *American economic journal: applied economics*, 1(4):200–232
- Augsburg, B., De Haas, R., Harmgart, H., and Meghir, C. (2015). The impacts of microcredit: Evidence from bosnia and herzegovina. *American Economic Journal: Applied Economics*, 7(1):183–203

Matching:

- Dehejia, R. H. and Wahba, S. (2002). Propensity score-matching methods for nonexperimental causal studies. *Review of Economics and statistics*, 84(1):151–161 (larger, seminal paper, e.g., suitable for a group of two)
- List, J. A., Millimet, D. L., Fredriksson, P. G., and McHone, W. W. (2003). Effects of environmental regulations on manufacturing plant births: evidence from a propensity score matching estimator. *Review of Economics and Statistics*, 85(4):944–952

Regression

- Pei, Z., Pischke, J.-S., and Schwandt, H. (2019). Poorly measured confounders are more useful on the left than on the right. *Journal of Business & Economic Statistics*, 37(2):205–216

IV

- Angrist, J. and Evans, W. N. (1996). Children and their parents' labor supply: Evidence from exogenous variation in family size
- Falck, O., Gold, R., and Heblich, S. (2014). E-lections: Voting behavior and the internet. *American Economic Review*, 104(7):2238–2265
- Möller, J. and Zierer, M. (2018). Autobahns and jobs: A regional study using historical instrumental variables. *Journal of Urban Economics*, 103:18–33
- Müller, K. and Schwarz, C. (2023). From hashtag to hate crime: Twitter and anti-minority sentiment. *American Economic Journal: Applied Economics*, 15(3):270–312

RDD

- Barreca, A. I., Guldi, M., Lindo, J. M., and Waddell, G. R. (2011). Saving babies? revisiting the effect of very low birth weight classification. *The Quarterly Journal of Economics*, 126(4):2117–2123

- Hoekstra, M. (2009). The effect of attending the flagship state university on earnings: A discontinuity-based approach. *The Review of Economics and Statistics*, 91(4):717–724
- Altindag, O., Erten, B., and Keskin, P. (2022). Mental health costs of lockdowns: Evidence from age-specific curfews in turkey. *American Economic Journal: Applied Economics*, 14(2):320–343
- Lee, D. S. (2008). Randomized experiments from non-random selection in us house elections. *Journal of Econometrics*, 142(2):675–697

DiD

- Card, D. (1990). The impact of the mariel boatlift on the miami labor market. *ILR Review*, 43(2):245–257
- Pischke, J.-S. (2007). The impact of length of the school year on student performance and earnings: Evidence from the german short school years. *The Economic Journal*, 117(523):1216–1242
- Bharadwaj, P., Lakdawala, L. K., and Li, N. (2020). Perverse Consequences of Well Intentioned Regulation: Evidence from India’s Child Labor Ban. *Journal of the European Economic Association*, 18(3):1158–1195
- Bertrand, M., Duflo, E., and Mullainathan, S. (2004). How Much Should We Trust Differences-in-Differences Estimates? *The Quarterly Journal of Economics*, 119(1):249–275
(more method/inference overview)
- Roth, J., Sant’Anna, P. H., Bilinski, A., and Poe, J. (2023). What’s trending in difference-in-differences? a synthesis of the recent econometrics literature. *Journal of Econometrics*
(overview on new DiD literature)

SCM

- Cavallo, E., Galiani, S., Noy, I., and Pantano, J. (2013). Catastrophic natural disasters and economic growth. *Review of Economics and Statistics*, 95(5):1549–1561
- Kleven, H. J., Landais, C., and Saez, E. (2013). Taxation and international migration of superstars: Evidence from the european football market. *American economic review*, 103(5):1892–1924
- Belot, M. and Vandenberghe, V. (2014). Evaluating the ‘threat’effects of grade repetition: exploiting the 2001 reform by the french-speaking community of belgium. *Education Economics*, 22(1):73–89

Match and DiD

- Chintrakarn, P. (2008). Estimating the euro effects on trade with propensity score matching. *Review of International Economics*, 16(1):186–198