

# Content For Methods Comp

## Probability Theory

### Books

- 1) Bertsekas, Dimitri P. and Tsitsiklis, John (BT) Introduction to Probability Theory (second edition)
- 2) Ross, Sheldon. First Course in Probability Theory (8th Edition).

## 1 A Rigorous Model of Probability and Its Properties

- Axioms of probability
- Inclusion/Exclusion
- Conditional Probability
- Bayes' rule
- Independence

### *Require Reading*

- BT Chapter 1

## 2 Discrete and Continuous Random Variables

- Probability Mass Functions, Probability Density Functions
- Cumulative Mass Functions, Cumulative Density Functions
- Expectation, Variance
- Mass functions/density functions for famous random variables
- Functions of random variables.

### *Required Reading*

- BT Chapter 2 and 3

## 3 Joint Distributions

- Joint mass functions, joint density functions
- Marginalization
- Independence of random variables
- Expectation, covariance, variance

### *Required reading*

- Handout (Chapter 6, Ross)

## 4 Properties of Expectation, Moment Generating Functions, and Transformations

- Change of coordinates
- Properties of moment generating functions
- Iterated expectations

Require Readings

- BT Chapter 4

## 5 Convergence, Limit Theorems, and Inequalities

- Weak Law of Large Numbers
- Convergence in Probability
- Almost Sure Convergence
- Convergence in Distribution

*Required Readings*

- BT Chapter 5

# Regression

## Books

Regression:

- Greene, William. *Econometric Analysis*. 8th Edition.
- Wooldridge, Jeffrey. *Introductory Econometrics*. New York: South-Western. 5th edition.
- R. Carter Hill, William E. Griffiths, and Guay C. Lim. *Principles of Econometrics*. 4th edition.
- John Fox. *Applied Regression Analysis and Generalized Linear Models*. 2nd edition.
- Andrew, Gelman and Jennifer Hill. *Data Analysis Using Regression and Multilevel/Hierarchical Models*. Cambridge University Press. (regression modeling)
- Imai, Kosuke. Quantitative Social Science. An Introduction. *Princeton University Press*

Math and Probability

- Simon, Carl and Blume, Lawrence. *Mathematics for Economists*. New York: Norton.
- Bertsekas, Dimitri P. and Tsitsiklis, John (BT) *Introduction to Probability Theory* (second edition)

Computing:

- Paul Teetor. 2011. *R Cookbook*. O'Reilly Media.
- Fox, John and Sanford Weisberg. *An R Companion to Applied Regression*. 2nd ed. (R, with focus on regression modeling)
- Murrell, Paul. *R Graphics*. Chapman & Hall.
- Wickham, Hadley. *ggplot2: Elegant Graphics for Data Analysis*. Springer.
- Sarkar, Deepayan. *Lattice: Multivariate Data Visualization with R*. Springer.

## 1 Univariate Statistical Inference

### 1.1 Point Estimation

- Properties of Estimators
- Sampling Distribution
- Elementary Asymptotic Theory

*Required Readings:*

- Wooldridge, Appendix C1-C4
- Unless you are well familiar with this material you need to review: Wooldridge, Appendix A & B

### 1.2 Interval Estimation

- Confidence Intervals

*Required Readings:*

- Wooldridge, Appendix C5

### 1.3 Hypothesis Testing

- Logic of Statistical Testing
- p-Values

*Required Readings:*

- Wooldridge, Appendix C6-C7

## 2 What is Regression?

- Nonparametric Regression
- Linear Regression
- Bias-Variance Tradeoff

*Required Readings:*

- Wooldridge, Chapter 1

## 3 Simple Linear Regression

- Mechanics of Ordinary Least Squares
- Linear Model Assumptions
- Properties of the Least Squares Estimator
- Gauss-Markov Theorem
- Testing and Confidence Intervals
- Large Sample Inference

*Required Readings:*

- Wooldridge, Chapter 2
- Hill, Griffiths, and Lim, Chapters 2 & 3

## 4 Linear Regression with Two Regressors

### 4.1 Mechanics of Regression with Two Regressors

- Motivation for Multiple Regression
- Mechanics for OLS with Two Regressors

*Required Readings:*

- Wooldridge, Chapter 3
- Inference for OLS with Two Regressors

*Required Readings:*

- Wooldridge, Chapter 4 & 5

## 4.2 Omitted Variables and Multicollinearity

- Omitted Variable Bias
- Multicollinearity

*Required Readings:*

- Wooldridge, Chapters 6
- Alternative: Hill, Griffiths, and Lim, Chapter 6 (course website)

## 4.3 Dummy Variables, Interactions and Polynomials

- Dummy Variables
- Interaction Terms
- Polynomials and Logarithms

*Required Readings:*

- Wooldridge, Chapter 7
- Hill, Griffiths, and Lim, Chapter 4 & 7

# 5 Multiple Linear Regression

## 5.1 Mechanics of Multiple Regression

- Review of Matrix Algebra and Vector Calculus
- Mechanics of Multiple Linear Regression

## 5.2 Statistical Inference with Multiple Regression

- Statistical Inference for Multiple Linear Regression
- Testing Multiple Hypotheses

*Required Readings:*

- Wooldridge, Appendix D & E

# 6 Diagnosing and Fixing Problems in Linear Regression

## 6.1 Outliers and Influential Observations

- Plotting Residuals
- Standardized and Studentized Residuals
- Added Variable and Component Residual Plots
- Leverage and Influence

*Required Readings:*

- Fox, Chapter 11

## 6.2 Heteroskedasticity, Serial Correlation and Clustering

- Weighted Least Squares
- Heteroskedasticity-robust Standard Errors
- Cluster-robust Standard Errors
- Autocorrelation

### *Required Readings:*

- Wooldridge, Chapters 8–9
- Fox, Chapter 12
- Hill, Griffiths, and Lim, Chapter 8

# Causal Inference

## Books

- Angrist, Joshua D. and Jörn-Steffen Pischke. 2009. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press. (A standard reference for applied researchers for most topics covered in the first part of the course.)
- Morgan, Stephen L. and Christopher Winship. 2015. *Counterfactuals and Causal Inference: Methods and Principles for Social Research*, Second Edition. Cambridge University Press.
- Wooldridge, Jeffrey. 2010. *Econometric Analysis of Cross Section and Panel Data*, 2nd ed. MIT Press.
- Imbens, Guido and Donald B. Rubin. 2015. *Causal Inference for Statistics, Social, and Biomedical Sciences: An Introduction*. 1st Edition. Cambridge University Press.
- Gerber, Alan S., and Donald P. Green. 2012. *Field Experiments*. W. W. Norton.
- Rosenbaum, Paul R. 2009. *Design of Observational Studies*. Springer Series in Statistics.
- Rosenbaum, Paul R. 2002. *Observational Studies*. Springer-Verlag. 2nd edition.
- Pearl, Judea. 2009. *Causality: Models, Reasoning, and Inference*. New York: Cambridge University Press. 2nd edition.
- Manski, Charles F. 1995. *Identification Problems in the Social Sciences*. Cambridge: Harvard University Press.
- Rubin, Donald. 2006. *Matched Sampling for Causal Effects*. Cambridge University Press.

## 1 The Potential Outcome Model

- Counterfactual Responses and the Fundamental Identification Problem
- Estimands and Assignment Mechanisms
- Heterogeneity and Selection

*Readings* (★) indicates required

- Morgan and Winship: Chapter 1-2. (★)
- Angrist and Pischke: Chapter 1. (★)
- Holland, Paul W. 1986. **Statistics and Causal Inference**. *Journal of the American Statistical Association* 81(396): 945-960. (★)
- Sekhon, Jasjeet S. 2004. **Quality Meets Quantity: Case Studies, Conditional Probability and Counterfactuals**. *Perspectives on Politics* 2 (2): 281-293.

## 2 Randomized Experiments

- Identification of Causal Effects under Randomization
- Implementation, Estimation, Diagnostics, Blocking
- Threats to Validity

*Readings: Theory of Experiments*

- Angrist and Pischke: Chapter 2. (★)
- Rosenbaum, Paul R. 2002. *Observational Studies*. Springer-Verlag. 2nd edition. Chapter 2.
- Gerber, Alan S., and Donald P. Green. 2012. *Field Experiments*. W. W. Norton. Chapters 2-4.
- Neyman, Jerzy. 1923 [1990]. **On the Application of Probability Theory to Agricultural Experiments. Essay on Principles. Section 9.** *Statistical Science* 5 (4): 465-472. Trans. Dorota M. Dabrowska and Terence P. Speed.
- Lin, Winston. Forthcoming. **Agnostic Notes on Regression Adjustments to Experimental Data: Reexamining Freedman's Critique.** *The Annals of Applied Statistics*.

*Readings: Application of Experiments*

- Olken, Benjamin. 2007. **Monitoring corruption : Evidence from a field experiment in Indonesia.** *Journal of Political Economy* 115 (2): 200-249.
- Gerber, Alan S., Donald P. Green and Christopher W. Larimer. 2008. **Social Pressure and Voter Turnout: Evidence from a Largescale Field Experiment.** *American Political Science Review* 102 (1): 1-48. (★)
- Wantchekon, Leonard. 2003. **Clientelism and Voting Behavior: Evidence from a Field Experiment in Benin** *World Politics* 55 (3), April: 399-422.
- Chattopadhyay, Raghabendra and Esther Duflo. 2004. **Women as Policy Makers: Evidence from a Randomized Policy Experiment in India.** *Econometrica*, 72 (5): 1409-1443.

*Readings: Application of Natural Experiments*

- Hyde, Susan D. 2007. **The Observer Effect in International Politics: Evidence from a Natural Experiment.** *World Politics* 60(1): 37-63. (★)
- Ferraz, Claudio, and Federico Finan. 2008. **Exposing Corrupt Politicians: The Effects of Brazil's Publicly Released Audits on Electoral Outcomes.** *Quarterly Journal of Economics* 123(2): 703-45.
- Ho, Daniel E., and Kosuke Imai. 2008. **Estimating Causal Effects of Ballot Order from a Randomized Natural Experiment: The California Alphabet Lottery, 1978-2002.** *Public Opinion Quarterly* 72(2): 216-40.
- Dunning, Thad. 2012. *Natural Experiments in the Social Sciences: A Design-Based Approach*. New York: Cambridge University Press.

*Readings: Experiments Review Articles*

- Palfrey, Thomas. 2009. **Laboratory Experiments in Political Economy.** *Annual Review of Political Science* 12: 379-388.
- Druckman, James N., Donald P. Green, James H. Kuklinski, and Arthur Lupia. 2006. **The Growth and Development of Experimental Research in Political Science.** *American Political Science Review* 100(4): 627-635.
- Green, Donald P., Peter M. Aronow, and Mary C. McGrath. 2012. **Field Experiments and the Study of Voter Turnout.** *Journal of Elections, Public Opinion & Parties*: 1-22.
- Humphreys, Macartan, and Jeremy Weinstein. 2009. **Field Experiments and the Political Economy of Development.** *Annual Review of Political Science* 12: 367-378.
- Harrison, Glenn and John A. List. 2004. **Field Experiments.** *Journal of Economic Literature*, XLII: 1013-1059.



- List, John A., and Steven Levitt. 2006. *What Do Laboratory Experiments Tell Us About the Real World?* University of Chicago and NBER.
- Gaines, Brian J., and James H. Kuklinski. 2007. *The Logic of the Survey Experiment Reexamined*. *Political Analysis* 15: 1-20.

*Readings: Useful Methodological Guides for Experiments*

- Duflo, Esther, Abhijit Banerjee, Rachel Glennerster, and Michael Kremer. 2006. *Using Randomization in Development Economics: A Toolkit*. *Handbook of Development Economics*.
- Bloom, Howard S. 2008. "The Core Analytics of Randomized Experiments for Social Research." In *The SAGE Handbook of Social Research Methods*, eds. Pertti Alasuutari, Leonard Bickman, and Julia Brannen. London: SAGE.
- Bruhn, Miriam, and David McKenzie. 2009. *In Pursuit of Balance: Randomization in Practice in Development Field Experiments*. *American Economic Journal: Applied Economics* 1(4): 200-232.

## 3 Causal Effects under Selection on Observables

### 3.1 Selection on Observables

- Identification under Selection on Observables
- Subclassification

*Readings*

- Morgan and Winship: Chapters 3-4. (★)
- Rubin, Donald B. 2008. *For Objective Causal Inference, Design Trumps Analysis*. *Annals of Applied Statistics* 2(3): 808-840.
- Rosenbaum, Paul R. 2002. *Observational Studies*. Springer-Verlag. 2nd edition. Chapter 3.
- Rosenbaum, Paul R. 2005. *Heterogeneity and Causality: Unit Heterogeneity and Design Sensitivity in Observational Studies*. *The American Statistician* 59: 147-152.
- Acemoglu, Daron. 2005. *Constitutions, Politics, and Economics: A Review Essay on Persson and Tabellini's The Economic Effects of Constitutions*. *Journal of Economic Literature* XLIII: 1025-1048.

### 3.2 Matching Methods

- Covariate Matching, Balance Checks, Properties of Matching Estimators

*Readings: Matching Theory*

- Morgan and Winship: Chapter 5. (★)
- Imbens, Guido. 2014. *Matching Methods in Practice: Three Examples*. *NBER Working Paper 19959*.
- Sekhon, Jasjeet S. 2009. *Opiates for the Matches: Matching Methods for Causal Inference*. *Annual Review of Political Science* 12: 487-508.(★)
- Ho, Daniel E., Kosuke Imai, Gary King, and Elizabeth A. Stuart. 2007. *Matching as Nonparametric Preprocessing for Reducing Model Dependence in Parametric Causal Inference*. *Political Analysis* 15: 199-236.
- Stuart, Elizabeth A. 2009. *Matching methods for causal inference: A review and a look forward*

- Rubin: Chapters 3 to 5.
- Rosenbaum, Paul R., 1995. *Observational Studies*. New York: Springer-Verlag. Chapter 3.
- Abadie, Alberto and Guido W. Imbens. 2006. **Large Sample Properties of Matching Estimators for Average Treatment Effects**, *Econometrica* 74: 235-267.
- Abadie, Alberto, and Guido W. Imbens. 2011. **Bias-Corrected Matching Estimators for Average Treatment Effects**. *Journal of Business & Economic Statistics* 29(1): 1-11.

*Readings: Matching Applications*

- Lyall, Jason. 2010. **Are Co-Ethnics More Effective Counter-Insurgents? Evidence from the Second Chechen War**. *American Political Science Review*, 104:1 (February 2010): 1-20.
- Gordon, Sanford and Gregory Huber. 2007. **The Effect of Electoral Competitiveness on Incumbent Behavior**. *Quarterly Journal of Political Science* 2(2): 107-138.
- Eggers, Andrew and Jens Hainmueller. 2009. **MPs for Sale? Estimating Returns to Office in Post-War British Politics**. *American Political Science Review*. 103 (4): 513-533.
- Gilligan, Michael J. and Ernest J. Sergenti. 2008. **Do UN Interventions Cause Peace? Using Matching to Improve Causal Inference**. *Quarterly Journal of Political Science* 3 (2): 89-122.
- Sekhon, J., and R. Titiunik. 2012. **When Natural Experiments Are Neither Natural nor Experiments**. *American Political Science Review* 106(1): 35-57.
- Sen, Maya. 2014. **How Judicial Qualification Ratings May Disadvantage Minority and Female Candidates**. *Journal of Law and Courts*. 2 (1): 33-65.

### 3.3 Propensity Score Methods

- Identification, Propensity Score Estimation, Matching on the Propensity Score, Weighting on the Propensity Score, Reweighting methods

*Readings: Propensity Score Methods Theory*

- Morgan and Winship: Chapter 5. (★)
- Rubin: Chapters 10, 11 and 14 (all with Paul R. Rosenbaum).
- Imbens, Guido W. 2004. **Nonparametric Estimation of Average Treatment Effects under Exogeneity: A Review**. *Review of Economics and Statistics* 86 (1): 4-29.
- Hainmueller, Jens. 2012. **Entropy Balancing for Causal Effects: A Multivariate Reweighting Method to Produce Balanced Samples in Observational Studies**. *Political Analysis* 20 (1): 25-46.
- Glynn, Adam, and Kevin Quinn. 2010. **An Introduction to the Augmented Inverse Propensity Weighted Estimator**. *Political Analysis* 18(1): 36-56.

*Readings: Propensity Score Methods Applications*

- Rubin, Donald B. 2001. **Using Propensity Scores to Help Design Observational Studies: Application to the Tobacco Litigation**. *Health Services and Outcomes Research Methodology* 2 (3-4): 169-188.
- Blattman, Christopher. 2009. **From Violence to Voting: War and Political Participation in Uganda**. *American Political Science Review* 103 (2): 231-247.

### 3.4 Regression

- Agnostic Regression framework, Non-parametric Regression, Identification with Regression

#### *Readings*

- Angrist and Pischke: Chapter 3. (★)
- Morgan and Winship: Chapters 6-7. (★)
- Härdle, W and Linton, O. 1994. **Applied Nonparametric Methods**, in R. F. Engle and D. L. McFadden eds. *Handbook of Econometrics*, vol. 4. New York: Elsevier Science.
- White, H. 1980. **Using Least Squares to Approximate Unknown Regression Functions**. *International Economic Review* 21: 149-170.
- Hainmueller, J. and Hazlett, C. 2014. **Kernel Regularized Least Squares: Reducing Misspecification Bias with a Flexible and Interpretable Machine Learning Approach**. *Political Analysis* 22(2): 143-168. 2014.

### 3.5 Conclusion: Selection on Observables

- Can Non-Experimental Method Recover Causal Effects?

#### *Readings: Comparison of Experimental and Non-experimental Methods*

- Dehejia, Rajeev H. and Sadek Wahba. 1999. **Causal Effects in Non-Experimental Studies: Re-Evaluating the Evaluation of Training Programs**, *Journal of the American Statistical Association* 94 (448): 1053-1062.
- Heckman, James J., Hidehiko Ichimura and Petra Todd. 1998. **Matching as an Econometric Evaluation Estimator**, *Review of Economic Studies* 65: 261-294.
- Shadish, William R., M.H. Clark, and Peter M. Steiner. 2008. **Can Nonrandomized Experiments Yield Accurate Answers? A Randomized Experiment Comparing Random and Nonrandom Assignments**. *Journal of the American Statistical Association* 103 (484): 1334-1344. (★)
- Arceneaux, Kevin, Alan S. Gerber, and Donald P. Green. 2006. **Comparing Experimental and Matching Methods using a Large-Scale Voter Mobilization Experiment**. *Political Analysis* 14 (1): 1-36.
- John Concato, Nirav Shah, and Ralph Horwitz. 2000. **Randomized, Controlled Trials, Observational Studies, and the Hierarchy of Research Designs**. *New England Journal of Medicine* 342 (25): 1887-92.
- Benson, Kjell and Arthur J. Hartz. 2000. **A Comparison of Observational Studies and Randomized, Controlled Trials**. *New England Journal of Medicine* 342(25): 1878-86.

### 3.6 Sensitivity Analysis

- Nonparametric Bounds
- Formal sensitivity tests

#### *Readings*

- Guido W. Imbens. 2003. **Sensitivity to Exogeneity Assumptions in Program Evaluation**. *The American Economic Review* 93 (2): 126-32.
- Morgan and Winship: Chapter 12 (★)
- Rosenbaum, Paul R. 2002. *Observational Studies*. Springer-Verlag. 2nd edition. Chapter 4.

- Manski, Charles F. 1995. *Identification Problems in the Social Sciences*. Cambridge: Harvard University Press. Chapter 2.
- VanderWeele, Tyler J. , and Onyebuchi A. Arah. 2011. **Bias Formulas for Sensitivity Analysis of Unmeasured Confounding for General Outcomes, Treatments, and Confounders**. *Epidemiology* 22 (1): 42.
- Rosenbaum, Paul R. 2009. **Amplification of Sensitivity Analysis in Matched Observational Studies**. *Journal of the American Statistical Association* 104 (488): 1398-1405.

## 4 Causal Effects under Selection on Time-Invariant Characteristics

### 4.1 Difference-in-Differences Estimators

- Identification, Estimation, Falsification tests

*Readings: DID Theory*

- Angrist and Pischke: Chapter 5.2-5.4 (★)
- Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan. 2004. **How Much Should We Trust Differences-in-Differences Estimates?** *Quarterly Journal of Economics* 119 (1): 249-275.

*Readings: DID Applications*

- Lyall, Jason. 2009. **Does Indiscriminate Violence Incite Insurgent Attacks? Evidence from Chechnya**. *Journal of Conflict Resolution* 53 (3): 331-62.
- Card, David. 1990. **The Impact of the Mariel Boatlift on the Miami Labor Market**, *Industrial and Labor Relations Review* 44 (2): 245-257.
- Card, David. and Alan B. Krueger. 1994. **Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania,** *American Economic Review* 84 (4): 772-793.
- Bechtel, Michael M. and Jens Hainmueller. 2011. **How Lasting Is Voter Gratitude? An Analysis of the Short- and Long-Term Electoral Returns to Beneficial Policy**. *American Journal of Political Science* 55 (4): 852-868.

### 4.2 Panel Data Methods

- Fixed Effects and Random Effects Estimation

*Readings: Panel Methods Theory*

- Angrist and Pischke: Chapter 5.1 (★)
- Angrist and Pischke: Chapter 8 (★)
- Bai, Jushan. 2009. **Panel data models with interactive fixed effects**. *Econometrica* 77(4): 1229-1279.

*Readings: Panel Methods Applications*

- Ladd, Jonathan McDonald, and Gabriel S. Lenz. 2009. **Exploiting a Rare Communication Shift to Document the Persuasive Power of the News Media**. *American Journal of Political Science* 53 (2): 394-410. (★)
- Berrebi, Claude. and Esteban F. Klor. 2008. **Are Voters Sensitive to Terrorism? Direct Evidence from the Israeli Electorate**. *American Political Science Review* 102 (3): 279-301.

- Acemoglu, Daron, Simon Johnson, James A. Robinson, and Pierre Yared. 2008. **Income and Democracy**. *American Economic Review* 98 (3): 808-842.
- Hainmueller, Jens and Hangartner, Dominik. 2016. **Does Direct Democracy Hurt Immigrant Minorities? Evidence from Naturalization Decisions in Switzerland**. *American Journal of Political Science*.

### 4.3 Synthetic Control Methods (Optional)

#### *Readings*

- Abadie, Diamond, and Hainmueller. 2010. **Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program**. *Journal of the American Statistical Association* 105(490): 493-505.
- Abadie, Diamond, and Hainmueller. 2014. **Comparative Politics and the Synthetic Control Method**. *American Journal of Political Science*. 59(2): 495-510.
- Abadie, Alberto and Javier Gardeazabal. 2003. **The Economic Costs of Conflict: A Case Study of the Basque Country**. *American Economic Review* 92 (1). 113-132.

## 5 Causal Effects under Selection on Time-variant Characteristics

### 5.1 Instrumental Variables

- Identification: Using Exogenous Variation in Treatment Intake Given by Instruments
- Imperfect Compliance in Randomized Studies
- Wald Estimator, Local Average Treatment Effects, 2SLS

#### *Readings: Instrumental Variable Theory*

- Angrist and Pischke: Chapter 4 (★)
- Morgan and Winship: Chapter 8
- Morgan and Winship: Chapter 9 (★)
- Angrist, Joshua D., Guido W. Imbens, and Donald B. Rubin. 1996. **Identification of Causal Effects Using Instrumental Variables**. *Journal of the American Statistical Association* 91(434): 444-455.
- Abadie, Alberto 2003. **Semiparametric instrumental variable estimation of treatment response models**. *Journal of Econometrics* 113 (2003) 231-263.
- Gerber, Alan S., and Donald P. Green. 2012. *Field Experiments*. W. W. Norton. Chapters 5-6.
- Sovey, Allison J. and Donald P. Green 2011. **Instrumental Variables Estimation in Political Science: A Readers Guide**. *American Journal of Political Science* 55 (1): 188-200.

#### *Readings: Instrumental Variable Critique*

- Deaton, Angus. 2010. **Instruments, Randomization, and Learning About Development**. *Journal of Economic Literature* 48(2): 424-455.
- Hernan, Miguel A., and James M. Robins. 2006. **Instruments for Causal Inference: An Epidemiologist's Dream?** *Epidemiology* 17(4): 360-72.
- Imbens, Guido W. 2010. **Better LATE Than Nothing: Some Comments on Deaton (2009) and Heckman and Urzua (2009)**. *Journal of Economic Literature* 48(2): 399-423.

#### *Readings: Instrumental Variable Applications*

- Holger L. Kern and Jens Hainmueller **Opium for the Masses: How Foreign Free Media Can Stabilize Authoritarian Regimes**. *Political Analysis* (2009).
- Angrist and Krueger. 2001 **Instrumental Variables and the Search for Identification: From Supply and Demand to Natural Experiments**
- Acemoglu, Daron, Simon Johnson, and James A. Robinson. 2001. **The Colonial Origins of Comparative Development: An Empirical Investigation**. *American Economic Review* 91(5): 1369-1401.
- Clingingsmith, David, Asim Ijaz Khwaja, and Michael Kremer. 2009. **Estimating the Impact of the Hajj: Religion and Tolerance in Islam's Global Gathering**. *Quarterly Journal of Economics* 124(3): 1133-1170.
- Hidalgo, F. Daniel, Suresh Naidu, Simeon Nichter, and Neal Richardson. 2010. **Economic Determinants of Land Invasions**. *Review of Economics and Statistics* 92(3): 505-523.
- Angrist, Joshua D. 1990. **Lifetime Earnings and the Vietnam Era Draft Lottery: Evidence from Social Security Administrative Records**. *American Economic Review* 80(3): 313-336.

## 5.2 The Regression Discontinuity Design

- Sharp and Fuzzy Designs, Identification, Estimation, Falsification Checks

*Readings: RDD Theory*

- Imbens, Guido W., and Thomas Lemieux. 2008. **Regression Discontinuity Designs: A Guide to Practice**. *Journal of Econometrics* 142 (2): 615-35. (Part of special issue on RDD, all of which is of interest.) (★)
- Angrist and Pischke: Chapter 6 (★)
- Hahn, Jinyong, Petra Todd and Wilbert Van der Klaauw. 2001. **Identification and Estimation of Treatment Effects with a Regression Discontinuity Design**, *Econometrica* 69 (1): 201-209.

*Readings: RDD Applications*

- Eggers, Andrew, Fowler, Anthony, Hainmueller, Jens, Hall, Andrew B. and Snyder, James M. 2015. **On the Validity of the Regression Discontinuity Design for Estimating Electoral Effects: New Evidence from over 40,000 Close Races**. *American Journal of Political Science* 59(1): 259-274 (★).
- Hidalgo, F. Daniel. 2012. **Fraud or Enfranchisement? The Consequences of Electronic Voting for Political Representation in Brazil**. Working Paper.
- Lee, David S. 2008. **Randomized Experiments from Non-random Selection in U.S. House Elections**. *Journal of Econometrics* 142 (2): 675-697. (★)
- Hainmueller, Jens, and Holger Lutz Kern. 2008. **Incumbency as a Source of Spillover Effects in Mixed Electoral Systems: Evidence from a Regression- Discontinuity Design**. *Electoral Studies* 27: 213-27.
- Caughey, Devin, and Jasjeet Sekhon. 2011. **Elections and the Regression Discontinuity Design: Lessons From Close U.S. House Races, 1942-2008**. *Political Analysis* 19 (4): 385-408.
- Eggers, Andrew, Freier, Ronny, Grembi, Veronica and Nannicini, Tommaso. 2016. **Regression Discontinuity Designs Based on Population Thresholds: Pitfalls and Solutions**.
- Calonico, Sebastian, Cattaneo, Matias, and Titiunik, Rocio. 2014. **Robust Nonparametric Confidence Intervals for Regression-Discontinuity Designs** *Econometrica* 82(6): 2295-2326.
- Hainmueller, Jens, Hall, Andrew, and Snyder, James. 2015. **Assessing the External Validity of Election RD Estimates: An Investigation of the Incumbency Advantage** *Journal of Politics*. 77(3): 707-720.

- Hainmueller, Jens, Hangartner, Dominik, and Pierrantuono, Giuseppe. 2015. **Naturalization Fosters the Long-Term Political Integration of Immigrants**. *Proceedings of the National Academy of Sciences*. 112 (41) 12651-12656.
- Bertanha M, Imbens G. **External Validity in Fuzzy Regression Discontinuity Designs**. 2014. Working Paper.

## 6 Distributional Effects (Optional)

### 6.1 Quantile Regression

#### *Readings*

- Angrist and Pischke: Chapter 7 (★)
- Koenker, Roger and Kevin F. Hallock. 2001. **Quantile Regression**. *Journal of Economic Perspectives* 15 (4): 143-156(★)
- Bruenig, Christian and Brian D. Jones. 2011. **Stochastic Process Methods with an Application to Budgetary Data**. *Political Analysis* 19 (1): 103-117

### 6.2 Distributional Effects in Difference-in-Differences

#### *Readings*

- Athey, Susan and Guido W. Imbens. 2006. **Identification and Inference in Nonlinear Difference-in-Differences Models**. *Econometrica* 74 (2): 431–497.(★)

### 6.3 Instrumental Variables for Quantile Effects

#### *Readings*

- Abadie, Alberto, Joshua Angrist, and Guido Imbens. 2002. **Instrumental Variables Estimates of the Effect of Subsidized Training on the Quantiles of Trainee Earnings**. *Econometrica* 70 (1): 91–117.

# Model Based Inference

## Books

- Agresti, Alan. 2015. *Foundations of Linear and Generalized Linear Models*. Wiley. (Hereafter AA)
- Wasserman, Larry. 2013. *All of Statistics: A Concise Course in Statistical Inference*. Springer. (Hereafter AS)
- Wasserman, Larry. 2006. *All of Nonparametric Statistics* (Hereafter ANS)
- Degroot, Morris and Mark Schervish. Probability and Statistics
- Bertsekas, Dimitri P and Tsitsiklis, John. Introduction to Probability Theory
- Hastie, Tibshirani, and Friedman. 2009. *The Elements of Statistical Learning: Data Mining, Inference, and Prediction* 2nd edition. Springer. (Hereafter ES)

## 1 Likelihood Theory of Inference

- Likelihood curve/interpretation
- Asymptotic property of MLE estimates
- Invariance, Cramer-Rao Lower Bound

### *Required Readings*

- AS Chapter 9
- AA 4.1-4.4
- Degroot and Schervish 6.1-6.5

## 2 Generalized Linear Models

- Models for normally distributed outcomes
- Probit/Logit for binary choice
- Ordered probit, multinomial probit and multinomial logit
- Event count and survival analysis models
- Measures of model fit
- Likelihood ratio test and Wald Test

### *Required Readings*

- AA Chapter 4.4-4.6, 5, 6.1, 6.2, and 7
- AS Chapter 10.1-10.3, 10.6, 10.8



### 3 Machine Learning Methods

- LASSO
- Ridge
- Boosting/Bagging

#### *Required Readings*

- Elements of Statistical Learning, 3.4.1-3.4.2
- Hainmueller, Jens and Chad Hazlett. 2014. “Kernel Regularized Least Squares: Reducing Misspecification Bias with a Flexible and Interpretable Machine Learning Approach” *Political Analysis*. 22, 2. 143-168.

### 4 Nonparametric Estimation

- Density estimation
  - Bandwidth selection
  - nonparametric regression
- AS Chapter 6, 20
  - ANS Chapter 6
  - Beck, Nathaniel and Simon Jackman. 1998. “Beyond Linearity by Default: Generalized Additive Models”. *American Journal of Political Science* 42, 2. 596-627.