

HCMG 901: Applied Econometrics

Spring 2022

Atul Gupta
Assistant Professor
Wharton Health Care Management
306 Colonial Penn Center
atulgup@wharton.upenn.edu

Overview

This course covers econometric methods widely used in current applied economics research. The main goal of the class is to prepare you to conduct high quality, econometrically sound empirical analysis. Concepts, applications, and practice are emphasized, as opposed to technical derivations of estimators and their properties. The focus is on linear, non-linear, and panel data regression models. We cover several modern research designs in detail – matching, instrumental variables, difference-in-differences, Bartik, synthetic controls, and regression discontinuity. We also cover non-linear modeling approaches such as quantile and bunching models. Due to the large number of topics covered, the emphasis is on breadth, *not* depth.

Readings

The reading list comprises published articles and some working papers, which should be read *prior* to class. The papers have been chosen to illustrate the application, generally recent, of different empirical methods and strategies or are classics that should be known. While the reading list is extensive, I will typically ask students to read only 2–3 papers per class (thoroughly). The remaining papers are listed as useful references for future use in your research. I will post required papers on Canvas. While there is no assigned textbook for the class, we will closely follow *Mostly Harmless Econometrics: An Empiricist's Companion* by Angrist and Pischke. In addition, you may refer to select chapters in Andrew Jones' primer, *Applied Econometrics for Health Economists: A Practical Guide* (OHE Research, 2nd ed., 2007) and J. Wooldridge, *Econometric Analysis of Cross Section and Panel Data*.

Logistics

The class will meet every Monday 3.30 - 6.30 pm in the Chestnut room, Colonial Penn Center. Meeting by appointment.

Other Requirements and Grading

In addition to reading the assigned papers prior to class, you are required to:

- Complete 3-4 homework assignments. These will mainly involve data analysis by replicating existing papers.
- Data project - replicate analysis from a paper of your choice or perform original analysis. Present your analysis to the class and submit a brief report.
- Discuss an empirical paper in class (imagine you are a discussant at a conference)
- Final exam – this will draw on the class material and homework.

Grading: Project – 20%; class participation, paper discussion and assignments – 50%; final – 30%

Topics and Readings

* Indicates student discussion of a paper on a topic from the previous class (45 min)

† Indicates papers to be read prior to the class

Both are subject to change!

I. Jan 12 - Introduction and recap of classical estimation (Note: Wednesday, on zoom)

- A. Course overview
- B. Potential outcomes and causal inference
- C. Recap of basic estimators (OLS, GLS, WLS) and inference

MHE Chapter 2

Leamer, Edward E. "Let's take the con out of econometrics." *The American Economic Review* 73, no. 1 (1983): 31-43.

†Krueger, Alan B. "How computers have changed the wage structure: evidence from microdata, 1984–1989." *The Quarterly Journal of Economics* 108, no. 1 (1993): 33-60.

†DiNardo, John E., and Jörn-Steffen Pischke. "The returns to computer use revisited: Have pencils changed the wage structure too?" *The Quarterly Journal of Economics* 112, no. 1 (1997): 291-303.

Imbens, Guido W., and Jeffrey M. Wooldridge. "Recent developments in the econometrics of program evaluation." *Journal of economic literature* 47, no. 1 (2009): 5-86.

Heckman, James J. "Building bridges between structural and program evaluation approaches to evaluating policy." *Journal of Economic literature* 48, no. 2 (2010): 356-98.

† [optional] Angrist, Joshua D., and Jörn-Steffen Pischke. "The credibility revolution in empirical economics: How better research design is taking the con out of econometrics." *Journal of economic perspectives* 24, no. 2 (2010): 3-30.

Athey, Susan, and Guido W. Imbens. "The state of applied econometrics: Causality and policy evaluation." *Journal of Economic Perspectives* 31, no. 2 (2017): 3-32.

Jan 17 – MLK Day holiday – no class

II. Jan 24 - Classical estimation and testing (Contd.)

- A. Recap of basic estimators (OLS, GLS, WLS) and inference
- B. Weighting
- C. Log transformation

MHE Chapters 2, 3 (excl. 3.3)

Manning, Willard G. "The logged dependent variable, heteroscedasticity, and the retransformation problem." *Journal of health economics* 17, no. 3 (1998): 283-295.

†Manning, Willard G., and John Mullahy. "Estimating log models: to transform or not to transform?" *Journal of health economics* 20, no. 4 (2001): 461-494.

†Solon, Gary, Steven J. Haider, and Jeffrey M. Wooldridge. "What are we weighting for?" *Journal of Human resources* 50, no. 2 (2015): 301-316.

III. Jan 31 - Matching

- A. Propensity score matching
- B. Nonparametric matching

MHE Chapter 3.3

†LaLonde, Robert J. "Evaluating the econometric evaluations of training programs with experimental data." *The American economic review* (1986): 604-620.

Heckman, James J., Hidehiko Ichimura, and Petra E. Todd. "Matching as an econometric evaluation estimator: Evidence from evaluating a job training programme." *The review of economic studies* 64, no. 4 (1997): 605-654.

†Dehejia, Rajeev H., and Sadek Wahba. "Propensity score-matching methods for nonexperimental causal studies." *Review of Economics and statistics* 84, no. 1 (2002): 151-161.

Abadie, Alberto, David Drukker, Jane Leber Herr, and Guido W. Imbens. "Implementing matching estimators for average treatment effects in Stata." *The stata journal* 4, no. 3 (2004): 290-311.

†Smith, Jeffrey A., and Petra E. Todd. "Does matching overcome LaLonde's critique of non-experimental estimators?" *Journal of econometrics* 125, no. 1-2 (2005): 305-353.

Abadie, Alberto, and Guido W. Imbens. "On the failure of the bootstrap for matching estimators." *Econometrica* 76, no. 6 (2008): 1537-1557.

Blackwell, Matthew, Stefano Iacus, Gary King, and Giuseppe Porro. "CEM: Coarsened exact matching in Stata." *The Stata Journal* 9, no. 4 (2009): 524-546.

Hainmueller, Jens. "Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies." *Political analysis* (2012): 25-46.

IV. Feb 7 - Instrumental variables (I)

- A. Discussion of Illing et al. paper (matching)
- B. Basic theory; 2SLS

MHE Chapter 4

†Angrist, Joshua D. "Lifetime earnings and the Vietnam era draft lottery: evidence from social security administrative records." *The American Economic Review* (1990): 313-336.

Angrist, Joshua D., and Alan B. Keueger. "Does compulsory school attendance affect schooling and earnings?" *The Quarterly Journal of Economics* 106, no. 4 (1991): 979-1014.

†Angrist, Joshua D., Guido W. Imbens, and Donald B. Rubin. "Identification of Causal Effects Using Instrumental Variables." *Journal of the American Statistical Association* 91, no. 434 (1996): 444-55.

Angrist, Joshua D., and William N. Evans. "Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size." *American Economic Review* 88, no. 3 (1998): 450-477.

† [optional] Angrist, Joshua D., and Alan B. Krueger. "Instrumental variables and the search for identification: From supply and demand to natural experiments." *Journal of Economic perspectives* 15, no. 4 (2001): 69-85.

***Illing, Hannah, Johannes F. Schmieder, and Simon Trenkle. The gender gap in earnings losses after job displacement. No. w29251. National Bureau of Economic Research, 2021.**

V. Feb 14 - Instrumental variables (II)

- A. Discussion of Angrist and Kolesar paper (IV theory)
- B. Heterogeneous treatment effects and LATE
- C. Judges designs

†Imbens, Guido W., and Joshua D. Angrist. "Identification and Estimation of Local Average Treatment Effects." *Econometrica* 62, no. 2 (1994): 467-475.

Imbens, Guido W., and Donald B. Rubin. "Estimating outcome distributions for compliers in instrumental variables models." *The Review of Economic Studies* 64, no. 4 (1997): 555-574.

Abadie, Alberto. "Semiparametric instrumental variable estimation of treatment response models." *Journal of econometrics* 113, no. 2 (2003): 231-263.

Finkelstein, Amy, Sarah Taubman, Bill Wright, Mira Bernstein, Jonathan Gruber, Joseph P. Newhouse, Heidi Allen, Katherine Baicker, and Oregon Health Study Group. "The Oregon health insurance experiment: evidence from the first year." *The Quarterly journal of economics* 127, no. 3 (2012): 1057-1106.

†Maestas, Nicole, Kathleen J. Mullen, and Alexander Strand. "Does disability insurance receipt discourage work? Using examiner assignment to estimate causal effects of SSDI receipt." *American Economic Review* 103, no. 5 (2013): 1797-1829.

Doyle Jr, Joseph J., John A. Graves, Jonathan Gruber, and Samuel A. Kleiner. "Measuring returns to hospital care: Evidence from ambulance referral patterns." *Journal of Political Economy* 123, no. 1 (2015): 170-214.

Mogstad, Magne, Alexander Torgovitsky, and Christopher R. Walters. Identification of causal effects with multiple instruments: Problems and some solutions. No. w25691. National Bureau of Economic Research, 2019.

***Angrist, Joshua, and Michal Kolesár. One instrument to rule them all: The bias and coverage of just-id iv. No. w29417. National Bureau of Economic Research, 2021.**

VI. Feb 21 - Instrumental variables (III)

- A. Discussion of Diamond et al. paper (IV, matching)
- B. Essential heterogeneity and MTE

Heckman, James J., Sergio Urzua, and Edward Vytlacil. "Understanding instrumental variables in models with essential heterogeneity." *The Review of Economics and Statistics* 88, no. 3 (2006): 389-432.

†Basu, Anirban, James J. Heckman, Salvador Navarro-Lozano, and Sergio Urzua. "Use of instrumental variables in the presence of heterogeneity and self-selection: an application to treatments of breast cancer patients." *Health economics* 16, no. 11 (2007): 1133-1157.

Heckman, James J., and Edward J. Vytlacil. "Econometric evaluation of social programs, part II: Using the marginal treatment effect to organize alternative econometric estimators to evaluate social programs, and to forecast their effects in new environments." *Handbook of econometrics* 6 (2007): 4875-5143.

†Doyle Jr, Joseph J. "Child protection and child outcomes: Measuring the effects of foster care." *American Economic Review* 97, no. 5 (2007): 1583-1610.

Kowalski, Amanda E. "Reconciling seemingly contradictory results from the Oregon health insurance experiment and the Massachusetts health reform." No. w24647. National Bureau of Economic Research, 2018.

Zhou, Xiang, and Yu Xie. "Marginal treatment effects from a propensity score perspective." *Journal of Political Economy* 127, no. 6 (2019): 3070-3084.

***Diamond, Rebecca, Adam Guren, and Rose Tan. The effect of foreclosures on homeowners, tenants, and landlords. No. w27358. National Bureau of Economic Research, 2020.**

VII. Feb 28 - Panel data designs (I)

- A. Discussion of Cornelissen et al. paper (IV, MTE)

B. Differences in differences, triple difference

MHE Chapter 5

Card, David, and Alan B. Krueger. "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania." *The American Economic Review* 84, no. 4 (1994): 772-793.

†Gruber, Jonathan. "The Incidence of Mandated Maternity Benefits." *The American Economic Review*, vol. 84, no. 3, 1994, pp. 622–641.

†Finkelstein, Amy. "The aggregate effects of health insurance: Evidence from the introduction of Medicare." *The quarterly journal of economics* 122, no. 1 (2007): 1-37.

Craig Garthwaite, Tal Gross, and Matthew Notowidigdo, Public Health Insurance, Labor Supply, and Employment Lock, *Quarterly Journal of Economics* (2014): 653-696.

***Cornelissen, Thomas, Christian Dustmann, Anna Raute, and Uta Schönberg. "Who benefits from universal child care? Estimating marginal returns to early child care attendance." *Journal of Political Economy* 126, no. 6 (2018): 2356-2409.**

Mar 7 – Spring break – no class

VIII. Mar 14 - Panel data designs (II)

- A. Discussion of Cabral et al. paper (DD)
- B. Recent developments in DD (critiques and solutions)
- C. Bartik designs

Sun, Liyang, and Sarah Abraham. "Estimating dynamic treatment effects in event studies with heterogeneous treatment effects." *Journal of Econometrics* 225, no. 2 (2021): 175-199.

Callaway, Brantly, and Pedro HC Sant'Anna. "Difference-in-differences with multiple time periods." *Journal of Econometrics* 225, no. 2 (2021): 200-230.

Goodman-Bacon, Andrew. "Difference-in-differences with variation in treatment timing." *Journal of Econometrics* (2021).

De Chaisemartin, Clement, and Xavier d'Haultfoeuille. "Two-way fixed effects estimators with heterogeneous treatment effects." *American Economic Review* 110, no. 9 (2020): 2964-96.

Borusyak, Kirill, Peter Hull, and Xavier Jaravel. Quasi-experimental shift-share research designs. No. w24997. National Bureau of Economic Research, 2018.

Rodrigo Adão, Michal Kolesár, Eduardo Morales, Shift-Share Designs: Theory and Inference, *The Quarterly Journal of Economics*, Volume 134, Issue 4, November 2019, Pages 1949–2010,

Goldsmith-Pinkham, Paul, Isaac Sorkin, and Henry Swift. "Bartik instruments: What, when, why, and how." *American Economic Review* 110, no. 8 (2020): 2586-2624.

Borusyak, Kirill, and Peter Hull. Non-random exposure to exogenous shocks: Theory and applications. No. w27845. National Bureau of Economic Research, 2020.

***Cabral, Marika, Colleen Carey, and Sarah Miller. *The Impact of Provider Payments on Health Care Utilization: Evidence from Medicare and Medicaid*. No. w29471. National Bureau of Economic Research, 2021.**

IX. Mar 21 – Panel data designs (III)

- A. Discussion of Jaeger et al. paper (Bartik)
- B. Synthetic controls
- C. Clustering of standard errors

†Abadie, Alberto, Alexis Diamond, and Jens Hainmueller. "Synthetic control methods for comparative case studies: Estimating the effect of California's tobacco control program." *Journal of the American statistical Association* 105, no. 490 (2010): 493-505.

Abadie, Alberto, Alexis Diamond, and Jens Hainmueller. "Comparative politics and the synthetic control method." *American Journal of Political Science* 59, no. 2 (2015): 495-510.

Arkhangelsky, Dmitry, Susan Athey, David A. Hirshberg, Guido W. Imbens, and Stefan Wager. *Synthetic difference in differences*. No. w25532. National Bureau of Economic Research, 2019.

Abadie, Alberto. "Using synthetic controls: Feasibility, data requirements, and methodological aspects." *Journal of Economic Literature* 59, no. 2 (2021): 391-425.

Moulton, Brent R. "Random group effects and the precision of regression estimates." *Journal of econometrics* 32, no. 3 (1986): 385-397.

†Moulton, Brent R. "An illustration of a pitfall in estimating the effects of aggregate variables on micro units." *The review of Economics and Statistics* (1990): 334-338.

†Bertrand, M., E. Duflo, and S. Mullainathan, (2004): "How Much Should We Trust Differences-in-Differences Estimates?" *Quarterly Journal of Economics*, Vol 119, 249-275.

Cameron, A. Colin, Jonah B. Gelbach, and Douglas L. Miller. "Bootstrap-based improvements for inference with clustered errors." *The Review of Economics and Statistics* 90, no. 3 (2008): 414-427.

***Jaeger, David A., Joakim Ruist, and Jan Stuhler. Shift-share instruments and the impact of immigration. No. w24285. National Bureau of Economic Research, 2018.**

X. Mar 28 - Density based designs

- A. Discussion of Abadie et al. paper (Clustering)
- B. Regression Discontinuity
- C. RD-DiD

MHE Chapter 6

Black, Sandra E. "Do better schools matter? Parental valuation of elementary education." *The Quarterly Journal of Economics* 114, no. 2 (1999): 577-599.

Hahn, J., P. Todd, and W. Van der Klaauw, (2001), "Identification and Estimation of Treatment Effects with a Regression Discontinuity Design", *Econometrica*, Vol 69, No. 1, 201-209.

Lee, David S. "Randomized experiments from non-random selection in US House elections." *Journal of Econometrics* 142, no. 2 (2008): 675-697.

McCrary, Justin. "Manipulation of the running variable in the regression discontinuity design: A density test." *Journal of econometrics* 142, no. 2 (2008): 698-714.

Lalive, Rafael. "How do extended benefits affect unemployment duration? A regression discontinuity approach." *Journal of econometrics* 142, no. 2 (2008): 785-806.

†Card, David, Carlos Dobkin, and Nicole Maestas. "Does Medicare save lives?" *The quarterly*

journal of economics 124, no. 2 (2009): 597-636.

†Lee, David S., and Thomas Lemieux. "Regression discontinuity designs in economics." *Journal of economic literature* 48, no. 2 (2010): 281-355.

Gelman, Andrew, and Guido Imbens. "Why high-order polynomials should not be used in regression discontinuity designs." *Journal of Business & Economic Statistics* (2018): 1-10.

***Abadie, Alberto, Susan Athey, Guido W. Imbens, and Jeffrey Wooldridge. "When should you adjust standard errors for clustering?" No. w24003. National Bureau of Economic Research, 2017.**

XI. Apr 4 – Non-linear models

- A. Discussion of Adams et al. paper (RD)
- B. Quantile regression
- C. Bunching

MHE Chapter 7

Koenker, Roger, and Gilbert Bassett Jr. "Regression quantiles." *Econometrica* (1978): 33-50.

Buchinsky, Moshe. "Changes in the US wage structure 1963-1987: Application of quantile regression." *Econometrica* (1994): 405-458.

†Abadie, Alberto, Joshua Angrist, and Guido Imbens. "Instrumental variables estimates of the effect of subsidized training on the quantiles of trainee earnings." *Econometrica* 70, no. 1 (2002): 91-117.

†Bitler, Marianne P., Jonah B. Gelbach, and Hilary W. Hoynes. "What mean impacts miss: Distributional effects of welfare reform experiments." *American Economic Review* 96, no. 4 (2006): 988-1012.

Kowalski, Amanda. "Censored quantile instrumental variable estimates of the price elasticity of expenditure on medical care." *Journal of Business & Economic Statistics* 34, no. 1 (2016): 107-117.

Persson, Petra. "Social insurance and the marriage market." *Journal of Political Economy* 128, no. 1 (2020): 252-300.

DeFusco, Anthony A., and Andrew Paciorek. "The interest rate elasticity of mortgage demand: Evidence from bunching at the conforming loan limit." *American Economic Journal: Economic Policy* 9, no. 1 (2017): 210-40.

†Manoli, Day, and Andrea Weber. "Nonparametric evidence on the effects of financial incentives on retirement decisions." *American Economic Journal: Economic Policy* 8, no. 4 (2016): 160-182.

***Adams, Alyce S., Raymond Kluender, Neale Mahoney, Jinglin Wang, Francis Wong, and Wesley Yin. *The Impact of Financial Assistance Programs on Health Care Utilization*. No. w29227. National Bureau of Economic Research, 2021.**

XII. April 11 – Selection models

- A. Discussion of Collier et al. paper (bunching)
- B. Selection models

Tobin, James. "Estimation of relationships for limited dependent variables." *Econometrica*:

(1958): 24-36.

Heckman, James. "Shadow prices, market wages, and labor supply." *Econometrica* (1974): 679-694.

†Van de Ven, Wynand PMM, and Bernard MS Van Praag. "The demand for deductibles in private health insurance: A probit model with sample selection." *Journal of econometrics* 17, no. 2 (1981): 229-252.

Heckman, James J., and Thomas E. MaCurdy. "Labor econometrics." *Handbook of econometrics* 3 (1986): 1917-1977.

†Jacoby, Hanan G., and Ghazala Mansuri. "Watta Satta: Bride exchange and women's welfare in rural Pakistan." *American Economic Review* 100, no. 4 (2010): 1804-25.

Dutz, Deniz, Ingrid Huitfeldt, Santiago Lacouture, Magne Mogstad, Alexander Torgovitsky, and Winnie van Dijk. *Selection in Surveys*. No. w29549. National Bureau of Economic Research, 2021.

***Collier, Benjamin L., Cameron Ellis, and Benjamin J. Keys. *The Cost of Consumer Collateral: Evidence from Bunching*. No. w29527. National Bureau of Economic Research, 2021.**

XIII. April 18 – Data project presentations

Each student/team: ~15 minutes, depending on the number of projects and interest

XIV. April 25 – Final exam in class