Department of Economics
Opportunity Insights

Harvard University

DRAFT SPRING 2024 SYLLABUS – SUBJECT TO CHANGE

ECON 50 / HKS SUP 135

Using Big Data to Solve Economic and Social Problems

Professor Raj Chetty
Email: chetty@opportunityinsights.org
Office: Opportunity Insights, 1280 Mass Ave.

Course Head: Gregory Bruich, Ph.D.
Email: gbruich@fas.harvard.edu
Office: Littauer Center 113

LECTURES Mondays and Wednesdays, 1:30-2:45 p.m. in Sanders Theater, 45 Quincy Street

LABS One per week. You will select your lab time when you register for the course. Labs will take place in Harvard Hall 201 and Harvard Hall 202.

COURSE DESCRIPTION

Economics 50 will show how "big data" can be used to understand and address some of the most important social and economic problems of our time. The course will give students an introduction to frontier research and policy applications in economics and social science in a non-technical manner that does not require prior coursework in economics or statistics, making it suitable both for students exploring economics for the first time, as well as for more advanced students. The course will include discussions with leading researchers and practitioners, who use big data in real-world applications.

Topics include equality of opportunity, education, racial disparities, innovation and entrepreneurship, health care, climate change, criminal justice, tax policy, and poverty in developing countries. In the context of these topics, the course will provide an introduction to basic methods in data science, including regression, causal inference, and machine learning. In empirical projects and weekly labs, students will work with real data to learn how the methods discussed in the course can be implemented in practice.

INSTRUCTORS

Raj Chetty is the William A. Ackman Professor of Economics at Harvard. Raj's current research, in collaboration with his Opportunity Insights research team, focuses on equality of opportunity: how can we given children from disadvantaged backgrounds the best chances of succeeding? Raj got his AB from Harvard in 2000 (where he lived in Hurlbut Hall as a first-year and then Pforzheimer House) and Ph.D. in 2003.

Gregory Bruich is a Lecturer in the Department of Economics at Harvard. He received his Ph.D. from the Department of Economics at Harvard University and his BA and BS from UC-Berkeley (where he took courses and worked with Raj). His research has focused on topics such as the impact of food stamp benefits on consumption and disability insurance on labor supply. In addition to Economics 50, he also teaches undergraduate and Ph.D.-level econometrics classes at Harvard. He is the Department of Economics' Concentration Adviser for Dunster House and Mather House.

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COURSE 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 how practitioners are using data to analyze social problems.

PEDAGOGICAL APPROACH

We seek to teach economics like a laboratory science, showing students how to *do* economics rather than presenting lectures about long-established results. Our approach draws inspiration from research on best practices in teaching in other settings. Mehta and Fine (2019) compared teaching practices across high school courses and found that in the most effective classes, *"rather than touring students through the textbook, teachers invited students to participate in the authentic work of the field….For example, a skillful science teacher in a high-poverty-district high school offered a course in which her students designed, researched, carried out and wrote up original experiments."* We seek to apply this approach to teaching introductory empirical economics by discussing frontier research in lectures and having students engage in research themselves in labs and empirical projects. This is a work in progress, and we welcome your feedback on how we can improve this class as we teach the course at Harvard and also seek to support this approach at other colleges and high schools.

STUDENT ENGAGEMENT

Although this is a large course, we are eager to provide as personalized and hands-on a learning experience to each student as possible, through several avenues:

- **OFFICE HOURS:** For office hours with the teaching fellows, there is a Google calendar on the course website where all the regular office hours and extra office hours times and locations will be posted.

  Professor Chetty will host office hours on most Mondays from 3-4 p.m. at Opportunity Insights. To attend, please email his Executive Assistant at chetty_ea@opportunityinsights.org with a brief description of what you'd like to discuss.

- **SLACK***:* We encourage you to ask questions on Slack and teaching fellows will respond on the site. This is valuable because other students often have the same question that you do and will benefit from seeing your interaction with your teaching fellow. Of course, feel free to email TFs directly as well if you prefer not to post your question publicly.

- **INFORMAL LUNCHES/DINNERS***:* Subject to COVID-19 precautions and protocols, Professor Chetty and his research team at Opportunity Insights will host a small number of lunches/dinners with students to facilitate more informal interactions. There will be a sign-up form available after the semester begins.

SIMULTANEOUS ENROLLMENT

The class has been approved by the Office of Undergraduate Education for a waiver from the usual simultaneous enrollment petition process. Students are allowed to simultaneously enroll in Economics 50 and another class that meets during the lecture times Mondays and Wednesdays 1:30-2:45 p.m. The lectures will be recorded. In-person attendance at a weekly lab is required. An alternative seating of the midterm exam will be available to accommodate students who are simultaneously enrolled in another course. The alternative seating will take place in the evening.

GENERAL EDUCATION, CERTIFICATE FOR CIVIC ENGAGEMENT, AND OTHER CREDIT

This class satisfies the Quantitative Reasoning with Data (QRD) general education requirement and has been approved for Harvard College's Certificate for Civic Engagement. This class (when taken for a letter grade) meets the writing elective requirement for the Economics concentration. For the Social Studies concentration, Economics 50 can fulfill either the economics or statistics requirement, but not both. It also is an approved economics elective for the Applied Math-Economics concentration and the Economics Secondary Field. It counts as a Related Course for the Statistics Concentration. It counts towards the Technology and Governance Requirement for the Government Department's Tech Science program.

This class is intended to complement Econ 10a/b by focusing on statistical methods and showing students how to apply the tools of economics using modern data science techniques.

LABS

The laboratory component of the class is designed to give you hands-on experience *doing* economics yourself by working through empirical problems with your peers and teaching fellows. Each lab will consist of a pre-recorded video and/or reading to be completed *before* lab, and a coding exercise to be completed *during* lab. Please bring your computer.

The labs are structured as "hackathons," whereby students are invited to complete their lab assignments in-class under the supervision and guidance of instructors (i.e., as opposed to a model in which students merely "learn about" how to complete their assignment during class, but then must do it at home, alone). Our goal is to lower the barriers for all students by having many teaching fellows, course assistants, and peers on hand to provide help.

EMPIRICAL PROJECTS

A key learning element of the course will be empirical projects. The empirical projects are more substantial than traditional problem sets and will include significant coding, reading, and writing elements that will put students in the shoes of social scientists doing research. Labs will be structured to provide the tools necessary to solve the empirical projects, and support will be provided so that coding skill is not a hindrance to achieving success on the projects.

We will teach and support the statistical software programs Stata and R/R Studio, but students are welcome to use other programs (e.g., SAS, SPSS, Python), provided that their code and work is clearly documented. Stata is the software of choice for most economists and is recommended for students with no prior experience with any other statistical software programs. For FAS students, Stata 18 is available for download. For non-FAS students, a 6 month student license can be purchased for $48.

LECTURE AND LABORATORY ATTENDANCE

In the interest of fostering interaction and discussion, students are expected to attend all lectures, unless they are simultaneously enrolled in another class. Since guest lecturers 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 guest lectures (see below). An alternative assignment will be available so that students who are unable to attend, including simultaneously enrolled students, can still receive the attendance points.

In-person attendance in the laboratory component of the course is required. Because of space and staffing constraints, students are required to attend their registered lab. The laboratory component of the course grade will be partly based on attendance (see below).

READINGS

There is no textbook for the course because the material is based entirely on recent research papers, mostly written within the past few years. Students are responsible for reading a small number of research papers, which appear in bold on the course reading list 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 of research papers for this purpose.

GRADING

Grades will be based on a midterm exam (25 percent), final exam (25 percent), empirical projects (30 percent), lab assignments and lab attendance (15 percent), and guest lecture attendance (5 percent). The midterm exam will take place on March 20. The final exam will take place during exam period: May 2-May 11, as assigned by the FAS Registrar. Students should not make travel plans before May 11 until the date of the final is finalized by the FAS Registrar. The class follows the FAS Registrar's policies and procedures for exams. Students who are unwell on the day of their exam should follow the process outlined in the Student Handbook (p. 40)

The distribution of grades in this course will be similar to other large General Education courses at Harvard.

PASS/FAIL: Harvard College students may opt to change grading option from letter graded to pass/fail. In order to receive a pass, students are expected to complete all course requirements by the date and time that they are due. Please complete the Grading Basis Change Request Form electronically. Please feel free to submit the online petition to change the grading option at any time. Please note that due to the volume of petitions, all the petitions will be processed during the fourth week of the semester even if they are submitted earlier.

CROSS REGISTRATION: The course is open to students from other faculties and from MIT and other schools with whom Harvard has cross-registration agreements. In general, cross registered students are expected to follow all the Harvard rules and schedules, including term start and end times, and the College's Spring Recess schedule. Please make sure to look at the Registrar's website for an overview of the Spring semester dates before cross-registering. Students wishing to cross-register in Economics 50 (FAS) should refer to these instructions. Students wishing to cross-register in SUP 135 (HKS) should refer to these instructions. You must submit a petition to add the class and receive

instructor and registrar approval. Please refer to this guide (especially step 8). Note that HKS students are first allowed to enroll in classes before students who are cross-registering from other schools. As a result, registrar approval for cross-registrant enrollment does not take place for the HKS class listing before January 24. Although you will not be able to officially enroll before then, you should still attend class on Monday January 22 and Wednesday January 24. If you later choose to drop the class, note that you must also write to the HKS and/or FAS registrar because they must remove you from the roster manually. Please note that Harvard School of Public Health (HSPH) graduate students should only enroll in the HKS SUP 135 class listing, due to program requirements. Other students should consult with their home departments.

ACADEMIC ACCOMMODATIONS: Harvard University values inclusive excellence and providing equal educational opportunities for all students. Our goal is to remove barriers for disabled students related to inaccessible elements of instruction or design in this course. If reasonable accommodations are necessary to provide access, please contact the Disability Access Office (DAO). Accommodations do not alter fundamental requirements of the course and are not retroactive. Students should request accommodations as early as possible, since they may take time to implement. Students should notify DAO at any time during the semester if adjustments to their communicated accommodation plan are needed.

COLLABORATION POLICY: Discussion and the exchange of ideas are essential to academic work. You are encouraged to consult with your classmates on the labs and empirical projects and to share sources. However, you must write up your answers individually in your own words based on your own understanding. You must ensure that all work you submit for evaluation is the result of your own research and writing and that it reflects your own approach to the topic. Note that this policy also precludes the submission of solutions generated by generative artificial intelligence (AI) tools like Google Bard or ChatGPT as your own. Moreover, simply re-phrasing words generated by another person or by AI is also not allowed. Further, you may not share your code or answers with other students. You must also adhere to standard citation practices in this discipline and properly cite any books, articles, websites, lectures, etc. that have helped you with your work. If you received any help with your assignments (e.g., feedback on drafts, help with code in office hours), you must also acknowledge this assistance. No collaboration of any kind is allowed during the midterm exam or the final exam.

GENERATIVE ARTIFICIAL INTELLIGENCE POLICY: See the course Collaboration Policy above as it pertains to the use of generative artificial intelligence (AI). Because generative AI tools, such as ChatGPT and Google Bard, are changing rapidly, the course generative AI policy may be updated during the spring 2024 semester. We draw your attention to the fact that different classes at Harvard could implement different AI policies, and it is the student's responsibility to conform to expectations for each course.

LATE WORK POLICY: All assignments must be submitted to Gradescope by the date and time that they are due. Assignments submitted late, but before solutions are posted or before graded work is returned to the class will be marked down by 50%. Assignments submitted after solutions are posted or after graded work is returned to the class will receive no credit. Please note that assignments cannot be submitted via email, and any assignments submitted over email will not be accepted.

ACADEMIC INTEGRITY: You are expected to uphold the Harvard College honor code and abide by the other University policies on academic honesty and integrity as given in the Harvard College Handbook for Students. As required by the College, all instances of suspected cheating will be referred to the Administrative Board.

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SELECTED TOPICS (subject to change)

Date	Num.	Topic	Selected Methods
Part I: Equality of Opportunity			
1/22	1	The Geography of Upward Mobility in America	correlation, regression
1/24	2	The Moving to Opportunity Experiment	potential outcomes, experiments
1/29	3	Causal Effects of Neighborhoods and Characteristics of High-Mobility Areas	quasi-experiments
1/31	4	Social Capital and Economic Mobility	network data, multivariate regression
2/5	5	Policies to Increase Upward Mobility	lotteries
2/7	6	Housing Stability and Evictions	[Guest Lecture: Alan Cohen]
2/12	7	Economic Mobility: Historical and International Perspectives	distributional analysis
2/14	8	Upward Mobility, Innovation, and Growth	propensity score reweighting
2/19		*No class - Presidents' Day*	
Part II: Education			
2/21	9	Higher Education and Upward Mobility	regression discontinuity
2/26	10	Admission to Highly Selective Private Colleges	multiple-rater research design
2/28	11	Improving Upward Mobility through the Higher Education System	
3/4	12	Primary Education	experiments
3/6	13	Teachers and Charter Schools	event study designs, competitive equilibrium
March 11-15 Spring Break - no class			
3/18	14	Empirical Methods	
3/20	15	**Midterm Exam**	
Part III: Racial Disparities & Criminal Justice			
3/25	16	Racial Disparities in Economic Opportunity	dynamic models and steady states
3/27	17	Measuring Implicit Bias	implicit association test
4/1	18	An Algorithmic Approach to Reducing Racial Disparities in Pain	[Guest Lecture: Emma Pierson]
4/3	19	Bias in Algorithms	label choice
4/8	20	Improving Judicial Decisions	machine learning
Part IV: Health			
4/10	21	Improving Health Outcomes	hazard models
4/15	22	The Economics of Health Care and Insurance	adverse selection

Part V: Climate Change

4/17	23	The Economics of the Global Energy Challenge	[Guest Lecture: Michael Greenstone]
4/22	24	Effects of Air and Water Pollution	diff-in-differences, externalities
4/24	25	Policies to Mitigate Climate Change	discount rates, external validity

April 25-May 1 reading period
May 2-May 11 final exam period

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 labs, or in the empirical projects, and may be useful references in those contexts.

Part I: Equality of Opportunity

Geography of Economic Mobility

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

Alesina, Alberto, Sebastian Hohmann, Stelios Michalopoulos, Elias Papaioannou. 2021. "Intergenerational Mobility in Africa." *Econometrica* 89(1): 1-35.

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.

The Moving to Opportunity Experiment

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

Ludwig, Jens, Greg J. Duncan, Lisa A. Gennetian, Lawrence F. Katz, Ronald C. Kessler, Jeffrey R. Kling, and Lisa Sanbonmatsu. 2012. "Neighborhood Effects on the Long-Term Well-Being of Low-Income Adults." *Science* 331(6101): 1505-1510.

Pollack, Craig E., Amanda L. Blackford, Shawn Du, Stefanie Deluca, Rachel J.L. Thornton, and Bradley Herring. 2019. "Association of Receipt of a Housing Voucher With Subsequent Hospital Utilization and Spending." *Journal of the American Medical Association* 322(21): 2115-2124.

Causal Effects of Neighborhoods

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.

Chyn, Eric and Lawrence F. Katz. 2021. "Neighborhoods Matter: Assessing the Evidence for Place Effects." *Journal of Economic Perspectives* 35(4): 197–222.

Social Capital

Chetty, Raj, Matthew O. Jackson, Theresa Kuchler, Johannes Stroebel, et al. 2022. "Social Capital I: Measurement and Associations with Economic Mobility." *Nature* 608(7921): 108-121. Non-technical summary

Chetty, Raj, Matthew O. Jackson, Theresa Kuchler, Johannes Stroebel, et al. 2022. "Social Capital II: Determinants of Economic Connectedness." *Nature* 608(7921): 122-134. Non-technical summary

Putnam, Robert. 2000. *Bowling Alone: The Collapse and Revival of American Community*. Simon and Schuster.

Putnam, Robert. 2016. *Our Kids: The American Dream in Crisis*. Simon and Schuster.

Social Networks and Peer Effects

Aral, Sinan and Christos Nicolaides. 2017. "Exercise Contagion in a Global Social Network." *Nature Communications* 8(14753).

Bailey, Michael, Drew Johnston, Theresa Kuchler, Johannes Stroebel, and Arlene Wong. 2022. "Peer Effects in Product Adoption." *American Economic Journal: Applied Economics* 14(3): 488–526.

Christakis, Nicholas A., and James H. Fowler. 2007. "The spread of obesity in a large social network over 32 years." *New England Journal of Medicine* 357 (4), 370–379.

Sacerdote, Bruce I. 2001. "Peer Effects with Random Assignment: Results for Dartmouth Roommates." *Quarterly Journal of Economics* 116(2): 681-704.

Policies to Improve Upward Mobility

Bergman, Peter, Raj Chetty, Stefanie DeLuca, Nathaniel Hendren, Lawrence F. Katz, and Christopher Palmer. 2019. "Creating Moves to Opportunity: Experimental Evidence on Barriers to Neighborhood Choice," NBER Working Paper No. 26164. Non-technical summary

Dobbie, Will, and Roland G. Fryer Jr. 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.

Housing Stability and Evictions

Collinson, Rob, John Eric Humphries, Nick Mader, Davin Reed, Daniel Tannenbaum, and Winnie van Dijk. 2022. "Eviction and poverty in American Cities: Evidence from Chicago and New York," NBER Working Paper No. 30382.

Graetz, Nick, Carl Gershenson, Peter Hepburn, Sonya R. Porter, Danielle H. Sandlerand, and Matthew Desmond. 2023. "A comprehensive demographic profile of the US evicted population." *Proceedings of the National Academy of Science*s 120(41): 1-6.

Gromis, Ashley, Ian Fellows, James R. Hendrickson, Lavar Edmonds, Lillian Leung, Adam Porton, and Matthew Desmond. 2023. "Estimating eviction prevalence across the United States." *Proceedings of the National Academy of Sciences* 119(21): 1-8.

Historical Trends

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

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

Deming, David J. 2017. "The Growing Importance of Social Skills in the Labor Market." *Quarterly Journal of Economics* (132)4: 1593–1640.

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

Hendren, Nathaniel, and Ben Sprung-Keyser. 2020. "A Unified Welfare Analysis of Government Policies." *Quarterly Journal of Economics* 135(3): 1209–1318.

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.

International Comparisons

Alesina, Alberto, Sebastian Hohmann, Stelios Michalopoulos, Elias Papaioannou. 2021. "Intergenerational Mobility in Africa." *Econometrica* 89(1): 1-35.

Atlas de Oportunidades. 2020. Article in *El País*.

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

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

Britto, Diogo G. C., Alexandre Fonseca, Paolo Pinotti, Breno Sampaio, and Lucas Warwar. 2022. "Intergenerational Mobility in the Land of Inequality: Estimates for Brazil." IZA Discussion Paper No. 1561.

Manduca, Robert, Maximilian Hell, Adrian Adermon, Jo Blanden, Espen Bratberg, Anne C. Gielen, Hans van Kippersluis, Keun Bok Lee, Stephen Machin, Martin D. Munk, Martin Nybom, Yuri Ostrovsky, Sumaiya Rahman, Outi Sirniö. 2020. "Trends in Absolute Income Mobility in North America and Europe." IZA Discussion Paper No. 13456.

van der Weide, Roy, Christoph Lakner, Daniel Gerszon Mahler, Ambar Narayan, and Rakesh Gupta. 2024. "Intergenerational mobility around the world: A new database," *Journal of Development Economics* 166 (2024) 103167.

World Bank. 2023. "Chapter 3 Expanding opportunities: A map for equitable growth in South Asia," in *Expanding Opportunities: Toward Inclusive Growth. South Asia Economic Focus*. World Bank, Washington, DC

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* 134(2): 715–783. 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

Bleemer, Zachary. 2021. "Top Percent Policies and the Return to Postsecondary Selectivity." Working Paper.

Bleemer, Zachary and Aashish Mehta. 2021. "Will Studying Economics Make You Rich? A Regression Discontinuity Analysis of the Returns to College Major." *American Economic Journal: Applied Economics*, forthcoming.

Chetty, Raj, John N. Friedman, Emmanuel Saez, Nicholas Turner, and Danny Yagan. 2020. "Income Segregation and Intergenerational Mobility Across Colleges in the United States." *Quarterly Journal of Economics* 135(3): 1567–1633. Non-technical summary

Chetty, Raj, David J. Deming, and John N. Friedman. 2023. "Diversifying Society's Leaders? The Determinants and Causal Effects of Admission to Highly Selective Private Colleges." NBER Working Paper No. 31492. Non-technical summary. HKS Policycast podcast discussion with Raj Chetty and David Deming.

DeLuca, Stefanie, Nicholas W. Papageorge, Joseph L. Boselovic, Seth Gershenson, Andrew Gray, Kiara M. Nerenberg, Jasmine Sausedo, and Allison Young. 2021. "'When Anything Can Happen': Anticipated Adversity and Postsecondary Decision-Making." NBER Working Paper No. 29472.

Dynarski, Susan, C.J. Libassi, Katherine Michelmore, 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. Non-technical summary.

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.

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, S. F., Ho, A. D., Shear, B. R., Fahle, E. M., Kalogrides, D., Jang, H., Chavez, B., Buontempo, J., & DiSalvo, R. (2019). Stanford Education Data Archive (Version 3.0). https://edopportunity.org/

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 & Criminal Justice

Racial Disparities and Segregation

Chetty, Raj, Nathaniel Hendren, Maggie R. Jones, and Sonya R. Porter. 2020. "Race and Economic Opportunity in the United States: An Intergenerational Perspective." *Quarterly Journal of Economics* 135(2): 711–783. Non-technical summary

Derenoncourt, Ellora, Chi Hyun Kim, Moritz Kuhn, and Moritz Schularick. 2022. "Wealth of two nations: The U.S. racial wealth gap, 1860-2020." working paper.

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

Banaji, Mahzarin and Anthony Greenwald. 2013. *Blindspot*, Delacorte Press.

Charlesworth, Tessa E. S. and Mahzarin R. Banaji. 2019. "Patterns of Implicit and Explicit Attitudes: I. Long-Term Change and Stability From 2007 to 2016." *Psychological Science* 30(2) 174–192.

Charlesworth, Tessa E. S. and Mahzarin R. Banaji. 2022. "Patterns of Implicit and Explicit Attitudes: III. Long-Term Change in Gender Stereotypes." *Social Psychological and Personality Science* 13(1): 14–26.

Charlesworth, Tessa E. S. and Mahzarin R. Banaji. 2022. "Persistence and Responsiveness in Attitude Change from 2007-2020." *Psychological Science*, forthcoming.

Caliskan, Aylin, Joanna J. Bryson, and Arvind Narayanan. 2017. "Semantics derived automatically from language corpora contain human-like biases," *Science* 356(6334): 183-186.

von der Malsburg, Titus, Till Poppels, and Roger P. Levy. 2020. "Implicit Gender Bias in Linguistic Descriptions for Expected Events: The Cases of the 2016 United States and 2017 United Kingdom Elections," *Psychological Science* 31(2): 115–128.

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.

Wolgast, Sima, Martin Bäckström, and Fredrik Björklund. 2017. "Tools for fairness: Increased structure in the selection process reduces discrimination." *PLOS ONE* 12(12): e0189512.

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Stata Resources

For FAS students, Stata 18 is available for download from FAS IT. For students from other departments and faculties, Stata 18 is available for purchase at a reduced price for students.

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