Ph.D. in "Life Course Research" – Socio-demographic curriculum
Academic Year 2025-2026

Causal inference

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Objectives

The aim of the course is to introduce students to the basics of causal inference. We will cover theoretical concepts, review case studies, and hold two lab sessions. After an introduction and an overview of the main empirical strategies, we will discuss the following topics:

- Instrumental variables
- Propensity score matching
- Difference-in-differences

The lab sessions will be conducted in **R**.

Program

Monday: Dalit Contini
Introduction to causal inference. The potential outcomes framework. Overview of the main empirical strategies. Instrumental variable estimation.
hours: 10-13, 14-16

Tuesday: Bruno Arpino
Propensity score matching. The logic of balancing on observables. Estimation of the propensity score, common support, and matching algorithms (nearest-neighbour, caliper, kernel). Assessing balance and overlap, implementing treatment effect estimation, and discussing main assumptions and limitations. Comparison and combination with regression models.
hours: 10-13

Wednesday: Margherita Silan
Lab on Propensity score matching. Theoretical insights into inverse probability of treatment weighting, propensity score with machine learning, multiple treatments scenarios.
hours: 10-13, 14-16

Thursday: Cristian Usala
Difference-in-differences: theory and lab
hours: 10-13, 14-16

Requirements

Students are expected to have prior knowledge of regression analysis and basic familiarity with R.

Suggested reading materials

Textbooks

- Cunningham, S. (2021). *Causal Inference: The Mixtape.* Yale University Press. JSTOR, https://mixtape.scunning.com/
- Guo, S., & Fraser, M. W. (2014). *Propensity score analysis: Statistical methods and applications* (Vol. 11). SAGE publications.
- Imbens, G.W. & Rubin, D.B. (2015). *Causal inference for statistics, social, and biomedical sciences: An introduction*. Cambridge University Press.

An applied practitioners' guide

- Impact Evaluation in Practice, second edition World Bank Group https://openknowledge.worldbank.org/server/api/core/bitstreams/4659ef23-61ff-5df7-9b4e-89fda12b074d/content

Methodological papers

- Guo, S., Fraser, M., & Chen, Q. (2020). Propensity score analysis: recent debate and discussion. *Journal of the Society for Social Work and Research*, *11*(3), 463-482
- Lee, B. K., Lessler, J., & Stuart, E. A. (2010). Improving propensity score weighting using machine learning. *Statistics in medicine*, *29*(3), 337-346.
- McCaffrey, D. F., Ridgeway, G., & Morral, A. R. (2004). Propensity score estimation with boosted regression for evaluating causal effects in observational studies. *Psychological methods*, *9*(4), 403.
- McCaffrey, D. F., Griffin, B. A., Almirall, D., Slaughter, M. E., Ramchand, R., & Burgette, L. F. (2013). A tutorial on propensity score estimation for multiple treatments using generalized boosted models. *Statistics in medicine*, *32*(19), 3388-3414.
- Setoguchi, S., Schneeweiss, S., Brookhart, M. A., Glynn, R. J., & Cook, E. F. (2008). Evaluating uses of data mining techniques in propensity score estimation: a simulation study. *Pharmacoepidemiology and drug safety*, *17*(6), 546-555.
- Silber, J. H., Rosenbaum, P. R., Ross, R. N., Ludwig, J. M., Wang, W., Niknam, B. A., ... & Fleisher, L. A. (2014). Template matching for auditing hospital cost and quality. *Health services research*, *49*(5), 1446-1474.

An empirical study

- Dinas, E., Matakos, K., Xefteris, D., Hangartner, D. (2019). *Waking Up the Golden Dawn: Does Exposure to the Refugee Crisis Increase Support for Extreme-Right Parties?*. Political Analysis, 27(2), 244-254. https://doi.org/10.1017/pan.2018.48. Replication data: https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/3IWTGB