Using Big Data to Solve Economic and Social Problems

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Stanford University, Spring 2017

**Format:** This course consists of eleven (11) one hour and twenty minute lectures delivered at Stanford University in Spring 2017 (Economics 45).

**Description:** This introductory course shows how "big data" can be used to understand and solve some of the most important social and economic problems of our time. The course gives students an introduction to frontier research in applied economics and social science that does not require prior coursework in Economics or Statistics. Topics include equality of opportunity, education, health, the environment, and criminal justice. In the context of these topics, the course provides an introduction to basic statistical methods and data analysis techniques, including regression analysis, causal inference, quasi-experimental methods, and machine learning.

When taught at Stanford in 2017, the course also included guest lecturers David Leonhardt, Alex Laskey, Jini Kim, Sendhil Mullainathan, and Matthew Gentzkow, who discussed real-world applications of data science; these guest lectures are not included in the online version.

**Goals:** The course has three principal learning objectives: 1) to introduce students to frontier social science research on key social and economic issues in the United States, 2) to teach students how to understand and analyze quantitative data, and 3) to show students how practitioners use “big data” to analyze social problems.

**Prerequisites:** None. Some prior background in statistics is recommended but not required.

**Acknowledgements:** I am indebted to Rebecca Toseland, the Head Section Leader for the course, for her assistance in helping prepare course materials and organize the class and to the Equality of Opportunity Project research team for developing much of the content in these lectures.
Course Outline

Part I: Equality of Opportunity

1  Introduction and the Geography of Upward Mobility
2  Policies to Improve Upward Mobility
3  Opportunity, Innovation, and Economic Growth

Part II: Education

4  Higher Education
5  Primary Education
6  Do Charter Schools Work?

Part III: Health

7  Improving Health Outcomes
8  The Economics of Health Care and Insurance

Part IV: Environment

9  Social Costs of Climate Change and Pollution
10 Policies to Mitigate Climate Change

Part V: Justice

11 Criminal Justice and Discrimination
Reading List

Part I: Equality of Opportunity

1 - Introduction and the Geography of Upward Mobility


* Non-technical summary “The Impacts of Neighborhoods on Intergenerational Mobility”

Optional Reading


2 - The Geography of Upward Mobility cont’d and Policies to Improve Upward Mobility


*Non-technical summary “The Fading American Dream: Trends in Absolute Income Mobility Since 1940.”

Optional Reading


3 - Opportunity, Innovation, and Economic Growth


Optional Reading


Part II: Education

4 – Higher Education


Optional Reading


5 - Primary Education


*Non-technical summary “Measuring the Impacts of Teachers I: Evaluating Bias in Teacher Value-Added Estimates.”


Optional Reading


**Guest Lecture #1: David Leonhardt, Columnist & Founding Editor of The Upshot, The New York Times**

David Leonhardt is an Op-Ed columnist for The New York Times. David was previously the Washington bureau chief and the founding editor of *The Upshot*, a Times website covering politics and policy. In 2011, he received the Pulitzer Prize for commentary, for his columns on the financial crisis and its aftermath. As a staff writer for The Times Magazine, he won the Gerald Loeb Award in 2009 for the story, “*Obamanomics*.” He is the author of the best-selling *e*-book, “Here’s the Deal: How Washington Can Solve the Deficit and Spur Growth.”

6 – Do Charter Schools Work?


**Optional Reading**


Part III: Health

7 – Improving Health Outcomes


Optional Reading


8 - The Economics of Health Care and Insurance


* Non-technical summary “Subsidizing Health Insurance for Low-Income Adults: Evidence from Massachusetts and Implications for Future Health Reforms”

*Non-technical summary of research on the Oregon Health Insurance Experiment.


Optional Reading


**Guest Lecture #2: Jini Kim, Founder & CEO, Nuna**

**Jini Kim** is the Founder and CEO of [Nuna](http://www.nuna.com), a healthcare technology startup that works with both public and private sector partners to understand and improve how people use healthcare. She took a leave of absence from Nuna to participate in the “tech surge” that saved the Healthcare.gov site, work that led to a *TIME magazine cover story* by Steven Brill. Kim was previously a product manager at Google Health, tasked with determining Google’s strategy in genomics. Her work led to the funding of research labs and startups in genetic sequencing and large database work on genotypic/phenotypic associations. In addition, Kim was the product manager of the Go team, Google’s first programming language. She was also responsible for helping to launch Google Public Data, which fostered her deep understanding of how to create tools for people who have little to no experience with data analytics or visualization.

**Part IV: Environment**

**9 – Social Costs of Climate Change and Pollution**

—Skim the report/highlights for background knowledge—*


Optional Reading


10 – Policies to Mitigate Climate Change


Optional Reading


**Guest Lecture #3: Alex Laskey, Founder, Opower and VP, Utilities Solutions, Oracle**

*Alex Laskey’s keynote at TED's annual conference.*

*Case Study: Game Changers: Opower’s Quest to Make Everyone in the World Care about Energy*

Alex Laskey is Vice President of Utilities Solutions for Oracle Utilities. He was previously the President and Founder of Opower, which was acquired by Oracle in 2016. Alex grew Opower from a two-person startup to a publicly-traded global business serving more than half of the largest electric and gas utilities in the world. At Oracle, Alex is a strategic consultant to those clients, and also speaks frequently on trends in energy and technology. Alex delivered a keynote at TED's annual conference, was named to Fortune’s 40 under 40 list, and was a Technology Pioneer at the Davos World Economic Forum. Alex serves on the board of the Conservation Lands Foundation and received his B.A. from Harvard College.

**Part V: Criminal Justice, Discrimination, and Political Polarization**

**11 – Criminal Justice and Discrimination**


*Optional Reading*


**Guest Lecture #4: Sendhil Mullainathan, Professor of Economics, Harvard University**


**Sendhil Mullainathan** is the Robert C. Waggoner Professor of Economics at Harvard University. He has done research on poverty (such as how poverty impedes cognitive function), discrimination (using fictitious resumes to measure it) and other areas of behavioral economics, especially as they inform policy or important social problems. His current work focuses on machine learning. Mullainathan is a recipient of the MacArthur “genius” Award, has been designated a “Young Global Leader” by the World Economic Forum, labeled a “Top 100 Thinker” by Foreign Policy Magazine, and named to the “Smart List: 50 people who will change the world” by Wired Magazine (UK).

**Guest Lecture #5: Matthew Gentzkow, Professor of Economics, Stanford University**


**Optional Reading**


Matthew Gentzkow is Professor of Economics at Stanford University. He studies empirical industrial organization and political economy, with a focus on media industries. He received the 2014 John Bates Clark Medal, given by the American Economic Association to the American economist under the age of forty who has made the most significant contribution to economic thought and knowledge. He is a fellow of the American Academy of Arts and Sciences and the Econometric Society, a senior fellow at the Stanford Institute for Economic Policy Research, and a former co-editor of *American Economic Journal: Applied Economics*. He was educated at Harvard University, where he earned a bachelor's degree in 1997, a master's degree in 2002, and a PhD in 2004.

**Probability, Statistics, and Econometrics References**


**Stata Resources**


UCLA’s IDRE Stata Modules: [http://stats.idre.ucla.edu/stata/modules/](http://stats.idre.ucla.edu/stata/modules/)