Econ 481-3
Topics in Econometrics
Spring 2022

Lecture: TTh 1:30-3:20, in Person!! Yay!!!!! ☺

Instructor: Ivan Canay

Office:	3353 KGH
Phone:	847-491-2929
Email:	iacanay@northwestern.edu
Web Page:	http://sites.northwestern.edu/iac879
Office Hours:	by appointment

Course Description: This course is the third quarter in the graduate econometrics sequence. It is divided in three parts. Part I presents a comprehensive discussion of the most popular instrumental variables approaches for causal inference currently used in applied work. Part II presents what I consider to be the fundamental notions behind asymptotic approximations, with a discussion of uniform inference. Part III covers recent developments in the literature of Differences in Differences.

Grading: Grading will consist on weekly reports (submitted via Canvas), two problem sets due on **May 3rd** and **May 19th**, and an in-class presentation on one of the topics of Part III. The problem sets will be available a week and a half before the due date and will consist of theoretical questions and empirical/methodological questions. Weekly reports should avoid displays and formulas and be limited to a maximum of two pages. Finally, for the in-class presentation the students must prepare a slide presentation and write a 8-10 pages long set of lecture notes as described below. The weighting scheme for the final grade will be:

Weekly Reports:	20%
Problem sets:	50%
in-Class presentation:	30%

Lecture Notes: I will provide lecture notes or slides every week with related references you are supposed to read. The readings listed below include most of the articles we will discuss in class.

in-class Presentation: Students should split into **4 groups** and choose one of the topics of Part III by **April 26th**. The following is expected:

- **Day of presentation**: A slide presentation available to students the morning before class.

- **Day of presentation**: A set of lecture notes that is about 8-10 pages long in a similar format than the one used for the class lecture notes. I expect minimal copy-pasting from the original sources.
- **Grading the day after**: Grading will evaluate the clarity of the slides, the clarity of the lecture note, and the quality of the exposition during the presentation. This part of the course will involve anonymous peer grading, so each student will have to fill out the grading form after each presentation and send it to the instructor.

AccessibleNU: Any student requesting accommodations related to a disability or other condition is required to register with AccessibleNU (847-467-5530) and provide professors with an accommodation notification from AccessibleNU, preferably within the first two weeks of class. All information will remain confidential.

Lecture Recordings: Unauthorized student recording of classroom or other academic activities (including advising sessions or office hours) is prohibited. Unauthorized recording is unethical and may also be a violation of University policy and state law. Students requesting the use of assistive technology as an accommodation should contact AccessibleNU. Unauthorized use of classroom recordings — including distributing or posting them — is also prohibited. Under the University's Copyright Policy, faculty own the copyright to instructional materials — including those resources created specifically for the purposes of instruction, such as syllabi, lectures and lecture notes, and presentations. Students cannot copy, reproduce, display or distribute these materials. Students who engage in unauthorized recording, unauthorized use of a recording or unauthorized distribution of instructional materials will be referred to the appropriate University office for follow-up

Tentative Course Schedule: Econ 481-3 Spring 2022

Lecture	Date	Topics	Evaluation
		Part I:	
		A Primer on Causal Inference with IVs	
1	Th, March 31	Selection on Observables	–
2	Tu, April 5	Roy Models and LATE	–
3	Th, April 7	Marginal Treatment Effects (MTEs)	–
4	Tu, April 12	Extrapolation and Some Extensions	–
5	Th, April 14	Surrogates I	PS1 out
6	Tu, April 19	Surrogates II	–
7	Th, April 21	Augmented IPW	–
8	Tu, April 26	Double Robustness	Pick Topic
		Part II:	
		Understanding Asymptotic Approximations	
9	Th, April 28	Local Asymptotics (b)	–
10	Tu, May 3	Contiguity (b)	PS1 due
11	Th, May 5	Local Asymptotic Normality (b)	PS2 out
12	Tu, May 10	Convolution Theorems (b)	–
13	Th, May 12	The Bahadur-Savage Problem (b)	–
14	Tu, May 17	Uniformity of the t-test (b)	–
15	Th, May 19	Uniformity of Subsampling (b)	PS2 due
		Part III*:	
		Differences in Differences	
16	Tu, May 24	Intro to DiD [29, 12] and [14, 32]	Presentation
17	Th, May 26	Parallel Trends [28][25][19]	Presentation
18	Tu, May 31	Staggered Adoption and TWFEs [7][11]	Presentation
19	Th, June 2	Beyond DiD [4][2]	Presentation

Readings

[1] Andrews, D. W. K. Inconsistency of the bootstrap when a parameter is on the boundary of the parameter space. *Econometrica 68*, 2 (March 2000), 399–405.

[2] Arkhangelsky, D., Athey, S., Hirshberg, D. A., Imbens, G. W., and Wager, S. Synthetic difference-in-differences. *American Economic Review 111*, 12 (2021), 4088–4118.

[3] Athey, S., Chetty, R., Imbens, G. W., and Kang, H. The surrogate index: Combining short-term proxies to estimate long-term treatment effects more rapidly and precisely. Tech. rep., National Bureau of Economic Research, 2019.

[4] Athey, S., and Imbens, G. W. Design-based analysis in difference-in-differences settings with staggered adoption. *Journal of Econometrics 226*, 1 (2022), 62–79.

[5] Bahadur, R., and Savage, L. J. The nonexistence of certain statistical procedures in nonparametric problems. *Annals of Mathematical Statistics 25* (1956), 1115–1122.

[6] Billingsley, P. *Probability and Measure*. Wiley-Interscience, 1995.

[7] Callaway, B., and Sant'Anna, P. H. Difference-in-differences with multiple time periods. *Journal of Econometrics 225*, 2 (2021), 200–230.

[8] Canay, I. A., Santos, A., and Shaikh, A. M. On the testability of identification in some nonparametric models with endogeneity. *Econometrica 81*, 6 (2013), 2535 – 2559.

[9] Chernozhukov, V., Chetverikov, D., Demirer, M., Duflo, E., Hansen, C., Newey, W., and Robins, J. Double/debiased machine learning for treatment and structural parameters, 2018.

[10] Chernozhukov, V., Escanciano, J. C., Ichimura, H., Newey, W. K., and Robins, J. M. Locally robust semiparametric estimation, 2020.

[11] De Chaisemartin, C., and d'Haultfoeuille, X. Two-way fixed effects estimators with heterogeneous treatment effects. *American Economic Review 110*, 9 (2020), 2964–96.

[12] De Chaisemartin, C., and D'Haultfoeuille, X. Two-way fixed effects and differences-in-differences with heterogeneous treatment effects: A survey. Tech. rep., National Bureau of Economic Research, 2022.

[13] Frangakis, C. E., and Rubin, D. B. Principal stratification in causal inference. *Biometrics 58*, 1 (2002), 21–29.

[14] Goodman-Bacon, A. Difference-in-differences with variation in treatment timing. *Journal of Econometrics 225*, 2 (2021), 254–277.

[15] Heckman, J. J., and Vytlacil, E. Structural equations, treatment effects, and econometric policy evaluation 1. *Econometrica 73*, 3 (2005), 669–738.

[16] Hoeffding, W. The large-sample power of tests based on permutations of observations. *The Annals of Mathematical Statistics 23*, 2 (1952), pp. 169–192.

[17] Imbens, G. W., and Angrist, J. D. Identification and estimation of local average treatment effects. *Econometrica 62*, 2 (1994), 467–475.

[18] Lehmann, E., and Romano, J. P. *Testing Statistical Hypotheses*, 3rd ed. Springer, New York, 2005.

[19] Manski, C. F., and Pepper, J. V. How do right-to-carry laws affect crime rates? coping with ambiguity using bounded-variation assumptions. *Review of Economics and Statistics 100*, 2 (2018), 232–244.

[20] Mogstad, M., Santos, A., and Torgovitsky, A. Using instrumental variables for inference about policy relevant treatment parameters. *Econometrica 86*, 5 (2018), 1589–1619.

[21] Nelson, F., and Savin, N. The danger of extrapolating asymptotic local power. *Econometrica 58*, 4 (1990), 977–981.

[22] Politis, D. N., Romano, J. P., and Wolf, M. *Subsampling*. Springer, New York, 1999.

[23] Pollard, D. *A User's Guide to Measure Theoretic Probability*. Cambrigde University Press, New York, 2002.

[24] Prentice, R. L. Surrogate endpoints in clinical trials: definition and operational criteria. *Statistics in medicine 8*, 4 (1989), 431–440.

[25] Rambachan, A., and Roth, J. An honest approach to parallel trends. *Unpublished manuscript, Harvard University* (2022).

[26] Robins, J. M., Rotnitzky, A., and Zhao, L. P. Estimation of regression coefficients when some regressors are not always observed. *Journal of the American statistical Association 89*, 427 (1994), 846–866.

[27] Romano, J. P. On non-parametric testing, the uniform behaviour of the t-test, and related problems. *Scandinavian Journal of Statistics 31* (2004), 567–584.

[28] Roth, J. Pre-test with caution: Event-study estimates after testing for parallel trends. *American Economic Review: Insights (forthcoming)* (2022).

[29] Roth, J., Sant'Anna, P. H., Bilinski, A., and Poe, J. What's trending in difference-in-differences? a synthesis of the recent econometrics literature. *arXiv preprint arXiv:2201.01194* (2022).

[30] Savin, N. E., and Würtz, A. H. Power of tests in binary response models. *Econometrica 67*, 2 (1999), pp. 413–421.

[31] Serfling, R. J. *Approximation Theorems of Mathematical Statistics*. John Wiley, New York, 1980.

[32] Sun, L., and Abraham, S. Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics 225*, 2 (2021), 175–199.

[33] van der Vaart, A. W. *Asymptotic Statistics*. Cambridge University Press, Cambridge, 1998.

[34] Vytlacil, E. Independence, monotonicity, and latent index models: An equivalence result. *Econometrica 70*, 1 (2002), 331–341.