

UNIVERSITY OF MARYLAND
Department of Economics

GUIDO KUERSTEINER

ECON 626
Fall 2022

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Lecture: F 2:00-4:30pm TYD 0101

Recitation: M 5-6:15pm TYD 2102, meets irregularly, as needed

Office Hours: Th: 1-2pm

TEACHING ASSISTANT

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Office Hours: Tu: 4-5pm (TYD 3115M)

ECON 626 - EMPIRICAL MICROECONOMETRICS

COURSE GOALS AND DESCRIPTION

Course Description

This course aims to connect microeconomic methods with empirical practice. Topics include linear and nonlinear models, causal inference (instrumental variables, difference-in-differences, regression discontinuity, matching, synthetic controls), and techniques for correct statistical inference (robust tests under weak identification, clustering, bootstrap, randomization inference). The course will be taught by example, using a published paper as an illustration for the techniques to be discussed. The discussion will focus on what tools are appropriate for what type of data and empirical questions. The course provides ample opportunity to practice using the tools covered with real data sets from published articles. It also offers training in scientific writing and proper techniques of presenting empirical results.

Course Objectives

1. To introduce the most important and commonly used econometric tools for microeconomic applications. The focus in this course is on reduced form methods.
2. To illustrate the use of linear models in microeconomics, emphasizing both the practical implementation of these models and the application of these models to the question of causal inference.
3. To familiarize students with modern statistical and econometric software (Stata and MATLAB) in order to use these models and techniques. A self-study Matlab tutorial will

be provided. Problem sets using Stata will focus on replicating published papers.

REQUIREMENTS

Students are expected to have completed the first year sequence in econometrics either in the Economics department or in AREC.

PRINCIPAL TEXT

Joshua D. Angrist and Jörn-Steffen Pischke. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press, 2009 (AP)

SUPPLEMENTARY TEXTS

Joshua D. Angrist and Jörn-Steffen Pischke. *Mastering Metrics*, Princeton University Press, 2015

Arellano, M. *Panel Data Econometrics*, Oxford University Press, 2003.

Baltagi, B.H., *Econometric Analysis of Panel Data*, Wiley, Fourth Edition, 2013.

Baum, C.F. *An Introduction to Stata Programming*. Stata Press, 2009. URL

<http://www.stata.com/bookstore/isp.html>

Cameron, A.C., and P.K. Trivedi, *Microeconometrics, Methods and Applications*, Cambridge, 2005.

Cameron, A.C. and Pravin K. Trivedi. *Microeconometrics Using Stata*, Revised Edition. Stata Press, 2nd edition, 2010. URL <http://cameron.econ.ucdavis.edu/musbook/mus.html>

Green, W.A., *Econometric Analysis*, 7th edition, Prentice Hall, 2011. (G)

Imbens, G. W. and Rubin, D.B., *Causal Inference for Statistics, Social and Biomedical Sciences*. Cambridge 2015

Rubin, D.B., *Matched Sampling for Causal Effects*, Cambridge 2006

J. Scott Long. *The Workflow of Data Analysis using Stata*. Stata Press, 2009. URL

<http://www.stata-press.com/data/wdaus.html>

Wooldridge, J.M., *Econometric Analysis of Cross Sectional Panel Data*, MIT Press, 2010. (W)

ADDITIONAL GENERAL REFERENCES

In addition to the above texts, below is a list of additional texts that may be helpful as background reading.

Joshua D. Angrist and Alan B. Krueger. Empirical strategies in labor economics. In Orley Ashenfelter and David Card, editors, *Handbook of Labor Economics*, volume 3A, chapter 23, pages 1277–1366. Elsevier Science, Amsterdam, 1999.

Guido W. Imbens and Jeffrey M. Wooldridge. Recent developments in the econometrics of program evaluation. *Journal of Economic Literature*, 47(1):5–86, 2009.

GRADING POLICY

Econometrics Quiz	0%
Homework	50%
Final Exam	50%

Problem Set Due Dates

“PS short” are short problem sets that will be recorded as handed in on time/not handed in on time but will not be part of the final course grade if handed in on time. “PS long” are longer problem sets that require carefully typed answers, and that will be graded as part of the course grade.

9/16	PS 1 short due
9/30	PS 1 long due
10/7	PS 2 short due
10/21	PS2 long due
10/28	PS3 short due
11/18	PS3 long due
12/9	PS4 long due

FINAL EXAM: Final Exam Week – Take Home Exam.

UNIVERSITY AND GRADUATE SCHOOL RULES AND REGULATIONS:

University policies can be found here: <https://policies.umd.edu/>

In particular:

- <https://policies.umd.edu/general-administration/university-of-maryland-disability-accessibility-policy-and-procedures>
- <https://policies.umd.edu/general-administration/university-of-maryland-policy-and-procedures-on-sexual-harassment-and-other-sexual-misconduct>
- <https://policies.umd.edu/student-affairs/university-of-maryland-policy-on-excused-absence>
- <https://policies.umd.edu/research/university-of-maryland-intellectual-property-policy>

All graduate school policies can be found here: <https://gradschool.umd.edu/course-related-policies>

COURSE OUTLINE AND TIME TABLE

All references to AP as well as papers listed under *Applications* and discussed in class are required reading. Other papers discussed in class are recommended, with an understanding that more technical material is outside the scope of the course.

1. Causal Inference, Experimental Ideal, Rubin Causal Model

References:

AP, ch1

Hahn, J, Kuersteiner, G. and Mazzocco, M. (2020) Joint Time Series and Cross-Section Limit Theory under Mixingale Assumptions, forthcoming, *Econometric Theory*

Holland, P. 1986. Statistics and causal inference. *Journal of the American Statistical Association* 81, 945–60.

Heckman, J.J. and Robb, R. (1985) "Alternative Methods for Evaluating the Impact of Interventions: An Overview", *Journal of Econometrics*, 30, 239-267.

Heckman, J.J. and E. Vytlacil (2005), "Structural Equations, Treatment Effects and Econometric Policy Evaluation," *Econometrica*, 73, 669-738.

Kuersteiner (2008) "Granger-Sims Causality" in the *New Palgrave Dictionary of Economics*, 2nd edition, edited by Steven Durlauf and Lawrence Blume, Macmillan

Pearl, J. 2000. *Causality*. Cambridge: Cambridge University Press

Rosenzweig, M.R. and C. Udry (2019), "External Validity in a Stochastic World: Evidence from Low-Income Countries," *Review of Economic Studies*, Volume 87, Issue 1, January 2020, Pages 343–381.

Rubin (1974): Estimating Causal Effects of Treatments in Randomized and Nonrandomized Studies, *Journal of Educational Psychology*, vol 66, 688-701.

2. Linear Regression, Regression Control, Dummy variables and Interactive Effects

References:

AP, ch3

Applications

Dale and Krueger (2002), Estimating the Payoff to Attending a more Selective College: an Application of Selection on Observables and Unobservables, *Quarterly Journal of Economics*, 1491-1527.

Jacob, Brian and Jens Ludwig (2012), The Effects of Housing Assistance on Labor Supply:

Evidence from a Voucher Lottery, *American Economic Review*, 102(1): 272-304.

3. **Instrumental Variables – Basics, LATE**

References:

AP, ch4

Applications

Acemoglu, Daron and Joshua Angrist (2000), How Large Are Human-Capital Externalities? Evidence from Compulsory Schooling Laws. *NBER Macroeconomics Annual*, Vol. 15 (2000), pp. 9-59.

Angrist, Joshua, Kathryn Graddy, Guido W. Imbens (2000): The Interpretation of Instrumental Variables Estimators in Simultaneous Equations Models with an Application to the Demand for Fish. *The Review of Economic Studies*, Vol. 67, 499-527.

Angrist, Joshua (1990), Lifetime Earnings and the Vietnam Era Draft Lottery: Evidence From Social Security Administrative Records, *American Economic Review*, 80, 313-335.

Clark, Damon and Paco Martorell (2014), The Signaling Value of a High School Diploma,” *Journal of Political Economy*, 2014, pp. 283-318.

Jacob, Brian and Jens Ludwig (2012), The Effects of Housing Assistance on Labor Supply: Evidence from a Voucher Lottery, *American Economic Review*, 102(1): 272-304.

Stephens, Melvin, and Dou-Yan Yang (2014), Compulsory Education and the Benefits of Schooling, *American Economic Review*, 104(6), pp.1777-1792.

Econometric Theory

Imbens, G.W. and Angrist, J. (1994), Identification and Estimation of Local Average Treatment Effects, *Econometrica*, 62, 467-475.

Heckman, J. J. and R. Pinto (2018), Unordered Monotonicity. *Econometrica* 86 (1), 1-35.

Heckman, J.J. and E Vytlacil (2005) Structural Equations, Treatment Effects, and Econometric Policy Evaluation, *Econometrica*, 73, 669-738.

Kitagawa, T (2015), A Test for Instrument Validity, *Econometrica*, 83(5), 2043-2063.

Lee and Weidner (2021): Bounding Treatment Effects by Pooling Limited Information across Observations, arXiv.

Mogstad, M., A. Torgovitsky, and C. Walters (2020a). The Causal Interpretation of Two-Stage Least Squares with Multiple Instrumental Variables. Technical Report

w25691, NBER.

Mogstad, M., A. Torgovitsky, and C. R. Walters (2020b). Policy Evaluation with Multiple Instrumental Variables. Working Paper 27546, NBER.

Mountjoy, J. (2019, February). Community Colleges and Upward Mobility. SSRN Scholarly Paper ID 3373801, Social Science Research Network, Rochester, NY.

Mourifie, I. and Y. Wan (2016): Testing Local Average Treatment Effect Assumptions, *The Review of Economics and Statistics*, 99, 305-313.

Vytlacil, E. (2002): Independence, Monotonicity, and Latent Index Models: An Equivalence Result, *Econometrica*, 70, 331-341.

4. Difference in Difference

References:

AP, ch5

Applications

Card, David and Alan Krueger (1994), Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania." *American Economic Review* 84(4), pp. 772-793.

Norberg, K. L. Bierut and R. Gruzca (2009), Long-Term Effects of Minimum Drinking Age Laws on Past-Year Alcohol and Drug Use Disorders, *Alcoholism: Clinical and Experimental Research*, Vol 33, 2180–2190.

Neumark, D. , I. Salas and W. Wascher (2014): Revising the Minimum Wage and Employment Debate: Throwing out the Baby with the Bathwater?" *Industrial and Labor Relations Review* 67, pp. 608-48.

Richardson, G. and W. Troost (2009), Monetary Intervention Mitigated Banking Panics During the Great Depression: Quasi Experimental Evidence from a Federal Reserve District Border, 1929-1933.

Theory

Athey, S. and G.Imbens (2021), Design-based Analysis in Difference-in-Difference settings with staggered adoption. *Journal of Econometrics*, forthcoming.

Callaway, B. and P. H.C. Sant’Anna (2021), Difference-in-Differences with multiple periods, *Journal of Econometrics*, 225(2), 200-230.

De Chaisemartin C. and X. D’Haultfoeuille (2018), Fuzzy Differences in Differences,

Review of Economic Studies, 999-1028.

De Chaisemartin C. and X. D'Haultfoeuille (2018), Two-Way Fixed Effects Estimators with Heterogeneous Treatment Effects, *American Economic Review*, 2964-2996.

Roth, J and Sant'Anna, P. (2021) When Is Parallel Trends Sensitive to Functional Form?, working paper.

Roth, J, P. Sant'Anna, A. Bilinski and J. Poe (2022) What's Trending in Difference-in-Differences. A Synthesis of the Recent Econometrics Literature.

5. Synthetic Controls

Applications

Abadie, Alberto (2021): Using Synthetic Controls: Feasibility, Data Requirements, and Methodological Aspects, *Journal of Economic Literature*, Vol 52(2), 391-425.

Abadie, A. and Javier Gardeazabal (2003), The Economic Cost of Conflict: A Case Study of the Basque Country, *American Economic Review*, Vol. 93, No. 1, pp. 113-132.

Abadie, A., Alexis Diamond, Jens Hainmueller (2010), Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program *Journal of the American Statistical Association*. June 1, 2010, 105(490): 493-505.

Abadie, Alberto, Alexis Diamond and Jens Hainmueller (2015), Comparative Politics and the Synthetic Control Method, *American Journal of Political Science*, Vol. 59, No. 2, pp. 495-510.

Neumark, D., I. Salas and W. Wascher (2014): Revising the Minimum Wage and Employment Debate: Throwing out the Baby with the Bathwater?" *Industrial and Labor Relations Review* 67, pp. 608-48.

Theory

Arkhangelsky, D, Athey, S, Hirshberg, D.A., Imbens, G.W., Wagner, S. : Synthetic Difference In Differences, 2021, forthcoming

Ferman, B: On the Properties of the Synthetic Control Estimator with Many Periods and Many Controls, *JASA*, 2021, 1764-1772.

6. Matching, Inverse Probability Weighted Estimation

References:

AP, ch2

Applications

Angrist, Joshua (1998), Estimating the Labor Market Impact of Voluntary Military Service Using Social Security Data on Military Applicants, *Econometrica*, Vol. 66, No. 2, pp. 249-288

Angrist, Joshua and Guido Kuersteiner (2011), Causal Effects of Monetary Policy Shocks: Semiparametric Conditional Independence Tests with Multinomial Propensity Score, *The Review of Economics and Statistics*, Vol 93, 725-747.

Angrist, Joshua, Guido Kuersteiner and Oscar Jorda (2018): Semiparametric Estimates of Monetary Policy Effects: String Theory Revisited, *Journal of Business and Economic Statistics*, .

Dehejia, Rajeev and Sadek Wahba (1999), Causal Effects in Nonexperimental Studies: Reevaluating the Evaluation of Training Programs, *Journal of the American Statistical Association*, Vol 94, 1053-1062.

Dehejia, Rajeev and Sadek Wahba (2002), Propensity Score-Matching Methods for Nonexperimental Causal Studies, *The Review of Economics and Statistics*, Vol. 84, No. 1, pp. 151-161.

LaLonde, Robert J. (1986), Evaluating the Econometric Evaluations of Training Programs with Experimental Data. *The American Economic Review*, Vol. 76, No. 4. (Sep., 1986), pp. 604-620.

Smith, J.A. and P. E. Todd (2005), Does matching overcome LaLonde's critique of nonexperimental estimators? *Journal of Econometrics* 125, pp. 305–353.

Econometric Theory

Abadie, Alberto and Guido Imbens (2006), Large Sample Properties of Matching Estimators for Average Treatment Effects, *Econometrica*, Vol 74, 235-267.

Abadie, Alberto and Guido Imbens (2008), On the Failure of the Bootstrap for Matching Estimators, Vol 76, 1537-1557.

Hirano, Keisuke, Guido Imbens, Geert Ridder (2003), Efficient Estimation of Average Treatment Effects using the Estimated Propensity Score, *Econometrica*, Vol 71, 1161-1189.

Rosenbaum, P and D.Rubin (1983), "The Central Role of Propensity Score in Observational Studies for Causal Effects" *Biometrika*, 70, 41-55.

Vytlacil, E. (2002), “Independence, Monotonicity and Latent Index Models: An Equivalence Result,” *Econometrica*, 70, 331-341.

Software

<https://almost-matching-exactly.github.io/>

7. **Regression Discontinuity**

References:

AP ch 6.

Applications

Angrist and Lavy (2009), Using Maimonides' Rule to Estimate the Effect of Class Size on Scholastic Achievement, *The Quarterly Journal of Economics*, Vol 114, 533-575.

Carpenter, Christopher and Carlos Dobkin (2011), The Minimum Legal Drinking Age and Public Health, *Journal of Economic Perspectives*, Vol 25, 133-156.

Dieterle, S, O. Bartalotti, Q. Brummet, (2020), Revisiting the Effects of Unemployment Insurance Extensions on Unemployment: A Measurement-Error-Corrected Regression Discontinuity Approach, *American Economic Journal – Economic Policy*, Volume 12, Issue 2, p. 84-114.

Kuersteiner, Guido, David Phillips and Mauricio Villamizar-Villegas (2016), Effective Sterilized Foreign Exchange Intervention? Evidence from a Rule-Based Policy, BEWP 964.

Lee, D. (2008), “Randomized experiments from non-random selection in U.S. House elections,” *Journal of Econometrics*, 142, 675-697.

Van der Klaauw, W. (2003), “Estimating the Effects of Financial Aid Offers on College Enrollment: A Regression-Discontinuity Approach,” *International Economic Review*, 43, 1249-1287

Econometric Theory

Armstrong, T. B., and M.Kolesár, (2018), “Optimal Inference in a Class of Regression Models,” *Econometrica*, 655–683.

Bartalotti, O. Q. Brummet, S. Dieterle, (2020), A Correction for Regression Discontinuity Designs With Group-Specific Mismeasurement of the Running Variable, *Journal of Business & Economic Statistics*, forthcoming.

Cattaneo, M.D. N. Idrobo and R. Titiunik (2019), A Practical Introduction to Regression Discontinuity Designs: Foundations, *Elements in Quantitative and Computational Methods for the Social Sciences*, Cambridge University Press.

Eckles, D., N. Ignatiadis, S. Wager and H. Wu (2020): Noise Induced Randomization in Regression Discontinuity Designs, arXiv.

Fan, J. (1996), “Local Polynomial Modelling and Its Applications,” New York: Chapman and Hall.

Hahn, J., Todd, P., van der Klaauw, W. (2001), “Evaluating the Effect of An Antidiscrimination Law Using A Regression-Discontinuity Design,” *NBER Working Paper 7131*.

Hahn, J., Todd, P., van der Klaauw, W. (2001), “Identification and estimation of treatment effects with a regression-discontinuity design,” *Econometrica* 69, 201–209.

Lee, David and Thomas Lemieux (2010), Regression Discontinuity Designs in Economics, *Journal of Economic Literature*, Vol 48, 281-355.

McCrary, J. (2008), “Manipulation of the running variable in the regression discontinuity design: A density test,” *Journal of Econometrics*, 142, 698-714.

Imbens, Guido and Karthik Kalyanaraman (2012), Optimal Bandwidth Choice for the Regression Discontinuity Estimator, *Review of Economic Studies*, 933-959.

Imbens, G.W. and T. Lemieux, (2008), “Regression discontinuity designs: A guide to practice,” *Journal of Econometrics*, 142, 615-637.

Imbens, G.W. and S. Wager (2019), “Optimized Regression Discontinuity Designs,” *The Review of Economics and Statistics*, 101(2), 264-278.

Porter, J., 2003. Estimation in the regression discontinuity model. Harvard University manuscript, May 2003.

8. Instrumental Variables – Weak instruments, Many Instruments, Robust Inference

Applications:

Angrist, Joshua and Alan Krueger (1991), Does Compulsory School Attendance Affect Schooling and Earnings? *The Quarterly Journal of Economics*, Vol 106, 970-1014.

Econometric Theory

Bound, J., D. A. Jaeger, R. Baker (1995): Problems with Instrumental Variables Estimation When the Correlation Between the Instruments and the Endogenous Explanatory Variable is Weak, *Journal of the American Statistical Association*, 90, 443-450.

Donald, Stephen and Whitney Newey (2001), Choosing the Number of Instruments. *Econometrica*, Vol 69, 1161-1191.

Dufour, J.M. (1997): Some Impossibility Theorems in Econometrics with Applications to Structural and Dynamic Models. *Econometrica*, 1365-1387.

Hansen, Christian, Jerry Hausman, Whitney Newey (2008): Estimation With Many Instrumental Variables, *Journal of Business and Economic Statistics*, Vo 26, p. 398-422.

Hausman, Jerry, Whitney Newey, Tiemen Woutersen, John Chao, Norman Swanson (2012), Instrumental variable estimation with heteroskedasticity and many instruments, *Quantitative Economics* 3, 211–255

Keane, M. and T. Neal (2022): A Practical Guide to Weak Instruments, UNSW Economics Working Paper No. 2021-05d, Available at SSRN: <https://ssrn.com/abstract=3846841>

Kleibergen, Frank (2002), Pivotal Statistics for Testing Structural Parameters in Instrumental Variables Regression. *Econometrica*, Vol 70, 1781-1803.

Kleibergen, Frank (2005), Testing parameter in GMM without assuming that they are identified. *Econometrica*, Vol 73, 1103-1123.

Lee, H. and B.M. Pötscher (2006), Can one Estimate the Conditional Distribution of Post-Model-Selection Estimators?, *The Annals of Statistics*, 2554-2591.

Lee, H. and B.M. Pötscher (2008), Can one Estimate the Unconditional Distribution of Post-Model-Selection Estimators?, *Econometric Theory*, 338-376.

Lee, D.S., J. McCrary, M.J. Moreira and J.R. Porter (2021), Valid T-Ratio Inference for IV. NBER Working Paper 29124.

Montiel Olea, J and C. Pflueger (2013), A robust Test for Weak Instruments, *Journal of Business and Economic Statistics*, 358-369.

Kuersteiner, Guido and Ryo Okui (2010), Constructing Optimal Instruments by First-Stage Prediction Averaging, *Econometrica*, Vol 78, 697-718.

Moreira, Marcelo J 2003, A conditional likelihood ratio test for structural models *Econometrica* 71, pg. 1027-1048.

Staiger, Douglas and James Stock (1997), Instrumental Variables Regression with Weak Instruments, *Econometrica*, Vol. 65, No. 3, pp. 557-586.

Stock, James and Motohiro Yogo (2005), Testing for Weak Instruments in Linear IV Regression. In: Andrews DWK Identification and Inference for Econometric Models. New York: Cambridge University Press ; 2005. pp. 80-108.

9. Robust Standard Errors, Clustering, Bootstrap, Randomization Inference

References:

AP ch 8.

Econometric Theory

Andrews, I and M. Kasy, Publication Bias

Abadie, A., S. Athey, G.W. Imbens and J. Wooldridge (2017), When Should You Adjust Standard Errors for Clustering?, working paper.

Bertrand M., E. Duflo and S. Mullainathan (2004), How much should we trust Differences in Differences Estimates? Quarterly Journal of Economics, pp. 249-275.

Bester, C. A., T. G. Conley, and C. B. Hansen (2011), Inference with Dependent Data Using Cluster Covariance Estimators, Journal of Econometrics, 165, p137-151.

Cameron, A. C., Gelbach, J. G., and D. L. Miller (2006, 2011). Robust Inference with Multi-Way Clustering. NBER Technical Working Paper 0327 and Journal of Business and Economic Statistics,

Cameron, A. C., Gelbach, J. G., and D. L. Miller (2008), Bootstrap-Based Improvements for Inference with Clustered Errors, Review of Economics and Statistics, 90, 414-427

Cameron, A.C. and D.L. Miller (2015): A Practitioners Guide to Cluster Robust Inference, Journal of Human Resources, Vol 50, 317-372.

Hansen, C.B. (2007), Generalized least squares inference in panel and multilevel models with serial correlation and fixed effects, Journal of Econometrics, Vol 140, pp. 670-694.

Hausman, Jerry and Guido Kuersteiner (2008): Difference in Difference meets Generalized Least Squares: Higher Order Properties of Hypotheses Tests, Journal of Econometrics, Vol 144, 371-391.

Ibragimov, R. and U.K. Mueller (2009), t-Statistic Based Correlation and Heterogeneity Robust Inference, Journal of Business & Economic Statistics, Vol 28, pp.453-467.

Ibragimov, Rustam and Ulrich K. Müller (2016), Inference with few heterogeneous clusters, *The Review of Economics and Statistics*, Vol 98, 83-96.

Rosenbaum, P.R. (1984), Conditional Permutation Tests and the Propensity Score in Observational Studies, *Journal of the American Statistical Association*, Vol 79, pp.565-574.