

### ECON 1152 and HKS SUP 135: Using Big Data to Solve Economic and Social Problems

Instructor: Professor Raj Chetty  
Email: [chetty@fas.harvard.edu](mailto:chetty@fas.harvard.edu)  
For appointments, contact Madeleine Marino:  
[mjmarino@g.harvard.edu](mailto:mjmarino@g.harvard.edu)

Head Section Leader: Gregory Bruich, Ph.D.  
Email: [gbruich@fas.harvard.edu](mailto:gbruich@fas.harvard.edu)  
Office: Littauer 113

#### Teaching Fellows:

Gregory Davis	<a href="mailto:gdavis@g.harvard.edu">gdavis@g.harvard.edu</a>
Pedro Gabriel Degiovanni	<a href="mailto:pedrodegiovanni@g.harvard.edu">pedrodegiovanni@g.harvard.edu</a>
Michael Droste	<a href="mailto:mdroste@fas.harvard.edu">mdroste@fas.harvard.edu</a>
Diana Goldemberg, Ph.D.	<a href="mailto:diana_goldemberg@g.harvard.edu">diana_goldemberg@g.harvard.edu</a>
Caroline Geiger	<a href="mailto:caroline_kelley@g.harvard.edu">caroline_kelley@g.harvard.edu</a>
Gru Han	<a href="mailto:gruhan@fas.harvard.edu">gruhan@fas.harvard.edu</a>
Hanno Hilbig	<a href="mailto:hhilbig@g.harvard.edu">hhilbig@g.harvard.edu</a>
Alejandro Lagomarsino	<a href="mailto:alagomarsino@g.harvard.edu">alagomarsino@g.harvard.edu</a>
John Macke	<a href="mailto:jmacke@g.harvard.edu">jmacke@g.harvard.edu</a>
Ian Nason	<a href="mailto:nason@g.harvard.edu">nason@g.harvard.edu</a>
Lena Shi	<a href="mailto:yulenashi@g.harvard.edu">yulenashi@g.harvard.edu</a>
Mikko Silliman	<a href="mailto:silliman@g.harvard.edu">silliman@g.harvard.edu</a>
Niharika Singh	<a href="mailto:niharikasinh@g.harvard.edu">niharikasinh@g.harvard.edu</a>
Tanggap Yuan, Ph.D.	<a href="mailto:tanggapyuan@g.harvard.edu">tanggapyuan@g.harvard.edu</a>

**Lectures:** Tuesday & Thursdays, 12-1:15 p.m in Sanders Theater, Memorial Hall, [45 Quincy Street](#)

**Sections:** 1 per week at times to be arranged. Sections will be divided into two groups: one for students with no prior coursework in statistics/econometrics and another intended for those who have taken courses in statistics/econometrics. You may choose which type of section you would like to attend depending upon your background. Kennedy School students must enroll in the more advanced section.

**Course Description:** This course will show how "big data" can be used to understand and solve some of the most important social and economic problems of our time. The course will give students an introduction to frontier research in applied economics and social science that does not require prior coursework in Economics. Topics include equality of opportunity, education, innovation and entrepreneurship, health care, climate change, and crime. In the context of these topics, the course will also provide an introduction to basic statistical methods and data analysis techniques, including regression analysis, causal inference, quasi-experimental methods, and machine learning. The course will include discussions with leading practitioners who will discuss how they use big data in real-world applications.

**Note:** This class (when taken for a letter grade) meets the writing elective requirement for the Economics concentration. It also is an approved economics elective for the Applied Math-Economics concentration. It satisfies the Empirical and Mathematical Reasoning general education requirement.

**Goals:** The course has three principal learning objectives: 1) to introduce students to frontier social science research on key social and economic issues, 2) to teach students how to analyze data using

modern quantitative methods and basic programming techniques, and 3) to show students to how practitioners are using data to analyze social problems.

**Academic Accommodations:** Students needing academic accommodations because of a documented disability must present their Faculty Letter from the Accessible Education Office (AEO) by Thursday, February 7.

**Grading:** Grades will be based on a midterm exam (30 percent), final exam (40 percent), four empirical projects (25 percent), and lecture attendance (5 percent). Graduating seniors who are finishing these this semester may choose to omit the midterm and have their grade based on the final exam (70 percent), empirical projects (25 percent), and lecture attendance (5 percent). See below for tentative dates for each of these assignments and exams.

**Schedule for Exams and Empirical Projects**

	<b>Assigned</b>	<b>Due</b>
Empirical Project 1	2/7	2/21
Empirical Project 2	2/21	3/7
Midterm	March 14 (in class)	
Empirical Project 3	4/4	4/18
Empirical Project 4	4/18	5/2
Final exam	May 13 (tentative)	

**Empirical Projects:** A key element of the course will be four empirical projects, which will give students hands-on experience in working with data. We recommend and will support using the statistical software program Stata for these projects, but students are welcome to use other programs (e.g., SPSS, R, Python), provided that their code and work is clearly documented. The empirical projects are designed to be more substantial than traditional problem sets and will include significant coding, reading, and writing elements that will give students a sense of how social scientists approach research.

**Lecture Attendance:** In the interest of fostering interaction and discussion, students are required to attend all lectures. If you are unable to make it to a lecture for a documented reason (e.g., an illness), you may request a recording of the lecture by emailing Gregory Bruich with documentation of the reason for your absence. Since guest discussants have generously offered their time to our class, student attendance will be taken when we have a guest. Students' grades will be partly based on attendance at those lectures (see above).

**Required readings.** Students are responsible for reading a small number of required papers, which appear in bold on the course reading list (starting on page 5 below). As we go along, we will let you know when each of the required readings should be done. The first reading should be done in the first week. Please focus on understanding the main ideas, rather than technical details. We recommend starting with non-technical summaries and introductions for this purpose.

**Collaboration Policy:** Discussion and the exchange of ideas are essential to academic work. You are encouraged to consult with your classmates on the empirical projects and to share sources. However, you should ensure that any work you submit for evaluation is the result of your own research and that it reflects your own approach to the topic. You must also adhere to standard citation practices and properly cite any books, articles, websites, lectures, etc. that have helped you with your work. If you received any help with your work (e.g., feedback on drafts, help with code or programming), you must also acknowledge this assistance. No collaboration of any kind is allowed during the midterm or final exam.

## Lectures

Num.	Topic	Selected Methods
<u>Part I: Equality of Opportunity</u>		
1	The Geography of Upward Mobility in America	correlation, regression
2	Causal Effects of Neighborhoods	quasi-experiments
3	Moving to Opportunity vs. Place-Based Approaches	experiments
4	The American Dream in Historical Perspective	distributional analysis
5	Upward Mobility, Innovation, and Economic Growth	propensity score reweighting
<u>Part II: Education</u>		
6	Higher Education and Upward Mobility	Bayes rule
7	The Causal Effect of Colleges	regression discontinuity
8	Primary Education	experiments
9	Teachers and Charter Schools	event study designs, competitive equilibrium
<u>Part III: Racial Disparities</u>		
10	Racial Disparities in Economic Opportunity	dynamic models and steady states
<u>Part IV: Health</u>		
11	Improving Health Outcomes	hazard models
12	The Economics of Health Care and Insurance	adverse selection
<u>Part V: Criminal Justice</u>		
13	Improving Judicial Decisions	machine learning
<u>Part VI: Climate Change</u>		
14	Effects of Air and Water Pollution	diff-in-differences, externalities
15	Policies to Mitigate Climate Change	discount rates, external validity
<u>Part VII: Tax Policy</u>		
16	Income Taxation	supply and demand models, synthetic controls
17	Behavioral Public Economics	behavioral economics
<u>Part VIII: Economic Development and Institutional Change</u>		
18	Institutions and Economic Development	historical data analysis

\*Note: the Spring 2019 course at Harvard included 5 guest lectures by external speakers, which are not included in the list above.

## Course Readings

Students are responsible for reading a small number of required papers (in bold below). Please focus on understanding the main ideas, rather than technical details. We recommend starting with non-technical summaries and introductions for this purpose. The other papers will be discussed in lecture, in section, or in the empirical projects, and may be useful references in those contexts.

### Part I: Equality of Opportunity

#### *Geography of Economic Mobility*

**Chetty, Raj, John Friedman, Nathaniel Hendren, Maggie R. Jones, and Sonya R. Porter. 2018.** “The Opportunity Atlas: Mapping the Childhood Roots of Social Mobility.” NBER Working Paper No. 25147. [Non-technical summary.](#)

Chetty, Raj, Nathaniel Hendren, Patrick Kline, and Emmanuel Saez. 2014. “Where Is the Land of Opportunity? The Geography of Intergenerational Mobility in the United States.” *Quarterly Journal of Economics* 29 (4): 1553–1623. [Non-technical summary.](#)

Chetty, Raj, Nathaniel Hendren, and Lawrence F. Katz. 2016. “The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment.” *American Economic Review* 106 (4): 855–902. [Non-technical summary](#)

Chetty, Raj, and Nathaniel Hendren. 2018. “The Impacts of Neighborhoods on Intergenerational Mobility I: Childhood Exposure Effects.” *Quarterly Journal of Economics* 133(3): 1107-1162. [Non-technical summary.](#)

#### *Historical Trends*

Autor, David H. 2014. “Skills, education, and the rise of earnings inequality among the ‘other 99 percent.’” *Science* 344(6186): 843-85.

Berman, Yonatan. 2019. “The Long Run Evolution of Absolute Intergenerational Mobility.” Working paper.

**Chetty, Raj, David Grusky, Maximilian Hell, Nathaniel Hendren, Robert Manduca, and Jimmy Narang. 2017.** “The Fading American Dream: Trends in Absolute Income Mobility Since 1940.” *Science* 356 (6336): 398-406. [Non-technical summary](#)

Goldin, Claudia and Lawrence Katz. 2010. *The Race Between Education and Technology* Belknap Press of Harvard University Press, Cambridge, Mass.

Piketty, Thomas and Emmanuel Saez. 2003. “Income Inequality in the United States, 1913-1998.” *Quarterly Journal of Economics* 118(1): 1-39.

Saez, Emmanuel and Gabriel Zucman. 2016. “Wealth Inequality in the United States since 1913: Evidence from Capitalized Income Tax Data.” *Quarterly Journal of Economics* 131(2): 519-578.

*Innovation, Mobility, and Growth*

Bell, Alex, Raj Chetty, Xavier Jaravel, Neviana Petkova, and John Van Reenen. 2019. “Who Becomes an Inventor in America? The Importance of Exposure to Innovation.” *Quarterly Journal of Economics*, forthcoming. [Non-technical summary](#).

Bian, Lin, Sarah-Jane Leslie, and Andrei Cimpian. 2017. “Gender Stereotypes about Intellectual Ability Emerge Early and Influence Children’s Interests.” *Science* 391 (6323): 389–91.

Part II: Education

*Higher Education*

Chetty, Raj, John N. Friedman, Emmanuel Saez, Nicholas Turner, and Danny Yagan. 2018. “Mobility Report Cards: The Role of Colleges in Intergenerational Mobility.” NBER Working Paper No. 24441. [Non-technical summary](#)

**Dynarski, Susan, C.J. Libassi, Katherine Micheltore, and Stephanie Owen. 2018. “Closing the Gap: The Effect of a Targeted, Tuition-Free Promise on College Choices of High-Achieving, Low-Income Students.” NBER Working Paper No. 25349**

Ekowo, Manuela and Iris Palmer. 2016. [The Promise and Peril of Predictive Analytics in Higher Education](#). New America Education Policy Program Report.

Hoxby, Caroline, and Sarah Turner. 2013. “Expanding College Opportunities for High-Achieving, Low Income Students.” *Stanford Institute for Economic Policy Research Discussion Paper*, no. 12-014: 1–57.

Zimmerman, Seth D. 2014. “The Returns to College Admission for Academically Marginal Students.” *Journal of Labor Economics* 32(4): 711-754.

*Primary Education*

Chetty, Raj, John N. Friedman, Nathaniel Hilger, Emmanuel Saez, Diane Whitmore Schanzenbach, and Danny Yagan. 2011. “How Does Your Kindergarten Classroom Affect Your Earnings? Evidence from Project STAR.” *Quarterly Journal of Economics* 126 (4): 1593–1660. [Non-technical summary](#).

Chetty, Raj, John N. Friedman, and Jonah E Rockoff. 2014. “Measuring the Impacts of Teachers I: Evaluating Bias in Teacher Value-Added Estimates.” *American Economic Review* 104 (9): 2593–2632. [Non-technical summary](#).

**Chetty, Raj, John N. Friedman, and Jonah E. Rockoff. 2011. “Measuring the Impacts of Teachers II: Teacher Value-Added and Student Outcomes in Adulthood.” *American Economic Review* 104 (9): 2633–79. [Non-technical summary](#).**

Fredriksson, Peter, Björn Öckert, and Hessel Oosterbeek. 2013. “Long-Term Effects of Class Size.” *Quarterly Journal of Economics* 128 (1): 249–85.

Reardon, Sean. 2016. “School Segregation and Racial Academic Achievement Gaps.” *Russell Sage Foundation Journal of the Social Sciences* 2 (5): 34–57.

Reardon, Sean, Demetra Kalagrides, and Kenneth Shores. 2016. "The Geography of Racial/ Ethnic Test Score Gaps." *CEPA Working Paper*, no. 16.

#### *Charter Schools*

Abdulkadiroğlu, Atila, Joshua D. Angrist, Susan M. Dynarski, Thomas J. Kane, and Parag A. Pathak. 2011. "Accountability and Flexibility in Public Schools: Evidence from Boston's Charters and Pilots." *Quarterly Journal of Economics* 126 (2): 699–748.

Dobbie, Will, and Roland G. Fryer. 2011. "Are High-Quality Schools Enough to Increase Achievement among the Poor? Evidence from the Harlem Children's Zone." *American Economic Journal: Applied Economics* 3 (3): 158–87.

### Part III: Racial Disparities

#### *Racial Disparities and Segregation*

**Chetty, Raj, Nathaniel Hendren, Maggie R. Jones, and Sonya R. Porter. 2018. "Race and Economic Opportunity in the United States: An Intergenerational Perspective." NBER Working Paper No. 24441. [Non-technical summary.](#)**

Fryer, Roland G., and Steven Levitt. 2004. "Understanding the Black-White Test Score Gap in the First Two Years of School." *Review of Economics and Statistics* 86 (2): 447-464.

Looney, Adam and Nicolas Turner. 2017. "[Work and Opportunity Before and After Incarceration.](#)" Economic Studies at The Brookings Institute Technical Report.

Pager, Devah. 2003. "The Mark of a Criminal Record." *American Journal of Sociology* 108(5): 937-975.

#### *Discrimination and Bias*

Abrams, David, Marianne Bertrand, and Sendhil Mullainathan. 2012. "Do Judges Vary in Their Treatment of Race?" *Journal of Legal Studies* 41 (2): 347–83.

**Bertrand, Marianne, and Sendhil Mullainathan. 2004. "Are Emily and Greg More Employable Than Lakisha and Jamal? A Field Experiment on Labor Market Discrimination." *American Economic Review* 94 (4): 991–1013.**

Eberhardt, Jennifer, Phillip Atiba Goff, Valerie J. Purdie, and Paul G. Davies. 2004. "Seeing Black: Race, Crime, and Visual Processing." *Journal of Personality and Social Psychology* 87(6): 876-893.

Edelman, Benjamin, Michael Luca, and Dan Svirsky. 2017. "Racial Discrimination in the Sharing Economy: Evidence from a Field Experiment." *American Economic Journal: Applied Economics* 9 (2): 1–22.

Glover, Dylan, Amanda Pallais, and William Pariente. 2017. "Discrimination as a Self-Fulfilling Prophecy: Evidence from French Grocery Stores." *Quarterly Journal of Economics* 132 (3): 1219-1260.

Stephens-Davidowitz, Seth. 2014. "The Cost of Racial Animus on a Black Candidate: Evidence using Google Search Data." *Journal of Public Economics* 118, 26-40.

## Part IV: Health

### *Improving Health Outcomes*

- Allcott, Hunt, Rebecca Diamond, Jean-Pierre Dubé, Jessie Handbury, Ilya Rahkovsky, and Molly Schnell. 2018. “Food Deserts and the Causes of Nutritional Inequality.” NBER Working Paper No. 24094.
- Bruich, Gregory A. 2014. “The effect of SNAP benefits on household expenditures and consumption: New evidence from scanner data and the November 2013 benefit cuts.” Harvard University working paper.
- Chetty, Raj, Michael Stepner, Sarah Abraham, Shelby Lin, Benjamin Scuderi, Nicholas Turner, Augustin Bergeron, and David Cutler. 2016. “The Association Between Income and Life Expectancy in the United States, 2001-2014.” *Journal of the American Medical Association* 315 (16): 1750–66. [Non-technical summary](#), [podcast discussion](#) with Raj Chetty and Angus Deaton, and [animated video](#).
- Hastings, Justine and Jesse Shapiro. 2018. “How are SNAP benefits spent? Evidence from a retail panel.” *American Economic Review* 108(12): 3493–3540.
- Hastings, Justine, Ryan Kessler, and Jesse Shapiro. 2018. “The effect of SNAP on the composition of purchased foods: Evidence and implications.” Brown University Working Paper.
- Lazer, David, Ryan Kennedy, Gary King, and Alessandro Vespignani. 2014. “The Parable of Google Flu: Traps in Big Data Analysis.” *Science* 343 (6167): 1203–5.**

### *The Economics of Health Care and Insurance*

- Baicker, Katherine, Sarah L. Taubman, Heidi L. Allen, Mira Bernstein, Jonathan H. Gruber, Joseph P. Newhouse, Eric C. Schneider, Bill J. Wright, Alan M. Zaslavsky, and Amy N. Finkelstein. 2013. “The Oregon Experiment — Effects of Medicaid on Clinical Outcomes.” *New England Journal of Medicine* 368: 1713–22. [Non-technical summary](#).
- Finkelstein, Amy N., Matthew Gentzkow, and Heidi Williams. 2016. “Sources of Geographic Variation in Health Care: Evidence from Patient Migration.” *Quarterly Journal of Economics* 131 (4): 1681–1726.
- Finkelstein, Amy, Nathaniel Hendren, and Mark Shepard. 2017. “Subsidizing Health Insurance for Low-Income Adults: Evidence from Massachusetts.” NBER Working Paper No. 23668. [Non-technical summary](#)**
- Taubman, Sarah L, Heidi L Allen, Bill J Wright, Katherine Baicker, and Amy N Finkelstein. 2014. “Medicaid Increases Emergency-Department Use: Evidence from Oregon’s Health Insurance Experiment.” *Science* 343 (6168): 263–68. [Non-technical summary](#).
- Wherry, Laura, Sarah Miller, Robert Kaestner, and Bruce Meyer. 2018. “Childhood Medicaid Coverage and Later Life Health Care Utilization.” *Review of Economics and Statistics* 100(2): 287-302.

## Part V: Criminal Justice

Heller, Sara B., Anuj K. Shah, Jonathan Guryan, Jens Ludwig, Sendhil Mullainathan, Harold A. Pollack. 2015. "Thinking, Fast and Slow? Some Field Experiments to Reduce Crime and Dropout in Chicago." NBER Working Paper No. 21178.

Hvistendahl, Mara. 2016. [Can 'Predictive Policing' Prevent Crime Before It Happens?](#) *Science News*.

James, Gareth, Daniela Witten, Trevor Hastie and Robert Tibshirani, "Tree-Based Methods," Chapter 8 in [An Introduction to Statistical Learning](#).

**Kleinberg, Jon, Himabindu Lakkaraju, Jure Leskovec, Jens Ludwig, and Sendhil Mullainathan. 2017. "Human Decisions and Machine Predictions." NBER Working Paper No. 23180.**

Kleinberg, John, Jens Ludwig, and Sendhil Mullainathan. 2016. [A Guide to Solving Social Problems with Machine Learning](#). *Harvard Business Review*.

Mohler, George, Martin Short, P. Jeffrey Brantingham, Frederick Schoenberg, and George Tita. 2011. "Self-Exciting Point Process Modeling of Crime." *Journal of the American Statistical Association* 106 (493): 100–108.

## Part VI: Climate Change

### *Effects of Air and Water Pollution*

Carleton, Tamma, and Solomon Hsiang. 2016. "Social and Economic Impacts of Climate." *Science* 353 (6304): 1112.

Dell, Melissa, Benjamin Jones, and Benjamin Olken. 2012. "Temperature Shocks and Economic Growth: Evidence from the Last Half Century." *American Economic Journal: Macroeconomics* 4(3): 66-95.

Giglio, Stefano, Matteo Maggiori, and Johannes Stroebel. 2015. "Very Long-Run Discount Rates." *Quarterly Journal of Economics* 130 (1): 1–53.

Isen, Adam, Maya Rossin-Slater, and W. Reed Walker. 2017. "Every Breath You Take - Every Dollar You'll Make: The Long-Term Consequences of the Clean Air Act of 1970." *Journal of Political Economy* 125(3): 848-909. [Non-technical summary](#).

Moore, Frances C., Nick Obradovich, Flavio Lehner, Patrick Baylis. 2019. "Rapidly Declining Remarkability of Temperature Anomalies May Obscure Public Perception of Climate Change." *Proceedings of the National Academy of Sciences*, 116(11): 4905–4910.

### *Policies to Mitigate Climate Change*

Allcott, Hunt, and Todd Rogers. 2014. "The Short-Run and Long-Run Effects of Behavioral Interventions: Experimental Evidence from Energy Conservation." *American Economic Review* 104(10): 3003–37.

Doyle, Joseph J., and Krislert Samphantharak. 2008. "\$2.00 Gas! Studying the Effects of a Gas Tax Moratorium." *Journal of Public Economics* 92 (3-4): 869–84.



Gallagher, Kelly Sims, and Erich Muehlegger. 2011. "Giving Green to Get Green? Incentives and Consumer Adoption of Hybrid Vehicle Technology." *Journal of Environmental Economics and Management* 61 (1):1–15.

**Ito, Koichiro. 2014. "Do Consumers Respond to Marginal or Average Price? Evidence from Nonlinear Electricity Pricing." *American Economic Review* 104 (2): 537–63.**

Li, Shanjun, Joshua Linn, and Erich Muehlegger. 2014. "Gasoline Taxes and Consumer Behavior." *American Economic Journal: Economic Policy* 6 (4): 302–42

Schultz, P. Wesley, Jessica M. Nolan, Robert B. Cialdini, Noah J. Goldstein, and Vidas Griskevicius. 2007. "The Constructive, Destructive, and Reconstructive Power of Social Norms." *Psychological Science* 18 (5): 429–34.

## Part VII: Tax Policy

### *Income Taxation*

Alesina, Alberto, Stefanie Stantcheva, and Edoardo Teso. 2018. "Intergenerational Mobility and Preferences for Redistribution." *American Economic Review* 108(2): 521–554

Chetty, Raj, Emmanuel Saez, and John Friedman. 2013. "Using Differences in Knowledge Across Neighborhoods to Uncover the Impacts of the EITC on Earnings." *American Economic Review*, 103(7): 2683-2721.

Chetty, Raj, Adam Looney, and Kory Kroft. 2009. "Salience and Taxation: Theory and Evidence," *American Economic Review* 99(4): 1145-77.

**Diamond, Peter and Emmanuel Saez. ["The Case for a Progressive Tax: From Basic Research to Policy Recommendations."](#) *Journal of Economic Perspectives* 25(4): 165–190.**

### *Savings and Wealth*

Chetty, Raj, John Friedman, Soren Leth-Petersen, Torben Nielsen, and Tore Olsen. 2014. "Active vs. Passive Decisions and Crowd-out in Retirement Savings Accounts: Evidence from Denmark," *Quarterly Journal of Economics* 129(3): 1141-1219. [Non-technical summary.](#)

Duflo, Esther, and Emmanuel Saez. 2003. "The Role of Information and Social Interactions in Retirement Plan Decisions: Evidence from a Randomized Experiment," *Quarterly Journal of Economics* 118: 815-842.

Madrian, Brigitte and Dennis Shea. 2001. "The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior." *Quarterly Journal of Economics* 116(4): 1149-1187.

## Part VIII: Economic Development and Institutional Change

Acemoglu, Daron, and James Robinson. 2008. [The Role of Institutions in Growth and Development.](#) Commission on Growth and Development Working Paper No. 10.

Asher, Sam, Paul Novosad, and Charlie Rafkin. 2019. "Intergenerational Mobility in India: Estimates from New Methods and Administrative Data." Dartmouth Working Paper.

Banerjee, Abhijit, and Esther Duflo. 2012. [\*Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty\*](#). PublicAffairs

**Dell, Melissa. 2010. "The Persistent Effects of Peru's Mining Mita." *Econometrica* 78(6): 1863-1903.**

Dell, Melissa, Nathan Lane, and Pablo Querubin. 2019. "The Historical State, Local Collective Action, and Economic Development in Vietnam." *Econometrica*, forthcoming.

Miguel, Edward Michael Kremer. 2004. "Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities." *Econometrica* 72(1): 159-217.

Muralidharan, Karthik and Venkatesh Sundararaman. 2011. "Teacher Performance Pay: Experimental Evidence from India." *Journal of Political Economy* 119(1): 39-77.

#### Statistics References

Angrist, Joshua D. and Jörn-Steffen Pischke. *Mastering 'Metrics: The Path from Cause to Effect*. Princeton: Princeton University Press, 2015.

Mullainathan, Sendhil and Jan Spiess. 2017. "[Machine Learning: An Applied Econometric Approach.](#)" *Journal of Economic Perspectives* 31 (2): 87-106.

Stock, James H. and Mark W. Watson. *Introduction to Econometrics*. 4th Edition. Boston: Pearson, 2018. Note: earlier editions and all international editions printed in English are acceptable.

#### Stata Resources

Stata is available for [download from FAS IT](#).

Introduction to Stata and R for Economists: <https://canvas.harvard.edu/courses/19323>

Stata's Base Reference Manual: <http://www.stata.com/bookstore/base-reference-manual/>

The Stata Blog: <https://blog.stata.com/>

UW-Madison SSCC <http://www.ssc.wisc.edu/sscc/pubs/sfs/home.htm>