

# Empirical Strategies

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These lectures cover many of the empirical modeling strategies discussed in Mostly Harmless Econometrics (MHE). The main theoretical ideas are illustrated with examples, including recent applications. Topics to be covered include regression and matching, the construction and interpretation of instrumental variables estimates, differences-in-differences identification strategies, and regression discontinuity methods.

We'll have lectures every morning. In addition to lectures, participants will have the opportunity to present work in progress. The atmosphere is informal. I encourage questions and class discussion – I'll be asking you questions too!

**Lecture 1: How Policy Experiments Reveal Cause and Effect (Chapters 1-2)**

*The Selection Problem*

*Experiments, IV, DD, and RD – an overview*

**Lectures 2: Regression (MHE 3.1-3.2)**

*Regression Mechanics*

3 reasons to love

The long and short of regression anatomy

*Causal Regression*

Omitted variables bias

Potential outcomes

Causal vs. casual

*Details*

Limited dependent variables and marginal effects

Review of OLS asymptotics

**Lecture 3: Matching and Training (MHE 3.3-3.4)**

*Matching and the CIA*

Estimating the effect of treatment on the treated

Theoretical and empirical comparison of regression and matching

*Training and the p-score*

The propensity score theorem

The Lalonde/Dehejia-Wahba/Smith-Todd controversy

Why the p-score is just all right with me

**Lectures 4-5: Instrumental Variables in Action (highlights from Chapter 4)**

*Constant-effects models*

IV and omitted variables bias: estimating a long regression without controls

Two-stage least squares (2SLS); 2SLS lingo and mistakes

The Wald estimator, grouped data, and two-sample IV

The bias of 2SLS (4.6.4)

*Instrumental variables with heterogeneous potential outcomes*

Local average treatment effects; The *compliers* concept

IV in randomized trials

Average causal response in models with variable treatment intensity

**Lecture 6: External Validity**

Extrapolating: External Validity and Overidentification in the LATE Framework  
(Angrist and Fernandez-Val, 2011)

**Lectures 7: Differences-in-Differences (Chapter 5)**

*DD basics*

The DD model; Regression DD  
DD assumptions and spec checks

*DD frontiers*

Synthetic Controls (Abadie, Diamond, and Hainmueller, 2010)  
Changes-in-changes (Athey and Imbens, 2006)

**Lecture 8-9: Regression Discontinuity Designs (Chapter 6)**

*RD Theory*

*Application*

The Elite Illusion (Abdulkadiroglu, Angrist, and Pathak, 2011)

**Lecture 10: Summary and Wrap-up**

READINGS

Text: J.D. Angrist and J.S. Pischke, *Mostly Harmless Econometrics: An Empiricist's Companion*, Princeton University Press, 2009.

Many of the readings are from *MHE*. Published journal articles should be available in JSTOR. Working papers are available from online sources.

REGRESSION RECAP

*MHE*, Chapters 1-2 and 3.1-3.2

The first two chapters explain our experimentalist perspective on applied econometrics. Chapter 3 covers regression basics and more advanced topics related to regression and matching.

*Limited dependent variables and marginal effects*

MHE 3.4.2

*Review of large-sample theory*

MHE 3.1.3

G. Chamberlain, "Panel Data," Chapter 22 in *The Handbook of Econometrics*, Volume II, Amsterdam: North-Holland, 1983.

MATCHING AND TRAINING

*Matching*

MHE 3.3.1

J. Angrist, "Estimating the Labor Market Impact of Voluntary Military Service Using Social Security Data on Military Applicants," *Econometrica*, March 1998.

A. Abadie and G. Imbens, "Large Sample Properties of Matching Estimators for Average Treatment Effects," *Econometrica* 74(1), 2006, 235-267.

G. Imbens, "Nonparametric Estimation of Average Treatment Effects under Exogeneity: A Review," *The Review of Economics and Statistics*, 86(1), 2004.

*Training and the propensity score*

MHE 3.3.2-3.3.3

O. Ashenfelter, "Estimating the Effect of Training Programs on Earnings," *The Review of Economics and Statistics* 60 (1978), 47-57.

O. Ashenfelter and D. Card, "Using the Longitudinal Structure of Earnings to Estimate the Effect of Training Programs on Earnings," *The ReStat* 67 (1985):648-66.

- R. LaLonde, "Evaluating the Econometric Evaluations of Training Programs with Experimental Data," *American Economic Review* 76 (September 1986): 604-62.
- J. Heckman and J. Hotz, "Choosing Among Alternative Nonexperimental Methods for Estimating the Impact of Social Programs: The Case of Manpower Training," *JASA* 84 (1989).
- P. Rosenbaum and R. Rubin, "Reducing Bias in Observational Studies Using Subclassification on the Propensity Score," *JASA* 79[387], September 1984, 516-524.
- R. Dehejia and S. Wahba, "Causal Effects in Nonexperimental Studies: Re-evaluating the Evaluation of Training Programs," *JASA* 94 (Sept. 1999).
- J. Smith and P. Todd, "Does Matching Overcome LaLonde's Critique of Nonexperimental Estimators?" *Journal of Econometrics*, 2005(1-2).
- J. Hahn, "On the Role of the Propensity Score in Efficient Estimation of Average Treatment Effects," *Econometrica* 66, March 1998.
- K. Hirano, G. Imbens, and G. Ridder, "Efficient Estimation of Average Treatment Effects Using the Estimated Propensity Score," *Econometrica* 71(4), 2003.

#### INSTRUMENTAL VARIABLES

(Part 1:2SLS with constant effects; the Wald estimator, grouped data, two-sample IV)

*MHE*, Section 4.1

- J. Angrist and A. Krueger, "Instrumental Variables and the Search for Identification," *Journal of Economic Perspectives*, Fall 2001.
- J. Angrist, "Grouped Data Estimation and Testing in Simple Labor Supply Models," *Journal of Econometrics*, February/March 1991.
- J. Angrist, "Lifetime Earnings and the Vietnam Era Draft Lottery: Evidence from Social Security Administrative Records," *American Economic Review*, June 1990.
- J. Angrist and A. Krueger, "Split-Sample Instrumental Variables Estimates of the Returns to Schooling," *JBES*, April 1995.
- Inoue, Atsushi and G. Solon, "Two-Sample Instrumental Variables Estimators," *The Review of Economics and Statistics*, August 2010.

*2SLS Mistakes: MHE*, Section 4.6.1.

*The bias of 2SLS*

*MHE*, Section 4.6.4

- J. Angrist, G. Imbens, and A. Krueger, "Jackknife Instrumental Variables Estimation," *Journal of Applied Econometrics* 14(1), 57-67.
- Flores-Lagunes, Alfonso, "Finite-Sample Evidence on IV Estimators with Weak Instruments," *Journal of Applied Econometrics* 22, 2007, 677-694.
- J. Hausman, et al., "Instrumental Variable Estimation with Heteroskedasticity and Many Instruments," Johns Hopkins Dept. of Economics Working Paper 566, Sept. 2009.
- M. Kolesar, et al., "Identification and inference with Many Invalid Instruments," NBER Working Paper No. 17519, October 2011.

#### INSTRUMENTAL VARIABLES WITH HETEROGENEOUS POTENTIAL OUTCOMES

*MHE*, Section 4.4

- G. Imbens and J. Angrist, "Identification and Estimation of Local Average Treatment Effects," *Econometrica*, March 1994.
- J. Angrist, G. Imbens, and D. Rubin, "Identification of Causal effects Using Instrumental Variables," with comments and rejoinder, *JASA*, 1996.
- J. Angrist and A. Krueger, "Does Compulsory Schooling Attendance Affect Schooling and Earnings?," *Quarterly Journal of Economics* 106, November 1991, 979-1014.
- J. Angrist, "Instrumental Variables in Experimental Criminological Research: What, Why, and How," *Journal of Experimental Criminological Research* 2, 2005, 1-22.
- Models with variable and continuous treatment intensity*

*MHE*, Section 4.5.3

- J. Angrist and G. Imbens, "Two-Stage Least Squares Estimation of Average Causal Effects in Models with Variable Treatment Intensity," *JASA*, June 1995.
- J. Angrist, K. Graddy, and G. Imbens, "The Interpretation of instrumental Variables Estimations in Simultaneous Equations Models with an Application to the Demand for Fish," *Rev. Ec. Studies* 67 (2000), 499-527.

#### EXTERNAL VALIDITY

- J. Angrist, V. Lavy, and Analia Schlosser, "Multiple Experiments for the Causal Link Between the Quantity and Quality of Children," *The Journal of Labor Economics*, October 2010.
- J. Angrist and I. Fernandez-Val, "Extrapo-LATEing: External Validity and Overidentification in the LATE Framework," NBER Working Paper No. 16566, December 2010.

#### DIFFERENCES-IN-DIFFERENCES

*MHE*, Chapter 5

- A. Abadie, A. Diamond, and J. Hainmueller, "Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program," *JASA* 105, June 2010.
- S. Athey and G. Imbens, "Identification and Inference in Nonlinear Differences-in-differences Models," *Econometrica* 74 (2006).

#### REGRESSION-DISCONTINUITY DESIGNS

*MHE*, Chapter 6

- T. Cook, "Waiting for Life to Arrive: A History of the Regression-Discontinuity Design in Psychology, Statistics, and Economics," *Journal of Econometrics* 142 (2008), 636-654.
- G. Imbens and T. Lemieux, "Regression Discontinuity Designs: A Guide to Practice," *Journal of Econometrics* 142 (2008), 615-35.
- D. Lee, "Randomized Experiments from Non-Random Selection in U.S. House Elections," *Journal of Econometrics* 142, 2008.
- J. Hahn, P. Todd, and W. van der Klaauw, "Identification and Estimation of Treatment Effects with a Regression-Discontinuity Design," *Econometrica* 69 (2001), 201-209.
- J. Angrist and V. Lavy, "Using Maimonides Rule to Estimate the Effect of Class Size on Scholastic Achievement," *QJE*, May 1999.

- G. Imbens and K. Kalyanaraman, "Optimal Bandwidth Choice for the Regression Discontinuity Estimator," NBER Working Paper No. 14726, February 2009.
- M. Urquiola and E. Verhoogen, "Class Size Caps, Sorting, and the Regression Discontinuity design," *The American Economic Review*, March 2009.
- B. Frandsen, M. Froelich, and B. Melly, "Quantile Treatment Effects in the RD Design," MIT Dept. of Economics, mimeo, 2010.
- D. Almond, J. Doyle, A. Kowalski, and H. Williams, "Estimating the Marginal Returns to Medical Care: Evidence from At-Risk Newborns," *The QJE* 125 (2010).
- A. Abdulkadiroglu, J. Angrist, and P. Pathak, "The Elite Illusion: Achievement Effects at Boston and New York exam Schools," NBER Working Paper No. 17264, July 2011.
- A. Barreca, M. Guildi, J. Lindo, and G. Waddell, "Saving Babies? Revisiting the Effect of Very Low Birthweight Classification," *The QJE*, November 2011.
- D. Almond, *et al.*, "Reply to Barreca, *et al.*," Same issue.