ICPSR Summer Program: UC Berkeley | July 6-10 2020 | 9:00am-5:00pm M-F | Location

Modern Difference in Difference Designs

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Course Description

Difference in Difference designs are one of the most versatile and powerful tools for observational causal inference in use today. In the last few years, we have seen a veritable explosion of work on DiD methods that has made it very difficult to keep track of rapidly changing standards. This five-day workshop will begin with the basic DiD design using two-way fixed effects and build up to the state-of-the-art applications. We will then move into advanced extensions like matching, synthetic control, asymmetric/staggered treatments, dynamic treatments, interference, and heterogeneous treatment effects. We will work though DiD designs with practical examples, assumptions, diagnostics, and code in R and Stata (when available).

This workshop is appropriate for anyone considering using observational causal inference tools and makes no assumption of pre-existing training beyond basic regression.

Readings

A full reading list will be provided to registered participants. However, a working reading list has been included on this draft of the syllabus to indicate what will be covered in class to varying degrees of depth. Please be aware that you are not expected to read everything on the syllabus before or during the workshop. The reading list is designed to give you additional material when you leave.

Software

Applications will be made available in Stata and R. However, not all of the tools covered are available in both software packages.

A list of required R packages will be provided to registered participants before the workshop.

Grades

You are not required to get a grade to take this workshop. Grades will be provided based on a take home exam due after the workshop is completed. The exam will contain both theoretical and software components.

COURSE OUTLINE

Monday Morning: Basic DiD Designs

- Overview of the Workshop
- The basic two-period two-group design
- Pre-Trend Tests
- Organizing the Literature around DiD

Recommended Reading

- Wing, C., et al. (2018). "Designing Difference in Difference Studies: Best Practices for Public Health Policy Research." Annual Review of Public Health 39: 453-469.
- Kahn-Lang, A., & Lang, K. (2019). The promise and pitfalls of differences-in-differences: Reflections on 16 and pregnant and other applications. Journal of Business & Economic Statistics, 1-14.
- Keele, L. J., Small, D. S., Hsu, J. Y., & Fogarty, C. B. (2019). Patterns of Effects and Sensitivity Analysis for Differences-in-Differences. arXiv preprint arXiv:1901.01869.

Monday Afternoon: Matching & Weighting

- Propensity Scores
- Matching
- Inverse Probability Weighting
- Overlap Weighting

Recommended Readings

- Stuart, E. A., Huskamp, H. A., Duckworth, K., Simmons, J., Song, Z., Chernew, M., & Barry, C. L. (2014). Using propensity scores in difference-in-differences models to estimate the effects of a policy change. Health Serv Outcomes Res Methodol, 14(4), 166-182. doi:10.1007/s10742-014-0123-z
- Daw, J. R. and L. A. Hatfield (2018). Matching in Difference-in-Differences: between a Rock and a Hard Place, Health Research & Educational Trust.
- Lindner, S. and K. J. McConnell (2019). "Difference-in-differences and matching on outcomes: a tale of two unobservables." Health Services and Outcomes Research Methodology 19(2-3): 127-144.
- Daw, J. R. and L. A. Hatfield (2018). "Matching and Regression to the Mean in Difference-in-Differences Analysis." Health Serv Res 53(6): 4138-4156.

Tuesday Morning: Synthetic Control

- Review of Propensity-Based Methods
- Basic Synthetic Control
- The synth package
- An Overview of Synthetic Control Extensions

Recommended Readings

- Abadie, A., et al. (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.
- McClelland, R. and S. Gault (2017). "The synthetic control method as a tool to understand state policy." Washington, DC: Urban-Brookings Tax Policy Center.
- Abadie, A. (2019). "Using synthetic controls: Feasibility, data requirements, and methodological aspects." Journal of economic literature.
- Ferman, B., Pinto, C., Possebom, V. (2017). Cherry picking with synthetic controls.

Tuesday Afternoon: Synthetic Control Extensions

- Augmented Synthetic Control
- Generalized Synthetic Control
- Synthetic controls for micro-level data
- The augsynth, gsynth, & microsynth packages in R

Recommended Readings

- Xu, Y., 2017. Generalized synthetic control method: Causal inference with interactive fixed effects models. Political Analysis, 25(1), pp.57-76.
- Robbins, M.W., Saunders, J. and Kilmer, B., 2017. A framework for synthetic control methods with high-dimensional, micro-level data: evaluating a neighborhood-specific crime intervention. JASA, 112(517), pp.109-126.
- Ben-Michael, E., Feller, A. and Rothstein, J., 2018. The augmented synthetic control method. arXiv preprint arXiv:1811.04170.

Wednesday Morning: Complex DiD Structures

- Small Numbers of Treated Groups
- Variation in Treatment Timing
- Multiple Time Periods
- Sharp and Fuzzy Treatments
- bacon and did packages in R & the DID_MULTIPLEGT package in Stata

Recommended Reading

- Athey, S., Imbens, G. W. (2018). Design-based analysis in difference-in-differences settings with staggered adoption.
- Goodman-Bacon, A., 2018. Difference-in-differences with variation in treatment timing (No. w25018). National Bureau of Economic Research.
- Callaway, B. and P. H. Sant'Anna (2019). "Difference-in-differences with multiple time periods." Available at SSRN 3148250.
- de Chaisemartin, C. and X. D'Haultfoeuille (2018). "Fuzzy Differences-in-Differences." The review of economic studies 85(2): 999-1028.

Wednesday Afternoon: Doubly Robust Complex DiD Structures

- Multiperiod Weighting
- Augmented Synthetic Control for Staggered Adoption
- augsynth

Recommended Reading

- Strezhnev, A. (2018). Semiparametric weighting estimators for multi-period difference-in-differences designs. Paper presented at the Annual Conference of the American Political Science Association, August.
- Ben-Michael, E., Feller, A., & Rothstein, J. (2019). Synthetic controls and weighted event studies with staggered adoption. arXiv preprint arXiv:1912.03290.

Thursday Morning: Tying Things Together

- Review of Propensities and Synthetic Control
- Review of Variation in Treatment Timing & Multiple Time Periods
- Organizing the Literature around DiD
- The augsynth, gsynth, & microsynth packages in R
- The bacon and did packages in R

Recommended Reading

- Arkhangelsky, D., Athey, S., Hirshberg, D. A., Imbens, G. W., & Wager, S. (2019). Synthetic difference in differences (No. w25532). National Bureau of Economic Research.
- Athey, S., Bayati, M., Doudchenko, N., Imbens, G., & Khosravi, K. (2018). Matrix completion methods for causal panel data models.
- Doudchenko, N., Imbens, G. W. (2016). Balancing, regression, difference-in-differences and synthetic control methods: A synthesis.
- Sofer, T., Richardson, D. B., Colicino, E., Schwartz, J., & Tchetgen, E. J. T. (2016). On Negative Outcome Control of Unobserved Confounding as a Generalization of Difference-in-Differences. Statistical science, 31(3), 348-361.
- Kropko, J., Kubinec, R. (2018). Why the two-way fixed effects model is difficult to interpret, and what to do about it. Available at SSRN 3062619.

Thursday Afternoon: Interference & Spillover

- Thinking about Interference
- Spatial Spillover in DiD
- Interference & Spillover in Doubly-Robust DiD

Recommended Reading

- Ogburn, E. L., VanderWeele, T. J. (2014). Causal diagrams for interference. Statistical science, 29(4), 559-578.
- Bowers, J., Fredrickson, M. M., & Panagopoulos, C. (2013). Reasoning about interference between units: A general framework. Political Analysis, 21(1), 97-124.
- Delgado, M. S., & Florax, R. J. (2015). Difference-in-differences techniques for spatial data: Local autocorrelation and spatial interaction. Economics Letters, 137, 123-126.
- De Castris, M., Pellegrini, G. (2015). Neighborhood effects on the propensity score matching (No. 0515).

Friday Morning: Heterogeneous Effects

- Distributions of Effects
- Quantiles of Effects
- Multilevel DiD

Recommended Reading

- Bonhomme, S., Sauder, U. (2011). Recovering distributions in difference-in-differences models: A comparison of selective and comprehensive schooling. Review of Economics and Statistics, 93(2), 479-494.
- Abraham, S., Sun, L. (2018). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. Available at SSRN 3158747.
- Kim, J., & Seltzer, M. 2007. Causal inference in multilevel settings in which selection process vary across schools. Working Paper 708, Center for the Study of Evaluation (CSE), UCLA: Los Angeles
- de Chaisemartin, C. and D'Haultfoeuille, X., 2019. Two-way fixed effects estimators with heterogeneous treatment effects (No. w25904). National Bureau of Economic Research.