# Syllabus
# Advanced Quantitative Methods:
# Causal Inference, Spring 2025

Jan P. Vogler  Andreas Videbæk Jensen

January 20, 2025

**Time & Place**
See below and on https://timetable.au.dk/schedule

**Contact:**
Jan P. Vogler (JPV) — e-mail: jan.vogler@ps.au.dk

Andreas Videbæk Jensen (AVJ)— e-mail: avj@ps.au.dk

## Short Description

This course presents a modern approach to studying causal questions in political science. In the first half of the course we introduce the core concepts of causality and inference, how to do experiments, and an important empirical tool for analyzing data (linear regression). In the second part of the course we look at different strategies for identifying causal effects using observational data, including matching, differences-in-differences, regression discontinuity designs, and others. Throughout, we will look at different applications of the methods we use, and we will also give you a chance to apply the different methods in weekly assignments.

The overall goal of the course is to become a critical consumer of causal claims in the social sciences and to give you the tools needed to do causal inference in practice.

## Intended Learning Outcomes

After having participated actively in the course, the student will be able to:

- present the assumptions and the principles behind selected designs for causal inference
- interpret statistical results and provide substantial conclusions from existing causal studies
- discuss the strengths and weaknesses in relation to existing causal studies

- develop well-founded research designs and analytical strategies with the aim of investigating specific causal questions.

## Exam

30 minute oral exam with no assistance. You will draw an excerpt of an empirical article. You then have 30 minutes to get an overview of the research question, data, identification strategy and results, which you will have to present. Following the presentation the examiner will ask questions on the content of the presentation as well as on different parts of the course.

## Class Activities

In the first class you will be split into study groups. You can use these study groups to complete the weekly assignments.

## Software

In class, we will use `Stata 16` and, in some cases, the statistical programming language `R`. License to Stata can be bought online via the department's website. `R studio` can be downloaded for free online. However, you are free to use whichever software you prefer.

## Inclusion

An essential goal of the course is to create an open and welcoming discussion atmosphere, based on which we can have a positive conversation about the theory and practice of causal inference. In our discussions, diversity of opinions, constructive discussion, and mutual respect will be key elements. A heterogeneity in backgrounds, experiences, and identities will greatly benefit us by allowing us to learn from each other and expand our thinking. All students are encouraged to voice their opinions and to do so in a way that displays respect for the opinions of other students in the course. Students who believe that these goals are inhibited in any way should contact us so that we can discuss their concerns.[1]

## Academic Integrity

A second essential goal is to uphold the standards of academic integrity in this course. Group-based work is expected to be done only by those who are officially assigned to the respective task. If you have any questions about academic integrity, please contact us so that we can discuss them.

[1] The wording of the sections on inclusion and academic integrity was adopted from a previous course syllabus by JPV.

## Books

We will use longer excerpts from the following books

- Angrist, J. and J.S. Pischke (2009), *Mostly Harmless Econometrics*, Princeton University Pres
- Stock J. H. & Watson, M. W. Introduction to Econometrics. 4th edition. Pearson, 2020 (SW).
- Gerber, A. S., & Green, D. P. (2012). Field experiments: Design, analysis, and interpretation. WW Norton

If you have an older version of *Stock and Watson* feel free to use it. We recommend that you buy *Mostly Harmless* and the *Field Experiments* book. The latter cannot be purchased from PB, but can be acquired online. The chapters you will have to read from *Field Experiments* are also available as pre-prints and can be found on the internet.

## Class Overview

Texts marked by a ($\star$) are in the curriculum. Extra/supplemental (i.e., non-mandatory) readings are marked by a ($\triangleright$).

Please note that the syllabus is preliminary and that additional texts might be added.

**Class 1: What is a causal effect?**
(AVJ, Time: February 3 [Monday], 12-15. 1330-024.)

- ⋆ Angrist, J. and J.S. Pischke (2009), *Mostly Harmless Econometrics*, Princeton University Press. Chapters 1-2
- ⋆ Samii, C. (2016). Causal empiricism in quantitative research. *The Journal of Politics*, 78(3), 941-955.
- ⋆ Rohrer, J. M. (2018). Thinking clearly about correlations and causation: Graphical causal models for observational data. *Advances in Methods and Practices in Psychological Science*, 1(1), 27-42.
- ▷ Hariri, J. G. (2012). Kausal inferens i statskundskaben. *Politica*, 44(2), 184-201.
- ▷ Holland, Paul W. (1986) Statistics and Causal Inference. *Journal of the American Statistical Association*: 81(396), 945-960.

**Class 2: Inference in Theory**
(AVJ, Time: February 10 [Monday], 12-15. 1330-024.)

- ⋆ Wooldridge, J. M. (2013). Introductory econometrics: a modern approach (5th international ed.). Publisher South-Western Cengage Learning. Appendix C and Chapter 3.4.
- ⋆ Heß, S. (2017). Randomization inference with Stata: A guide and software. The Stata Journal, 17(3), 630-651.
- ▷ Wooldridge, J. M. (2013). Introductory econometrics: a modern approach (5th international ed.). Publisher South-Western Cengage Learning. Appendix A-B.

  → *Read Appendices A and B for good context on some of the notation and operators that we will use.*

**Class 3: Inference in Practice**
(AVJ, Time: February 17 [Monday], 12-15. 1330-024.)

- ⋆ Simmons, J., Nelson, L., and Simonsohn, U. (2011). False-positive psychology: Undisclosed flexibility in data collection and analysis allow presenting anything as significant. *Psychological Science*. 22, 1359–1366.
- ⋆ Duflo, Esther, Abhijit Banerjee, Rachel Glennerster, and Michael Kremer. 2006. Section 4.1 "Sample size, design, and the power of experiments. Basic Principle" `Using Randomization in Development Economics: A Toolkit.` *Handbook of Development Economics.*

- ⋆ Gelman, A., & Carlin, J. (2014). Beyond power calculations: Assessing type S (sign) and type M (magnitude) errors. Perspectives on Psychological Science, 9, 641– 65
- ▷ Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. Science, 349(6251)
- ▷ Lenz, G., & Sahn, A. (2021). Achieving Statistical Significance with Control Variables and Without Transparency. Political Analysis.
- ▷ John P. A. Ioannidis, T. D. Stanley, Hristos Doucouliagos, The Power of Bias in Economics Research, The Economic Journal, Volume 127, Issue 605, October 2017, Pages F236–F265

**Class 4: Designing Experiments**
(AVJ, Time: February 24 [Monday], 12-15. 1330-024.)

- ⋆ McDermott, R. (2002). Experimental methods in political science. Annual Review of Political Science, 5(1), 31-61.
- ⋆ Slothuus, R. (2016). Assessing the influence of political parties on public opinion: The challenge from pretreatment effects. Political Communication, 33(2), 302-327.
- ⋆ Dafoe, A., Zhang, B. & Caughey, D. (2018) Information Equivalence in Survey Experiments. Political Analysis 26: 399-416.
- ⋆ Deaton, A., & Cartwright, N. (2018). Understanding and misunderstanding randomized controlled trials. Social Science & Medicine, 210, 2-21.
- ▷ Sniderman, P. M., & Grob, D. B. (1996). Innovations in experimental design in attitude surveys. Annual review of Sociology, 22(1), 377-399.
- ▷ Imbens, G. W. (2018). Comments On: Understanding and Misunderstanding Randomized Controlled Trails by Cartwright and Deaton. Stanford University, Graduate School of Business.

**Class 5: Analyzing Experiments**
(AVJ, Time: March 3 [Monday], 12-15. 1330-024.)

- ⋆ Gerber, A. S., & Green, D. P. (2012). Field experiments: Design, analysis, and interpretation. WW Norton. Chapters 2, 4 and 7
- ⋆ Bullock, J. G., Green, D. P., & Ha, S. E. (2010). Yes, but what's the mechanism?(don't expect an easy answer). *Journal of personality and social psychology*, 98(4), 550.
- ⋆ Enos, R. D. (2014). Causal effect of intergroup contact on exclusionary attitudes. Proceedings of the National Academy of Sciences, 111(10), 3699-3704.

▷ Gerber, A. S., & Green, D. P. (2012). Field experiments: Design, analysis, and interpretation. WW Norton. Chapter 1

**Class 6: Analyzing Observational Data with Linear Regression**
(AVJ, Time: March 10 [Monday], 12-15. 1330-024.)

⋆ Aronow, P. M., & Samii, C. (2016). Does regression produce representative estimates of causal effects? American Journal of Political Science, 60(1), 250-267.

▷ Angrist, J. and J.S. Pischke (2009), *Mostly Harmless Econometrics*, Princeton University Pres, Chapter 3.

▷ Wooldridge, J. M. (2013). Introductory econometrics: a modern approach (5th international ed.). Publisher South-Western Cengage Learning (pp. 70-113). Chapter 6-7

**Class 7: Interactive Models & Mid-term Assignment**
(AVJ, Time: March 17 [Monday], 12-15. 1330-024.)

⋆ Hainmueller, J., Mummolo, J., & Xu, Y. (2019). How much should we trust estimates from multiplicative interaction models? Simple tools to improve empirical practice. Political Analysis, 27(2), 163-192.

**Class 8: Matching**
(JPV, Time: March 24 [MONDAY], 12-15 . 1330-024.)

⋆ Elizabeth A. Stuart 2010 Matching Methods for Causal Inference: A Review and a Look Forward *Statistical Science*, Vol. 25, No. 1, 1–29. *Following sections are not part of the curriculum: 3.2.3 Weighting adjustments, 4.1 Numerical diagnostics, 6 Discussion*

⋆ Kam, C. D., & Palmer, C. L. (2008). Reconsidering the effects of education on political participation. The Journal of Politics, 70(3), 612-631.

⋆ King, G., and Nielsen, R. (2019). Why propensity scores should not be used for matching. Political analysis, 27(4), 435-454.

▷ Imbens, Guido. 2014. Matching Methods in Practice: Three Examples. NBER Working Paper 19959.

▷ Daniel Ho, Kosuke Imai, Gary King, and Elizabeth Stuart. 2007. "Matching as Nonparametric Preprocessing for Reducing Model Dependence in Parametric Causal Inference." *Political Analysis*, 15: 199–236.

**Class 9: Natural Experiments & Auxiliary Analyses**
(JPV, Time: March 31 [MONDAY], 12-15. 1330-024.)

- ⋆ Dunning, Thad (2008). Improving Causal Inference: Strengths and Limitations of Natural Experiments. *Political Research Quarterly* 61 (2): 282-293
- ⋆ Susan Athey and Guido W. Imbens. 2017. The State of Applied Econometrics: Causality and Policy Evaluation *Journal of Economic Perspectives*—Volume 31, Number 2—Spring 2017. NB: only read "Supplementary Analyses" pp. 17-21.
- ⋆ • Becker, S. O., Mergele, L., and Woessmann, L. (2020). The separation and reunification of Germany: Rethinking a natural experiment interpretation of the enduring effects of communism. Journal of Economic Perspectives, 34(2), 143-171.
- ⋆ Eggers, A.C., Tuñón, G. and Dafoe, A. (Forthcoming), Placebo Tests for Causal Inference. *American Journal of Political Science. 1-16.*

**Class 10: Difference-in-Differences**
(JPV, Time: April 7 [MONDAY], 12-15. 1330-024.)

- ⋆ Huntington-Klein, Nick. The Effect: An Introduction to Research Design and Causality, 2021. CRC Press, Chapter 18: Difference-in-Differences. Online here: https://theeffectbook.net/.
- ⋆ Stock J. H. & Watson, M. W. Introduction to Econometrics. 3rd edition. Pearson, 2015 (SW). 1.3 (re-read part on types of data)
- ⋆ Stock J. H. & Watson, M. W. Introduction to Econometrics. 3rd edition. Pearson, 2015 (SW). 13.4 (pp. 539-545)
- ⋆ Malesky, E. J., Nguyen, C. V., & Tran, A. (2014). The impact of recentralization on public services: A difference-in-differences analysis of the abolition of elected councils in Vietnam. American Political Science Review, 108(1), 144-168.

**Class 11: Panel Data & Fixed Effects**
(JPV, Time: April 23 [***WEDNESDAY (!)***], 9-12. 1330-038.)

- ⋆ Stock J. H. & Watson, M. W. Introduction to Econometrics. 3rd edition. Pearson, 2015 (SW). chapter 10
- ⋆ Van Noort, S. (2024). Industrialization and Democracy. World Politics, 76(3), 457-498.
- ▷ Angrist, J. and J.S. Pischke, *Mostly Harmless Econometrics*, Princeton University Press, 2009 (MHE). Chapter 5

▷ Rabe-Hesketh, S. & A. Skrondal (2012) "Multilevel and Longitudinal Modeling Using Stata. 3rd edition." College Station: Stata Press. (s. 73-97 + 123-147) (Brightspace).

**Class 12: Interrupted Time Series & Synthetic Control**
(JPV, Time: April 28 [MONDAY], 12-15. 1330-024.)

⋆ Shadish, W.R., Cook, T.D., & Campbell, D.T (2002) "Interrupted Time Series" Kapitel 6 fra *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. Boston: Houghton-Mifflin. (Brightspace)

⋆ Abadie, A., A. Diamond and J. Hainmueller (2015) Comparative Politics and the Synthetic Control Method *American Journal of Political Science*, April 2015, 59(2), 495–510.

⋆ Paglayan, A. S. (2021). The non-democratic roots of mass education: evidence from 200 years. American Political Science Review, 115(1), 179-198.

⋆ McElreath R. (2023). *Statistical Rethinking 2023 Online Lectures*. Watch until 16:53 of this video: https://www.youtube.com/watch?v=iwVqiiXYeC4.

▷ Abadie, A., A. Diamond and J. Hainmueller (2010), Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program," *Journal of the American Statistical Association*, vol. 105, 493-505.

**Class 13: Instrumental Variables**
(JPV, Time: May 5 [MONDAY], 12-15. 1330-024.)

⋆ Angrist, J. and J.S. Pischke (2009), *Mostly Harmless Econometrics*, Princeton University Pres, Chapter 4.

⋆ Stock J. H. & Watson, M. W. Introduction to Econometrics. 3rd edition. Pearson, 2015 (SW). chapter 12

⋆ Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The colonial origins of comparative development: An empirical investigation. American Economic Review, 91(5), 1369-1401.

⋆ Hariri, J. G. (2012). The autocratic legacy of early statehood. *American Political Science Review*, 106(3), 471-494.

**Class 14: Regression Discontinuity Design**
(JPV, Time: May 12 [MONDAY], 12-15. 1330-024.)

⋆ Angrist, J. and J.S. Pischke (2009), *Mostly Harmless Econometrics*, Princeton University Pres, Chapter 6.

- ⋆ Titiunik, R. & Skovron, C. (2017) A Practical Guide to Regression Discontinuity Designs in Political Science. Pages 1–47. *Unpublished Manuscript.*

- ⋆ Kuipers, N., & Sahn, A. (2023). The representational consequences of municipal civil service reform. American Political Science Review, 117(1), 200-216.

**Class 15: Review and Exam Preparation**
(JPV & AVJ, Time: TBA)

- ⋆ No readings.