Using Big Data to Solve Economic and Social Problems

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Causal Effects of Neighborhoods
Causal Effects of Neighborhoods vs. Sorting

Two very different explanations for variation in children’s outcomes across areas:

1. Sorting: different people live in different places

2. Causal effects: places have a causal effect on upward mobility for a given person
Identifying Causal Effects of Neighborhoods

- Ideal experiment: randomly assign children to neighborhoods and compare outcomes in adulthood.

- We approximate this experiment using a quasi-experimental design:
  - Study 3 million families who move across Census tracts in observational data.
  - Key idea: exploit variation in age of child when family moves to identify causal effects of environment.

Source: Chetty and Hendren QJE 2018; Chetty, Friedman, Hendren, Jones, Porter 2018
Income Gain from Moving to a Better Neighborhood
By Child’s Age at Move

Average Income at Age 35

Age of Child when Parents Move

$23K

$29K

$35K

$41K

Savin Hill

Roxbury
Move at age 2 from Roxbury to Savin Hill → average earnings of $38,000
Income Gain from Moving to a Better Neighborhood
By Child’s Age at Move

Average Income at Age 35

$41K
$35K
$29K
$23K

Age of Child when Parents Move

2 10 20 28

Savin Hill
Roxbury
Income Gain from Moving to a Better Neighborhood
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Average Income at Age 35

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Savin Hill

Roxbury
Identifying Causal Effects of Neighborhoods

- Key assumption: *timing* of moves to a better/worse area unrelated to other determinants of child’s outcomes

- This assumption might not hold for two reasons:
  1. Parents who move to good areas when their children are young might be different from those who move later
  2. Moving may be related to other factors (e.g., change in parents’ job) that affect children directly
Identifying Causal Effects of Neighborhoods

- Two approaches to evaluating validity of this assumption:
  1. Compare siblings’ outcomes to control for family effects
Identifying Causal Effects of Neighborhoods

- Two approaches to evaluating validity of this assumption:
  1. Compare siblings’ outcomes to control for family effects
  2. Use differences in neighborhood effects across subgroups to implement “placebo” tests
    - Ex: some places (e.g., low-crime areas) have better outcomes for boys than girls
    - Move to a place where boys have high earnings → son improves in proportion to exposure but daughter does not

- Conclude that about two-thirds of the variation in upward mobility across areas is due to causal effects
Characteristics of High-Mobility Areas
Why Does Upward Mobility Differ Across Areas?

- Why do some places produce much better outcomes for disadvantaged children than others?

- Begin by characterizing the properties of areas with high rates of upward mobility using correlational analysis.

- Do places with higher mobility tend to have better jobs, schools, different institutions, …?
Average Income at Age 35 of Children who Grew up in Low-Income Families

Job Growth Rate (%) from 1990-2010

High mobility, low growth

Low mobility, low growth

High mobility, high growth

Low mobility, high growth

Upward Mobility vs. Job Growth in the 30 Largest Metro Areas
Five Strongest Correlates of Upward Mobility

1. Segregation
   - Greater racial and income segregation associated with lower levels of mobility
Racial Segregation in Atlanta
Whites (blue), Blacks (green), Asians (red), Hispanics (orange)

Source: Cable (2013) based on Census 2010 data
Racial Segregation in Sacramento
Whites (blue), Blacks (green), Asians (red), Hispanics (orange)

Source: Cable (2013) based on Census 2010 data
Five Strongest Correlates of Upward Mobility

1. Segregation

2. Income Inequality
   - Places with smaller middle class have much less mobility
Five Strongest Correlates of Upward Mobility

1. Segregation

2. Income Inequality

3. School Quality
   - Higher expenditure, smaller classes, higher test scores correlated with more mobility
Five Strongest Correlates of Upward Mobility

1. Segregation

2. Income Inequality

3. School Quality

4. Family Structure
   - Areas with more single parents have much lower mobility
   - Strong correlation even for kids whose own parents are married
Five Strongest Correlates of Upward Mobility

1. Segregation

2. Income Inequality

3. School Quality

4. Family Structure

5. Social Capital
   - “It takes a village to raise a child”
Policies to Improve Upward Mobility
Policy Interest in Increasing Upward Mobility

- Recent research has shifted national conversation on poverty to focus on income mobility and the role of childhood environment
An Atlas of Upward Mobility Shows Paths Out of Poverty

By DAVID LEONHARDE, AMANDA COX and CLAIRE CAIN MILLER  MAY 4, 2015

In the wake of the Los Angeles riots more than 20 years ago, Congress created an anti-poverty experiment called Moving to Opportunity. It gave vouchers to help poor families move to better neighborhoods and awarded them on a random basis, so researchers could study the effects.

The results were deeply disappointing. Parents who received the vouchers did not seem to earn more in later years than otherwise similar adults, and children did not seem to do better in school. The program’s apparent failure has haunted social scientists and policy makers, making poverty seem all
Detailed Maps Show How Neighborhoods Shape Children for Life

Some places lift children out of poverty. Others trap them there. Now cities are trying to do something about the difference.

By Emily Badger and Quoctrung Bui

Oct. 1, 2018
In America, Where Y. Born Has a Huge Imp on How Far You'll Go Life

By Matthew Yglesias

Decades of risk created a pillar better than 1
Thursday.
It's well known that at this point that not only does the United States have an unusually large level of income inequality compared to other rich countries, but we have a low level of intergenerational mobility. Kids whose parents have low incomes, in other words, are very likely to grow up to have low incomes. But the United States is also very large compared to other rich countries, which raises the question of whether that pattern of mobility is new or simply an outlier that has previously been available shows that there's quite a bit of variation. It is a diverse set of metropolitan areas including most of the major coastal cities but also Salt Lake City and most of the low-income communities of the South Plains, kids born into the bottom fifth of the national income distribution have a fairly high chance of moving up into the top fifth. Conversely, there's a trend among the rest of the American South, and that a large portion in the industrial Midwest where intergenerational mobility is tiny.

Adjusting for income, the slowdown in the income spectrum. The big-income-middle-class families.
A Wake-Up Call for Charlotte-Mecklenburg
January 25, 2014

Over the last several decades, Charlotte-Mecklenburg has transformed from a small southern town to one of the country’s largest and most dynamic communities. We continue to attract people—nearly 50 a day—who move here to take advantage of our strong business climate, favorable weather and geographic location, and our reputation as a great place to live and raise a family. Accolades from the outside regularly tell us how tall we stand among other communities. As recently as February 7, 2017, U.S. News and World Report ranked us as the 14th best place to live in the country.¹

Yet, in 2013 when the headline broke about the Harvard University/UC Berkeley study that ranked Charlotte-Mecklenburg 50th out of 50 in upward mobility² for children born into our lowest income quintile, many in our community responded with disbelief. How, on the one hand, can we be such a vital and opportunity-rich community, and on the other, be ranked dead last in the odds that our lowest income children and youth will be able to move up the economic ladder as they become adults?
New ‘Atlas’ of mobility shows how kids from different Charlotte neighborhoods have done

October 1, 2018

Mobility ‘Atlas’ shows city kids’ progress

The Charlotte Observer

It’s hard to imagine a bigger gulf than the one between academic researchers crunching data at Harvard and families trapped by poverty and hopelessness in Charlotte.

The two came together in the public imagination four years ago, when professors labeled Charlotte the worst of the country’s 50 biggest commuting areas at giving children of poverty a chance to move into affluence. The sting of that label has driven sweeping change in the way local leaders talk about public policy, social justice and daily life.

Now the research team that shamed Charlotte into action has signed on to work with the city’s public and private officials to see whether data can help policy and philanthropy bring real-life change. They bring a massive database compiled by academics — with information on income, family status, rent, race, immigration and more — and are sharing it with the public as well as the experts.
Two Approaches to Increasing Upward Mobility

- **Moving to Opportunity**: Provide Affordable Housing in High-Opportunity Areas
- **Place-Based Investments**: Increase Upward Mobility in Low-Opportunity Areas
Moving to Opportunity

Note: this Section is Based on: Chetty, Hendren, Katz. “The Long-Term Effects of Exposure to Better Neighborhoods: New Evidence from the Moving to Opportunity Experiment” AER 2016
Affordable Housing Policies in the United States

- Many potential policies to help low-income families move to better neighborhoods:
  - Subsidized housing vouchers to rent better apartments
  - Mixed-income affordable housing developments (LIHTC)
  - Changes in zoning regulations and building restrictions

- Are such housing policies effective in increasing social mobility?
  - Useful benchmark: cash grants of an equivalent dollar amount to families with children
Affordable Housing Policies

- Economic theory predicts that **cash grants** of an equivalent dollar amount are better than expenditures on housing.

- Yet the U.S. spends $45 billion per year on housing vouchers, tax credits for developers, and public housing.

- Are these policies effective, and how can they be better designed to improve social mobility?

- Study this question here by focusing specifically on the role of housing vouchers for low-income families.
Question: will a given child $i$’s earnings at age 30 ($Y_i$) be higher if his/her family receives a housing voucher?

Definitions:

- $Y_i(V=1) = \text{child’s earnings if family gets voucher}$
- $Y_i(V=0) = \text{child’s earnings if family does not get voucher}$

Goal: estimate treatment effect of voucher on child $i$:

$$G_i = Y_i(V=1) - Y_i(V=0)$$
Fundamental problem in empirical science: we do not observe $Y_i(V=1)$ and $Y_i(V=0)$ for the same person

- We only see one of the two potential outcomes for each child
- Either the family received a voucher or didn’t…

How can we solve this problem?

- This is the focus of research on causality in statistics
Randomized Experiments

- Gold standard solution: run a randomized experiment (A/B testing in the lingo of tech firms)

- Example: take 10,000 children and flip a coin to determine if they get a voucher or not

- Difference in average earnings across the two groups is the average treatment effect of getting the voucher (average value of $G_i$)

- Intuition: two groups are identical except for getting voucher → difference in earnings capture causal effect of voucher
Importance of Randomization

- Suppose we instead compared 10,000 people, half of whom applied for a voucher and half of whom didn’t.

- Could still compare average earnings in these two groups.

- But in this case, there is no guarantee that differences in earnings are only driven by the voucher.

- There could be many other differences across the groups:
  - Those who applied may be more educated
  - Or they may live in worse areas to begin with.

- Randomization eliminates all other such differences.
Non-Compliance in Randomized Experiments

- Common problem in randomized experiments: non-compliance
  - In medical trials: patients may not take prescribed drugs
  - In voucher experiment: families offered a voucher may not actually use it to rent a new apartment
- We can’t force people to comply with treatments; we can only offer them a treatment
- How can we learn from experiments in the presence of such non-compliance?
Adjusting for Non-Compliance

- Solution: adjust estimated impact for rate of compliance

- Example: suppose half the people offered a voucher actually used it to rent a new apartment

  - Suppose raw difference in earnings between those offered voucher and not offered voucher is $1,000

  - Then effect of using voucher to rent a new apartment must be $2,000 (since there is no effect on those who don’t move)

- More generally, divide estimated effect by rate of compliance:

  $$ \text{True Impact} = \frac{\text{Estimated Impact}}{\text{Compliance Rate}} $$