

Using Big Data To Solve Economic and Social Problems

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Photo Credit: Florida Atlantic University



Residential Integration and Upward Mobility

- Recap of last lecture: helping families with young kids move to mixed-income neighborhoods using vouchers increases upward mobility
- Broader lesson: policies that reduce residential segregation likely to increase upward mobility
 - Providing tax credits to encourage building affordable properties in higher-income neighborhoods (Low-Income Housing Tax Credit)
 - Retaining housing options for low and middle income families as city centers gentrify
 - Improved urban planning, e.g. changes in zoning regulations that prevent dense development

A Historical Perspective on the American Dream

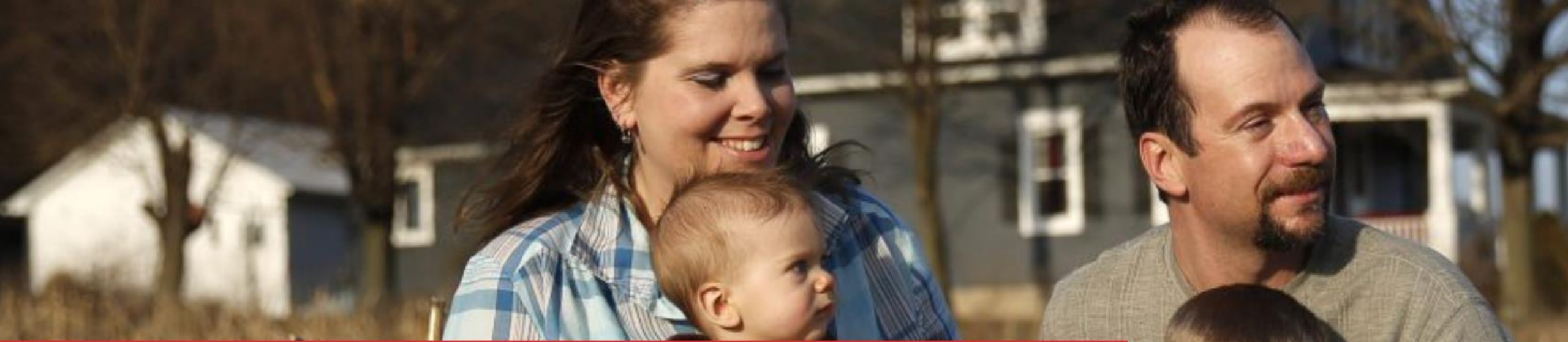
Trends in Mobility Over Time

- Thus far, we have focused on a snapshot of rates of mobility for children growing up in America today
- Often useful to take a historical perspective to understand today's economic and social challenges
- To provide such a perspective, examine trends in mobility over time at the national level

A Historical Perspective on the American Dream

- Historically, American Dream has been defined as aspiration that children should have higher standards of living than their parents
 - When asked to assess economic progress, children frequently compare their earnings to their parents [Goldthorpe 1987]
 - Obama (2014): “People’s frustrations are partly rooted “in the fear that their kids won’t be better off than they were”
- What fraction of children earn more than their parents, and how has this changed over time?

Reference: Chetty, Grusky, Hell, Hendren, Manduca, Narang. “The Fading American Dream: Trends in Absolute Income Mobility Since 1940.” *Science* 2017.



SOCIAL MOBILITY MEMOS

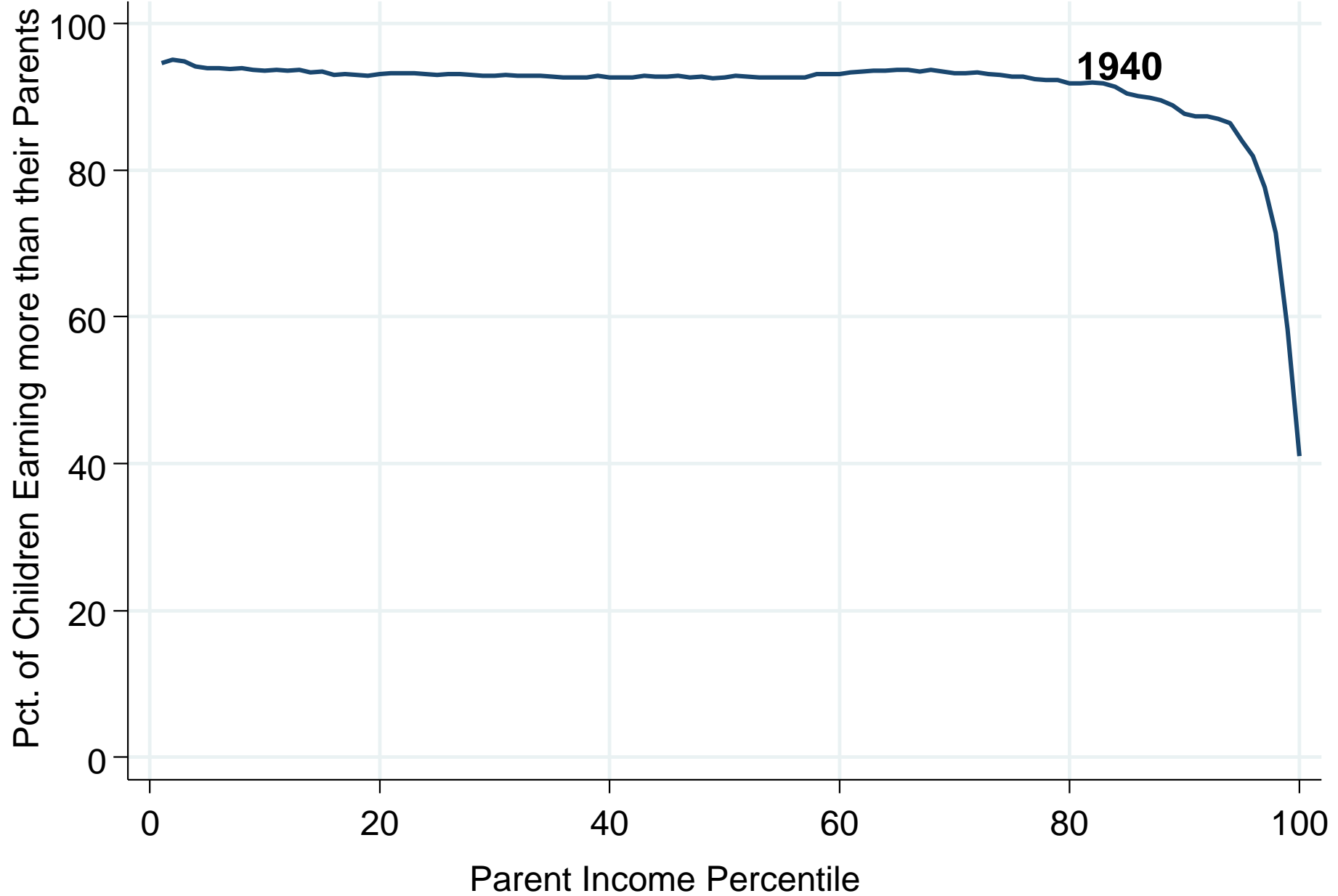
How many people are better off than their parents? Depends on how you cut the data.

Dimitrios Halikias and Richard V. Reeves · Wednesday, August 10, 2016

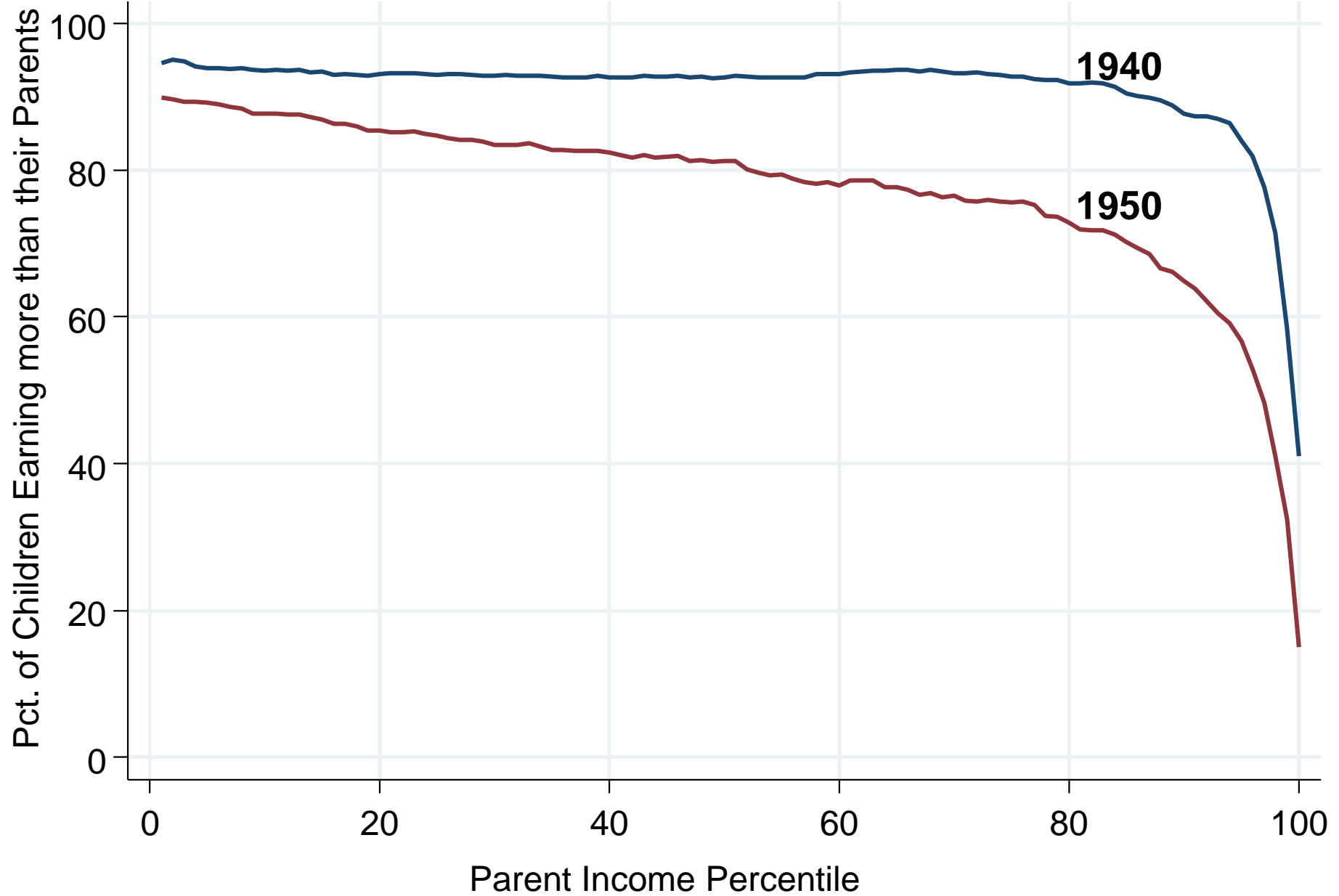
Measuring the American Dream

- Key data problem for studying historical trends in mobility: lack of large datasets linking parents and children
- We solve this problem by combining Census data back to 1940 with recent data from de-identified tax records

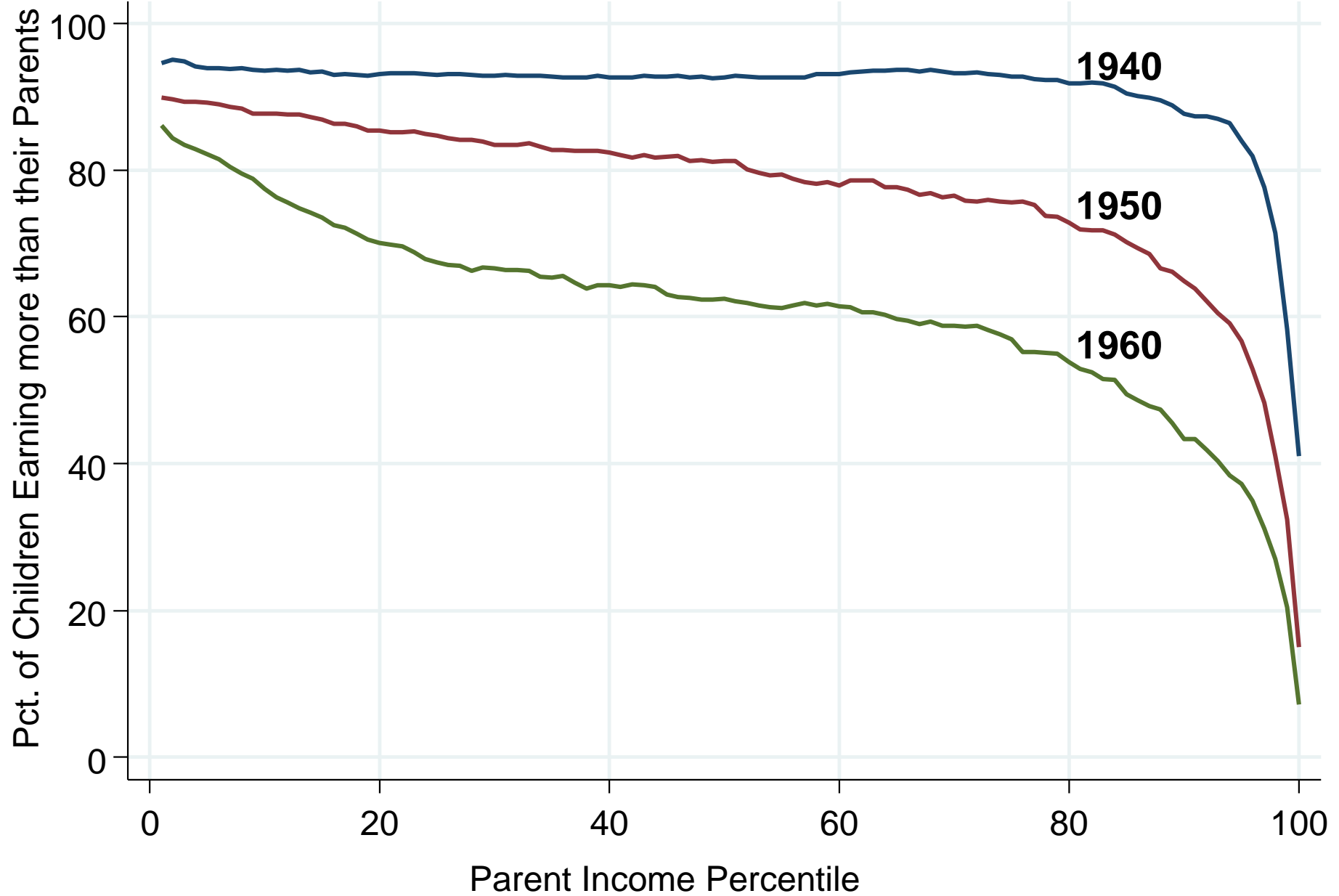
Percent of Children Earning More than their Parents By Parent Income Percentile



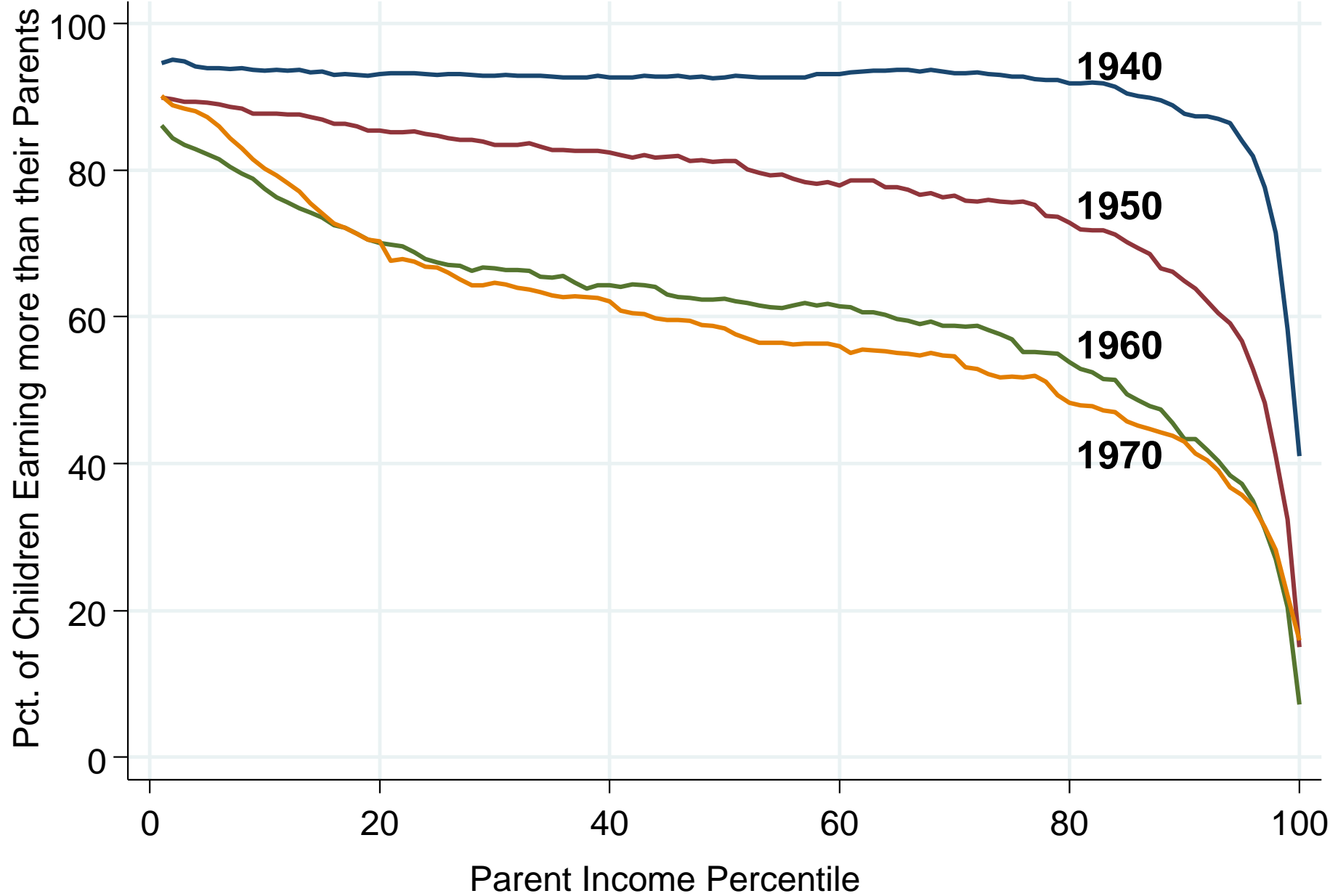
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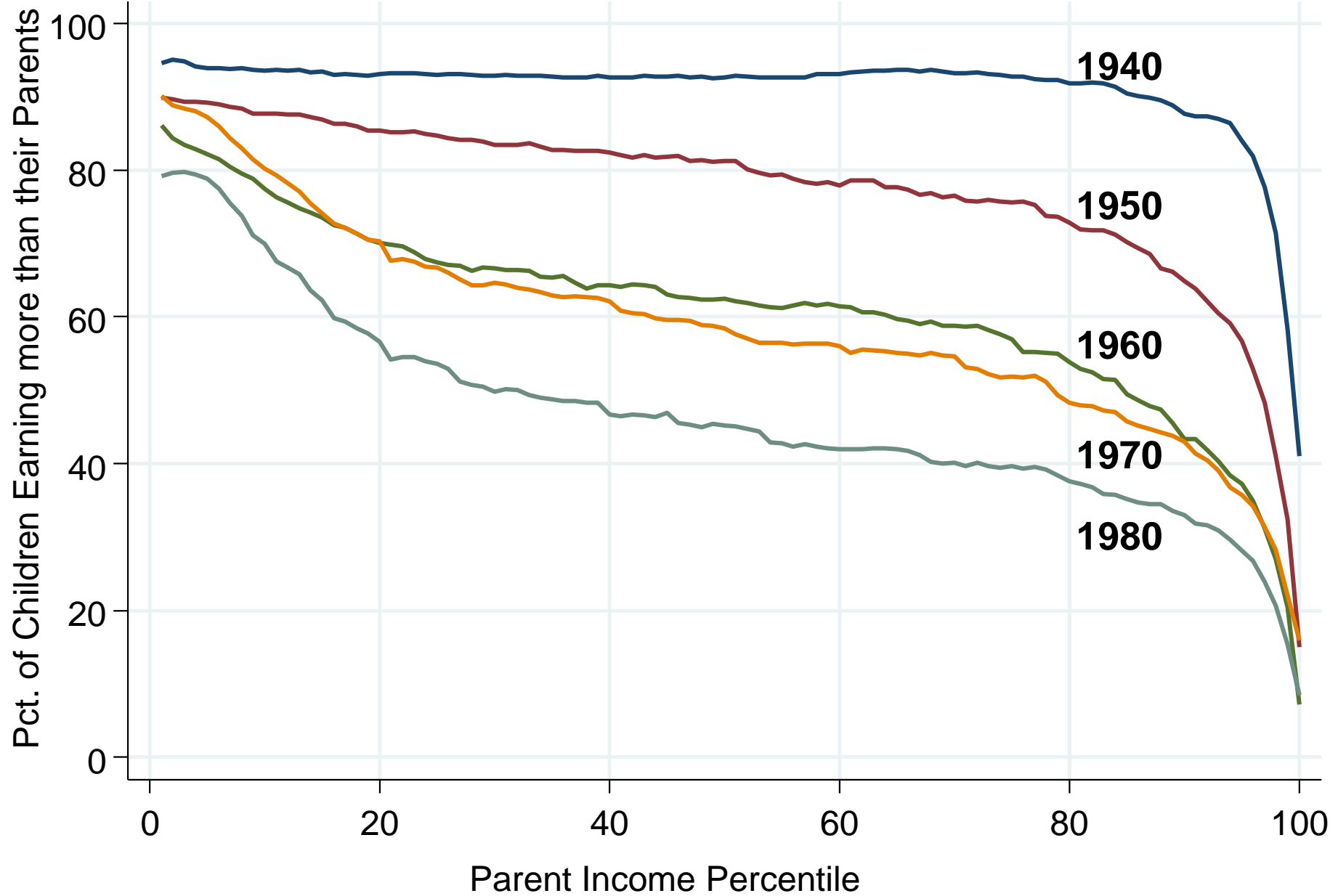
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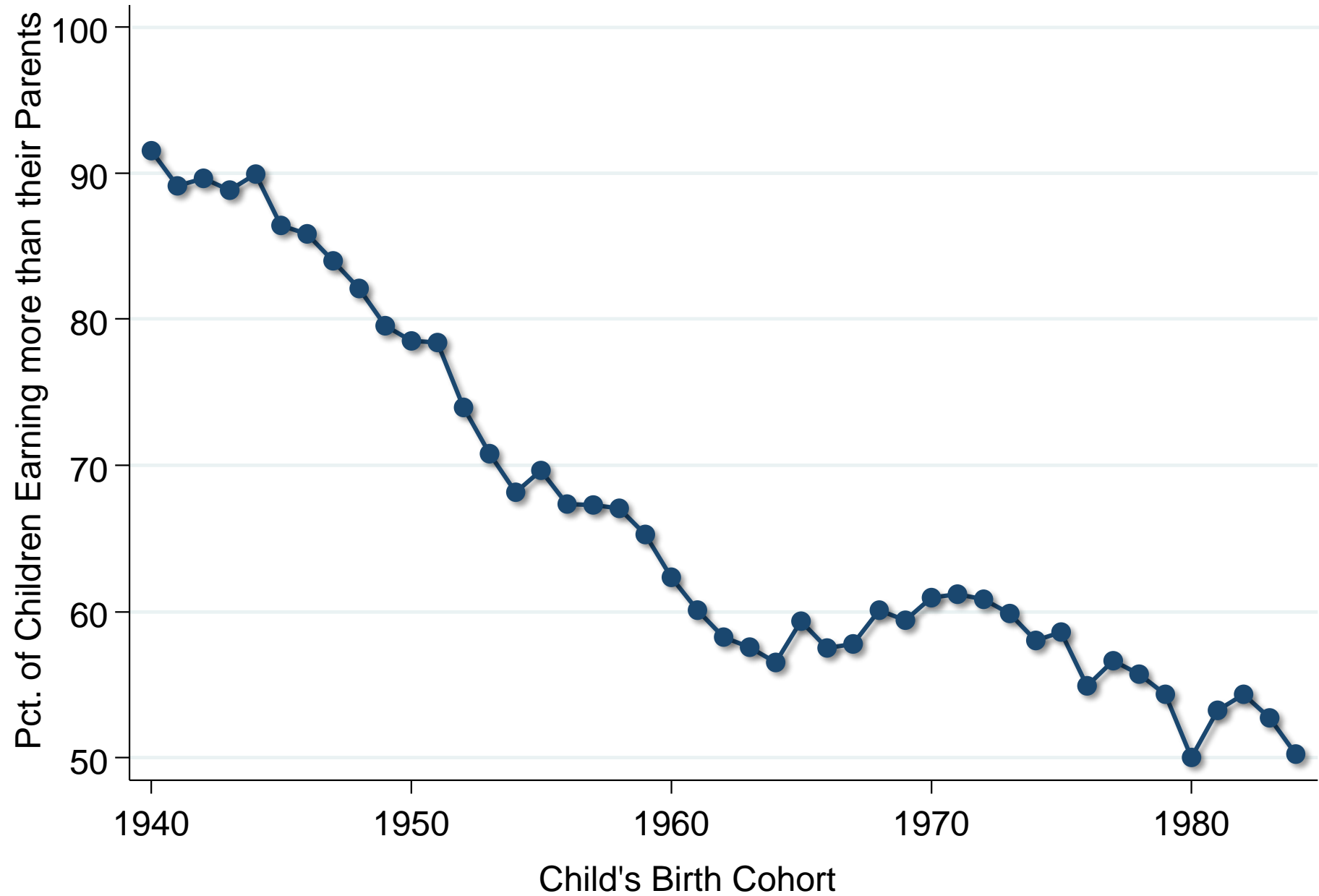
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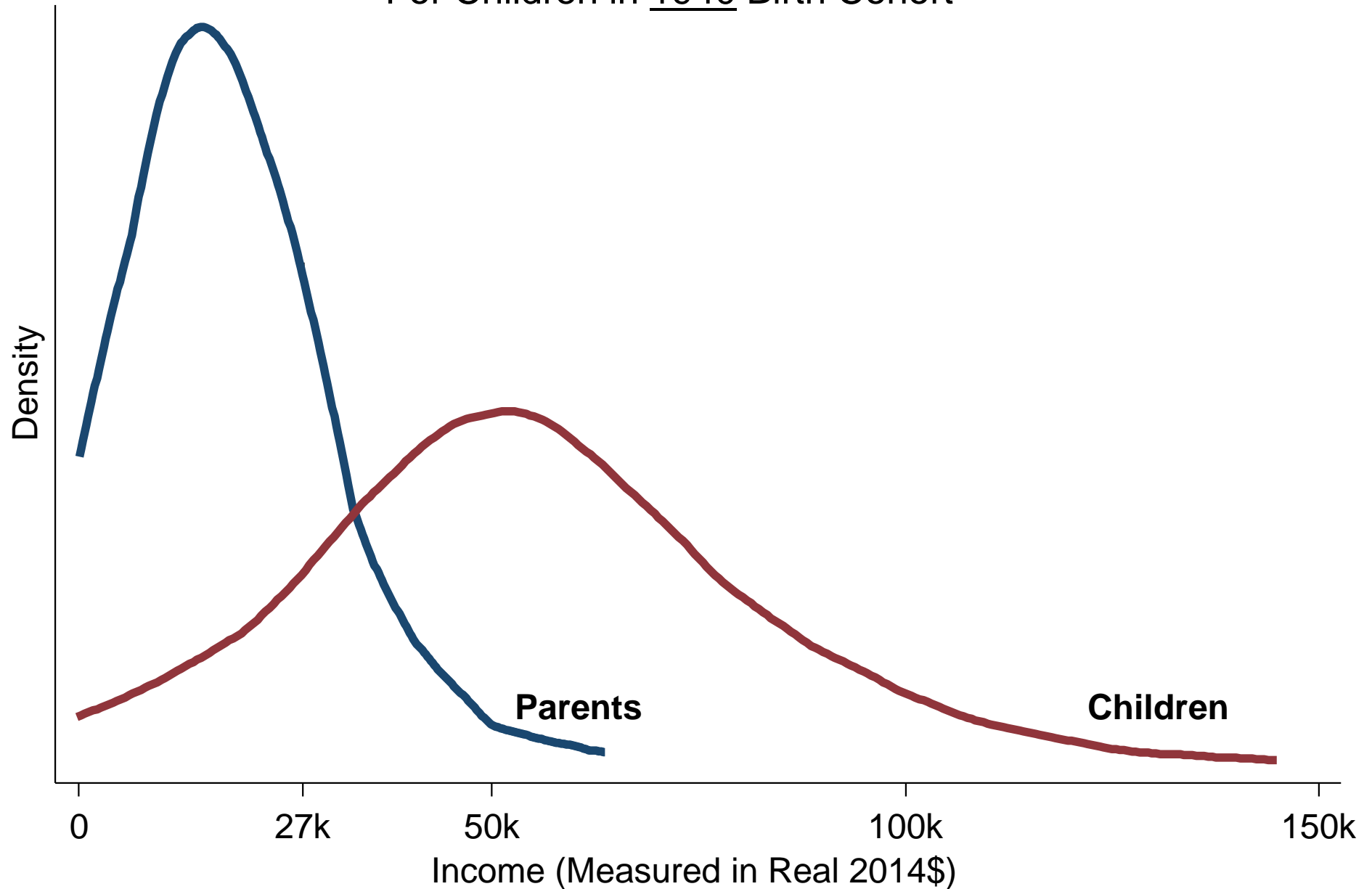


Percent of Children Earning More than Their Parents, by Birth Cohort



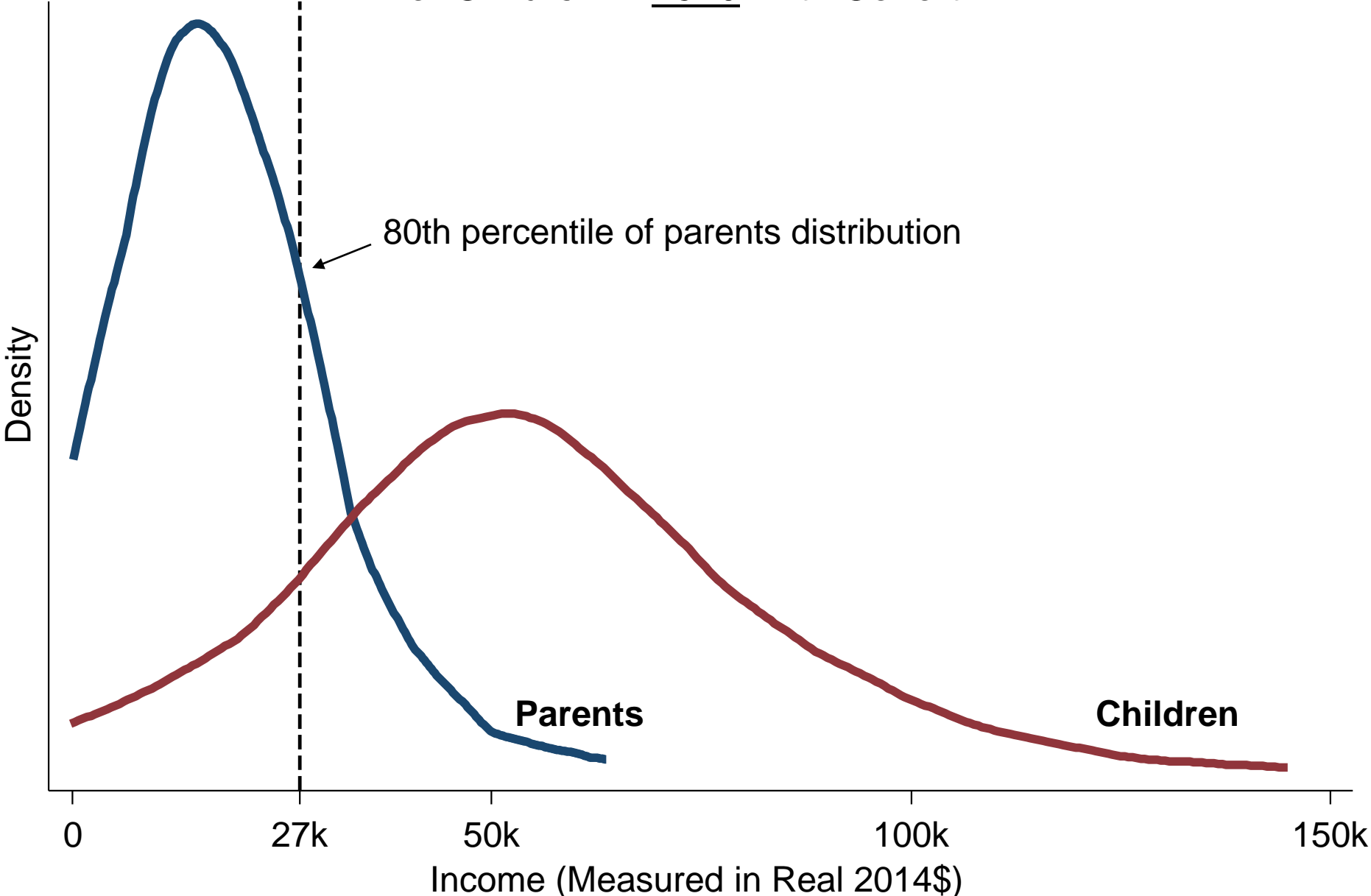
Household Income Distributions of Parents and Children at Age 30

For Children in 1940 Birth Cohort



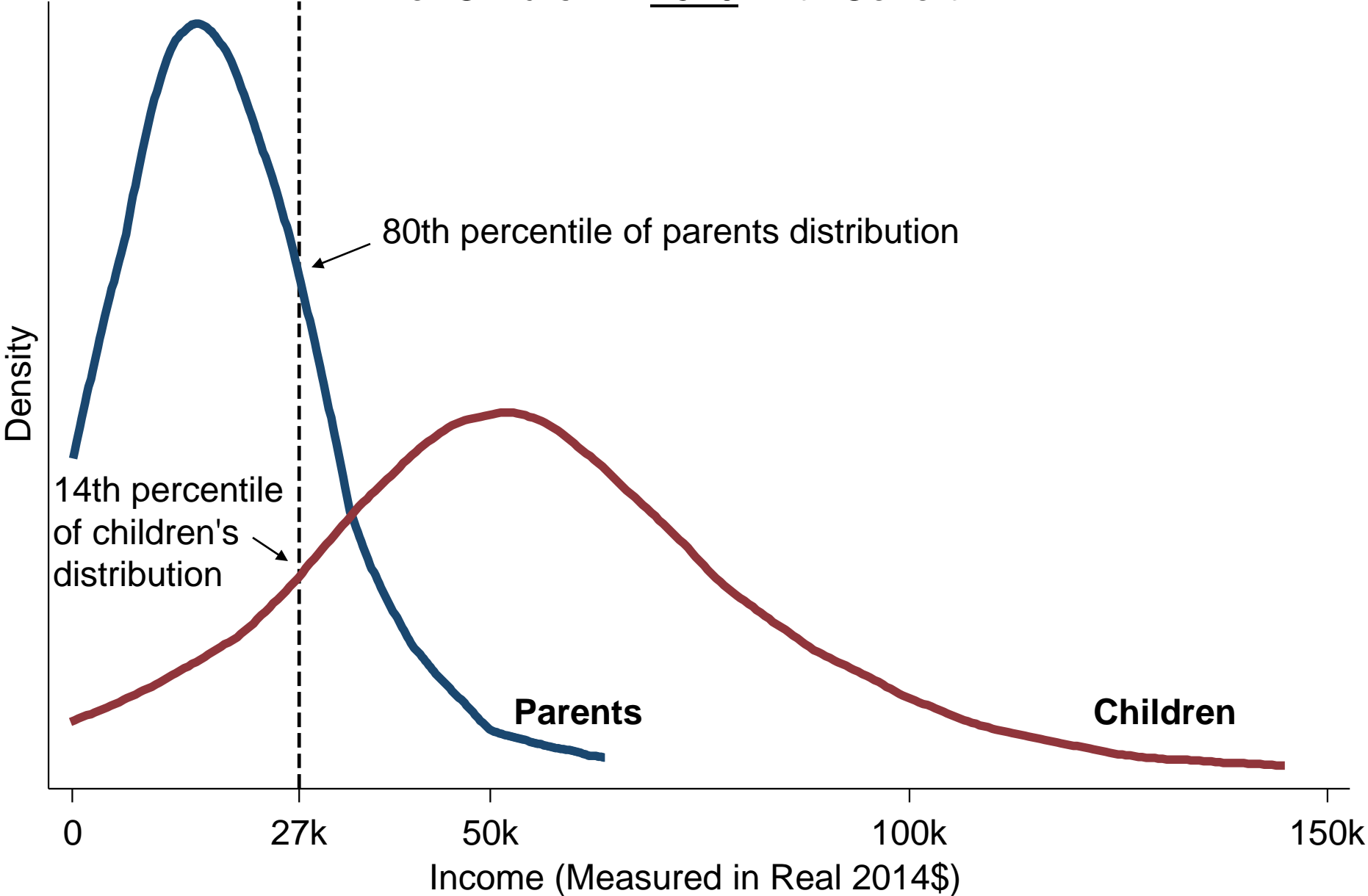
Household Income Distributions of Parents and Children at Age 30

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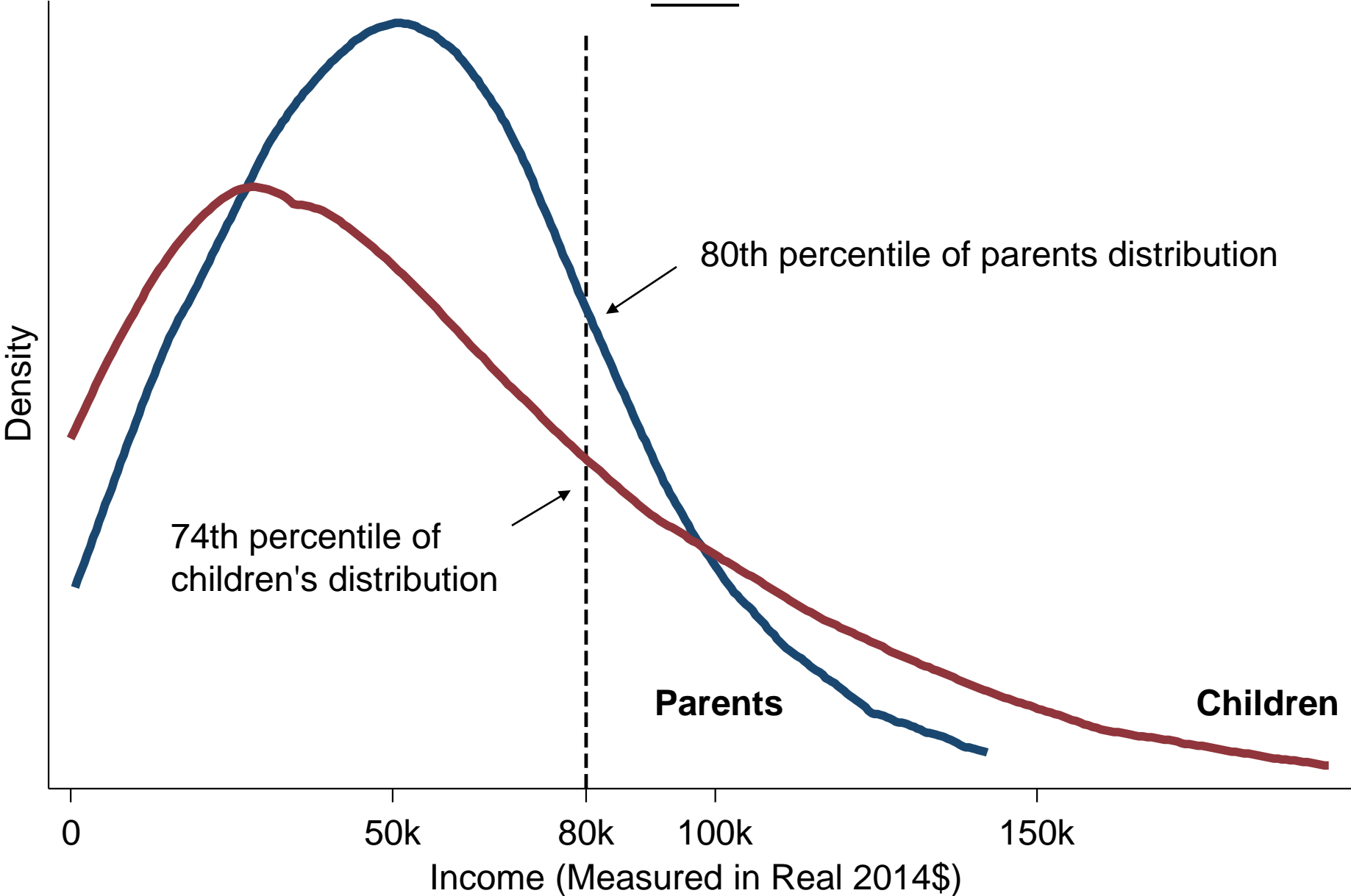
Household Income Distributions of Parents and Children at Age 30

For Children in 1940 Birth Cohort



Household Income Distributions of Parents and Children at Age 30

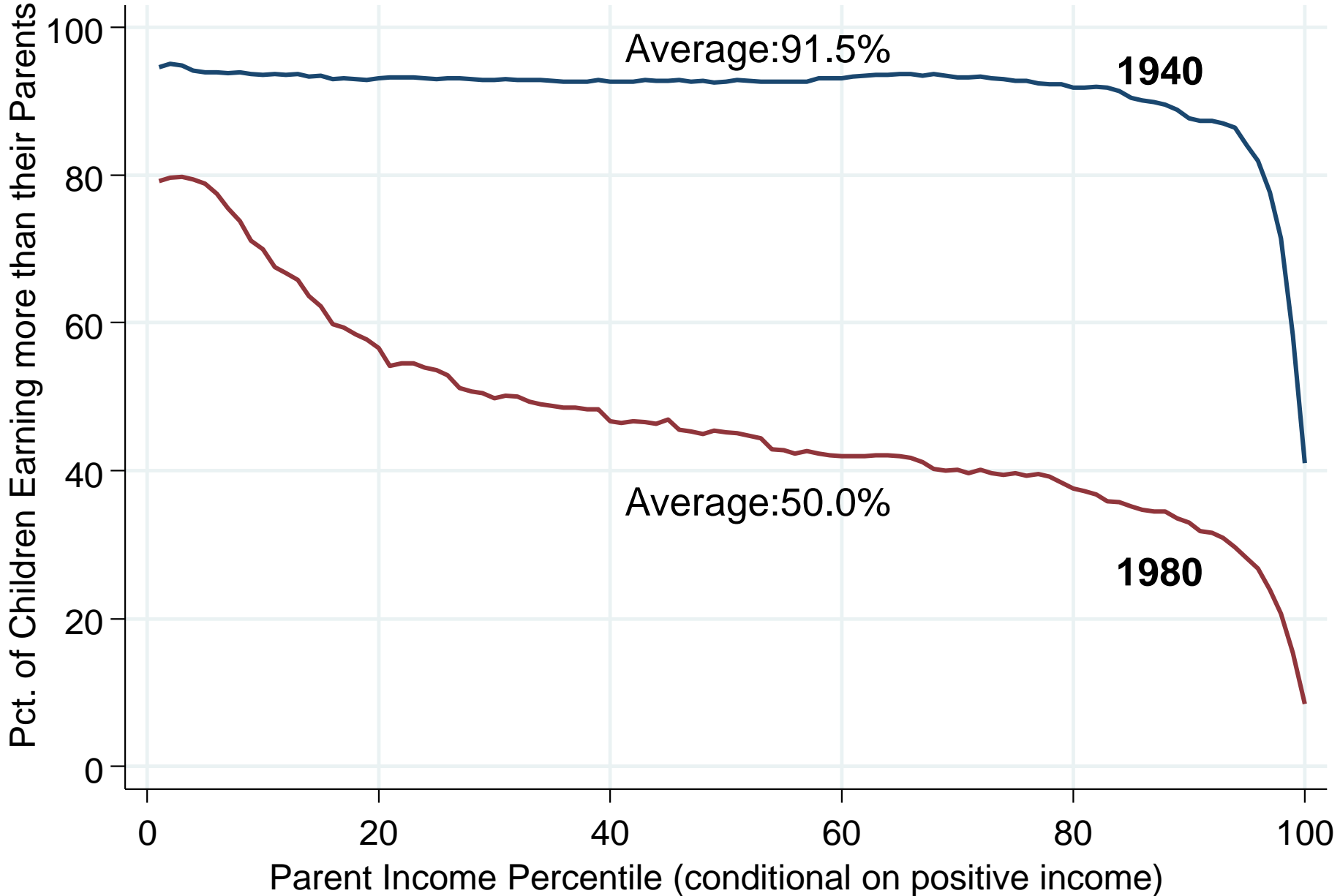
For Children in 1980 Birth Cohort



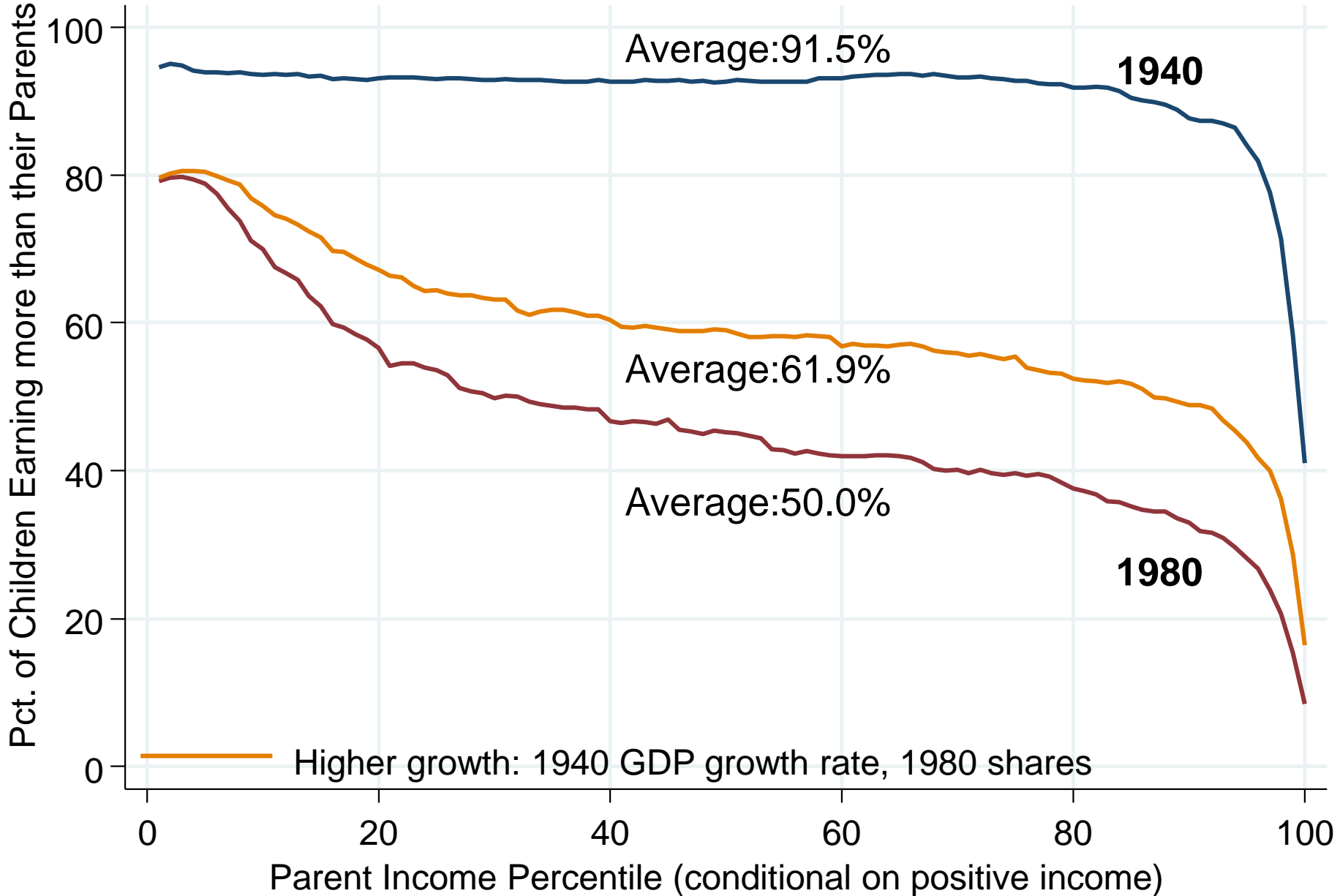
What Policies Can Revive Absolute Mobility?

- Two key macroeconomic changes since 1940: lower GDP growth rates and less equal distribution of growth
- Consider two hypothetical scenarios for children born in 1980:
 - 1. Higher growth:** growth rate since birth corresponding to 1940 cohort, with GDP distributed as it is today
 - 2. More broadly shared growth:** Same GDP growth as today, but distribute GDP across income groups as in 1940 cohort

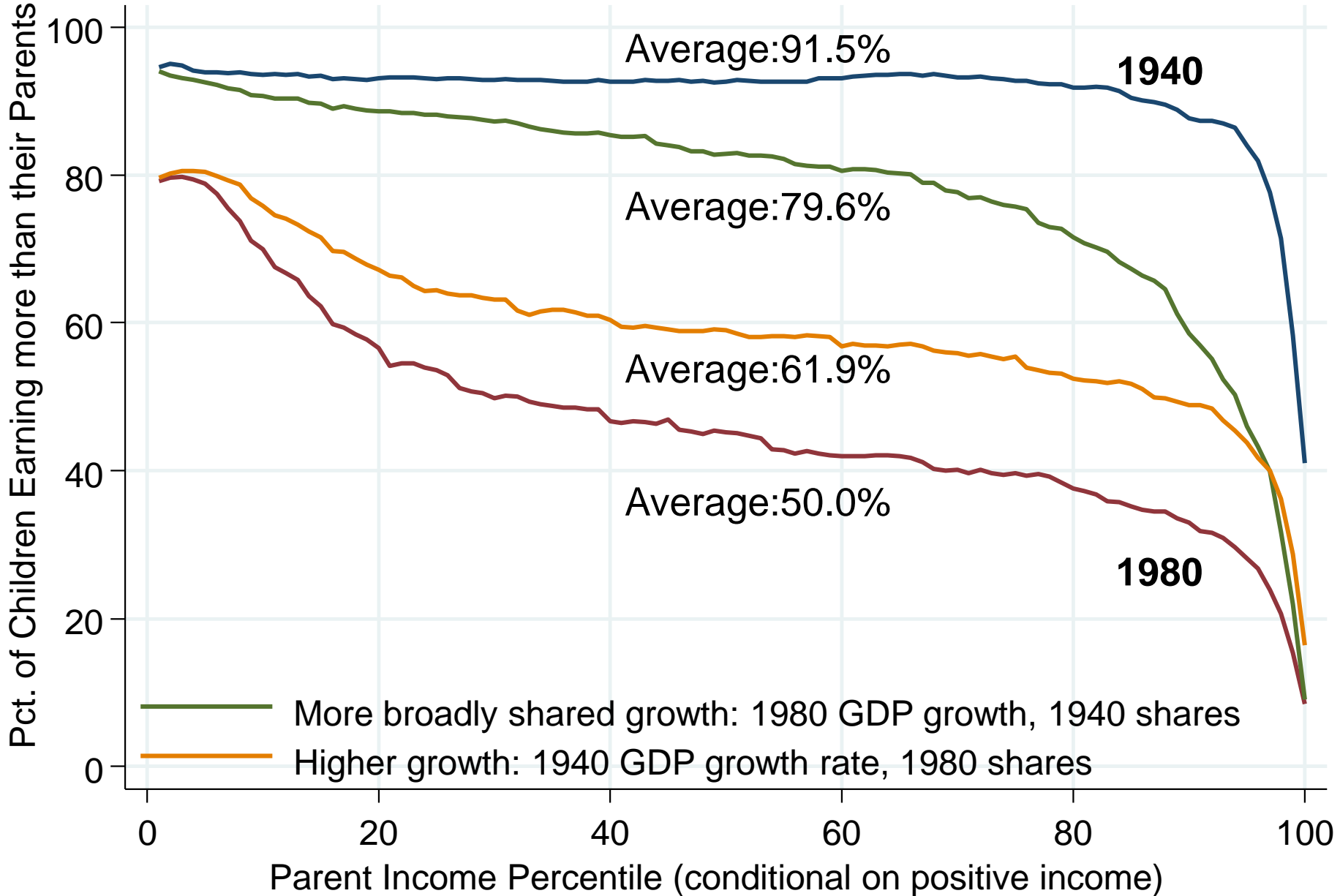
Percent of Children Earning More than Their Parents: Hypothetical Scenarios



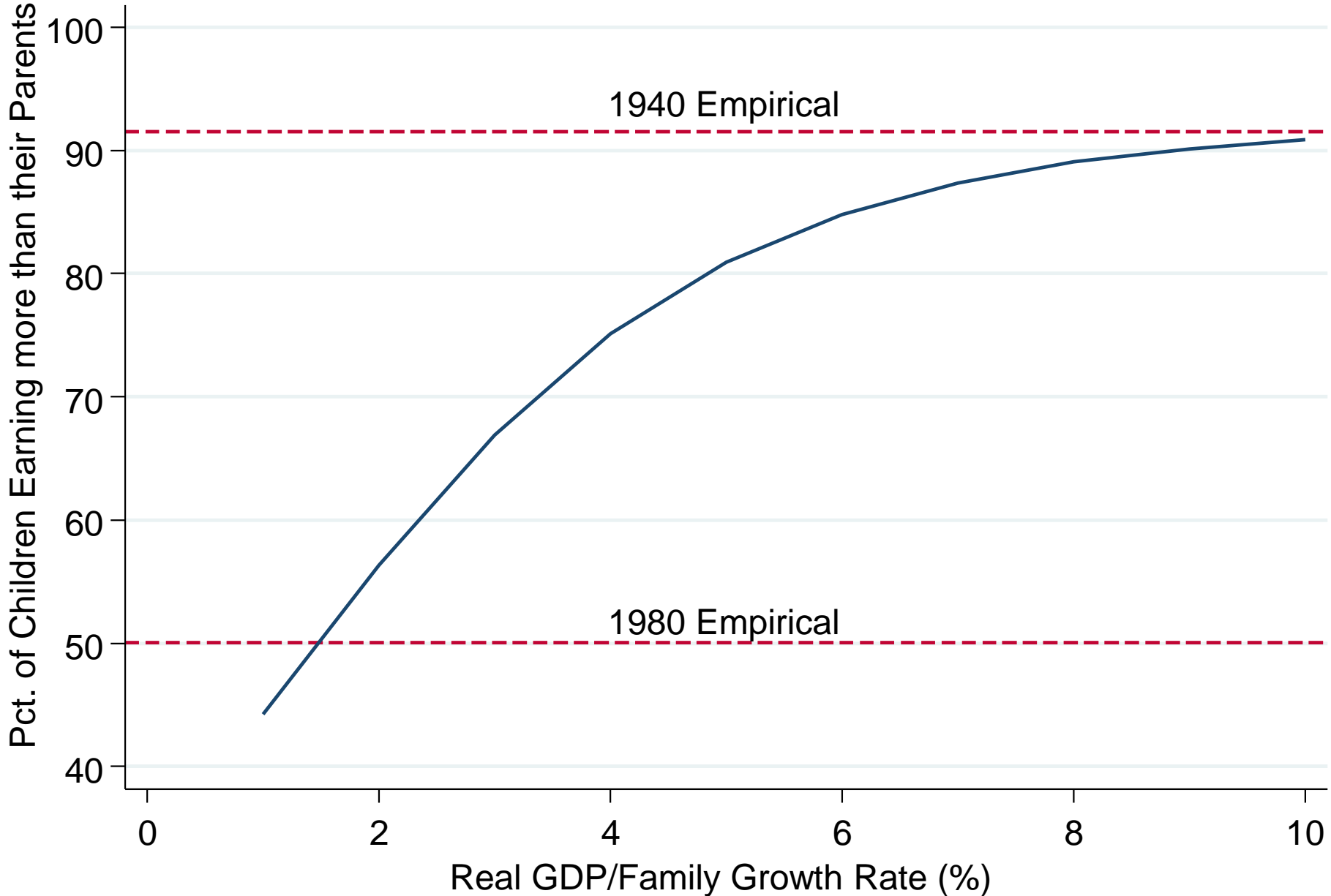
Percent of Children Earning More than Their Parents: Hypothetical Scenarios



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Percent of Children Earning More than Their Parents: Hypothetical Scenarios



Summary: Reviving the American Dream

1. Rates of absolute upward mobility have fallen from ~90% for 1940 birth cohort to ~50% for children entering labor market today
2. Reviving the American Dream of high rates of upward mobility will require *more broadly shared* economic growth
 - Need policies that will increase incomes in the bottom and middle of the income distribution
 - Could range from housing vouchers to investments in higher education to worker retraining

Is Increasing Social Mobility Desirable?

- Thus far we have assumed that our objective should be to increase mobility
- But policies that increase mobility may not be desirable from an efficiency perspective
 - Random college admissions would maximize social mobility
 - But would violate principle of meritocracy and would likely reduce total economic output and growth
- Next, assess tradeoff between mobility and growth, focusing on innovation as a driver of growth

Equality of Opportunity and Economic Growth

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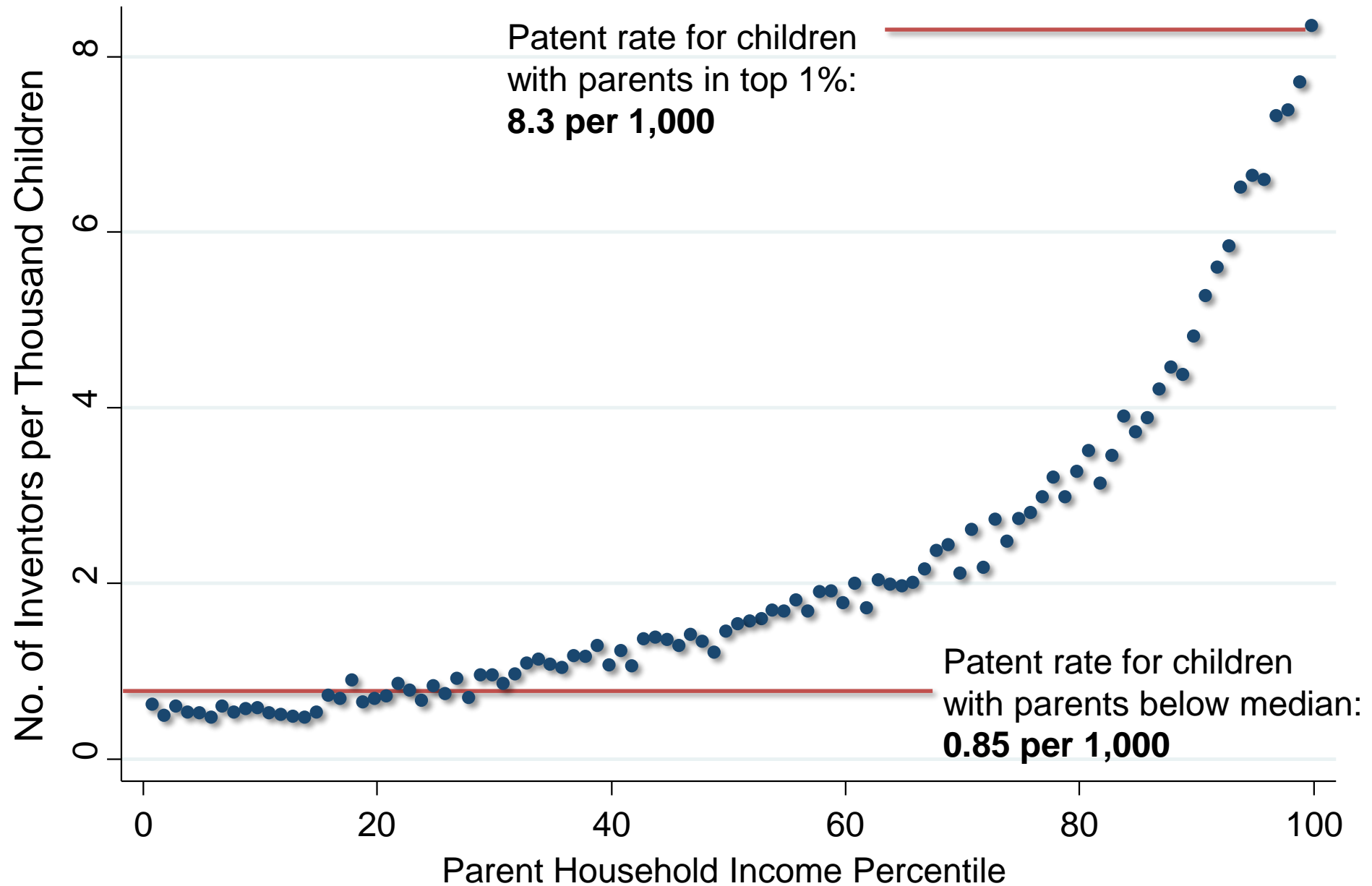
- Question: how does increasing equality of opportunity affect aggregate growth?
- Difficult to measure effects on growth directly
 - Instead, focus here on a channel that many economists think is the key driver of economic growth: innovation

Reference: Bell, Chetty, Jaravel, Petkova, and van Reenen. “The Lifecycle of Inventors” Working Paper 2016

Measuring Innovation

- Measure innovation using patent data
 - Standard proxy for invention in literature, with well known pros and cons
- Link universe of patent records in the United States from 1996-2010 to tax records
 - Use linked data to study the lives of 750,000 patent holders in the U.S., from birth to adulthood

Patent Rates vs. Parent Income Percentile



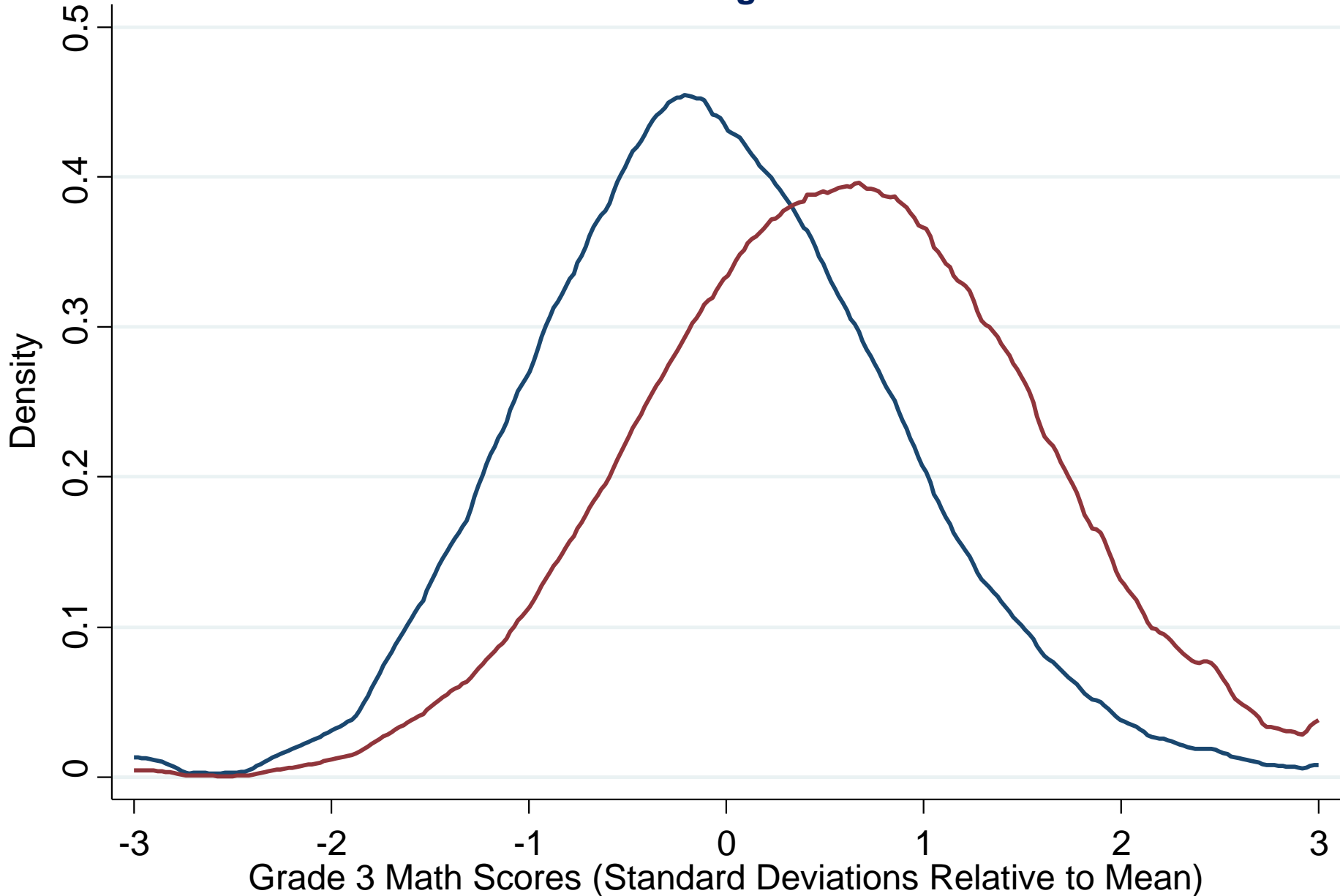
Why Do Patent Rates Vary with Parent Income?

- Correlation between parent income and children growing up to be inventors could be driven by three mechanisms:
 1. Endowments: Children from high-income families may have higher innate ability
 2. Preferences: lower income children may prefer other occupations
 3. Constraints: lower income children may face greater barriers to entry (poorer environment, lack of funding)

Do Differences in Ability Explain the Innovation Gap?

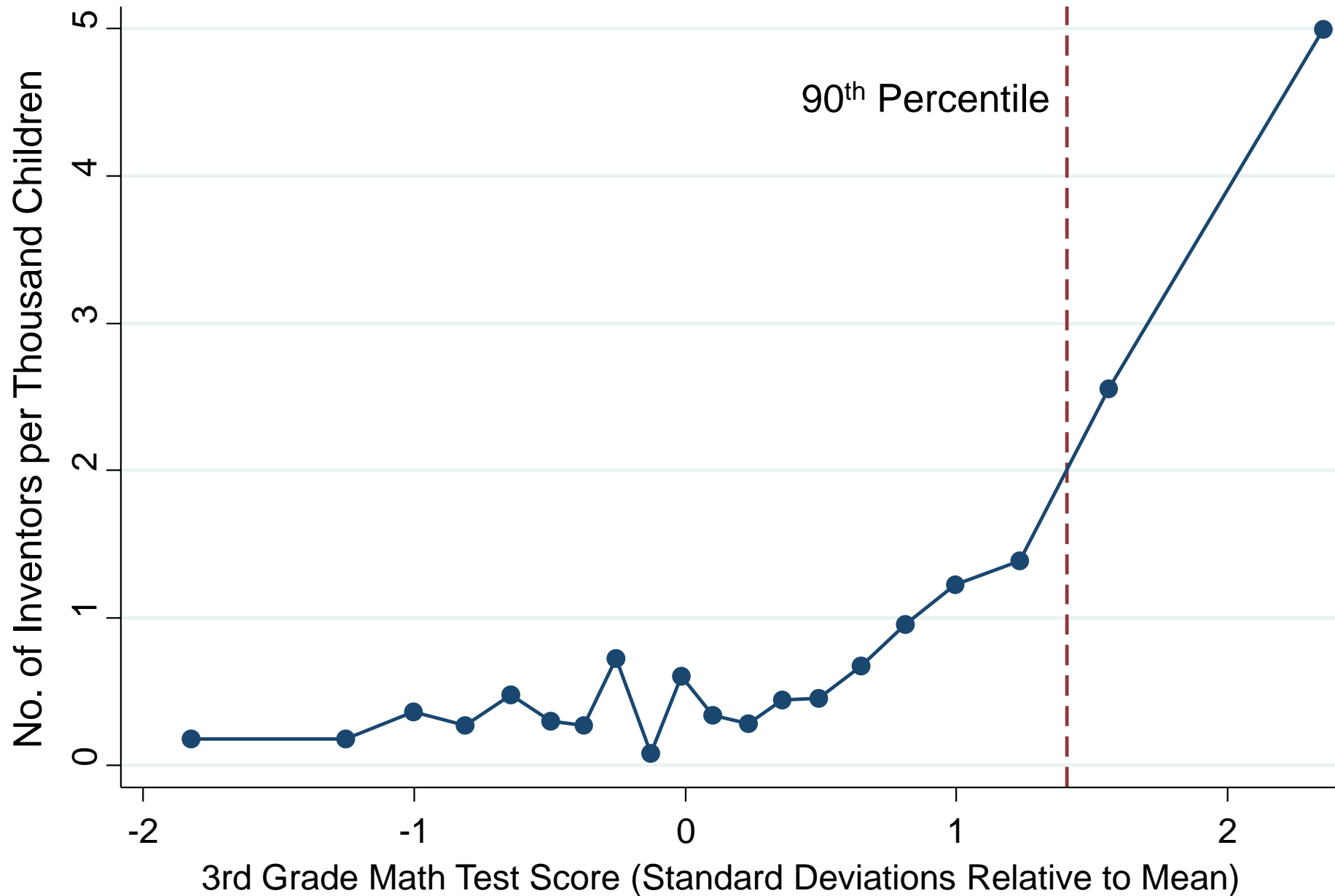
- Measure ability using test score data for children in NYC public schools [Chetty, Friedman, Rockoff 2014]
 - Math and English scores from grades 3-8 on standardized tests for 430,000 children born between 1979-84

Distribution of 3rd Grade Math Test Scores for Children of Low vs. High Income Parents

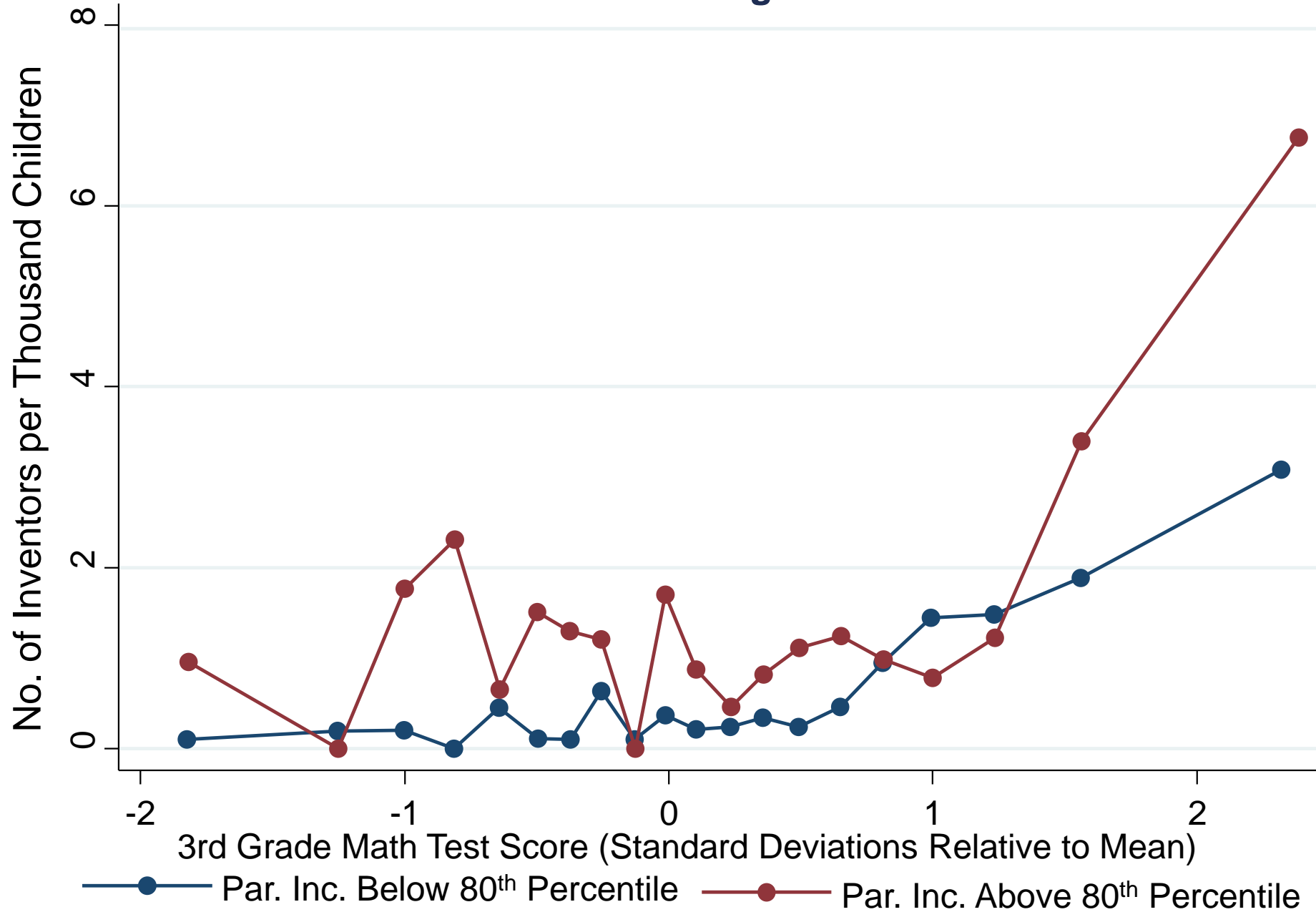


— Parent Income Below 80th Percentile — Parent Income Above 80th Percentile

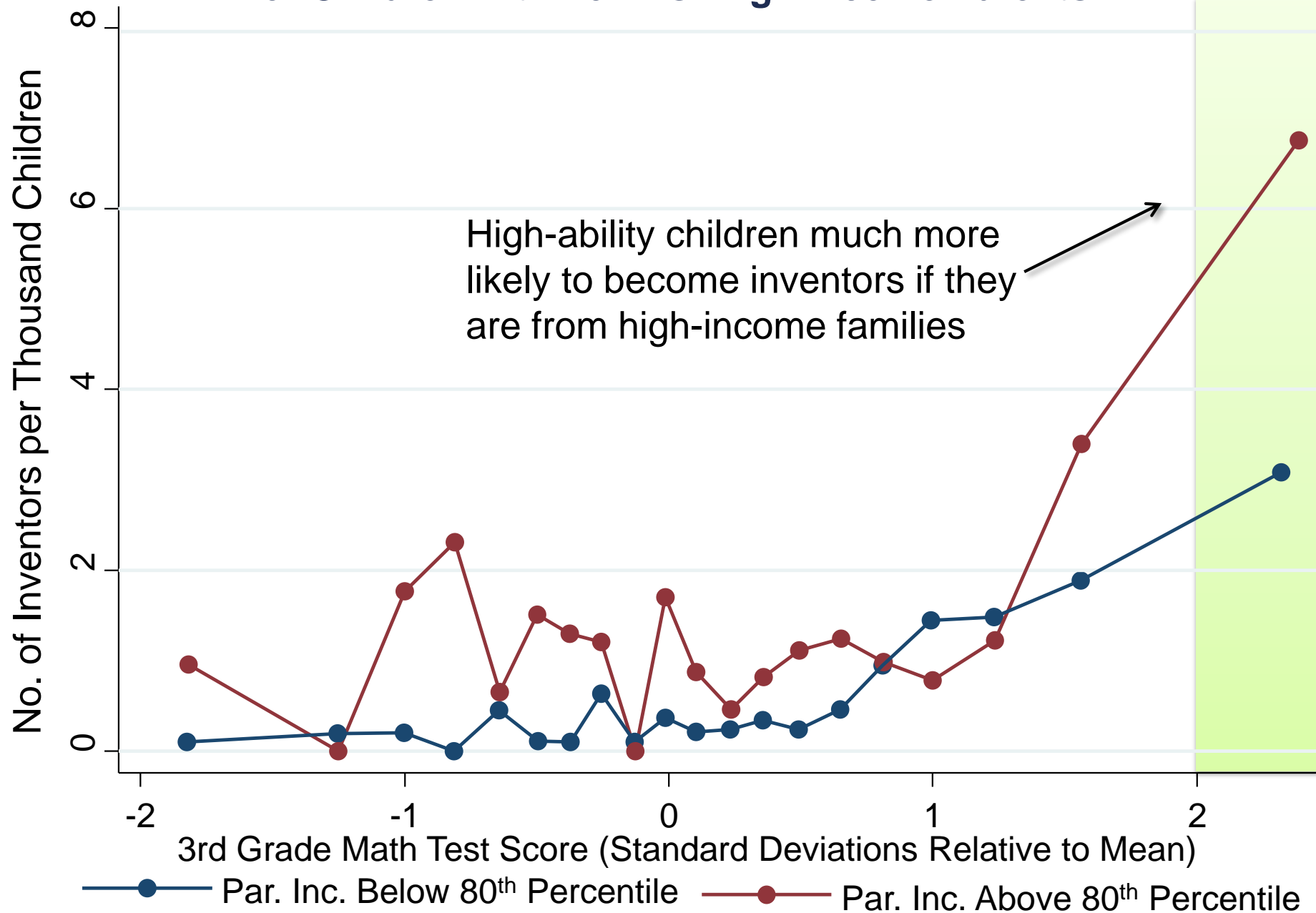
Patent Rates vs. 3rd Grade Math Test Scores



Patent Rates vs. 3rd Grade Math Test Scores for Children with Low vs. High Income Parents



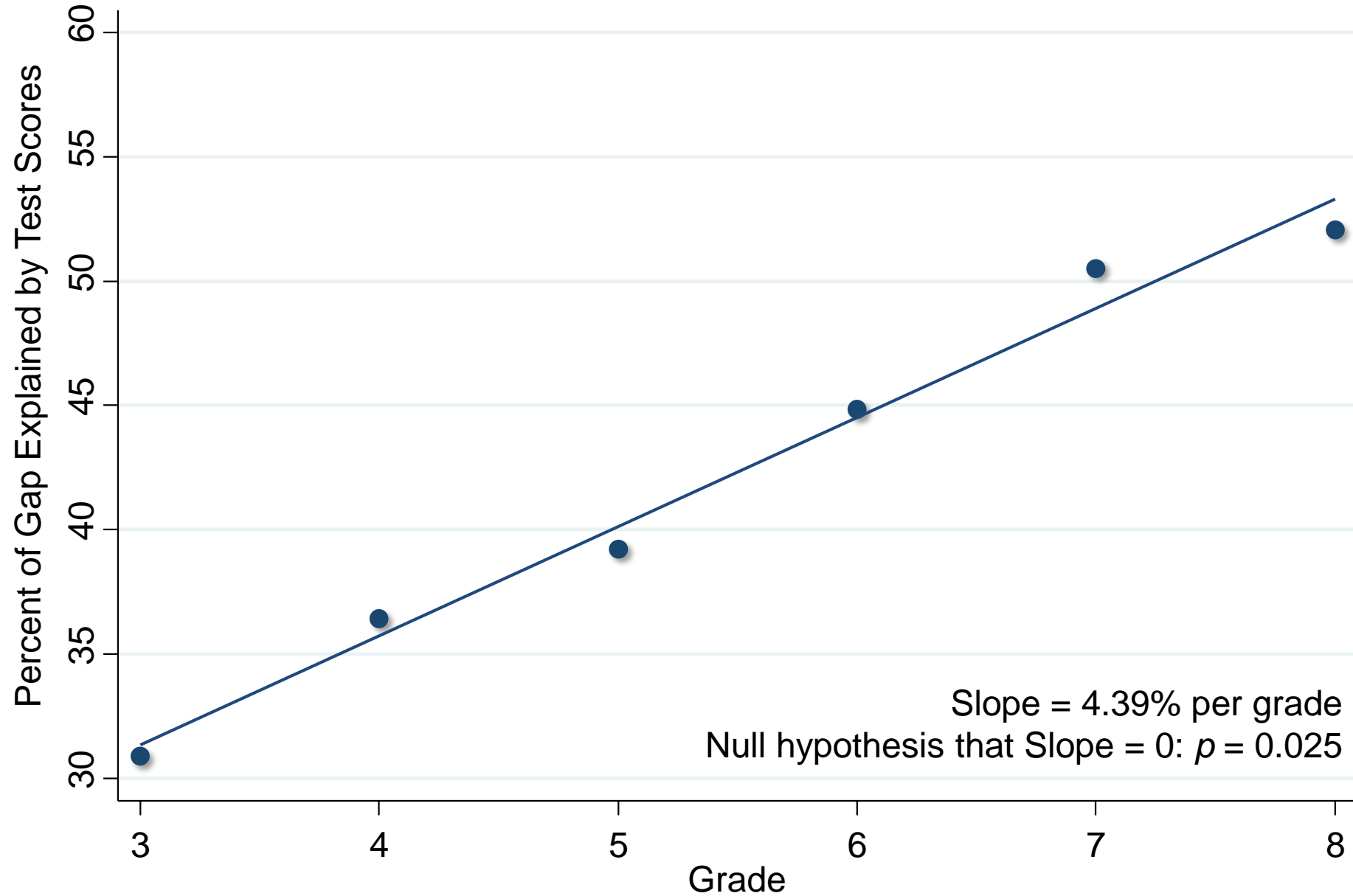
Patent Rates vs. 3rd Grade Math Test Scores for Children with Low vs. High Income Parents



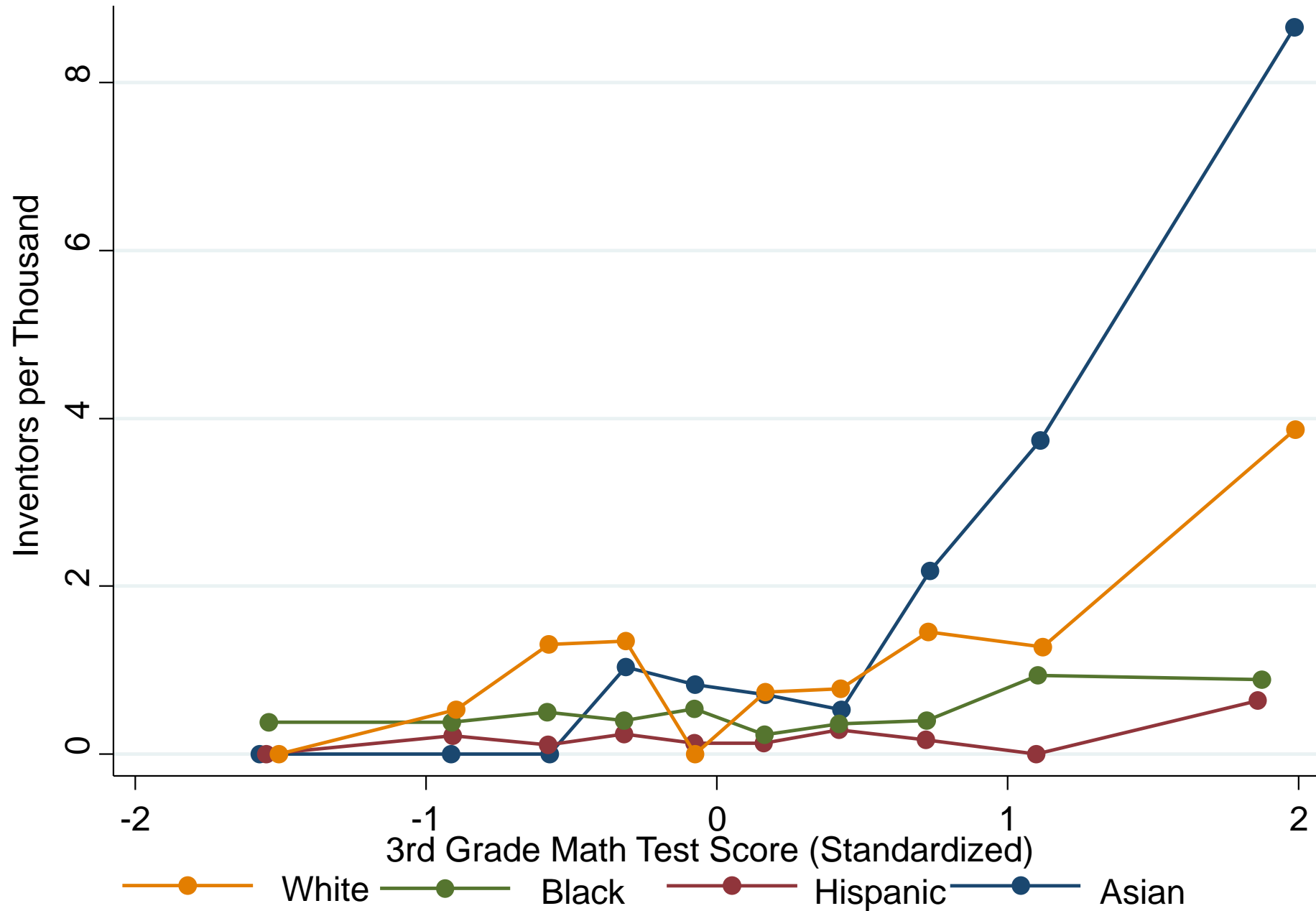
Innovation Gap Explained by Test Scores

- Differences in 3rd grade test scores account for **31%** of the income gap in innovation
 - If low-income children had same test score distribution as high-income children, gap in innovation would be 31% smaller
- Does this change if we use test scores in later grades?

Percentage of Innovation Gap Explained by Test Scores in Grades 3-8

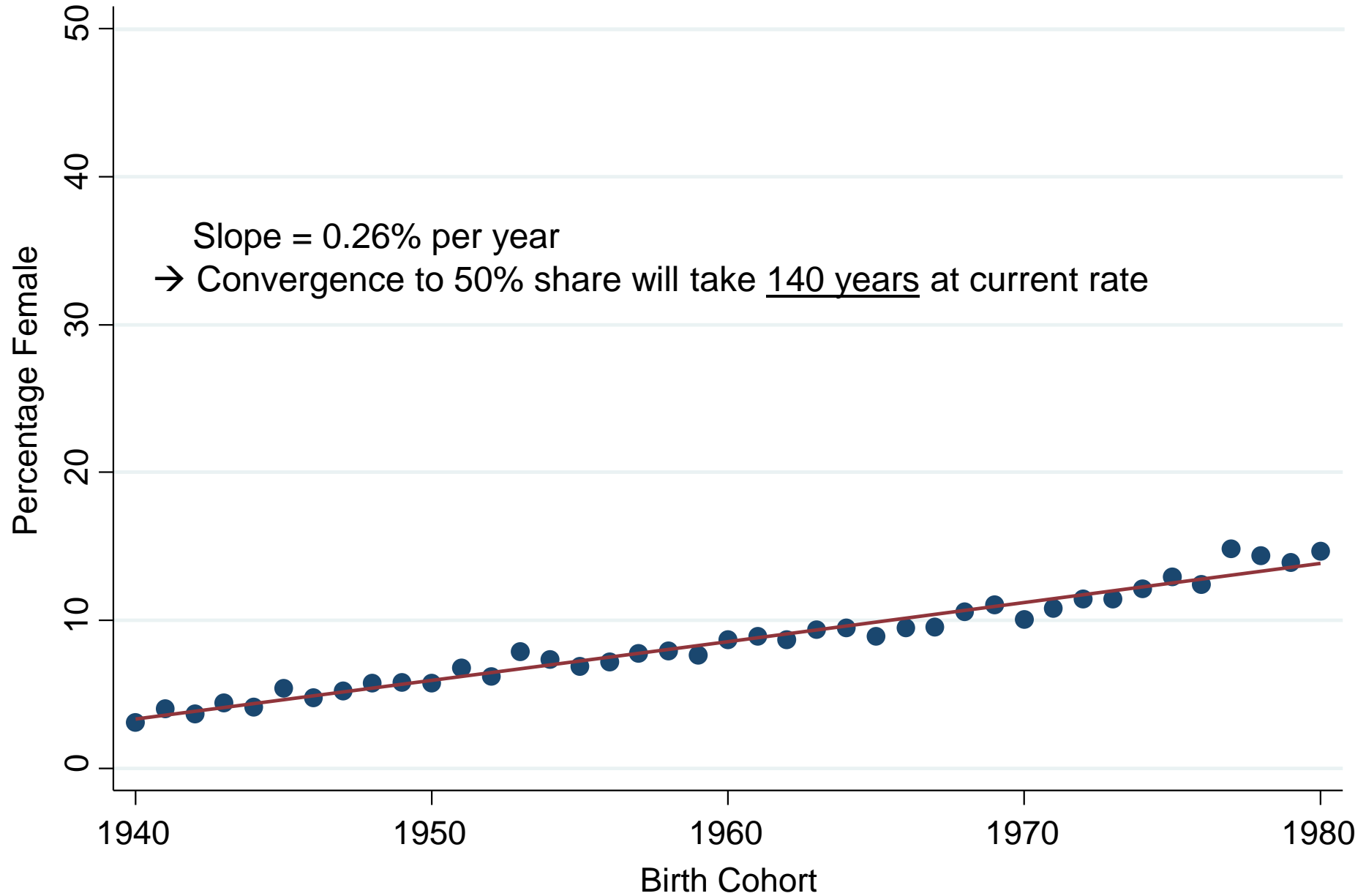


Patent Rates vs. 3rd Grad Math Scores by Race

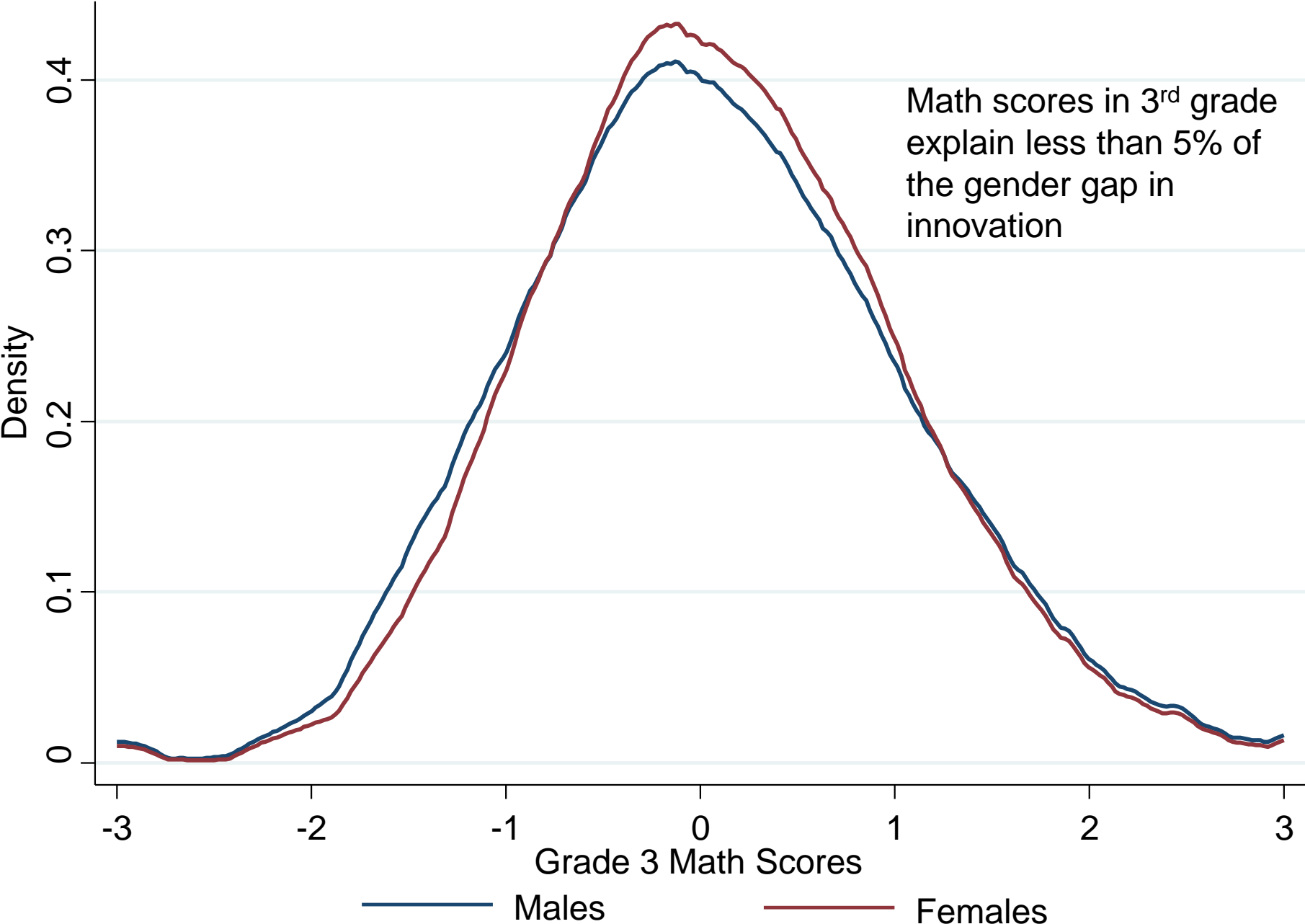


Gender Gap in Innovation

Percentage of Female Patent Holders by Birth Cohort



Distribution of Math Test Scores in 3rd Grade for Males vs. Females



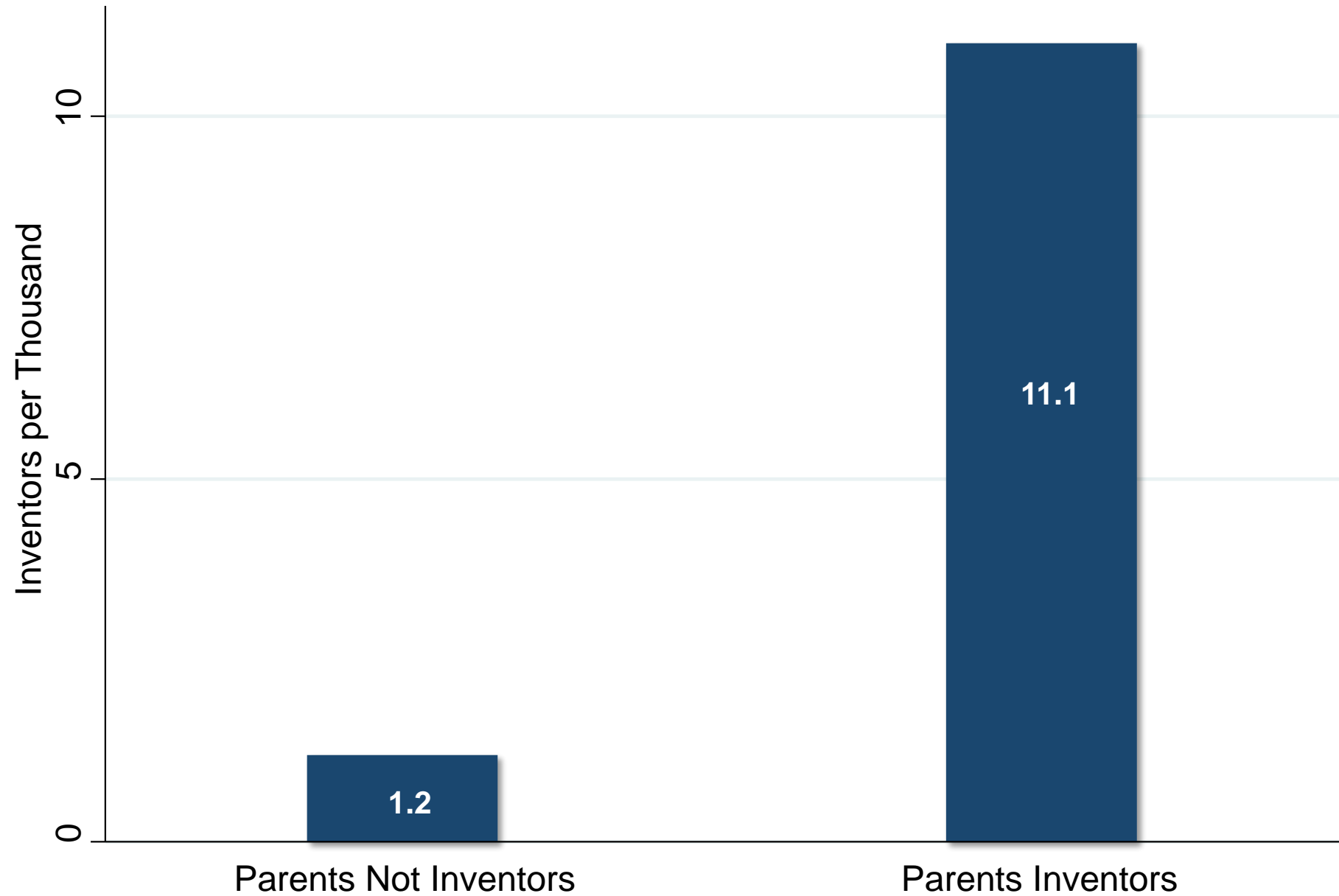
Differences in Ability and the Innovation Gap

- Test score data suggest that most of the innovation gap across income, race, and gender is not due to ability diffs.
 - But not conclusive because tests are imperfect measures of ability
 - And genetic ability may be better manifested in tests at later ages

Differences in Environment and the Innovation Gap

- Study role of environment by returning to idea of childhood exposure effects
 - Do differences in exposure to innovation during childhood explain innovation gap?
- Begin by analyzing relationship between children's and parents' innovation rates

Patent Rates for Children of Inventors vs. Non-Inventors



Exposure vs. Genetics

- Correlation between child and parent's propensity to patent could be driven by genetics or by environment
- To distinguish these two explanations, analyze propensity to patent by narrow technology class

Illustration of Technology Classes and Distance

Category: Computers + Communications

Sub-category: Communications

<u>Technology Class</u>	<u>Distance Rank</u>
<i>Pulse or digital communications</i>	0
Demodulators	1
Modulators	2
Coded data generation or conversion	3
Electrical computers: arithmetic processing and calculating	4
Oscillators	5
Multiplex communications	6
Telecommunications	7
Amplifiers	8
Motion video signal processing for recording or reproducing	9
Directive radio wave systems and devices (e.g., radar, radio navigation)	10

Child's Patent Rate by Distance from Father's Technology Class

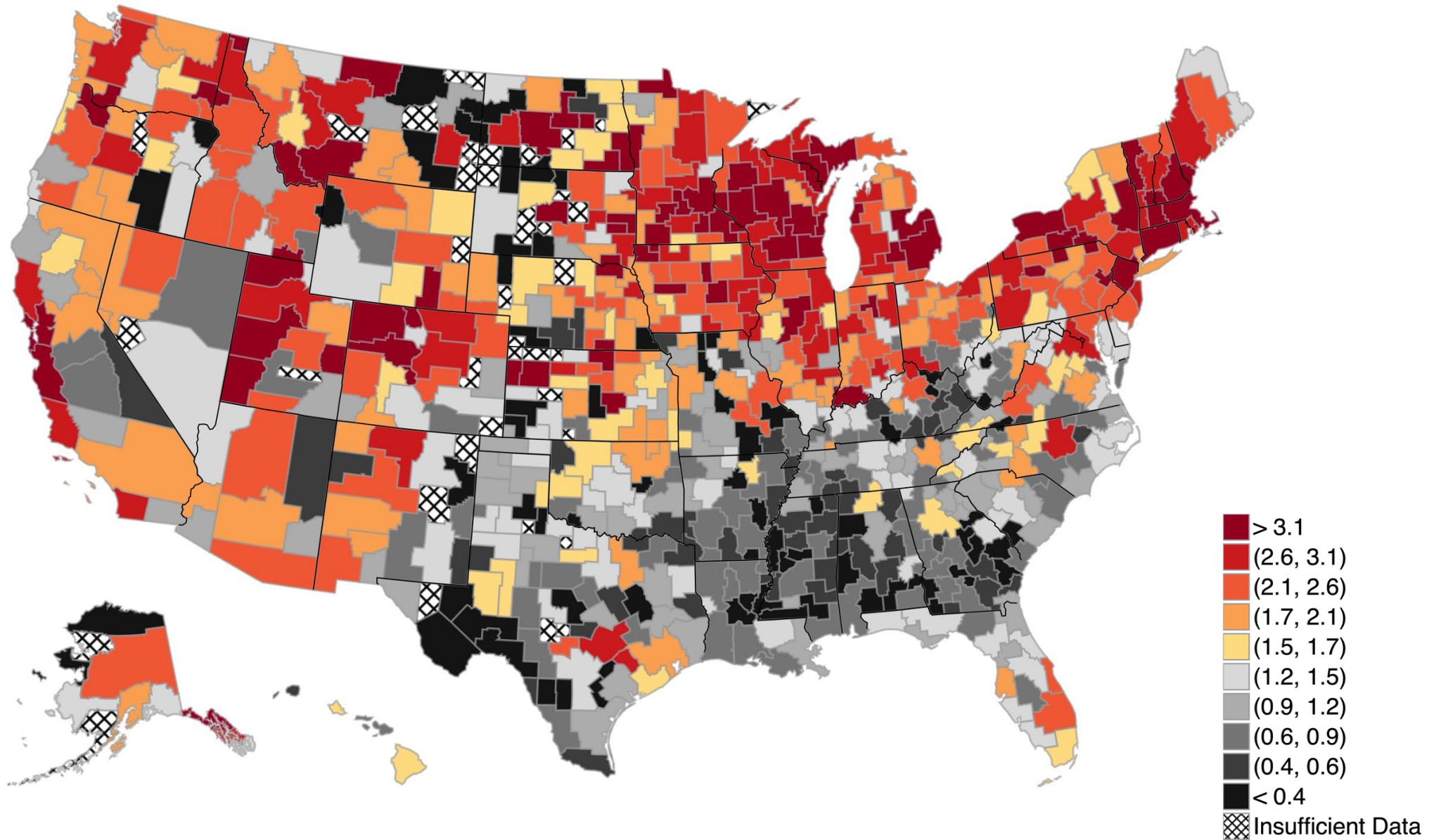


Neighborhood Exposure Effects and Innovation

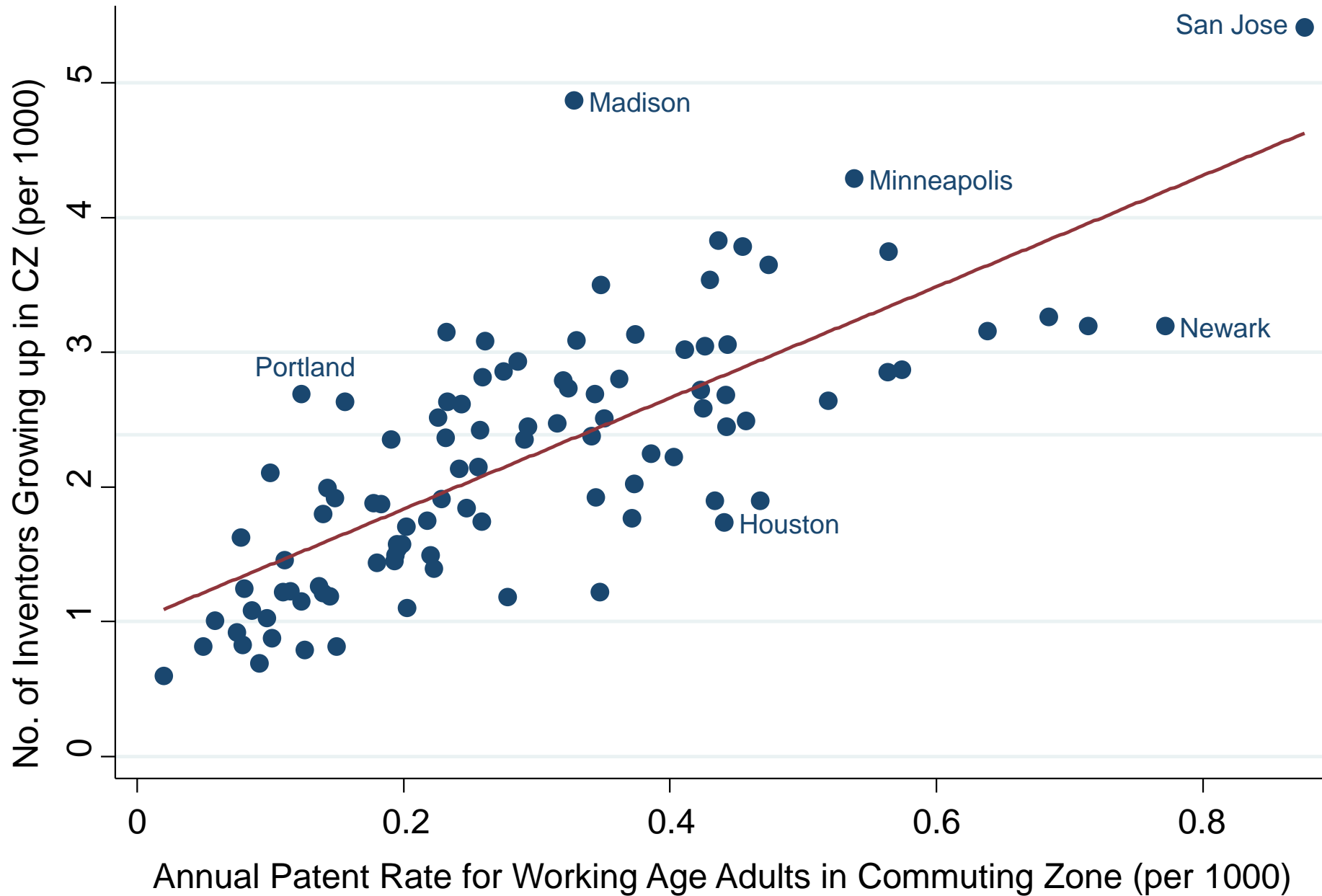
- Parents are only one potential source of exposure
- To capture broader sources of exposure, analyze variation across neighborhoods where child *grew up*

The Origins of Inventors in America

Patent Rates per 1000 Children by Area where Child Grew Up



Patent Rates of Children who Grow up in an Area vs. Patent Rates of Adults in that Area



Neighborhood Exposure Effects and Innovation

- Children raised in areas with more inventors are more likely to be inventors themselves
- Could again be driven by genetics or exposure effects
- Once again, study patterns *within* technological class to distinguish the two explanations
 - Exact technology class in which a child innovates is strongly related to where he grew up, conditional on location in adulthood
 - Kids who grow up in Minneapolis likely to patent in medical devices; kids who grow up in Bay Area likely to patent in computers

Exposure Effects and Gender Gaps in Innovation

- Exposure effects are also related to gender gaps in innovation
- Girls more likely to become inventors in a particular field if they grow up in an area with more female inventors in that field
- Suggests that gender gap can be self-perpetuating
 - Under-representation of female scientists in current generation reduces female scientists in next generation

Development of Gender Stereotypes During Childhood

- Bian et al. (Science 2017): conduct experiments to analyze development of gender stereotypes about intellectual ability
- Present children with pictures of men and women ask them to say who is “really nice” and who is “really smart”
 - At age 5: no difference across boys and girls
 - At age 6: girls much more likely to choose man as “really smart”
- Similarly, girls less likely to choose to play games that are for “children who are really smart” at age 6 than age 5