



Using Big Data to Solve Economic and Social Problems

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Spring 2019



HARVARD
UNIVERSITY



Causal Effects of Neighborhoods

Causal Effects of Neighborhoods vs. Sorting

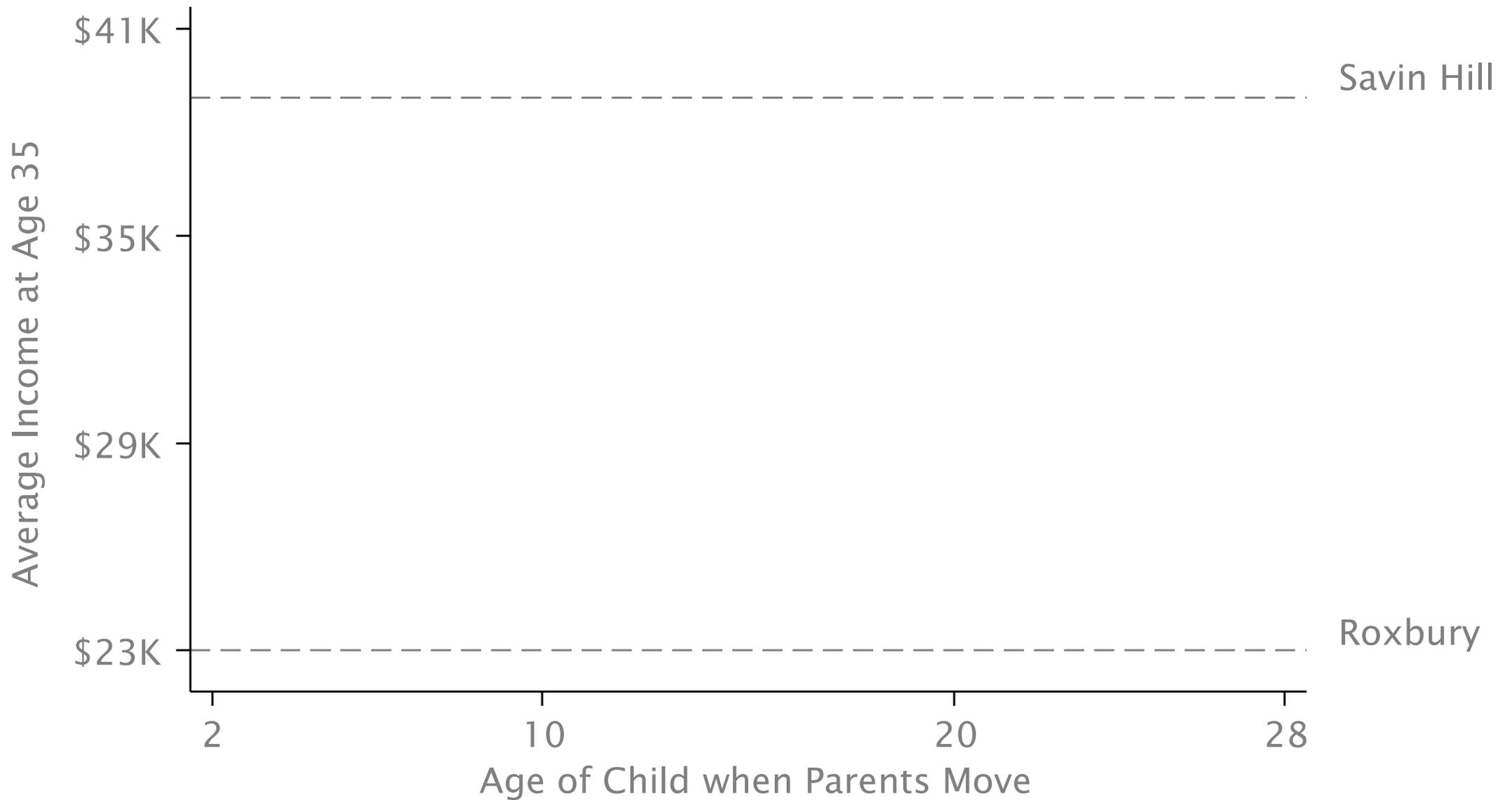
- Two very different explanations for variation in children's outcomes across areas:
 1. Sorting: different people live in different places
 2. Causal effects: places have a *causal* effect on upward mobility for a given person

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

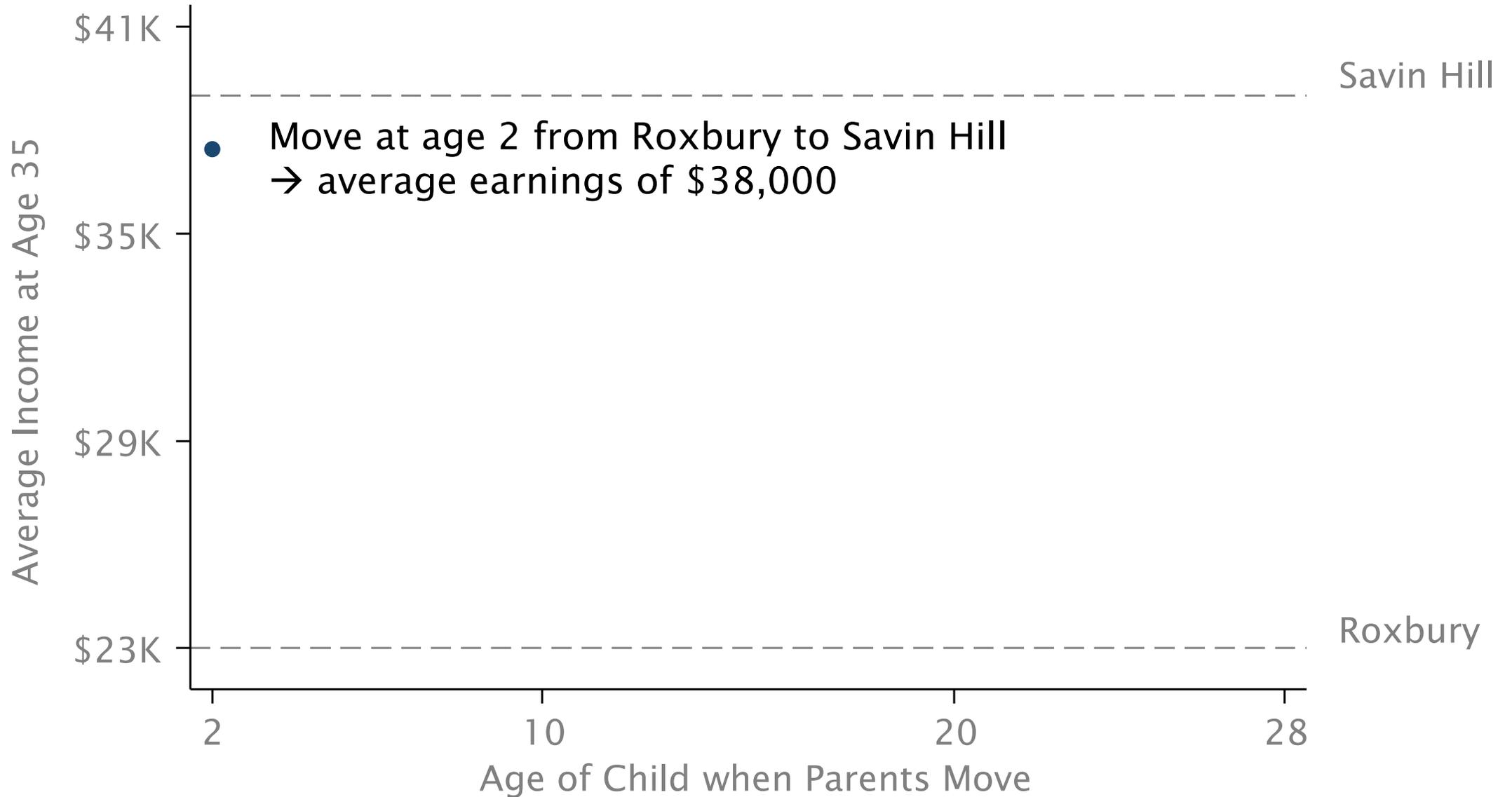
Income Gain from Moving to a Better Neighborhood

By Child's Age at Move



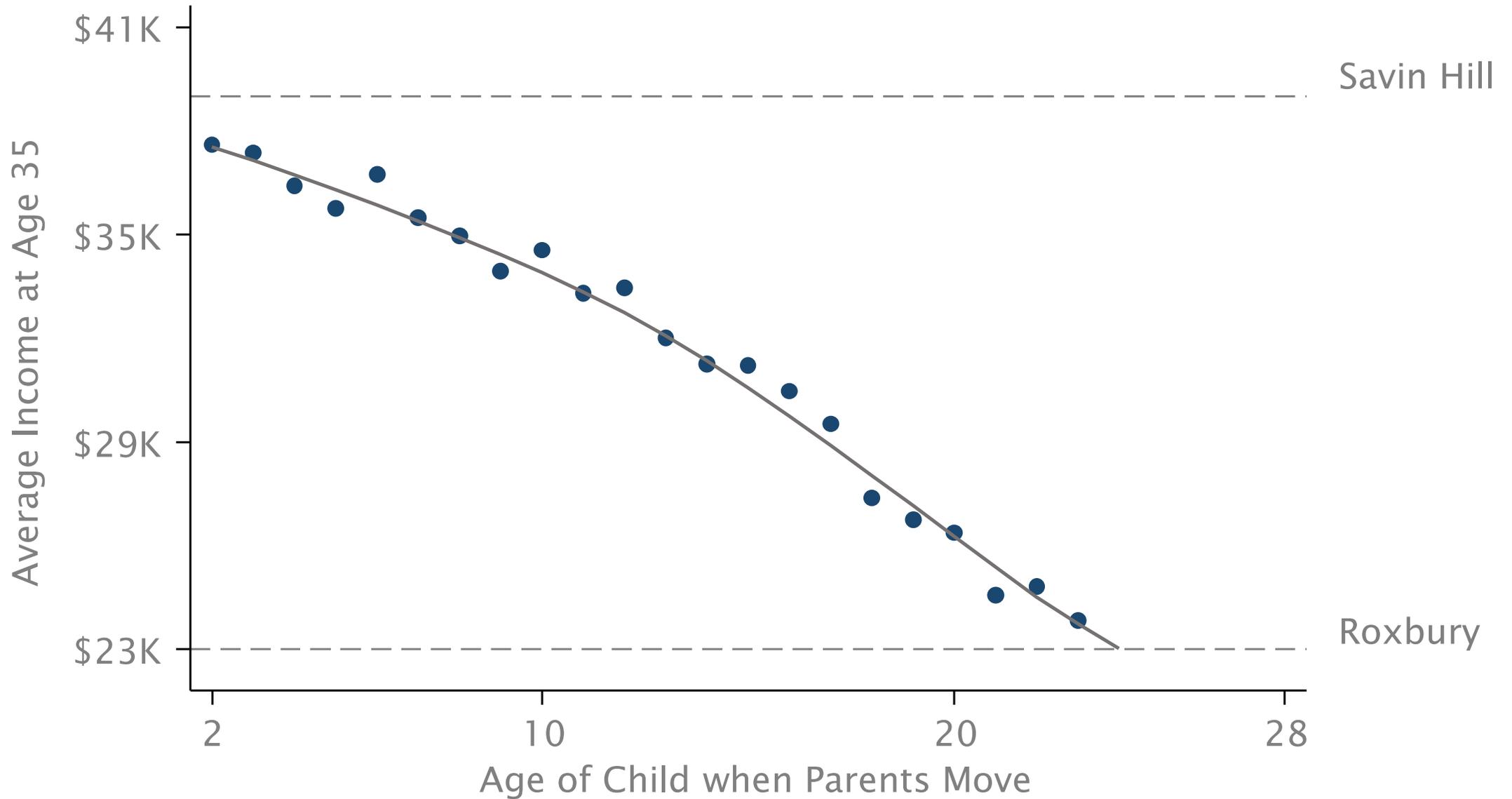
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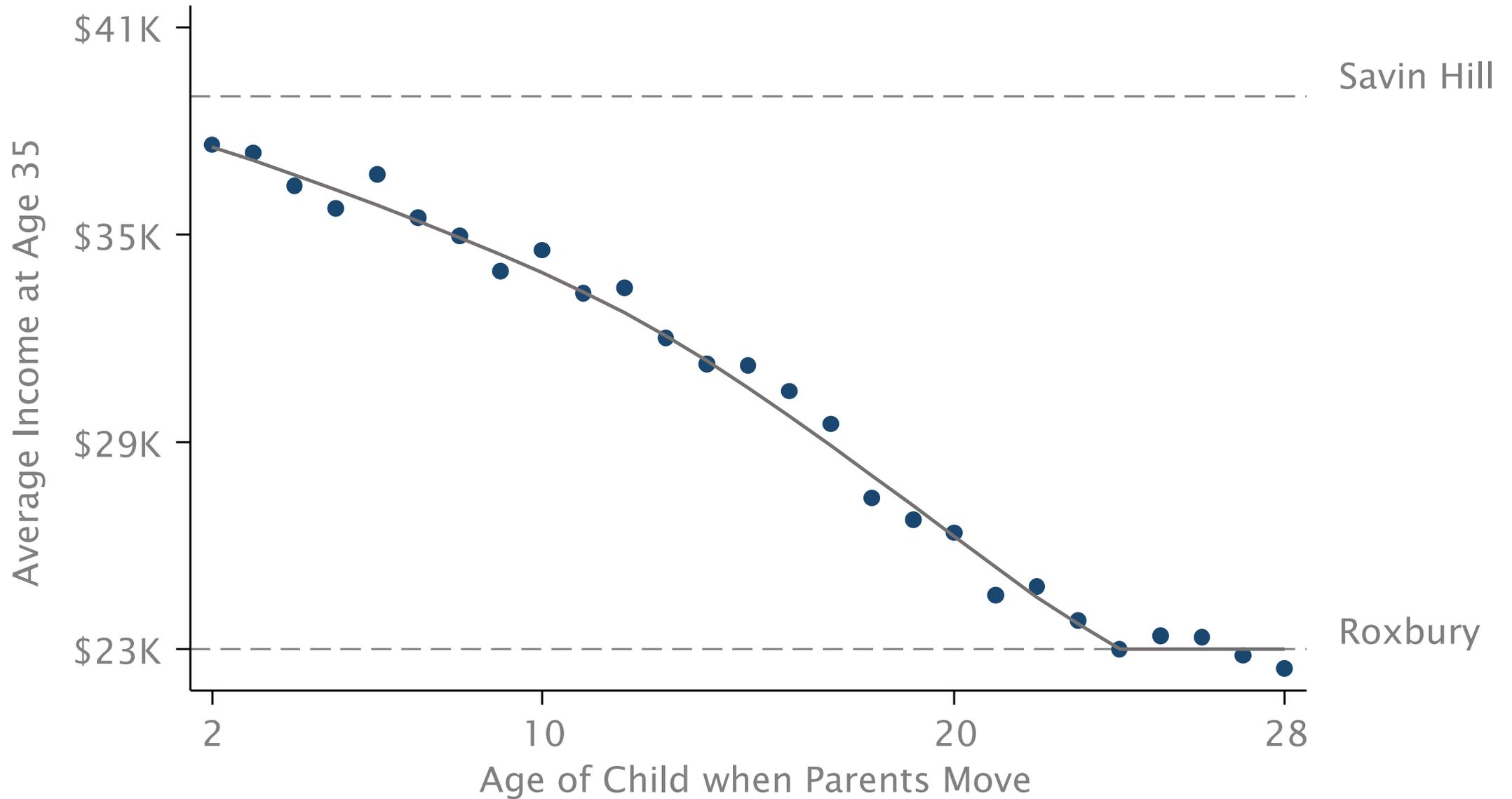
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Identifying Causal Effects of Neighborhoods

- 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

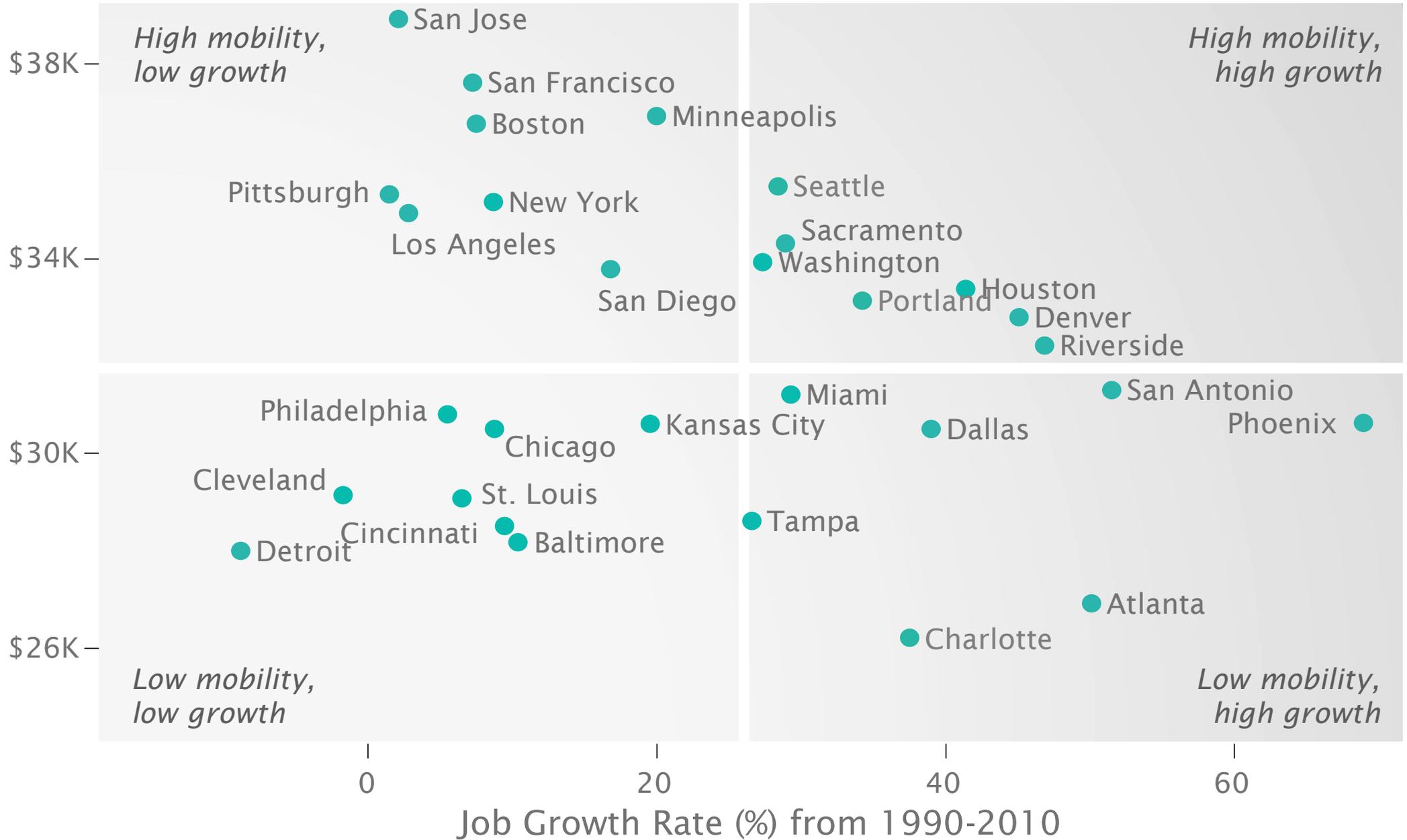
Characteristics of High-Mobility Areas

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, ...?

Upward Mobility vs. Job Growth in the 30 Largest Metro Areas

Average Income at Age 35 of Children
who Grew up in Low-Income Families



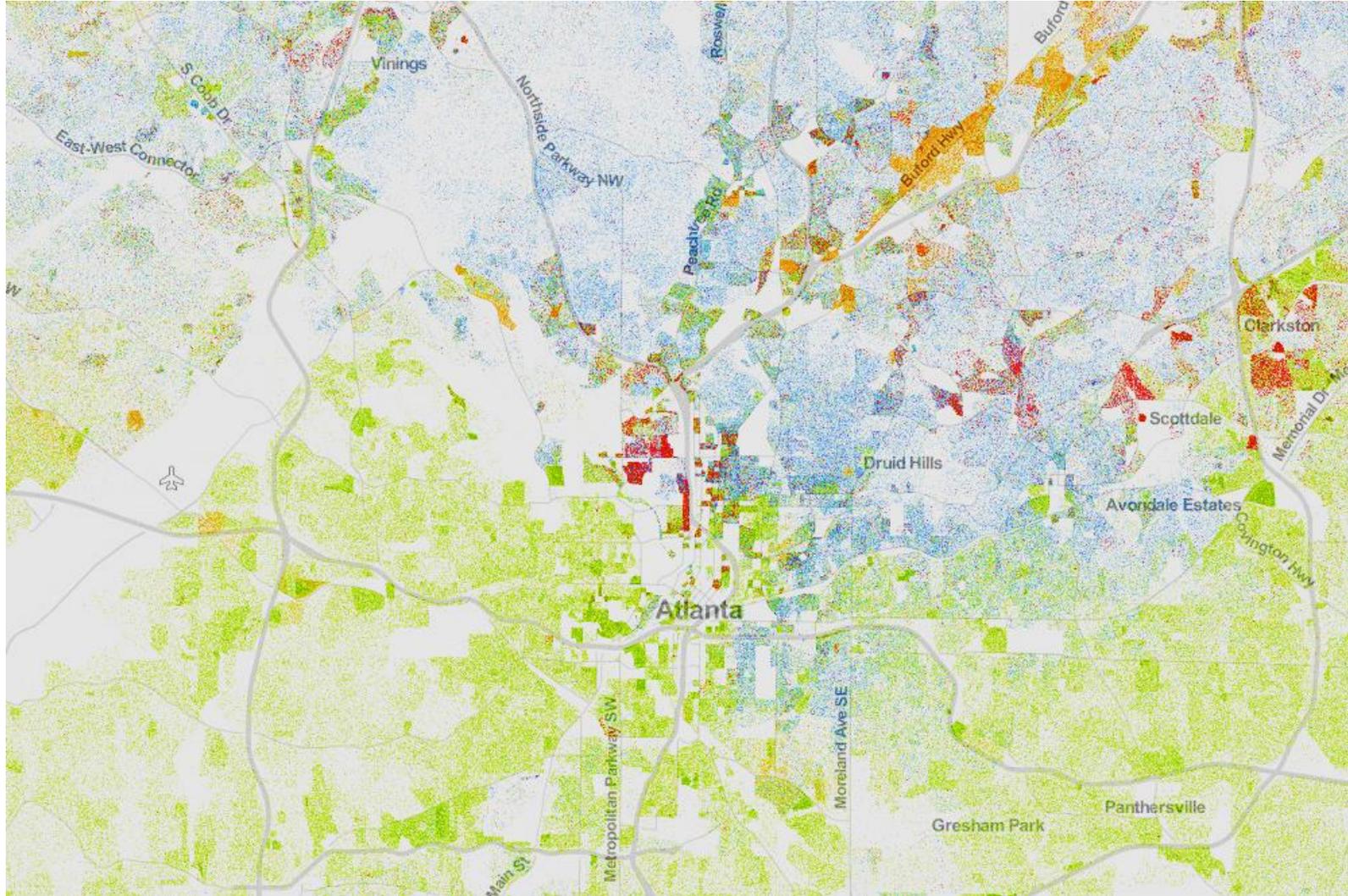
Five Strongest Correlates of Upward Mobility

1. Segregation

- Greater racial and income segregation associated with lower levels of mobility

Racial Segregation in Atlanta

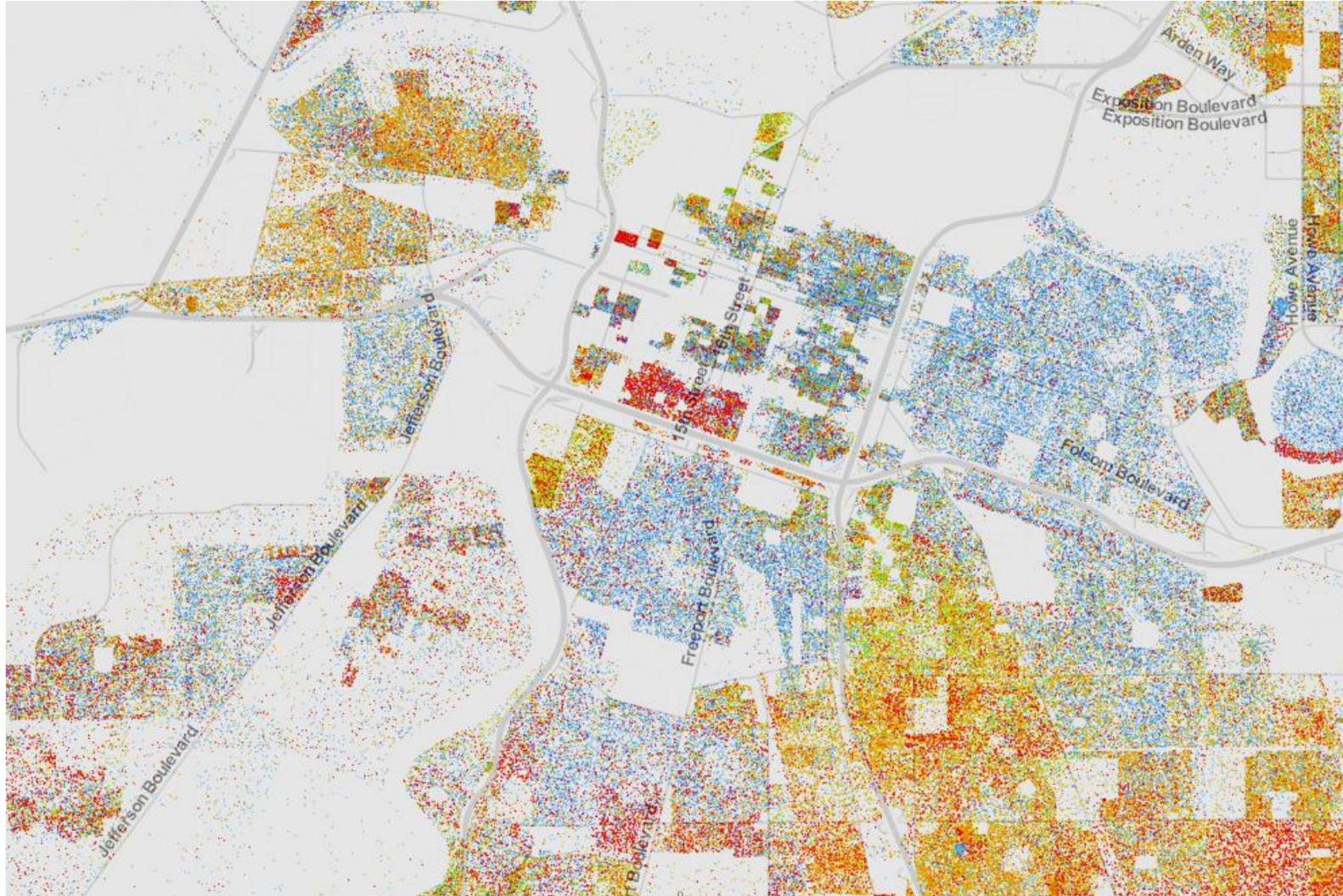
Whites (blue), Blacks (green), Asians (red), Hispanics (orange)



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”
 - Putnam (1995): “Bowling Alone”

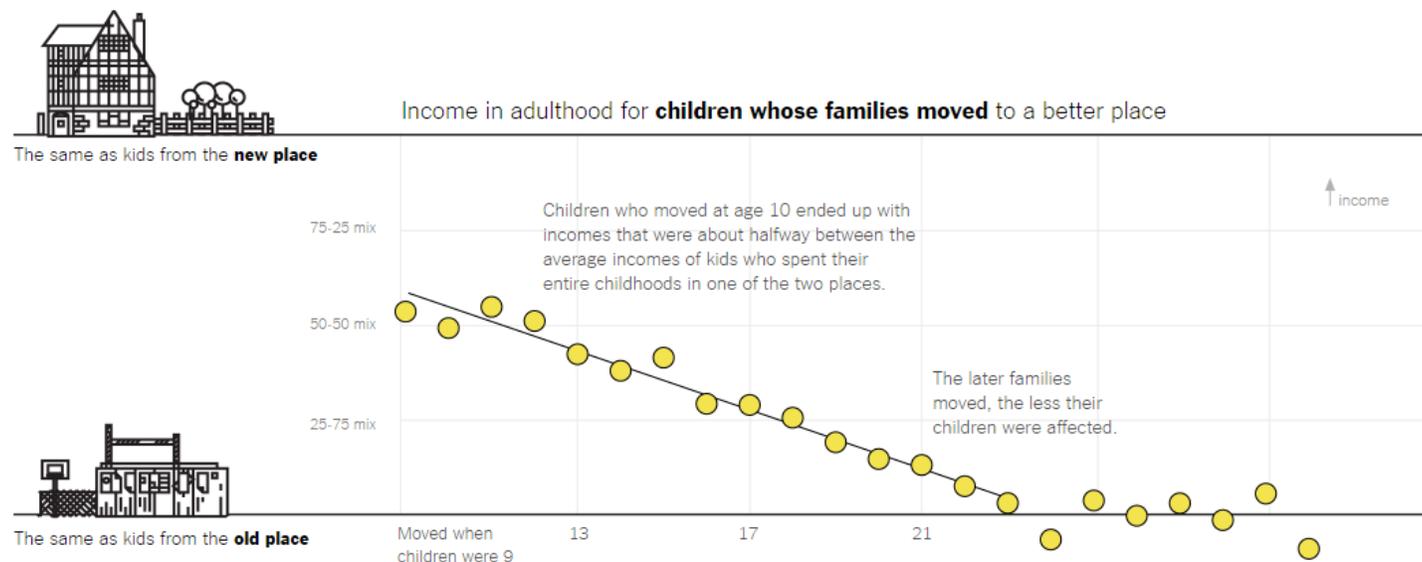
Policies to Improve Upward Mobility

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 LEONHARDT, 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

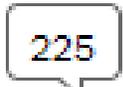
Detailed Maps Show How Neighborhoods Shape Children for Life

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 [Quoc Trung Bui](#)

Oct. 1, 2018



FiveThirtyEight

Politics Sports Science & Technology

DEC. 8, 2016, AT 2:15 PM

Inequality Is Dream

By Ben Casselman Filed under Economy

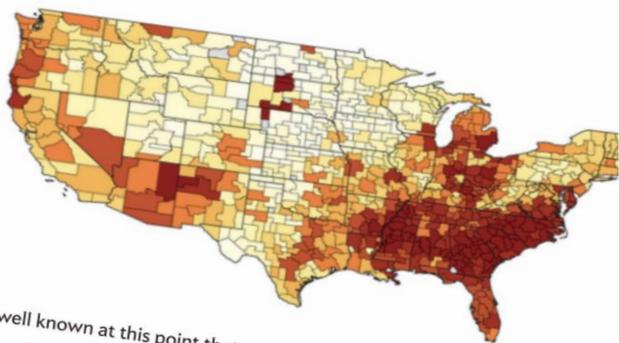
Decades of rising income inequality have eroded a pillar of American society: the idea that upward mobility is better than staying put.

Thursday. If the findings of a new study exploiting a richer dataset than has previously been available shows that there's quite a bit of variation. In a diverse set of metropolitan areas including most of the major coastal cities but also Salt Lake City and most of the low-population communities of the Great 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 broad crescent across most of the American South and then a large pocket in the industrial Midwest where intergenerational mobility is tiny.

adjusting for income, the slowdown in the income spectrum. The biggest middle-class families.

In America, Where You Born Has a Huge Impact on How Far You'll Go in Life

By Matthew Yglesias



It's well known 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 themselves grow up to have low incomes. But the United States is also very large compared to most other rich countries, which raises the question of how uniform that pattern of mobility is. A new study exploiting a richer dataset than has previously been available shows that there's quite a bit of variation. In a diverse set of metropolitan areas including most of the major coastal cities but also Salt Lake City and most of the low-population communities of the Great 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 broad crescent across most of the American South and then a large pocket in the industrial Midwest where intergenerational mobility is tiny.

...comes reflect household incomes in 2014 and 2015.

'All the News That's Fit to Print'

A Wider Net In an Inquiry At City Hall

2 Who Raised Money for Mayor a Focus

By WILLIAM K. RASHBAUM and AL BAKER

Signs of a sprawling municipal investigation in New York City have emerged in a seemingly random fashion over the last week. Four senior police officials were abruptly transferred or put on modified duty. A Manhattan restaurateur was arrested and charged with operating a Ponzi scheme. Among his investors were two men who had raised money for Mayor Bill de Blasio, and one of the men was also a generous campaign donor.

What ties these developments together — and others unfolding behind the scenes — is a long-running and wide-ranging investigation that has come to focus on possible corruption involving Mr. de Blasio's campaign fund-raising, the first major inquiry of his kind during the mayor's two-year tenure.

A federal grand jury in Manhattan has begun hearing evidence in the case, according to several people briefed on the matter. The inquiry has come to focus on the two fund-raisers: Jona Rechnittz, who raised money for Mr. de Blasio's campaign and was also a donor to both the campaign and to a nonprofit group that supported the mayor's agenda; and Jeremy Reichberg, who held a fund-raiser for that nonprofit.

Federal wiretaps in the case have captured their conversations, two of the people said, without elaborating on the substance of the discussions.

Both Mr. Rechnittz and Mr. Reichberg served on a committee that planned Mr. de Blasio's 2014 campaign.

Continued on Page A3

Germany to discuss security and intelligence issues. Back in Washington, his staff churned out its latest flattering video of Mr. Ryan, deploring identity politics and promoting a battle of ideas — set to campaign-style music. And his office continued to beat back the not-exactly-library-voice whisper campaign favoring a coup at the Republican convention in July that would elevate Mr. Ryan to the top of the ticket.

Mr. Ryan is indeed at the center of a national campaign — one he calls "Confident America" — but it is not necessarily for president.

Mr. Ryan has repeatedly said he has no intention of becoming his party's nominee this year. But he is deep into his own parallel operation to counter Donald J. Trump and help House and Senate candidates navigate the headwinds Mr. Trump would generate as the party's standard-bearer — or, for that matter, those that would be created by Senator Ted Cruz, who is only slightly more popular.

Mr. Ryan is creating a personality and policy alternative to run alongside the presidential effort — one that provides a foundation to rebuild if Republicans splinter and lose in the fall. "He is running a parallel policy campaign," said Senator Tim Scott, Republican of South Carolina.

He is shaping an agenda that he plans to roll out right before the convention, a supplement of sorts to the official party platform. He gives regular speeches on politics and policy — particularly on poverty and economic issues — then backs them up in the news media.

It is not a move without risks. When Belgian prosecutors announced that Mohamed Abrini, one of the men arrested on Friday, had confessed to being the mysterious third man in the Brussels Airport bombing, it seemed to mark a rare victory for Belgian law enforcement, which has struggled to track down extremists. But it also was a reminder of the ease with which the Islamic State's operatives move across borders and the shifting roles that suspects play: According to prosecutors, Mr. Abrini was a logistician in the Paris attacks but was meant to be a bomber in the Brussels attack — except that his bomb failed to explode.

There are almost certainly similar cells that are active in non-French-speaking countries and that have not yet surfaced. Britain, Germany and Italy are thought to be high on the list of Islamic State targets.

It adds up to a long road ahead in Europe for law enforcement and intelligence agencies but also



Tensions flare on a European border. Migrants stuck in Idomeni, Greece, faced tear gas from the Macedonian side on Sunday, in the latest unrest in the area. Page A8.

On Edges of G.O.P. Race, Ryan Wages His Own Policy Campaign

By JENNIFER STEINHAUER

WASHINGTON — As the Republican candidates for the White House battled in Wisconsin last week, Speaker Paul D. Ryan was conspicuously absent from his home state — but he was very much on the political stage.

He visited Prime Minister Benjamin Netanyahu in Israel, where he also met with local reporters and made several statements affirming the United States' commitment there, before heading to other Middle Eastern nations and

An Upset In Augusta

Danny Willett of England making his final putt on the 18th hole at the Masters in Augusta, Ga., on Sunday. Willett won by three strokes over Jordan Spieth, who had led by five with nine holes to go. Page D1.



Andrew Gombert/EuroPhoto Pressphoto Agency

Where the Poor Live in America May Help Determine Life Span

By NEIL IRWIN and QUOCTRUNG BUI

For poorer Americans, the place they call home can be a matter of life or death.

The poor in some cities — big ones like New York and Los Angeles, and also quite a few smaller ones like Birmingham, Ala. — live nearly as long as their middle-class neighbors or have seen rising life expectancy in the 21st century. But in some other parts of the country, adults with the lowest incomes die on

average as young as people in much poorer nations like Rwanda, and their life spans are getting shorter.

In those differences, documented in sweeping new research, lies an optimistic message: The right mix of steps to improve habits and public health could help people live longer, regardless of how much money they make.

One conclusion from this work, published on Monday in The Journal of the American Medical Association, is that the gap in life spans between rich and poor widened from 2001 to 2014. The top 1 percent in income among American men live 5 years longer than the poorest 1 percent; for women, the gap is 10 years. These rich Americans have gained three years of longevity just in this century. They live longer almost without regard to where they live. Poor Americans had very little gain as a

whole, with big differences among different places. But the fact that some places have increased the life span of their poorest residents suggests that improving public health doesn't require first fixing the broader, multidecade problem of income inequality. Small-scale, local policies to help the poor adopt and maintain healthier habits may succeed in extending their lives, regardless of what happens with trends in income inequality.

Continued on Page A11

A NEW PARIS PLOT BEFORE BRUSSELS SPREADS CONCERN

FEARS OF MORE ATTACKS

Revelations in Belgium Suggest Long Road to Containing ISIS

By ALISSA J. RUBIN and ERIC SCHMITT

BRUSSELS — The announcement on Sunday that the plotters of last month's Brussels terror attacks had originally intended to hit Paris again only heightened the concern among police and intelligence agencies that shadowy Islamic State networks could unleash new attacks at any time, not only in France and Belgium but in other European capitals.

As intelligence experts and officials took stock of what they have learned since the Nov. 13 assaults in and around Paris, which killed 130 people, several things have come into focus. The scale of the Islamic State's operations in Europe are still not known, but they appear to be larger and more layered than investigators at first realized; if the Paris and Brussels attacks are any model, the plotters will rely on local criminal networks in addition to committed extremists.

Even as the United States, its allies and Russia in the wake of the Islamic State, and have rolled back some of the extremist organization's gains on the battlefields of Iraq and Syria, the Islamic State appears to be posing a largely hidden and lethal threat across most of Europe.

When Belgian prosecutors announced that Mohamed Abrini, one of the men arrested on Friday, had confessed to being the mysterious third man in the Brussels Airport bombing, it seemed to mark a rare victory for Belgian law enforcement, which has struggled to track down extremists. But it also was a reminder of the ease with which the Islamic State's operatives move across borders and the shifting roles that suspects play: According to prosecutors, Mr. Abrini was a logistician in the Paris attacks but was meant to be a bomber in the Brussels attack — except that his bomb failed to explode.

There are almost certainly similar cells that are active in non-French-speaking countries and that have not yet surfaced. Britain, Germany and Italy are thought to be high on the list of Islamic State targets.

It adds up to a long road ahead in Europe for law enforcement and intelligence agencies but also

A Wake-Up Call for Charlotte-Mecklenburg

January 25, 2014

Land of opportunity? Not by a long shot

Charlotte is nation's worst big city
for climbing out of poverty

The Charlotte Observer

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.ⁱ

Yet, in 2013 when the headline broke about the Harvard University/UC Berkeley study that ranked Charlotte-Mecklenburg 50th out of 50 in upward mobilityⁱⁱ 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

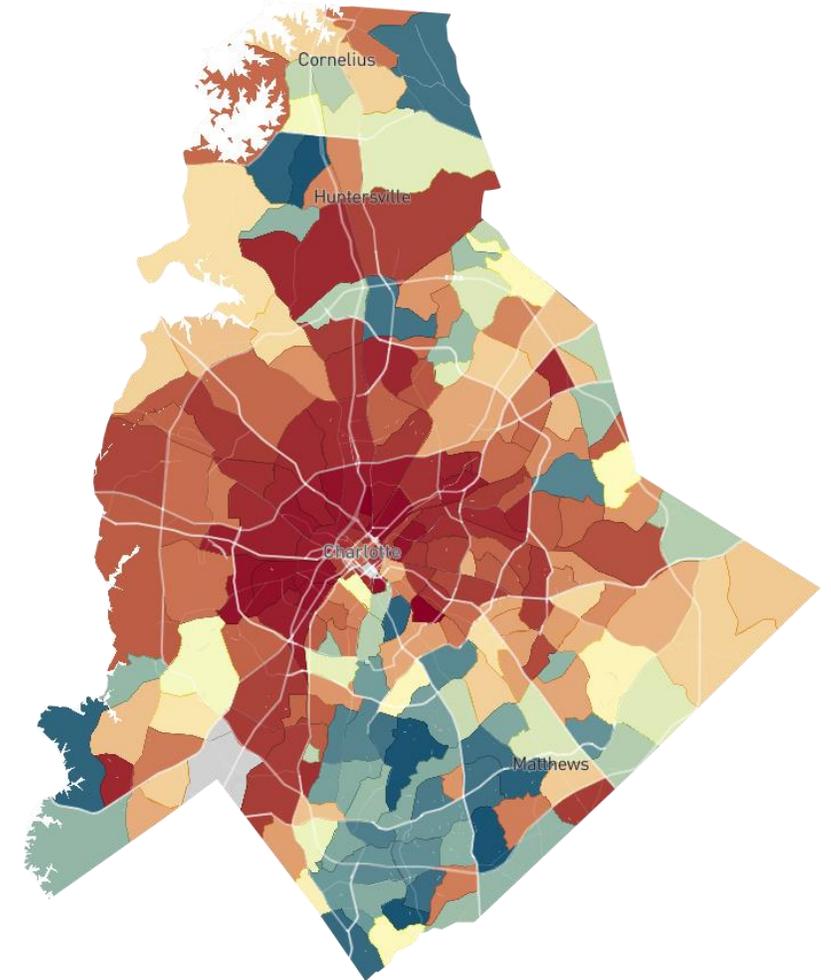
The Charlotte Observer

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.

The Geography of Opportunity in Charlotte



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

Studying the Effects of Housing Vouchers

- Question: will a given child i 's earnings at age 30 (Y_i) be higher if his/her family receives a housing voucher?
- Definitions:
 - $Y_i(V=1)$ = child's earnings if family gets voucher
 - $Y_i(V=0)$ = child's earnings if family does not get voucher
- Goal: estimate treatment effect of voucher on child i :

$$\mathbf{G_i = Y_i(V=1) - Y_i(V=0)}$$

Studying the Effects of Housing Vouchers

- 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:

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