

Stanford University
Graduate School of Business
Department of Economics

Spring Quarter 2025
MGTECON 607
ECON 272

Econometrics

Professor: Guido Imbens, GSB E349, Econ 322
email: imbens@stanford.edu,
Office Hours: by appointment

Course Assistant: Amar Venugopal
email: amar.venugopal@stanford.edu
Office Hours:

Course Description

Lectures

Each week there will be two in-person meetings, Monday-Wednesday 11:30-1:20pm, starting Monday March 31st, in Zambrano 301 at the GSB. Lecture notes, slides, some selected papers, and sometimes recordings of the lectures, will be posted on the course website forty-eight hours prior to class.

There will be two sets of required assignments.

First, each student will be assigned four lectures. For the assigned you have to submit a question about the material for that lecture 24 hours before the lecture. This can be based on the slides, which will be posted, or on the readings. This will start with the second lecture, Wednesday April 2nd.

In addition to the submitted questions there will be regular computational and theoretical exercises that you can do in self-selected study groups of 3-4 people, with the groups fixed for the entire course. If you have problem finding students to form a study group with, email Amar Venugopal and myself and we will assign you to a group. You can use any computer package you wish to use, and this may play a role in your study group selection. Solutions will be handed out written in Matlab.

There will also be a final exam, date TBD by the registrar's office. For non-econ-phd students the final exam is optional. For the econ-phd students it is required. Non-econ-phd students need to declare whether they want to take the final exam by the end of the fourth week (by midnight April 23rd). Grades will be based on the pre-class questions (40%) and the homework problem sets (60%) in each case distributed equally over all exercises in the set of exercises. For the students who do the final exam the pre-class questions will count for 24%, the homework problem sets for 36% and the final exam for 40%.

Books

There will be one textbook that will be used as a reference book and for additional material:

ANGRIST, J., AND S. PISCHKE (2008), *Mostly Harmless Econometrics*, Princeton University Press

In addition there will be a number of journal articles used as background. These are not essential for following the lectures, but useful for a deeper understanding of the material. Most of these are available through electronically.

Exam There will be an in-class exam, date tbd

Course Outline

1. Randomized Experiments (5 Lectures)

- (a) (Mon 3/31) Causality, Randomized Experiments, Fisher and Neyman
 - i. Lecture Notes, Part I, Chapter 1.
 - ii. Splawa-Neyman, Jerzy, Dorota M. Dabrowska, and T. P. Speed. "On the application of probability theory to agricultural experiments. Essay on principles. Section 9." *Statistical Science* (1990): 465-472.
 - iii. Deaton, Angus. "Instruments, randomization, and learning about development." *Journal of economic literature* 48.2 (2010): 424-55.
 - iv. Imbens, Guido W. "Better LATE than nothing: Some comments on Deaton (2009) and Heckman and Urzua (2009)." *Journal of Economic literature* 48.2 (2010): 399-423.
- (b) (Wed 4/2) Stratified and Paired Randomized Experiments, Power Analyses and P-Values
 - i. Lecture Notes, Part I, Chapters 2-3.
 - ii. Morgan, Kari Lock, and Donald B. Rubin. "Rerandomization to improve covariate balance in experiments." *The Annals of Statistics* (2012): 1263-1282.
 - iii. Wasserstein, Ronald L. "ASA statement on statistical significance and p-values." (2016): 131-133.
 - iv. Andrews, Isaiah, and Maximilian Kasy. Identification of and correction for publication bias. No. w23298. National Bureau of Economic Research, 2017.
 - v. Benjamin, Daniel J., et al. "Redefine statistical significance." *Nature Human Behaviour* 2.1 (2018): 6.
 - vi. Ioannidis, John, Tom D. Stanley, and Hristos Doucouliagos. "The power of bias in economics research." *The Economic Journal* 127.605 (2017).
- (c) (Mon 4/7) Clustered Randomized Experiments
 - i. Abadie, Alberto, Susan Athey, Guido W. Imbens, and Jeffrey M. Wooldridge. "When should you adjust standard errors for clustering?." *The Quarterly Journal of Economics* 138, no. 1 (2023): 1-35.
 - ii. Cameron, A. Colin, and Douglas L. Miller. "A practitioners guide to cluster-robust inference." *Journal of human resources* 50, no. 2 (2015): 317-372..
- (d) (Wed 4/9) Clustered Randomized Experiments

- i. Abadie, Alberto, Susan Athey, Guido W. Imbens, and Jeffrey M. Wooldridge. "When should you adjust standard errors for clustering?." *The Quarterly Journal of Economics* 138, no. 1 (2023): 1-35.
- ii. Cameron, A. Colin, and Douglas L. Miller. "A practitioners guide to cluster-robust inference." *Journal of human resources* 50, no. 2 (2015): 317-372..
- (e) (Mon 4/14) Multi-armed Bandits and other Complex Experiments
 - i. Scott, Steven L. "A modern Bayesian look at the multiarmed bandit." *Applied Stochastic Models in Business and Industry* 26, no. 6 (2010): 639-658.
 - ii. Bajari, Patrick, Brian Burdick, Guido W. Imbens, Lorenzo Masoero, James McQueen, Thomas S. Richardson, and Ido M. Rosen. "Experimental design in marketplaces." *Statistical Science* 38, no. 3 (2023): 458-476.

2. Identification (1 Lecture)

- (a) (Wed 4/16) Identification: Point Identification and Partial Identification of Average Treatment Effects
 - i. Heckman, James. "Varieties of selection bias." *The American Economic Review* 80, no. 2 (1990): 313-318.
 - ii. Manski, Charles F. "Nonparametric bounds on treatment effects." *The American Economic Review* 80, no. 2 (1990): 319-323.

3. The Credibility Crisis and the Credibility Revolution (1 Lecture)

- (a) (Mon 4/21) The Origins of the Credibility Crisis and the Credibility Revolution
 - i. Leamer, Edward E. "Let's take the con out of econometrics." *The American Economic Review* 73, no. 1 (1983): 31-43.
 - ii. LaLonde, Robert J. "Evaluating the econometric evaluations of training programs with experimental data." *The American economic review* (1986): 604-620.
 - iii. Angrist, Joshua D., and Jorn-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.

4. Directed Acyclical Graphs (1 Lecture)

- (a) (Wed 4/23) Directed Acyclical Graphs, the do-operator, and Structural Equation Models
 - i. Pearl, Judea. "Causal diagrams for empirical research." *Biometrika* 82, no. 4 (1995): 669-688.
 - ii. Pearl, Judea. "The do-calculus revisited." arXiv preprint arXiv:1210.4852 (2012).
 - iii. Imbens, Guido W. "Potential outcome and directed acyclic graph approaches to causality: Relevance for empirical practice in economics." *Journal of Economic Literature* 58, no. 4 (2020): 1129-79.

5. Observational Studies Under Unconfoundedness (3 Lectures)

(a) (Mon 4/28) Introduction to Unconfoundedness

- i. Imbens, Guido W. "Nonparametric estimation of average treatment effects under exogeneity: A review." *Review of Economics and statistics* 86.1 (2004): 4-29.
- ii. Abadie, Alberto, and Matias D. Cattaneo. "Econometric methods for program evaluation." *Annual Review of Economics* 10 (2018): 465-503.
- iii. Imbens, Guido W. "Matching methods in practice: Three examples." *Journal of Human Resources* 50.2 (2015): 373-419.
- iv. Part IX, Chapter 2.
- v. Abadie, Alberto, and Guido W. Imbens. "Large sample properties of matching estimators for average treatment effects." *Econometrica* 74.1 (2006): 235-267.
- vi. Hahn, Jinyong. "On the role of the propensity score in efficient semiparametric estimation of average treatment effects." *Econometrica* (1998): 315-331.
- vii. Hirano, Keisuke, Guido W. Imbens, and Geert Ridder. "Efficient estimation of average treatment effects using the estimated propensity score." *Econometrica* 71, no. 4 (2003): 1161-1189.

(b) (Wed 4/30) Double Robust Methods

- i. Bang, Heejung, and James M. Robins. "Doubly robust estimation in missing data and causal inference models." *Biometrics* 61, no. 4 (2005): 962-973.
- ii. Chernozhukov, Victor, Denis Chetverikov, Mert Demirer, Esther Duflo, Christian Hansen, and Whitney Newey. "Double/debiased/neyman machine learning of treatment effects." *American Economic Review* 107, no. 5 (2017): 261-65.

(c) (Mon 5/5) Heterogenous Treatment Effects and Estimating Policy Rules

- i. Wager, Stefan, and Susan Athey. "Estimation and inference of heterogeneous treatment effects using random forests." *Journal of the American Statistical Association* 113, no. 523 (2018): 1228-1242.
- ii. Hirano, Keisuke, and Jack R. Porter. "Asymptotics for statistical treatment rules." *Econometrica* 77, no. 5 (2009): 1683-1701. Athey, Susan, and Stefan Wager. "Policy learning with observational data." *Econometrica* 89, no. 1 (2021): 133-161.

6. Instrumental Variables (3 Lectures)

(a) (Wed 5/7) linear instrumental variables

(b) (Mon 5/12) nonlinear instrumental variables models and local average treatment effects

- i. Part X, Chapters 1-2.
- ii. Imbens, Guido W. "Instrumental Variables: An Econometrician's Perspective." *Statistical Science* 29.3 (2014): 323-358.

- iii. Imbens, Guido W., and Joshua D. Angrist. "Identification and Estimation of Local Average Treatment Effects." *Econometrica* 62.2 (1994): 467-475.
 - (c) (Wed 5/14) linear instrumental variables models with weak and many instruments
 - i. Chamberlain, Gary, and Guido Imbens. "Random effects estimators with many instrumental variables." *Econometrica* 72, no. 1 (2004): 295-306.
 - ii. Angrist, Joshua, and Michal Kolesr. "One instrument to rule them all: The bias and coverage of just-ID IV." *Journal of Econometrics* (2023): 105398.
 - iii. Stock, James H., Jonathan H. Wright, and Motohiro Yogo. "A survey of weak instruments and weak identification in generalized method of moments." *Journal of Business & Economic Statistics* 20, no. 4 (2002): 518-529.
- 7. Regression Discontinuity Designs (1 Lecture)
 - (a) (Mon 5/19) Regression Discontinuity Designs
 - i. Part X, Chapter 5.
 - ii. Imbens, Guido W., and Thomas Lemieux. "Regression discontinuity designs: A guide to practice." *Journal of econometrics* 142.2 (2008): 615-635.
 - iii. Armstrong, Timothy B., and Michal Kolesár. "Optimal inference in a class of regression models." *Econometrica* 86.2 (2018): 655-683.
 - iv. Imbens, Guido, and Stefan Wager. "Optimized Regression Discontinuity Designs." arXiv preprint arXiv:1705.01677 (2017).
- 8. Panel Data (4 Lectures)
 - (a) (Wed 5/21) Random Effects and Fixed Effects in Linear Panel Data Models
 - i. Chamberlain, Gary. "Panel data." *Handbook of econometrics* 2 (1984): 1247-1318.
 - ii. Meyer, Bruce D., W. Kip Viscusi, and David L. Durbin. "Workers' compensation and injury duration: evidence from a natural experiment." *The American economic review* (1995): 322-340.
 - iii. Goodman-Bacon, Andrew, "Difference-In-Differences with Variation in the Treatment Timing" NBER Working Paper, 2018.
 - iv. Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan. "How much should we trust differences-in-differences estimates?." *The Quarterly journal of economics* 119, no. 1 (2004): 249-275.
 - v. Athey, Susan, and Guido W. Imbens. "Identification and inference in nonlinear difference-in-differences models." *Econometrica* 74.2 (2006): 431-497.
 - (b) (Wed 5/28) Synthetic Control Methods: Basics
 - i. Abadie, Alberto, Alexis Diamond, and Jens Hainmueller. "Comparative politics and the synthetic control method." *American Journal of Political Science* 59.2 (2015): 495-510.
 - ii. Abadie, Alberto. "Using synthetic controls: Feasibility, data requirements, and methodological aspects." *Journal of Economic Literature* 59, no. 2 (2021): 391-425.

(c) (Mon 6/2) Synthetic Control Methods: Extensions

- i. Athey, Susan, Mohsen Bayati, Nikolay Doudchenko, Guido Imbens, and Khashayar Khosravi. "Matrix completion methods for causal panel data models." *Journal of the American Statistical Association* 116, no. 536 (2021): 1716-1730.
- ii. Arkhangelsky, D., Athey, S., Hirshberg, D. A., Imbens, G. W., & Wager, S. (2021). Synthetic difference-in-differences. *American Economic Review*, 111(12), 4088-4118.

(d) (Mon 6/4) Nonlinear Factor Models

- i.