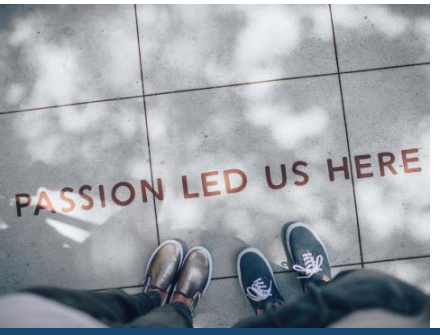


Using Big Data to Solve Economic and Social Problems

Professor Raj Chetty
Head Section Leader: Gregory Bruich, Ph.D.

Spring 2019

HARVARD UNIVERSITY

OPPORTUNITY INSIGHTS

Part II
Education

Education and Upward Mobility

- Education is widely viewed as one of the most scalable pathways to upward mobility

- But there is growing concern that education no longer provides a strong pathway to opportunity in the U.S.

  - U.S. students perform worse on standardized tests on average than in many European countries despite higher spending on schools

  - Sharp differences in quality of schools across districts

  - Rising costs of college → lack of access for low-income students

  - Concern that some colleges (e.g., for-profit institutions) may not produce good outcomes

Education and Upward Mobility

- How can we improve education in America?
  - Traditionally, measuring impacts of education systematically was difficult
  - Administrative data from colleges and school districts are giving us a more scientific understanding of the “education production function”
- Start with higher education, then turn to K-12 education
  - Reference: Chetty, Friedman, Saez, Turner, Yagan. “Mobility Report Cards: The Role of Colleges in Intergenerational Mobility” Working Paper 2017

How Do Colleges Shape Income Mobility in the U.S.?

- How does the higher education system affect intergenerational income mobility in the U.S.?
  - In principle, higher education can provide a pathway to upward mobility that is not directly shaped by the neighborhood where a child happens to grow up
  - But if children from higher-income families tend to attend better colleges, higher education system may not promote mobility
  - Colleges could actually *increase* intergenerational persistence of income if disparities in college attendance are sufficiently large

Effect of Higher Education System on Mobility

- Effect of higher education system on mobility depends upon three factors:

1. [Inputs] Parental income distributions by college
2. [Outputs] Students' earnings outcomes conditional on parental income by college
3. [Causal share] Portion of variation in students' earnings outcomes that is due to colleges' causal effects

Estimating the Three Parameters: Data

- Chetty et al. (2017) estimate these three parameters using data covering all college students in the U.S. from 1999-2013 (30 million students)

- Combine information from three sources to construct an anonymized dataset:

1. Parental and Student Income from income tax records
2. College attendance from 1098-T tax data and Pell grant data
3. SAT scores from College Board

– Note: all statistics are based on college *attendance* (not completion)

Parents' Income Distributions by College:
Income Segregation in the American Higher Education System

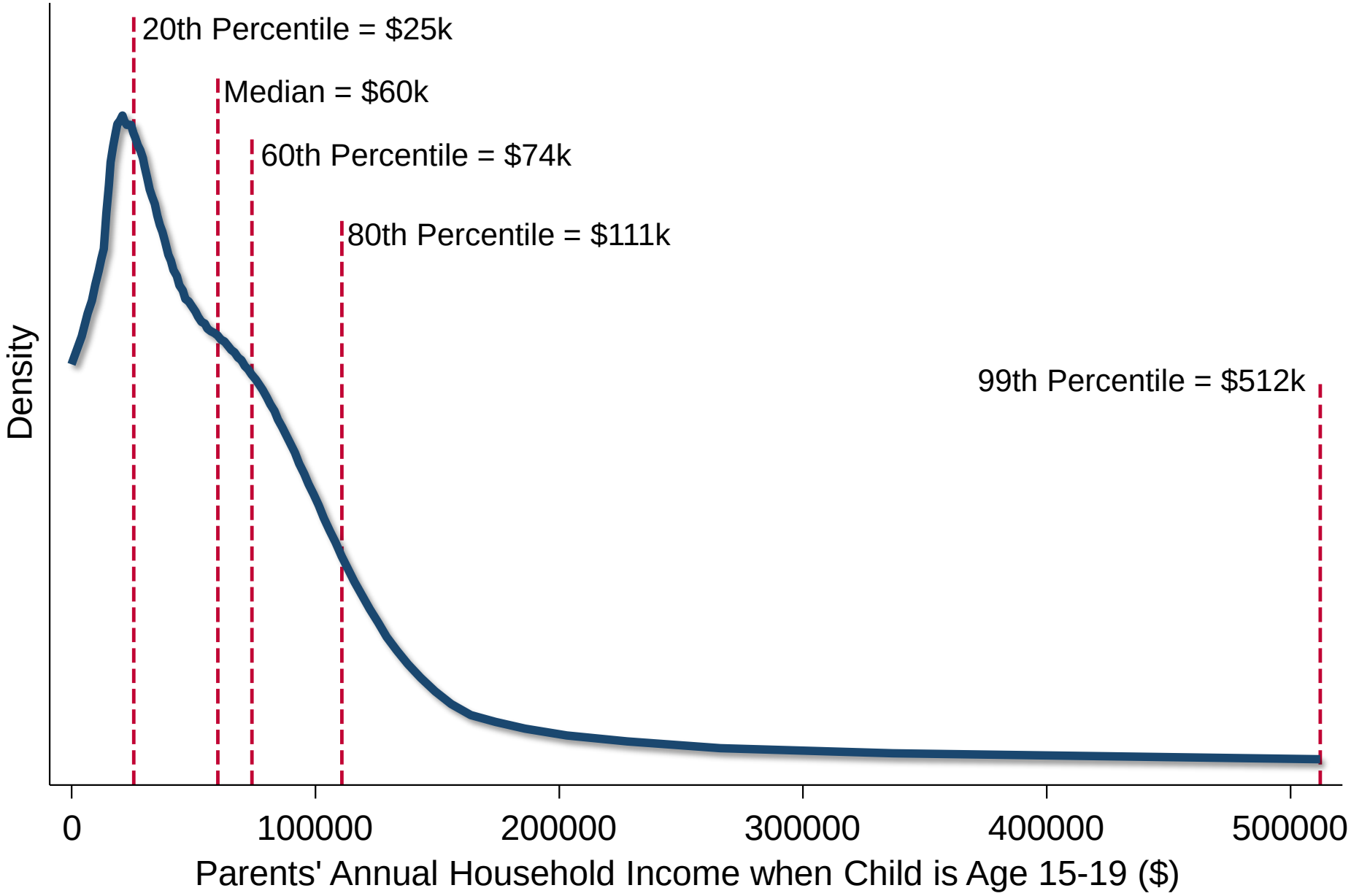
Measuring Parents' Incomes

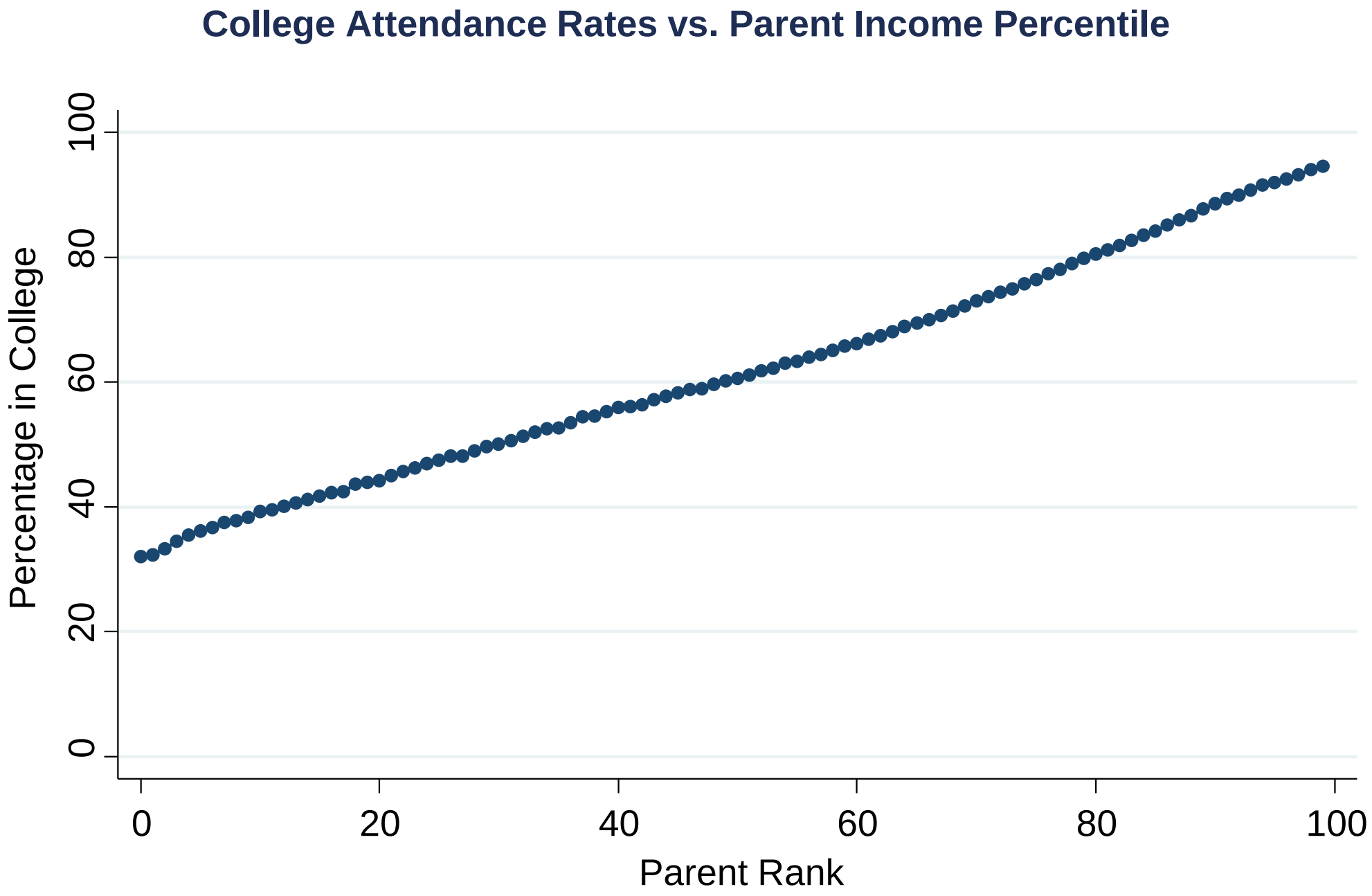
- Parent income: average pre-tax household income during five year period when child is aged 15-19

- Focus on percentile ranks, ranking parents relative to other parents with children in same birth cohort

Parent Household Income Distribution

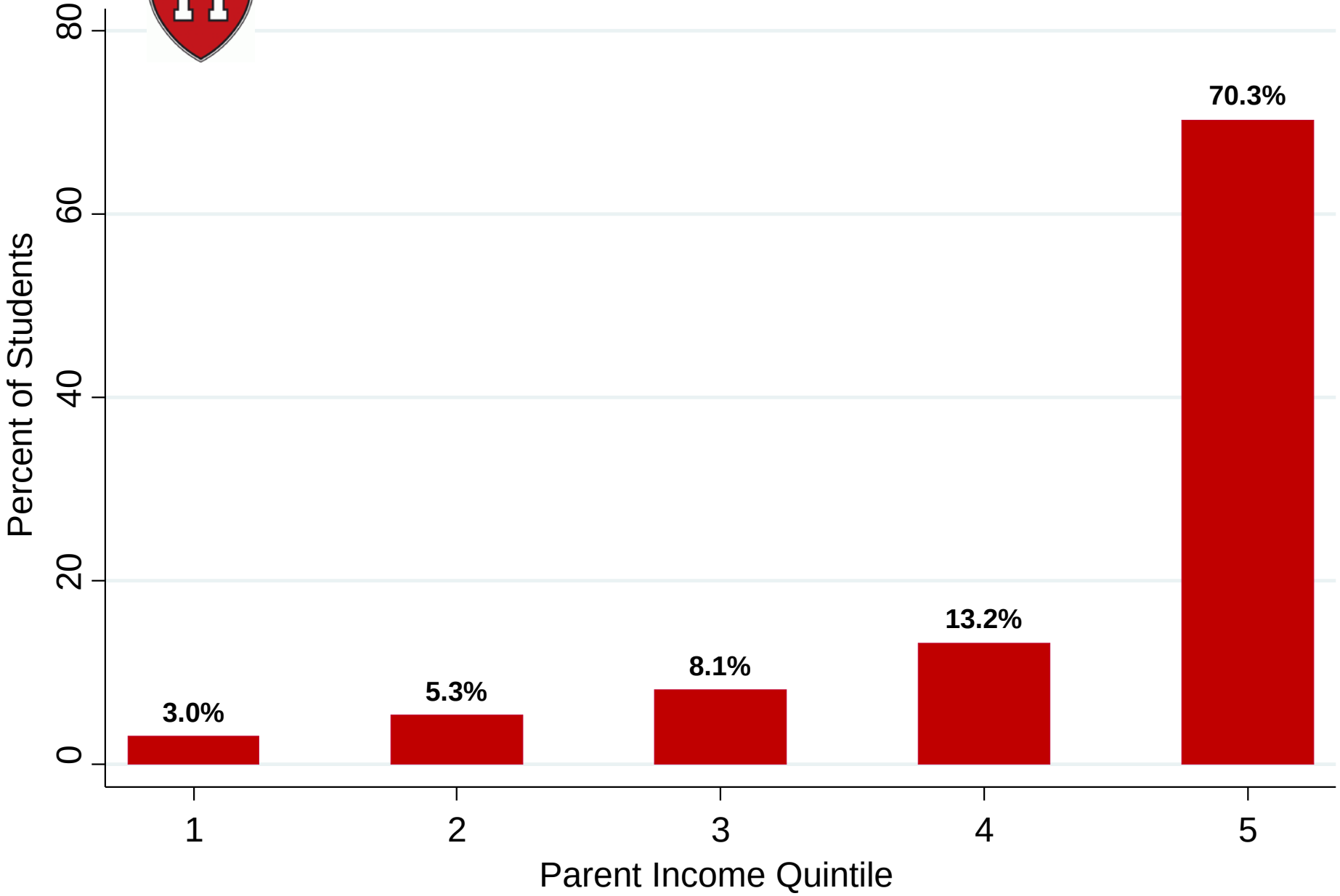
For Parents with Children in 1980 Birth Cohort




College Attendance Rates vs. Parent Income Percentile
Percentage in College
0
20
40
60
80
100
0
20
40
60
80
100
Parent Rank

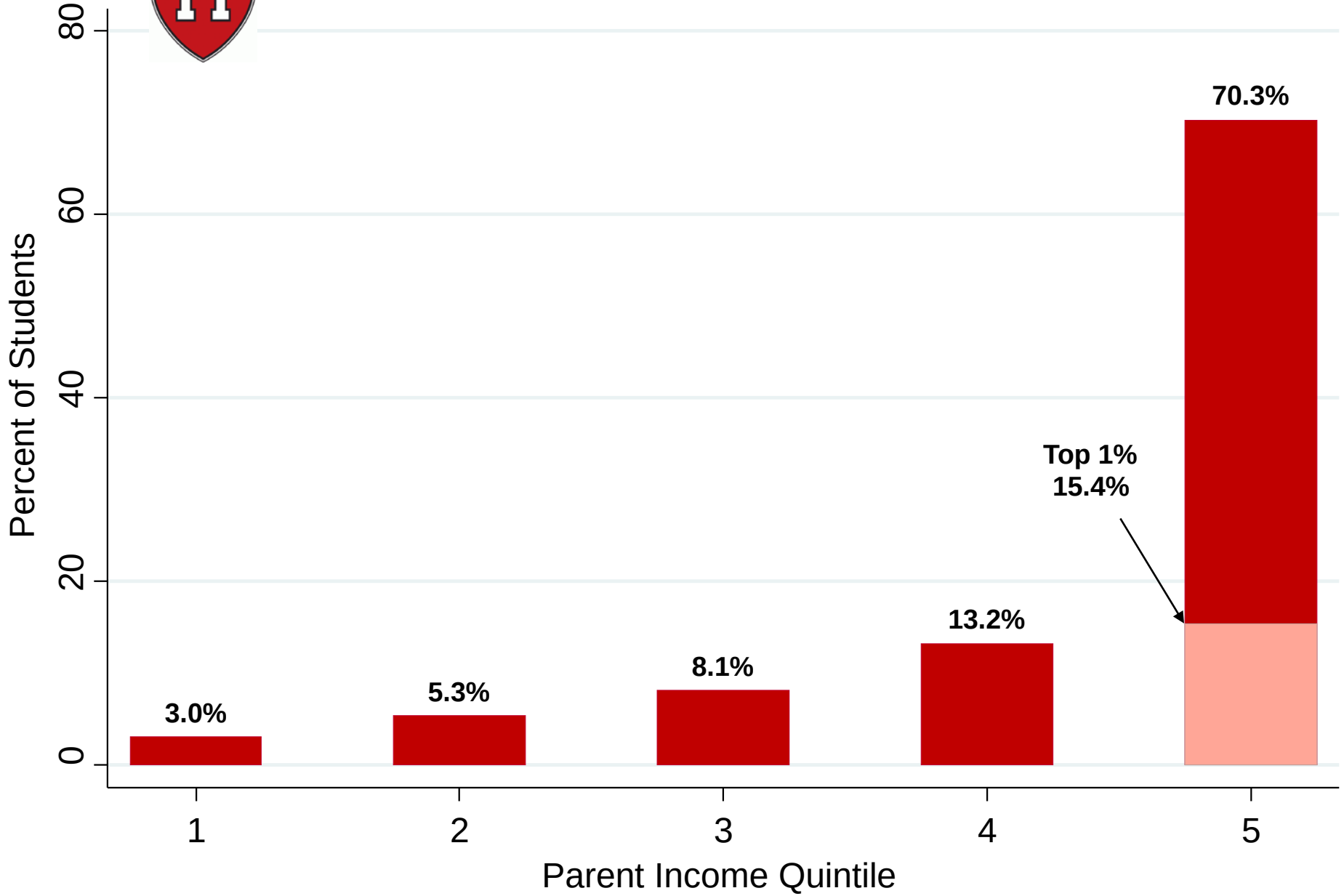
Parent Income Distribution at Harvard

Classes of 2002-2004



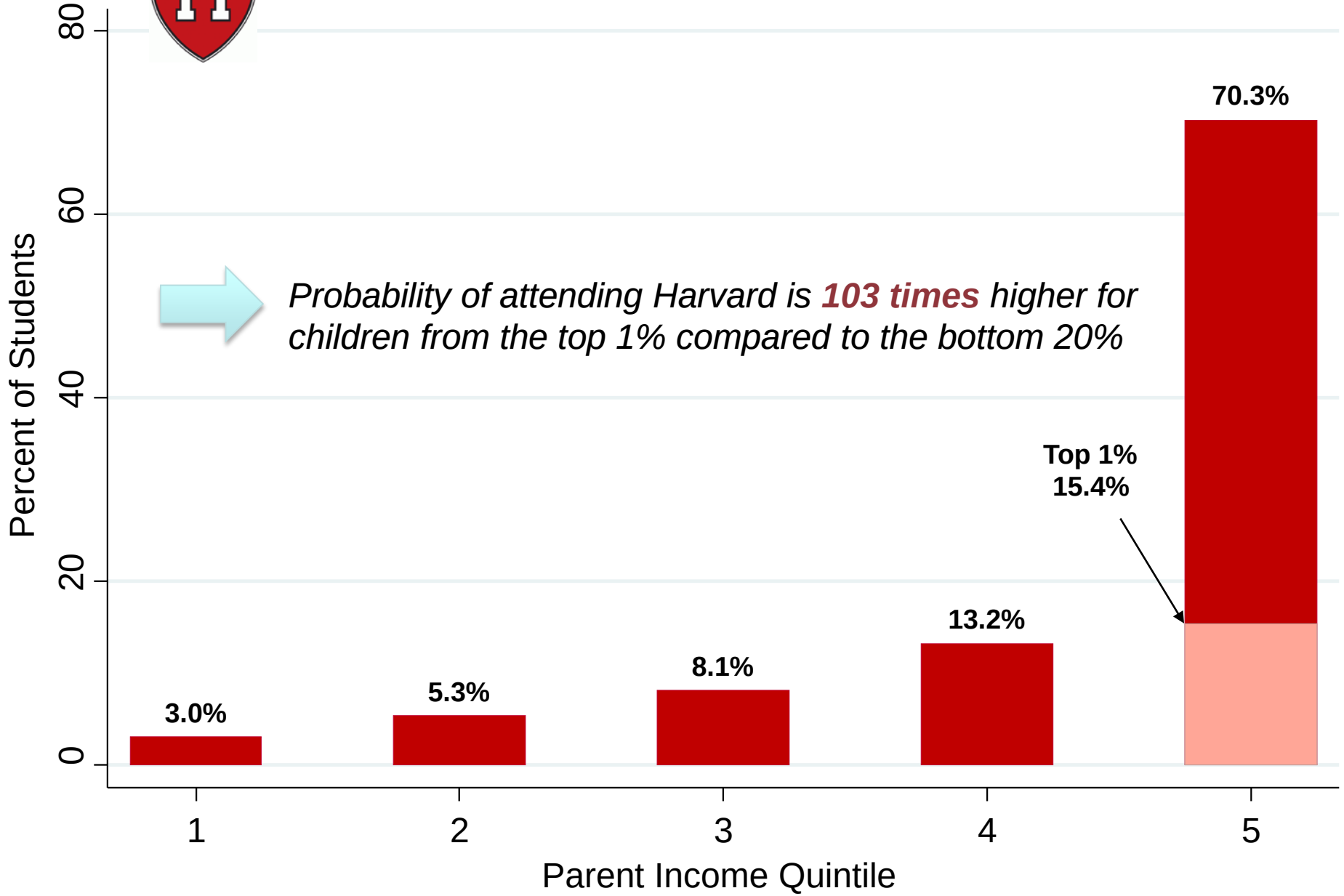
Parent Income Distribution at Harvard

Classes of 2002-2004



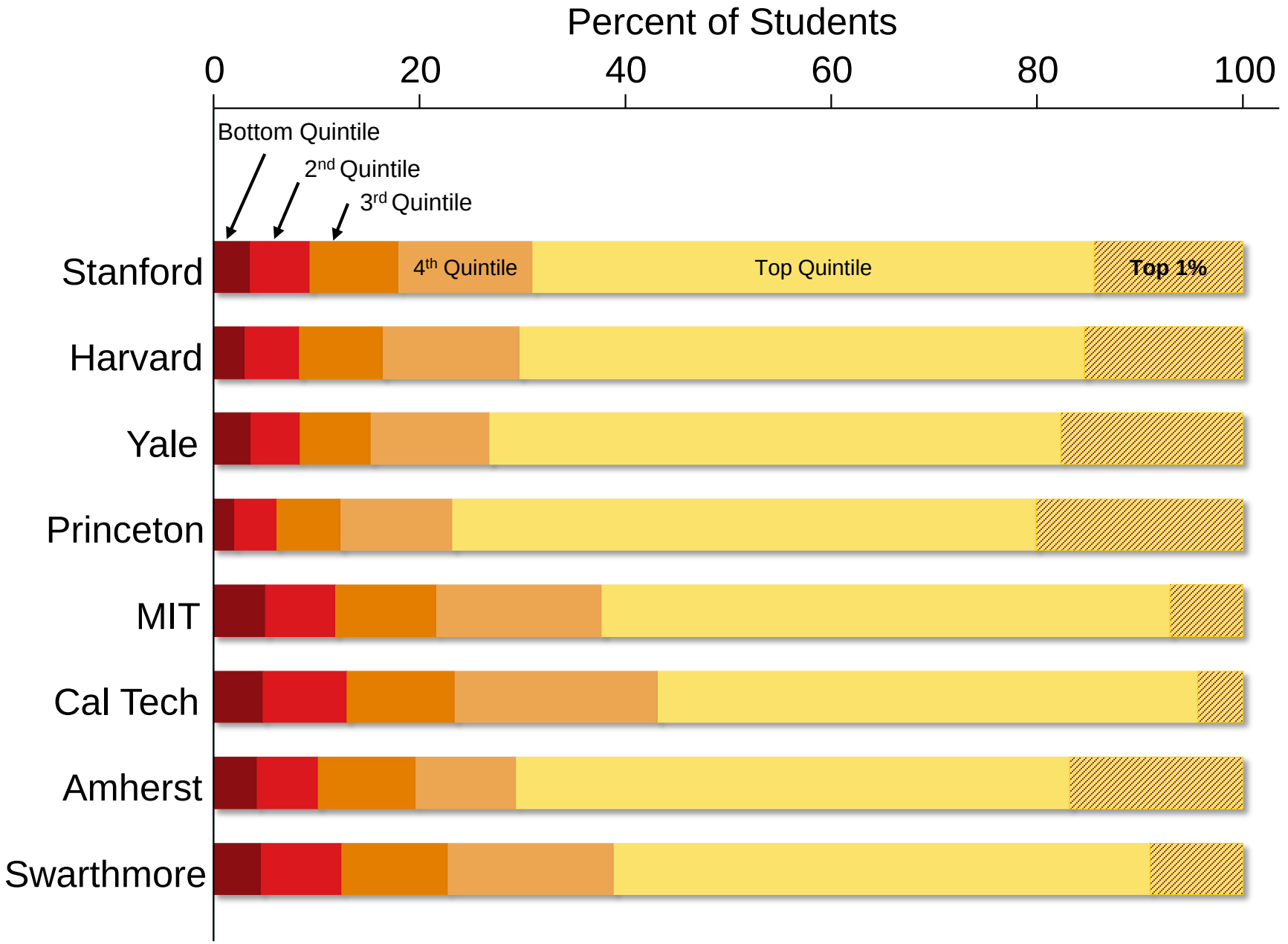
Parent Income Distribution at Harvard

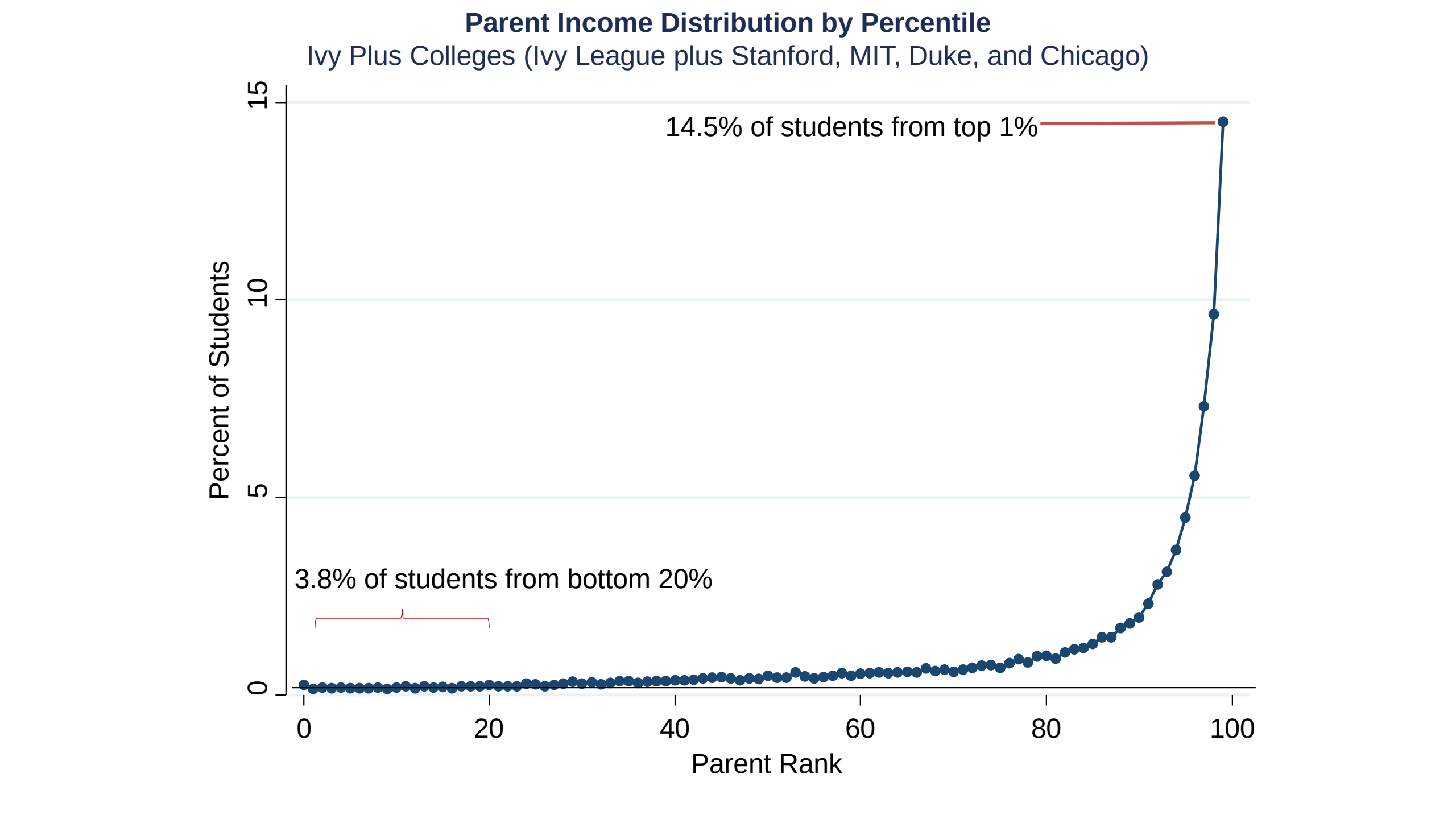
Classes of 2002-2004



*Probability of attending Harvard is **103 times** higher for children from the top 1% compared to the bottom 20%*

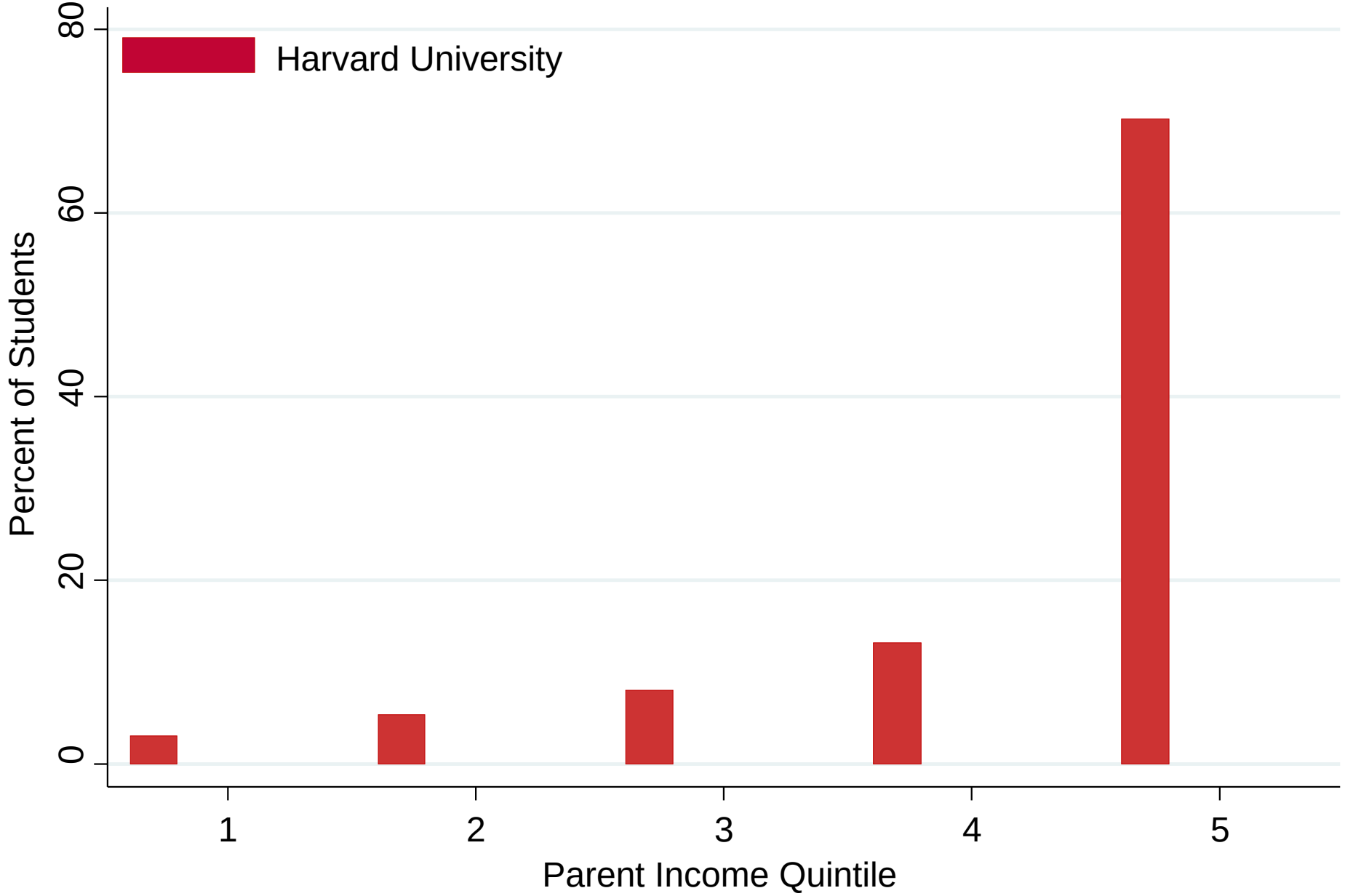
Parental Income Distribution of Students at Highly Selective Colleges

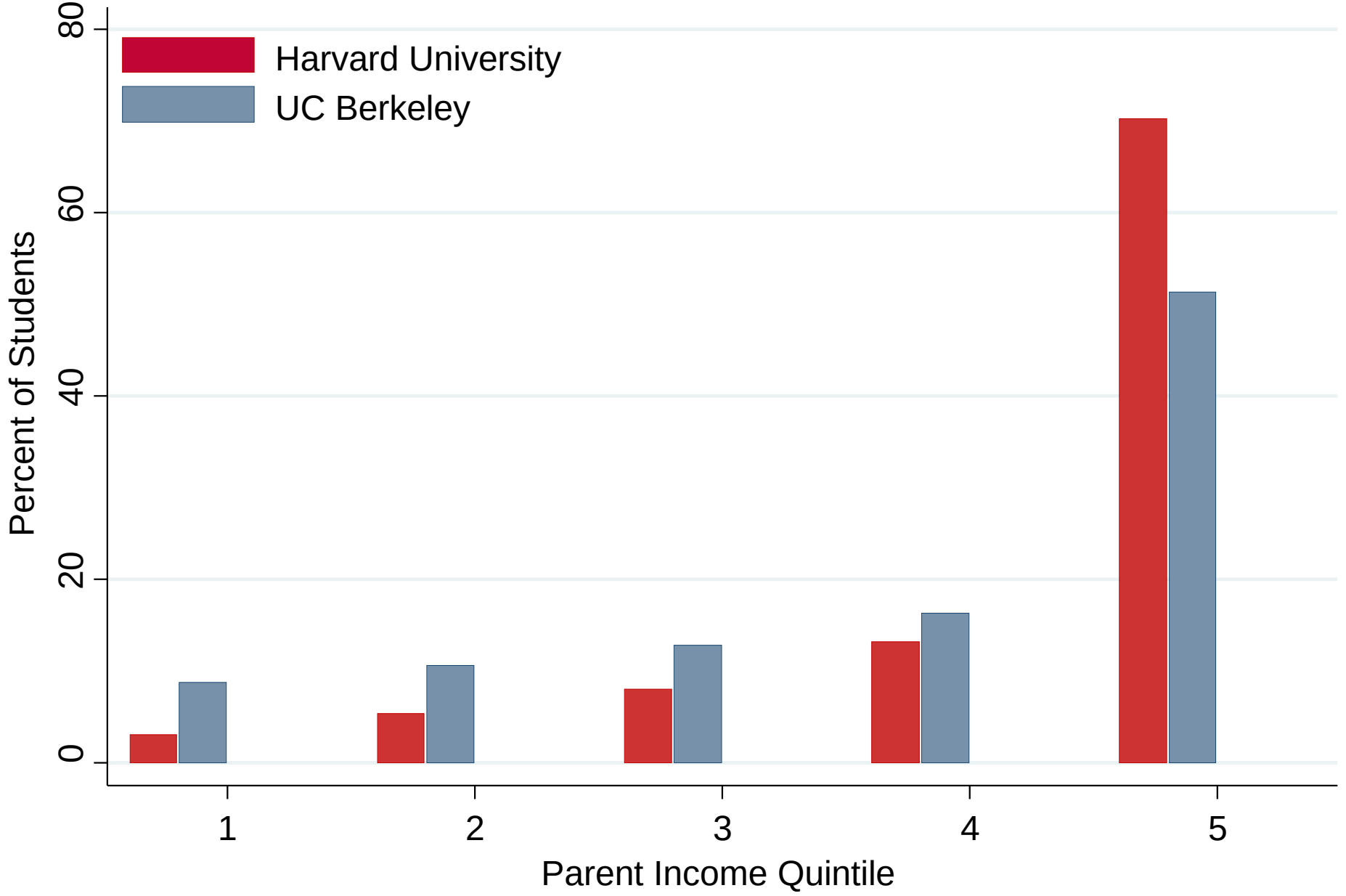



Parent Income Distribution by Percentile
Ivy Plus Colleges (Ivy League plus Stanford, MIT, Duke, and Chicago)
14.5% of students from top 1%
3.8% of students from bottom 20%
Percent of Students
0
5
10
15
0
20
40
60
80
100
Parent Rank

Parent Income Distributions by Quintile for 1980-82 Birth Cohorts

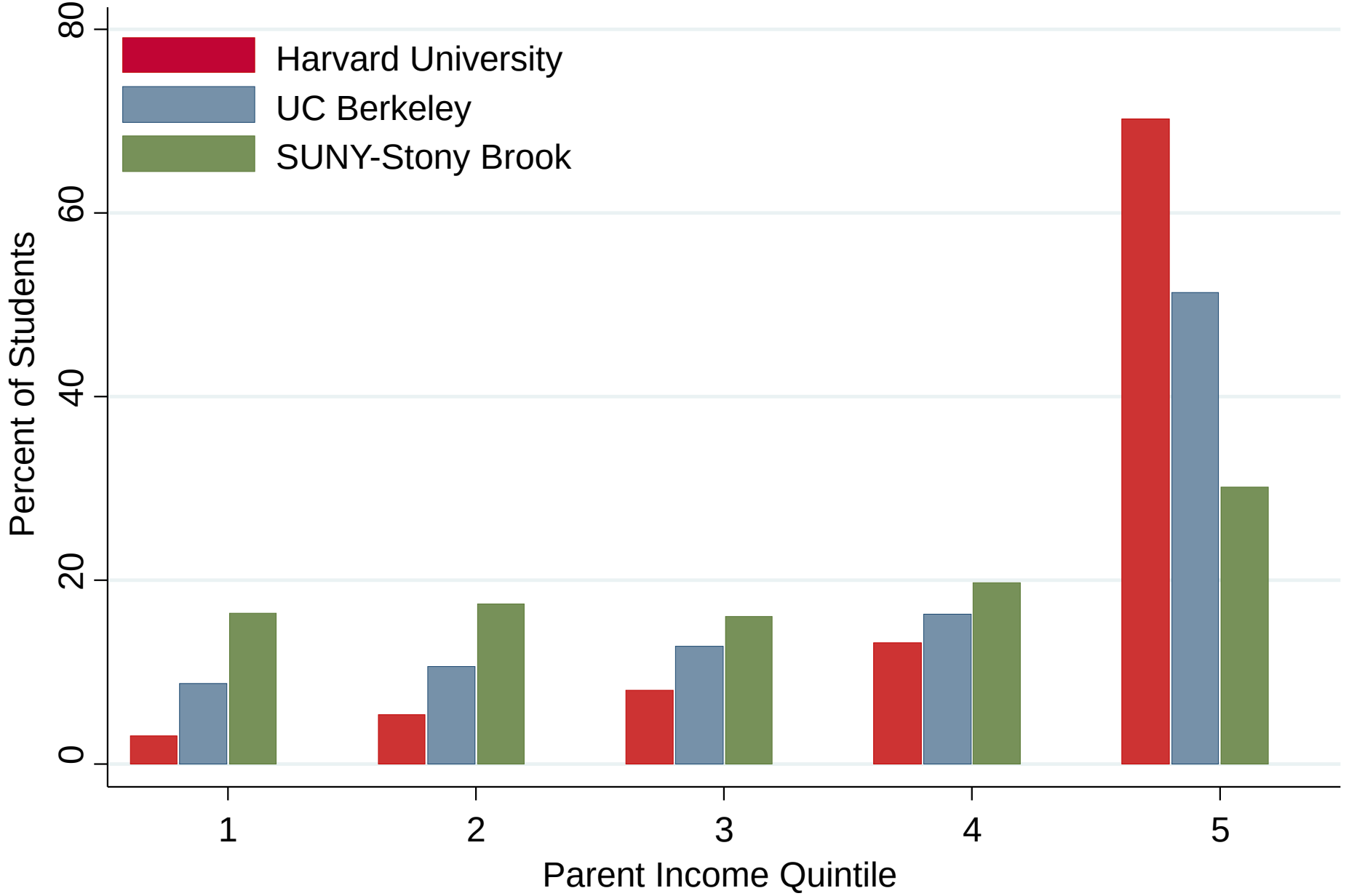
At Selected Colleges




Parent Income Distributions by Quintile for 1980-82 Birth Cohorts
At Selected Colleges
Harvard University
UC Berkeley
Percent of Students
0
20
40
60
80
1
2
3
4
5
Parent Income Quintile

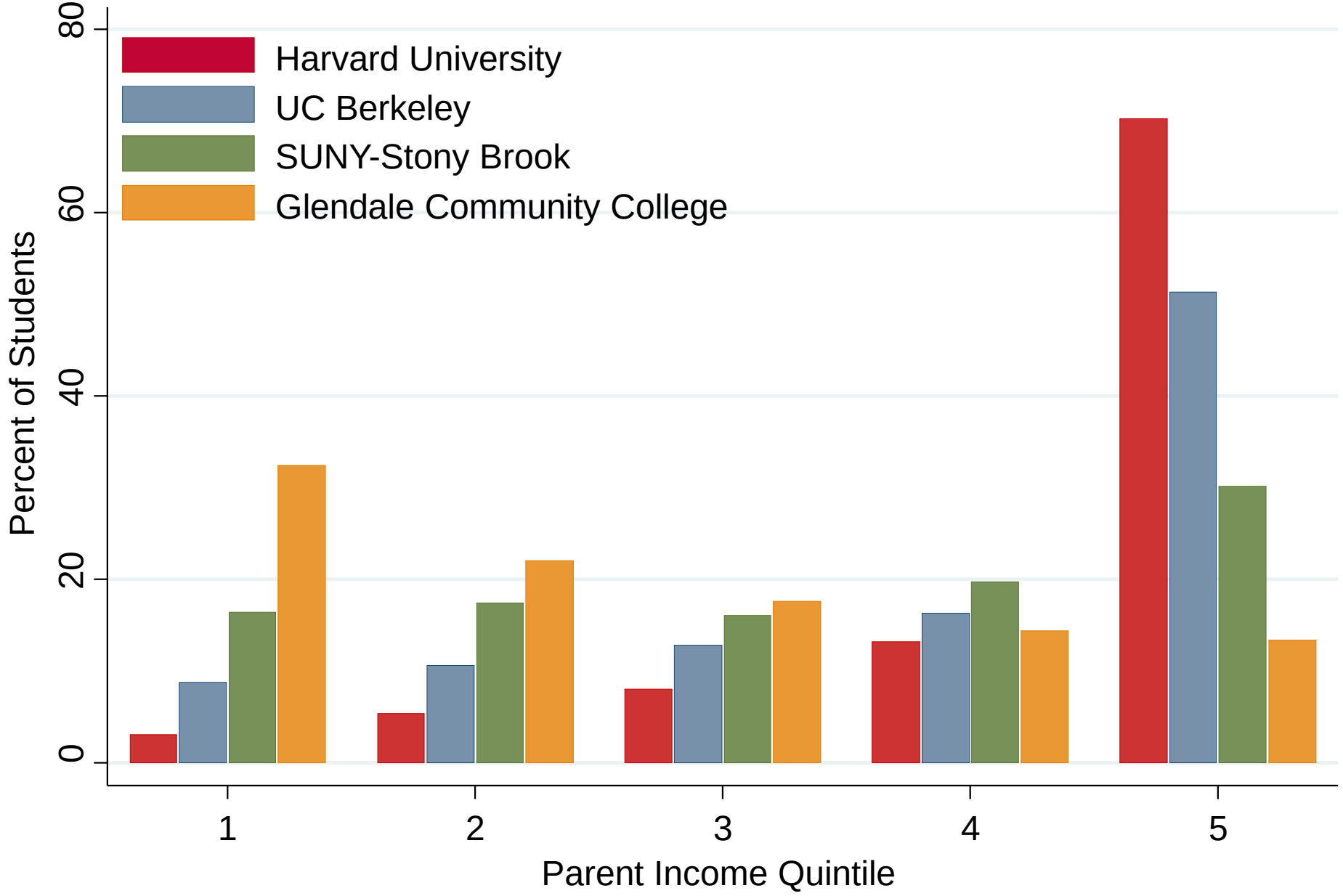
Parent Income Distributions by Quintile for 1980-82 Birth Cohorts

At Selected Colleges



Parent Income Distributions by Quintile for 1980-82 Birth Cohorts

At Selected Colleges



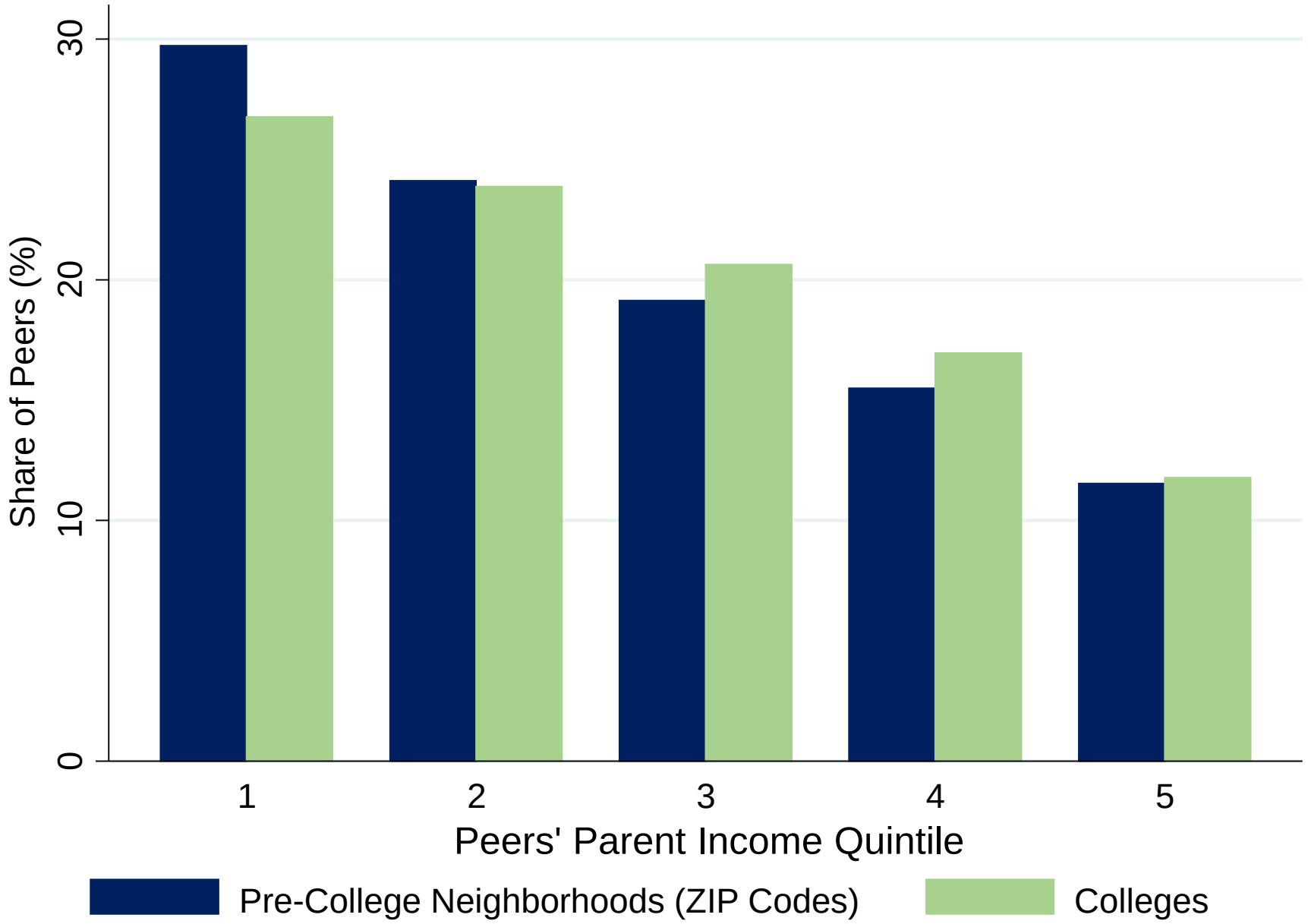
Parental Income Segregation Across Colleges

- Sharp differences in parental income distributions across colleges → there is significant segregation across colleges

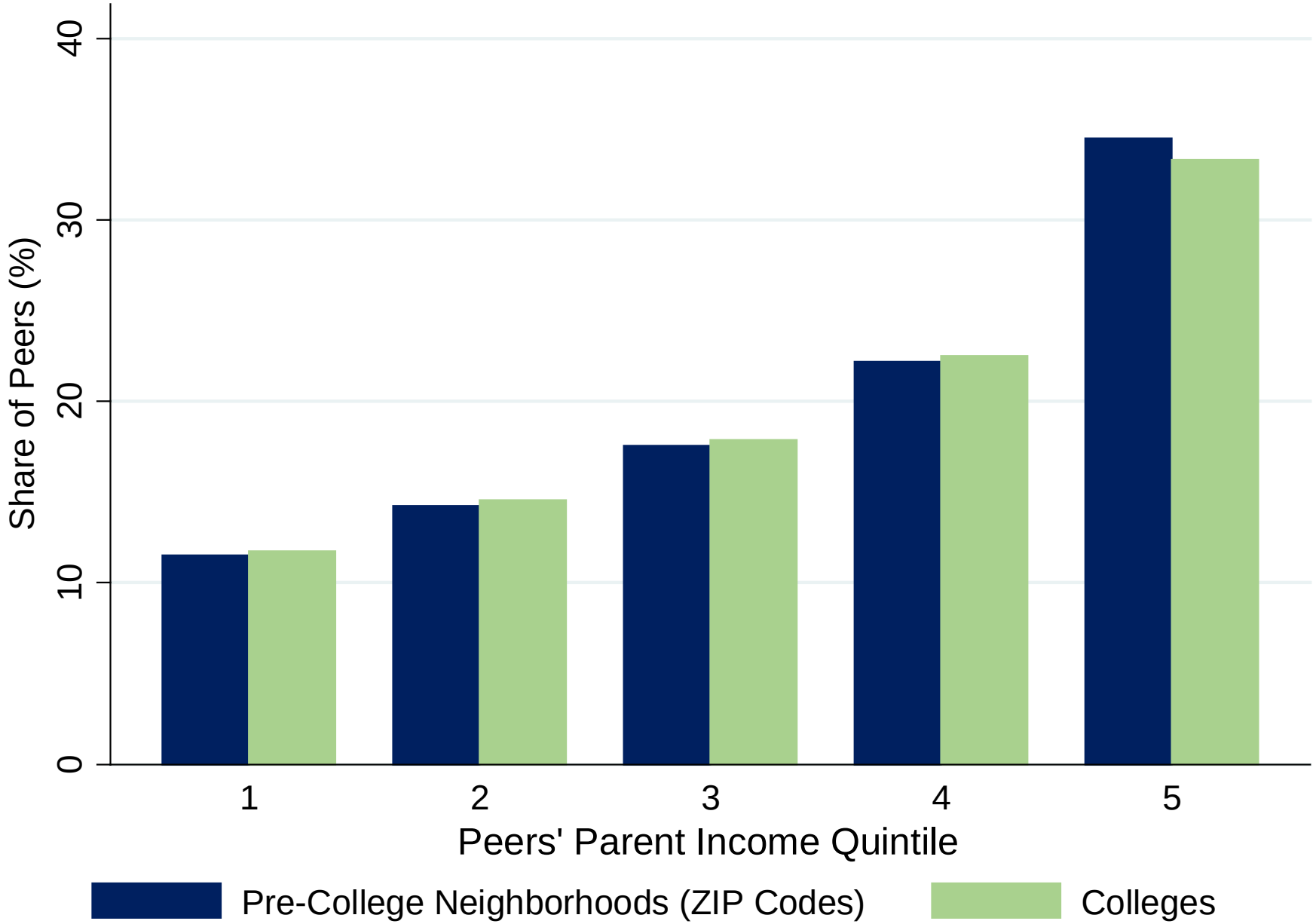
- Useful benchmark to quantify magnitude: compare to degree of segregation across neighborhoods

- Common perception: colleges foster greater interaction between children from different socioeconomic backgrounds than places in which they grew up

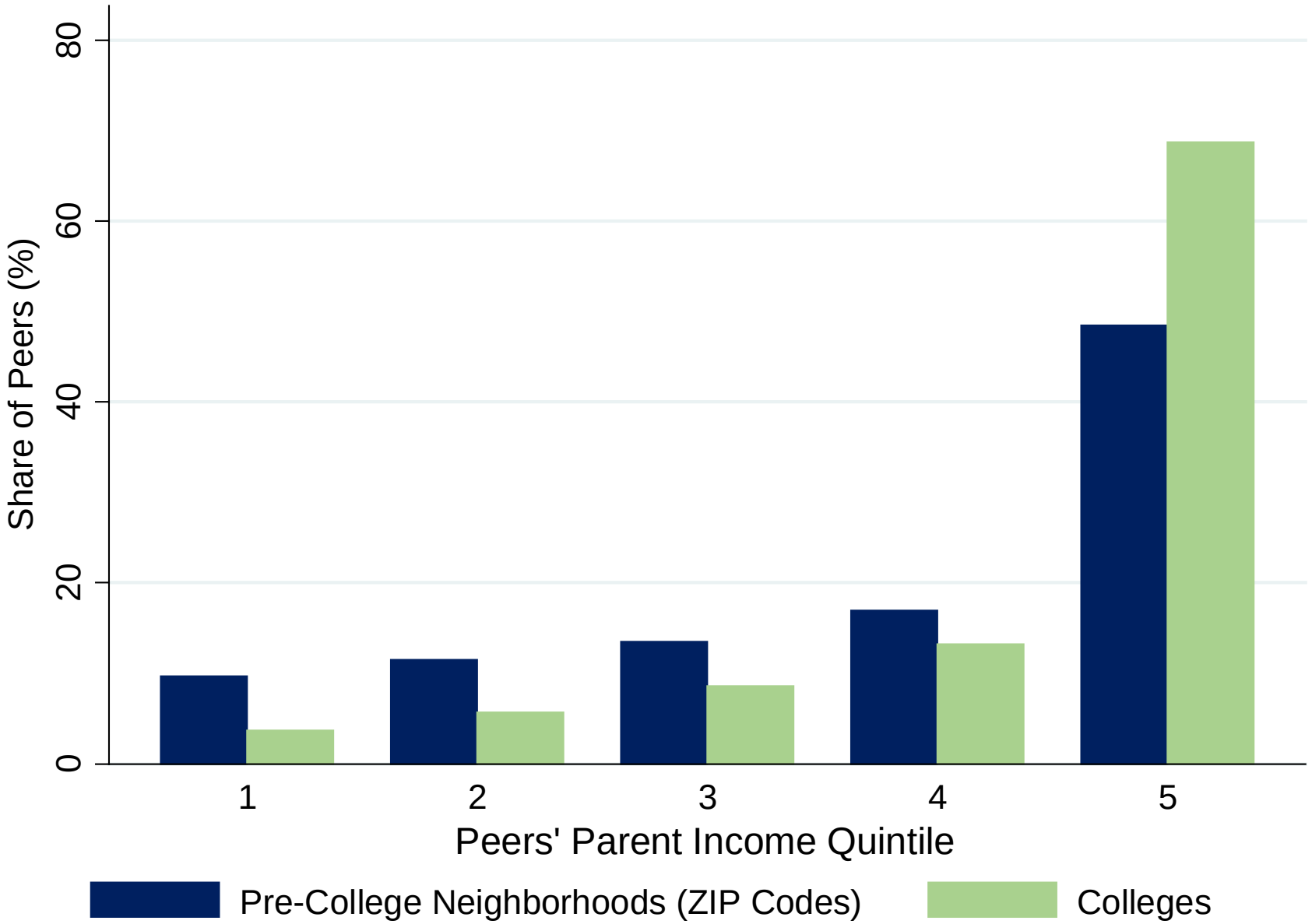
Parental Income Distribution of Peers of Children from Bottom Quintile



Parental Income Distribution of Peers of Children from Top Quintile



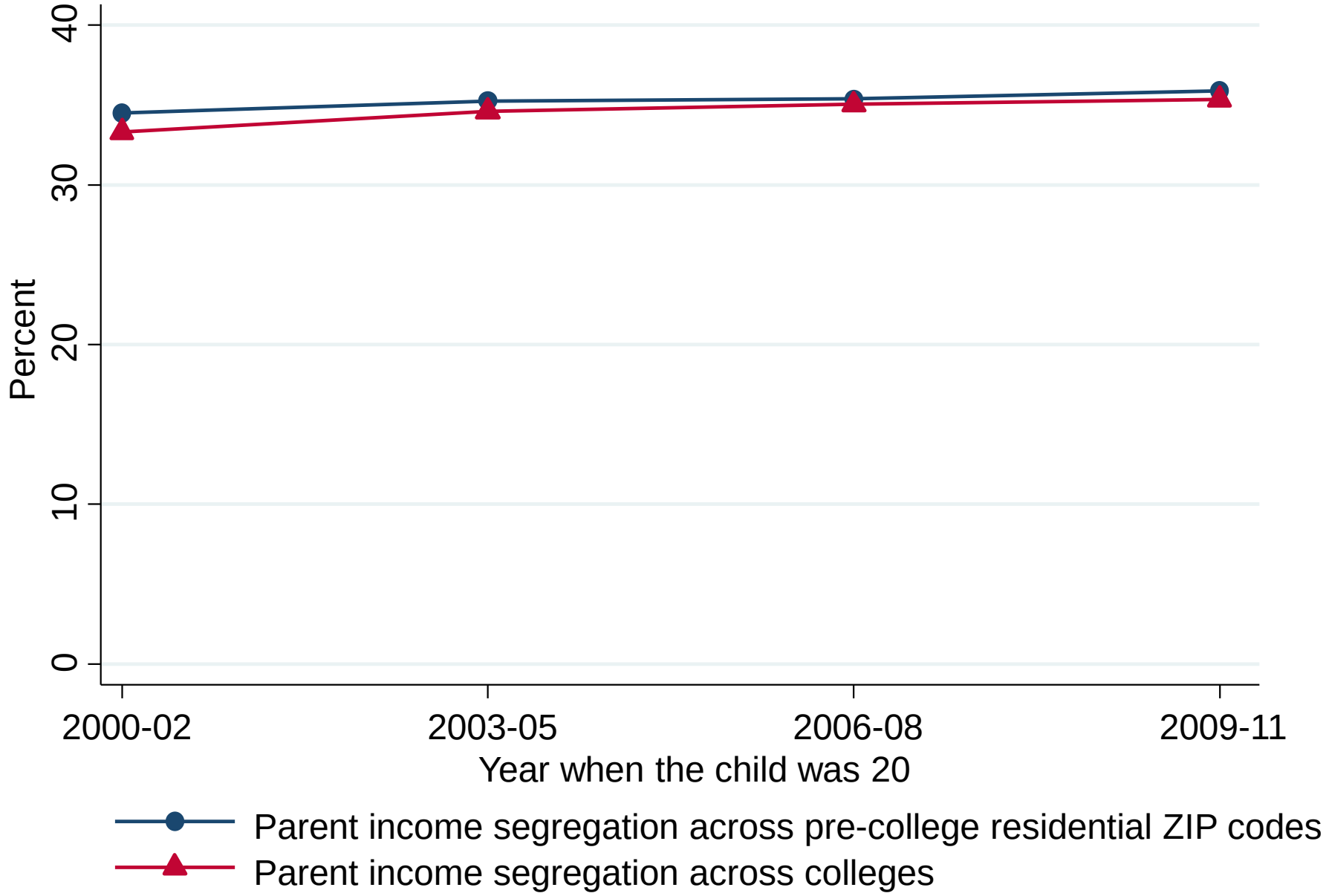
Parental Income Distribution of Peers of Ivy-Plus College Students from Top Quintile



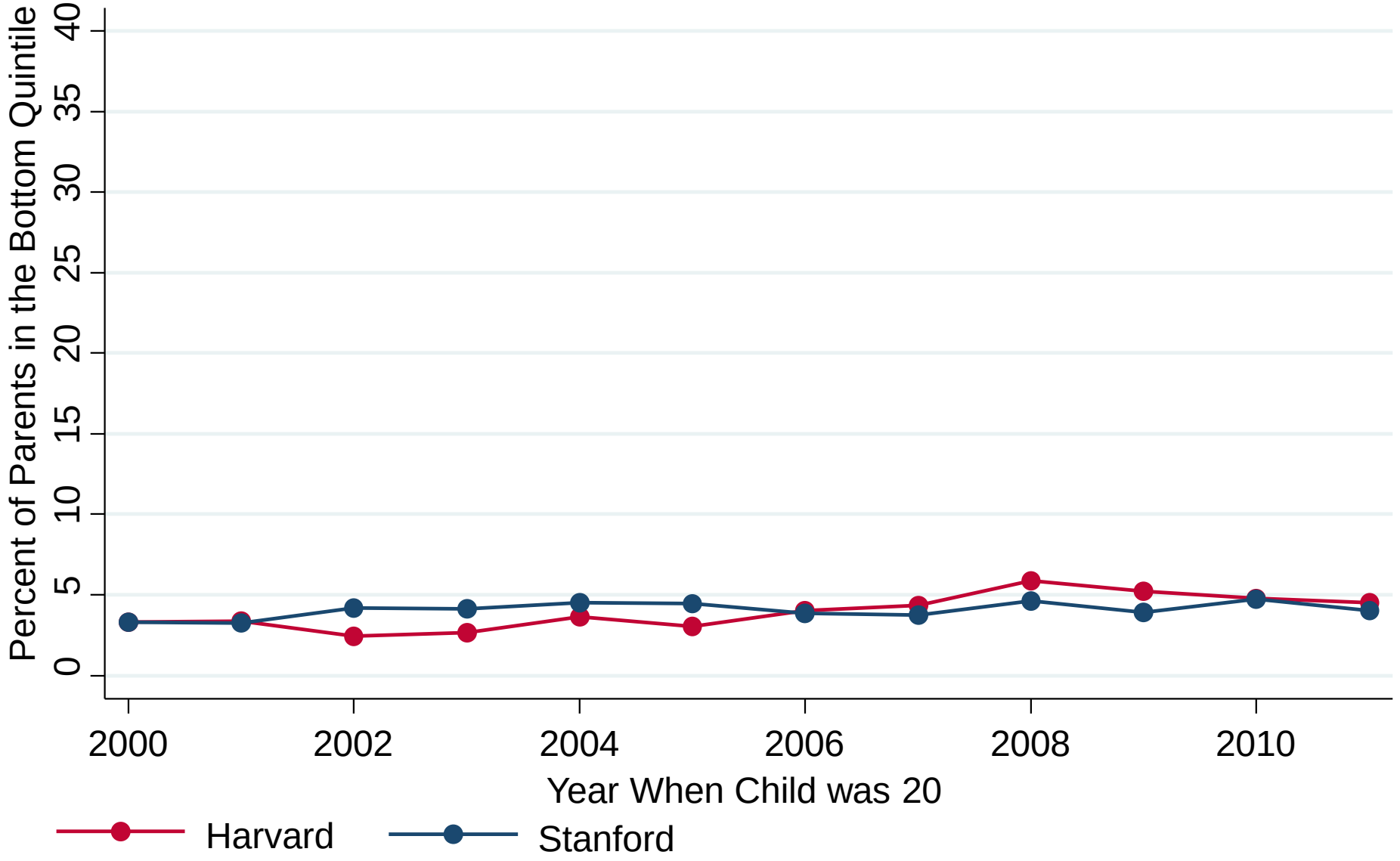
Trends in Income Segregation

- Preceding estimates are based on children born between 1980-82, who attended college in the early 2000s
- Substantial changes in higher education system since that time, e.g. substantial changes in financial aid and tuition policies
- How has income segregation across colleges changed in recent years?

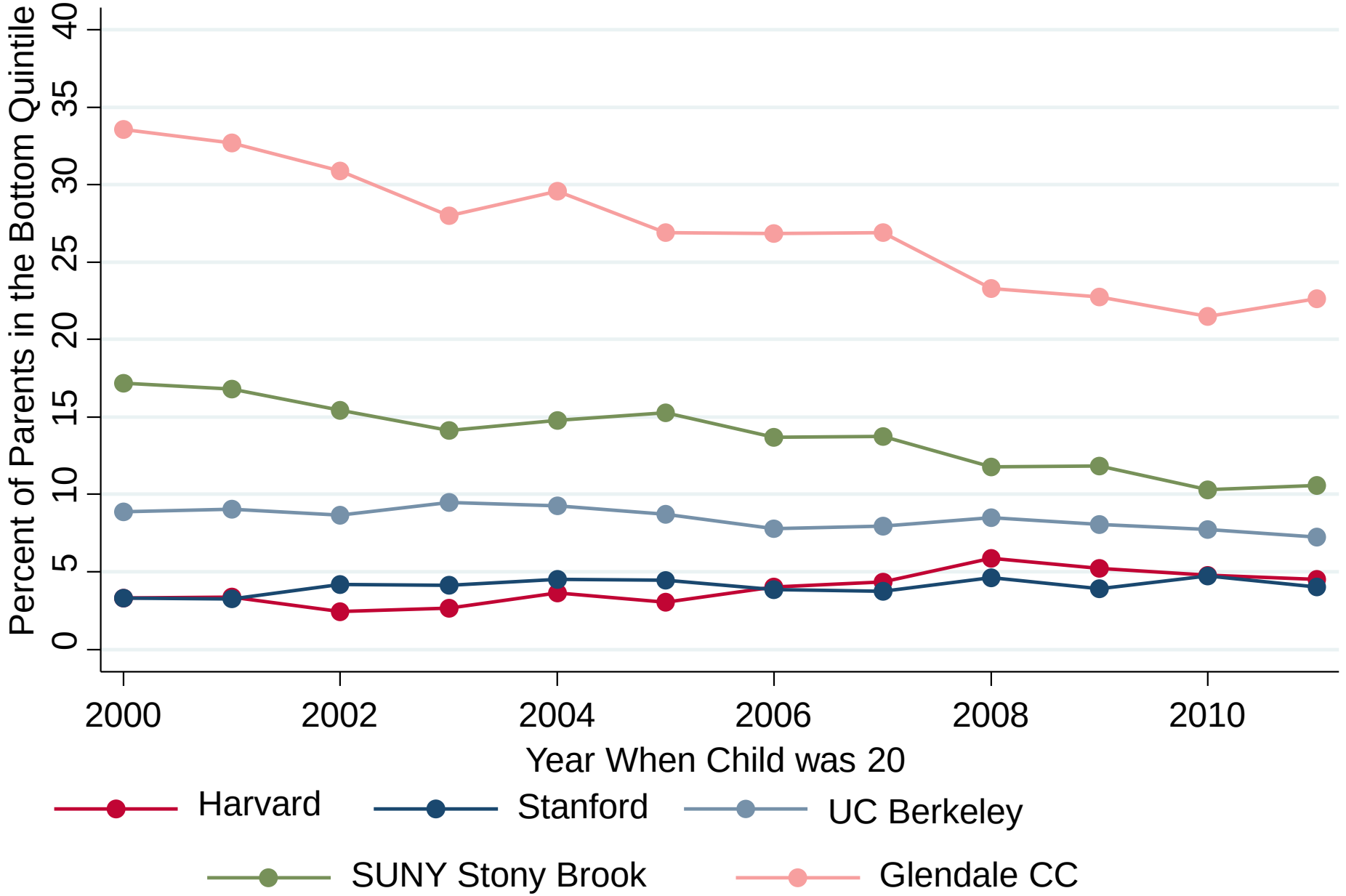
Fraction of Peers from the Top Quintile for Children from the Top Quintile



Trends in Low-Income Access from 2000-2011 at Selected Colleges



Trends in Low-Income Access from 2000-2011 at Selected Colleges



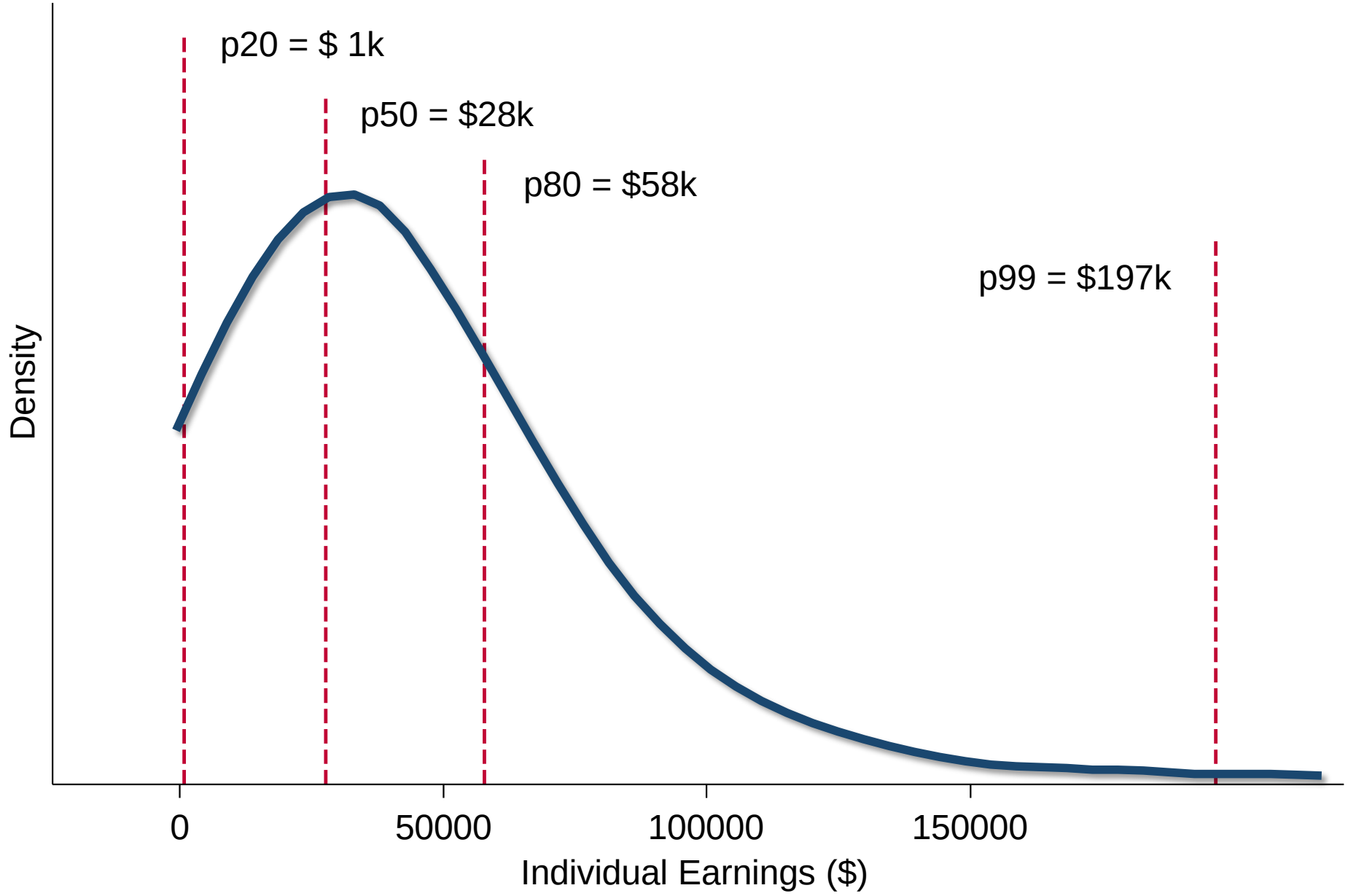
Outcomes: Students’ Earnings Distributions

Students' Earnings Outcomes

- Measure children's individual earnings in their mid-30s
  - Define percentile ranks by ranking children relative to others in same birth cohort

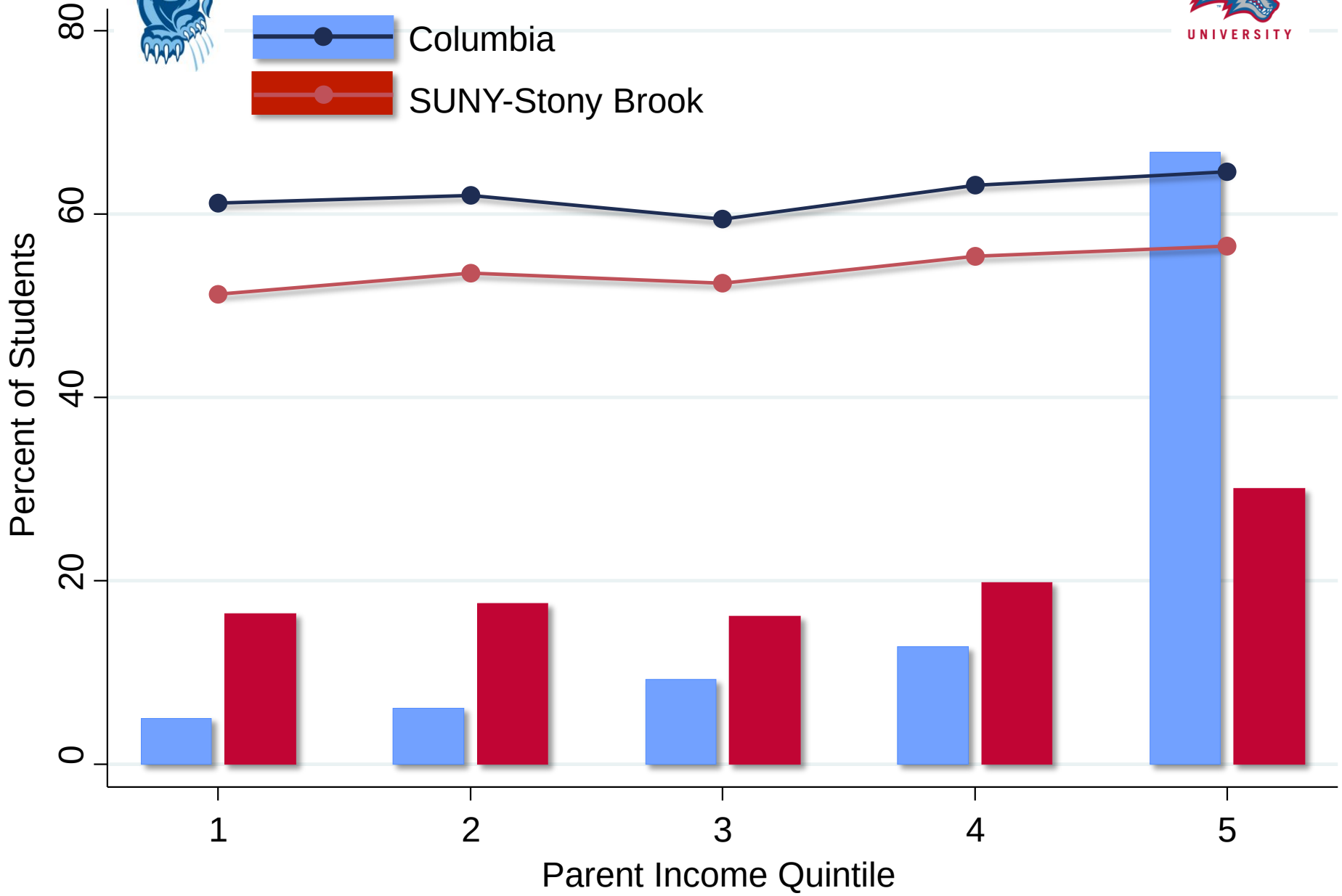
Distribution of Children's Individual Labor Earnings at Age 34

1980 Birth Cohort



Students' Earnings Outcomes

Columbia vs. SUNY-Stony Brook



Students' Earnings Outcomes

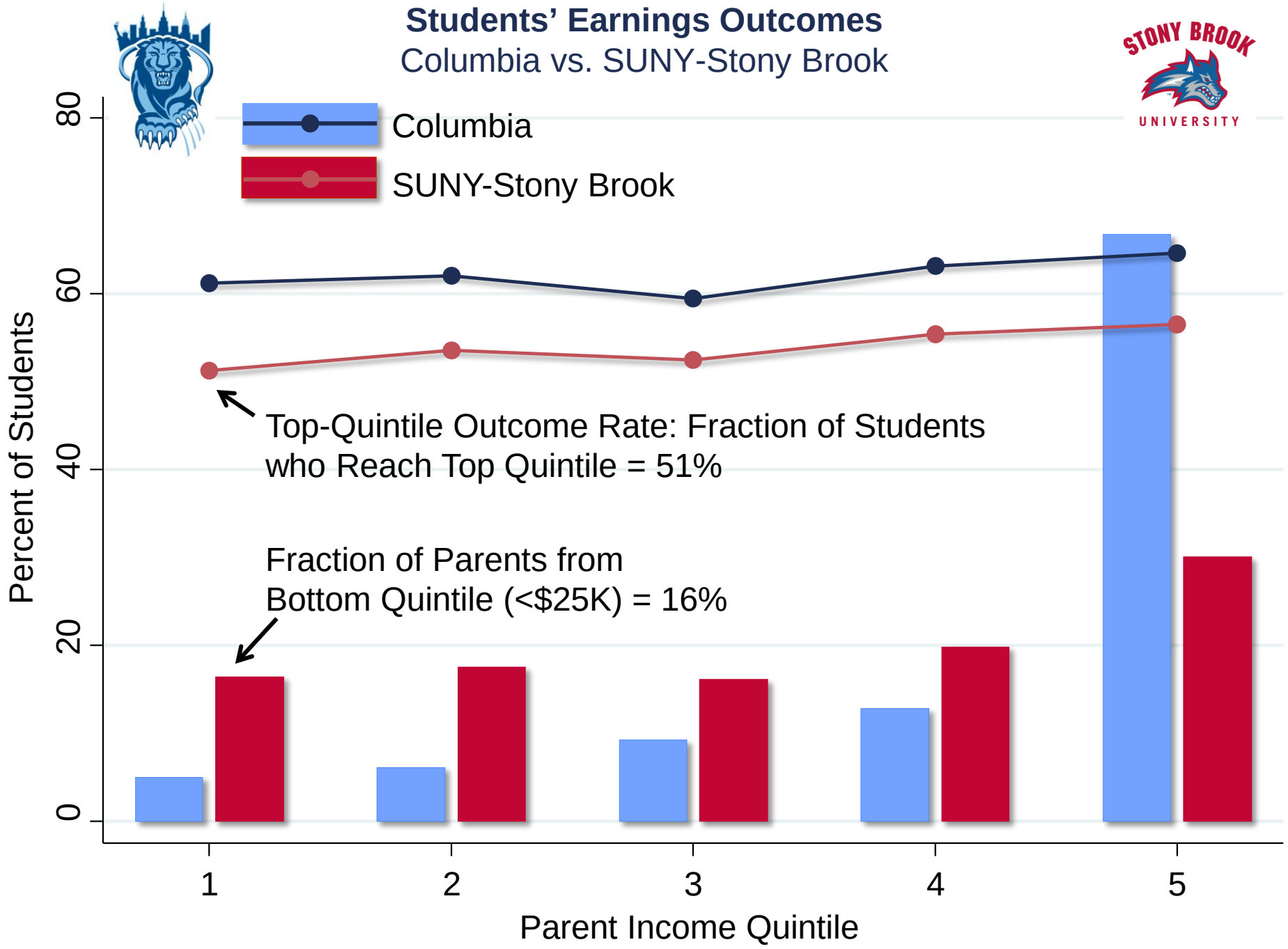
- Key lesson: most of the gap in outcomes between children from low vs. high-income families is explained by differences **between** rather than **within** colleges

- Raises possibility that reallocating student across colleges could potentially have a significant impact on intergenerational mobility

  - If gap in outcomes by parental income were large even within a given college, there would be little scope to have an impact through changes in college admissions policies

Differences in Mobility Rates Across Colleges

- We can combine data on parents' incomes and students' outcomes to characterize colleges' mobility rates
  - At which colleges in America do the largest number of children come from poor families and end up in the upper middle class?

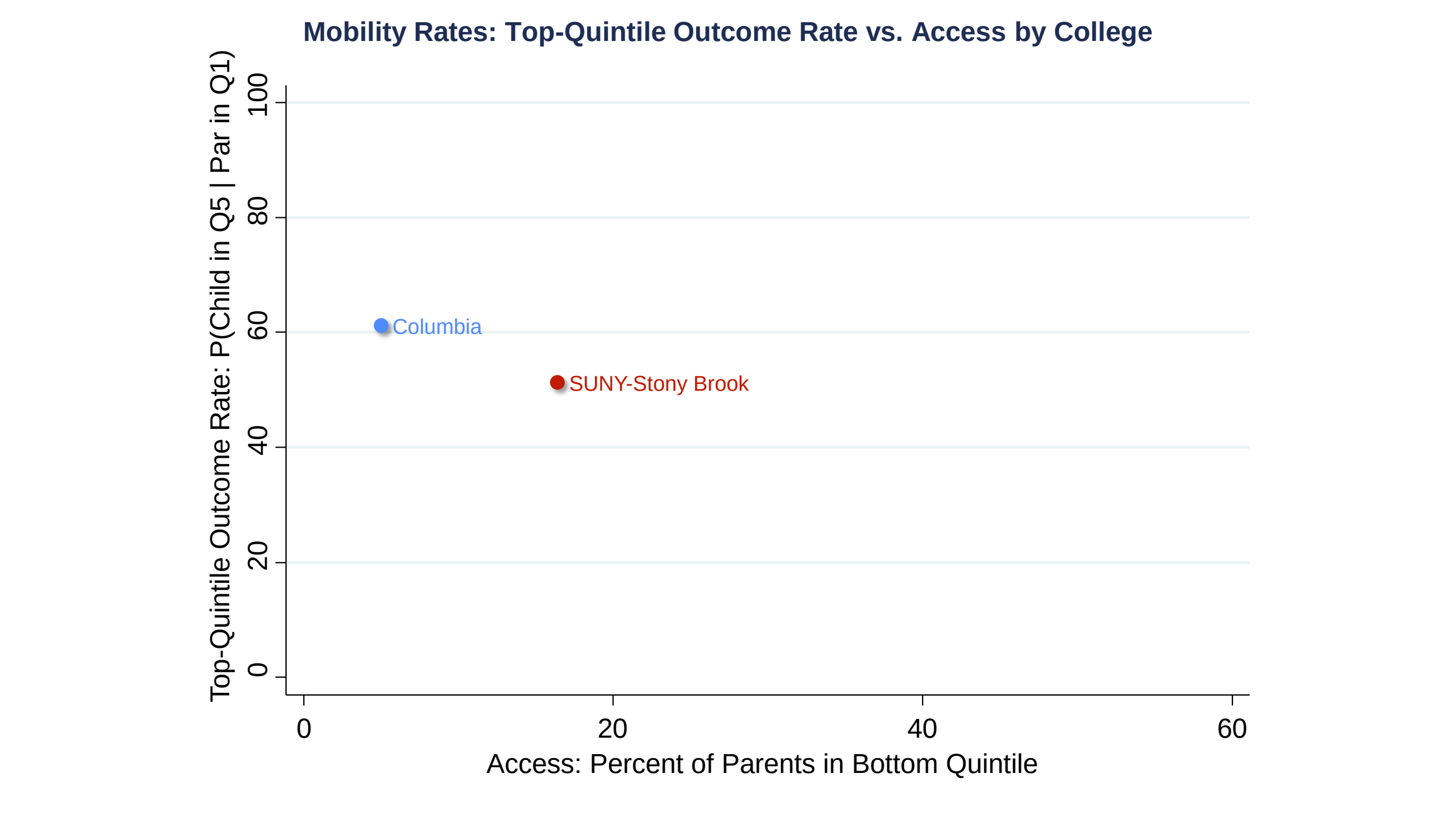

Students' Earnings Outcomes
Columbia vs. SUNY-Stony Brook
STONY BROOK
UNIVERSITY
Columbia
SUNY-Stony Brook
Top-Quintile Outcome Rate: Fraction of Students who Reach Top Quintile = 51%
Fraction of Parents from Bottom Quintile (<$25K) = 16%
Percent of Students
0
20
40
60
80
1
2
3
4
5
Parent Income Quintile

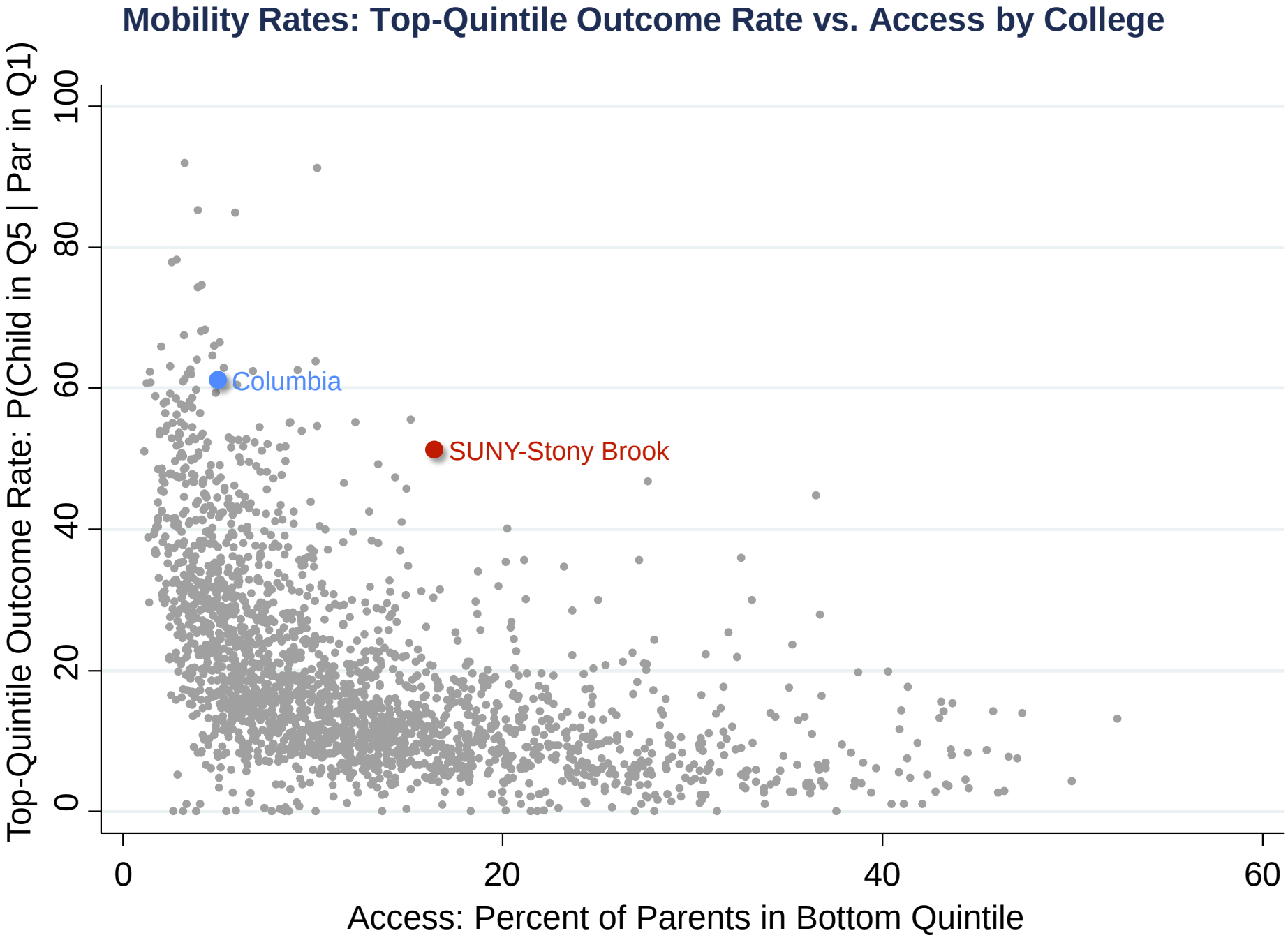
Measuring Mobility Rates

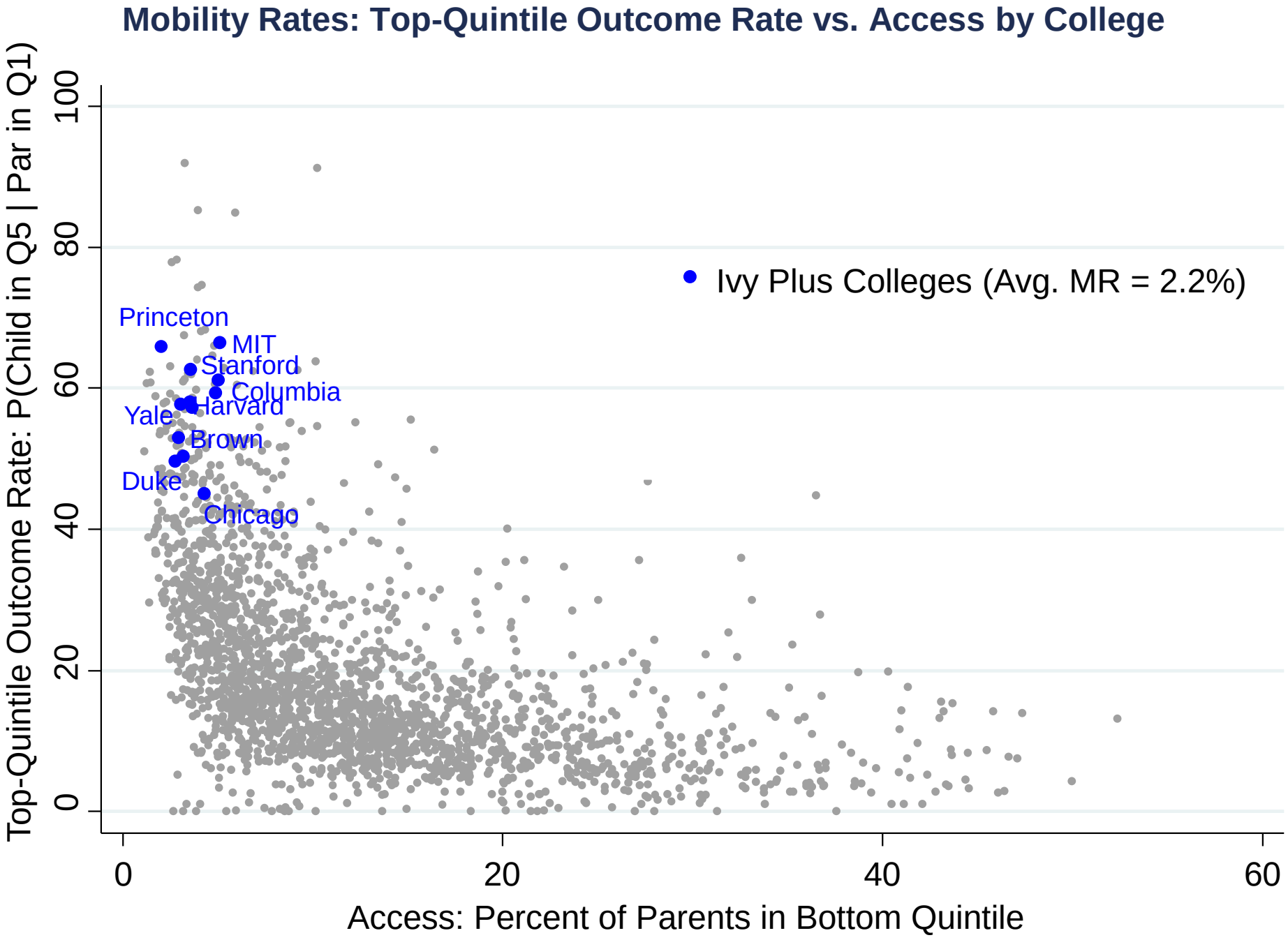
- Define a college's *mobility rate* (MR) as the fraction of its students who come from bottom quintile and end up in top quintile

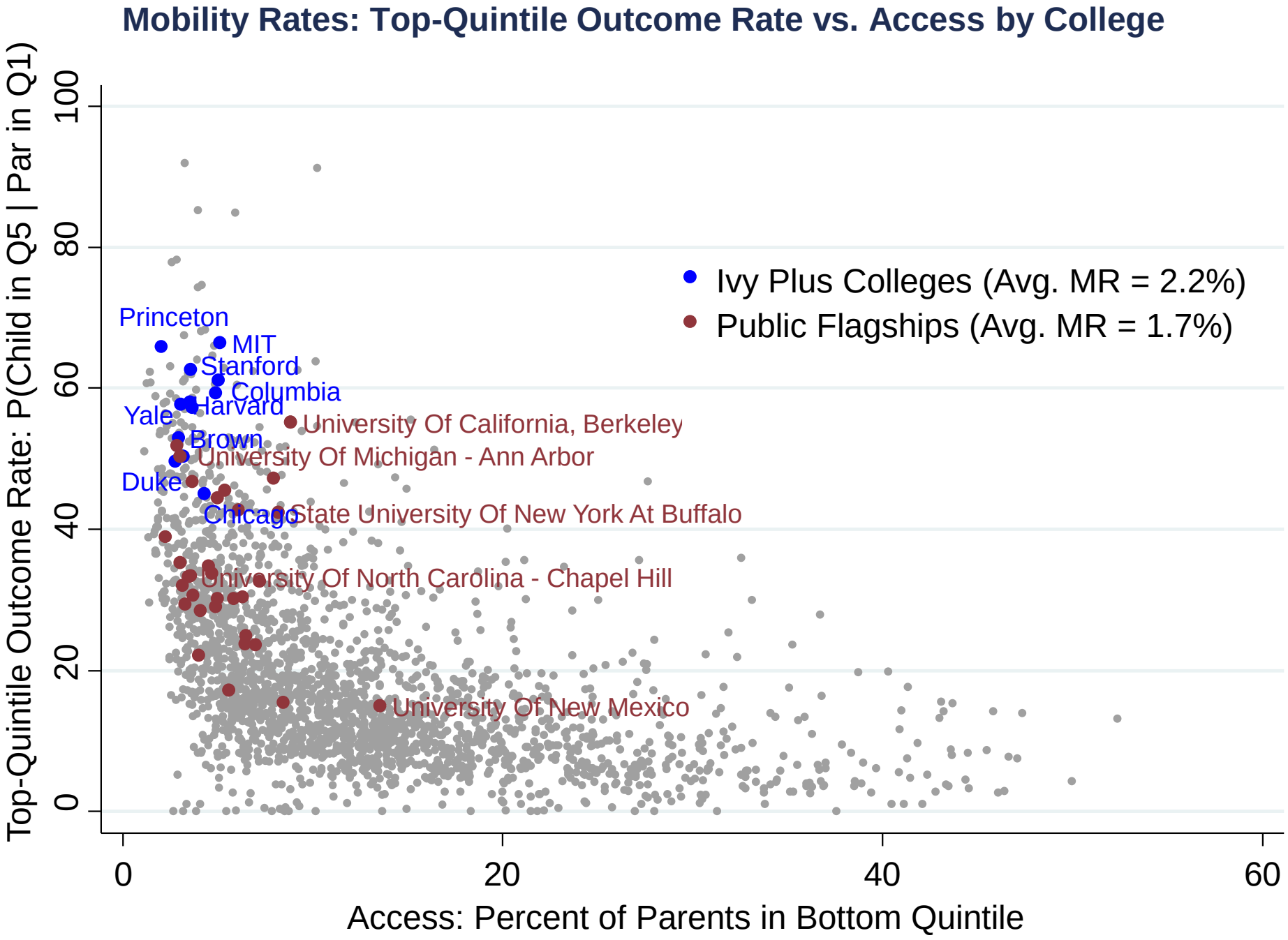
- Mobility rate is:

	Mobility Rate	=	Low-Inc. Access	x	Top-Quintile Rate
	↗		↗		↗
At SUNY:	**8.4%**	**=**	**16%**	**x**	**51%**
	Frac. of Parents in Q1 *and* Children in Q5		**Frac. of Parents in Q1**		**Frac. of Students who reach Q5 Given Parents in Q1**


Mobility Rates: Top-Quintile Outcome Rate vs. Access by College
Top-Quintile Outcome Rate: P(Child in Q5 | Par in Q1)
0
20
40
60
80
100
Columbia
SUNY-Stony Brook
0
20
40
60
Access: Percent of Parents in Bottom Quintile


Mobility Rates: Top-Quintile Outcome Rate vs. Access by College
Top-Quintile Outcome Rate: P(Child in Q5 | Par in Q1)
0
20
40
60
80
100
Columbia
SUNY-Stony Brook
0
20
40
60
Access: Percent of Parents in Bottom Quintile


Mobility Rates: Top-Quintile Outcome Rate vs. Access by College
Top-Quintile Outcome Rate: P(Child in Q5 | Par in Q1)
0
20
40
60
80
100
Access: Percent of Parents in Bottom Quintile
0
20
40
60
Ivy Plus Colleges (Avg. MR = 2.2%)
Princeton
MIT
Stanford
Columbia
Harvard
Yale
Brown
Duke
Chicago


Mobility Rates: Top-Quintile Outcome Rate vs. Access by College
Top-Quintile Outcome Rate: P(Child in Q5 | Par in Q1)
0
20
40
60
80
100
Access: Percent of Parents in Bottom Quintile
0
20
40
60
Ivy Plus Colleges (Avg. MR = 2.2%)
Public Flagships (Avg. MR = 1.7%)
Princeton
MIT
Stanford
Columbia
Harvard
Yale
Brown
Duke
Chicago
University Of California, Berkeley
University Of Michigan - Ann Arbor
State University Of New York At Buffalo
University Of North Carolina - Chapel Hill
University Of New Mexico

Top 10 Colleges in America By Bottom-to-Top Quintile Mobility Rate

Fraction of Students who come from Bottom Fifth and End up in Top Fifth