



Allievi Program, Master in Economics, and Ph.D. in Economics

ECONOMETRIC THEORY II: The Difference-in-Differences Toolkit

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Course Description

Perhaps the most popular empirical strategy for conducting causal inference in modern micro econometrics is the so called *difference-in-differences* (DiD) method. This course will study the origin, scope, recent developments, and limitations of DiD. It will start by reviewing the Rubin Causal Model and the experimental paradigm to introduce key notation and concepts that will facilitate the exposition of DiD. The course will cover a short refreshment about the nature of panel data, as well as the classic DiD estimator and its dynamic versions. It will also review identification assumptions and their testing, as well as mixed methodologies that couple DiD with regression discontinuity design (RDD) and with synthetic control

¹Please be prepared to make the most productive use of our time. Please send in advance an e-mail explaining what you want to discuss, attach the inputs that you think will be useful for the meeting (some bullet points, a paper, etc.). If our meeting is a follow up to a previous meeting it is essential that you send me an e-mail in advance in which you summarize what we agreed on in our previous meeting and provide a detailed explanation of any progress you have made since our previous meeting.

methods. DiD commands will be introduced for various statistical software, and empirical applications will be provided throughout the course.

Requirements and Grading

Students are expected to present software implementations (in groups) and empirical applications (individually). Presentations amount to 25% of the individual final grade. Clarity and brevity will be rewarded. Students will also have to work on two problems sets (in groups), which jointly represent 15% of the grade. There will be a final exam (30%) and a research paper (in groups), which should implement the methods and concepts reviewed during the course (30%).

Textbooks

No single textbook covers the material presented in this course. A number of the recommended readings will consist of journal articles.

Useful textbooks:

- Angrist, Joshua and Jorn-Steffen Pischke (2008). *Mostly Harmless Econometrics: An Empiricist's Companion*, Princeton University Press. (MHE)
- Cunningham, S. (2020) *Causal Inference. The Mixtape 1*. Yale University Press. (Early version available online on authors' page). (C)

Other references (this list will be updated):

- Ang, D. "The Effects of Police Violence on Inner-City Students." *Quarterly Journal of Economics* 136.1 (February 2021): 115-168
- Baker, A., D. F. Larcker, and C.CY Wang. (2021) "How Much Should We Trust Staggered Difference-In-Differences Estimates?."
- Bertrand, M., E. Duflo, and S. Mullainathan, (2004). "How Much Should We Trust Differences-in-Differences Estimates?" *Quarterly Journal of Economics* 119: 249-275
- Borusyak, K., Jaravel, X., and Spiess, J. (2021). "Revisiting event study designs: Robust and efficient estimation." *Review of Economic Studies*
- Callaway, B., and Sant'Anna, P. H. (2021). "Difference-in-differences with multiple time periods." *Journal of Econometrics*, 225(2), 200-230.

- Duflo, E. (2001), "Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusual Policy Experiment," *American Economic Review*, 91:795–813.
- Giorgelli, M. (2019) "The long term effects of management and technology transfers," *American Economic Review*
- Goodman-Bacon, A. (2021). "Difference-in-differences with variation in treatment timing." *Journal of Econometrics*, 225(2), 254-277.
- Holland, P. (1986). "Statistics and Causal Inference", *Journal of the American Statistical Association* 81(396): 945-970 (with discussion)
- Prem, M., M. Purroy, and J. Vargas (2023) "Landmines: The local effects of demining."
- Prem, M., Vargas, J. F., & Namen, O. (2023). The human capital peace dividend. *Journal of Human Resources*, 58(3), 962-1002.
- Rambachan, A., and Roth, J. (2023). "A more credible approach to parallel trends." *Review of Economic Studies*, rdad018.
- Roth, J. (2022). "Pretest with caution: Event-study estimates after testing for parallel trends." *American Economic Review: Insights*, 4(3), 305-322.
- Roth, J., Sant'Anna, P. H., Bilinski, A., & Poe, J. (2023). What's trending in difference-in-differences? A synthesis of the recent econometrics literature. *Journal of Econometrics*.

(Preliminary) Outline

1. Review of the Rubin Causal Model
2. The experimental paradigm
3. John Snow and the history of DiD
4. Static DiD, parallel trends and event studies
5. Staggered adoption and heterogeneous treatments effects
6. Taking pre-trends seriously
7. Difference-in-discontinuity
8. Synthetic DiD