Using Big Data To Solve Economic and Social Problems

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Photo Credit: Florida Atlantic University

Equality of Opportunity: Conclusions

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2. Improve childhood environment at all ages (not just earliest ages)

3. Focus not just on schools and housing but on networks and social norms

   - Using Facebook data to understand how networks affect poverty
   - What types of friendship structures lead to better outcomes for low-income children?
   - What conditions lead to more integration in networks across socio-economic groups?

Equality of Opportunity: Conclusions

1. Tackle social mobility at a local, not just national level

2. Improve childhood environment at all ages (not just earliest ages)

3. Focus not just on schools and housing but on networks and social norms

4. Use big data to measure local progress and performance

   - Working with government agencies to create a system to monitor local trends in inequality and opportunity

   - Local area data available at www.equality-of-opportunity.org

Education and Upward Mobility

Education and Upward Mobility

- Education is widely viewed as the most important and scalable pathway to upward mobility

- Historically, U.S. had steadily increasing levels of education, but this trend stopped around 1980
  - Goldin and Katz 2008: *The Race Between Education and Technology*
  - Technological progress continues to make machines better, but investment in human capital has not kept pace
  - This may be the key reason that earnings have stagnated for lower- and middle-income workers, leading to decline in upward mobility

Education and Upward Mobility

- Today, widespread concern that education no longer “levels the playing field” of 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 within America
  - 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 in this lecture
  - References:

Chetty, Friedman, Saez, Turner, Yagan. “Mobility Report Cards: The Role of Colleges in Intergenerational Mobility” Working Paper 2017

Hoxby, Caroline and Chris Avery. “The Missing One-Offs: The Hidden Supply of High-Income, Low-Achieving Students.” BPEA 2013

College Mobility Report Cards

- Begin with a descriptive analysis of the role of colleges in upward mobility
- Chetty et al. (2017) construct *mobility report cards* for every college in America
  - Statistics on distribution of parents' incomes and students' earnings outcomes at each college
- Use de-identified tax data and Pell records covering all college students aged 18-21 from 1999-2013 (30 million students)
  - Construct statistics based on college *attendance* (not completion)

College Mobility Report Cards

- Caveat: we do not identify the causal effects (“value added”) of colleges

- Instead, our descriptive analysis highlights the colleges that deserve further study as potential “engines of mobility”

Mobility Report Cards: Four Sets of Results

1. Access: Parents' Income Distributions

2. Outcomes: Students' Earnings Distributions

3. Differences in Mobility Rates Across Colleges

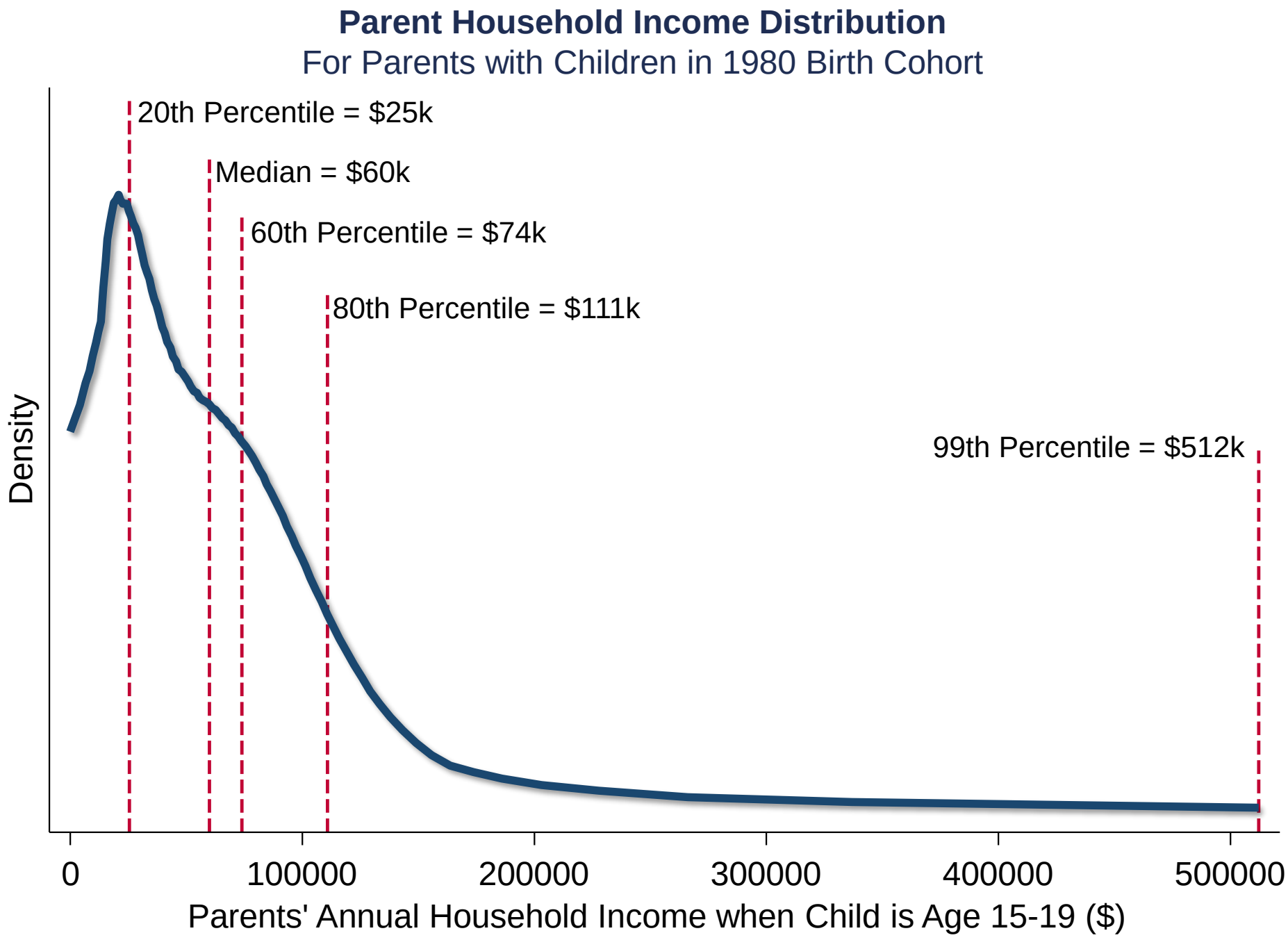
4. Trends Since 2000

Access: Parents’ Income Distributions

Measuring Parents' Incomes

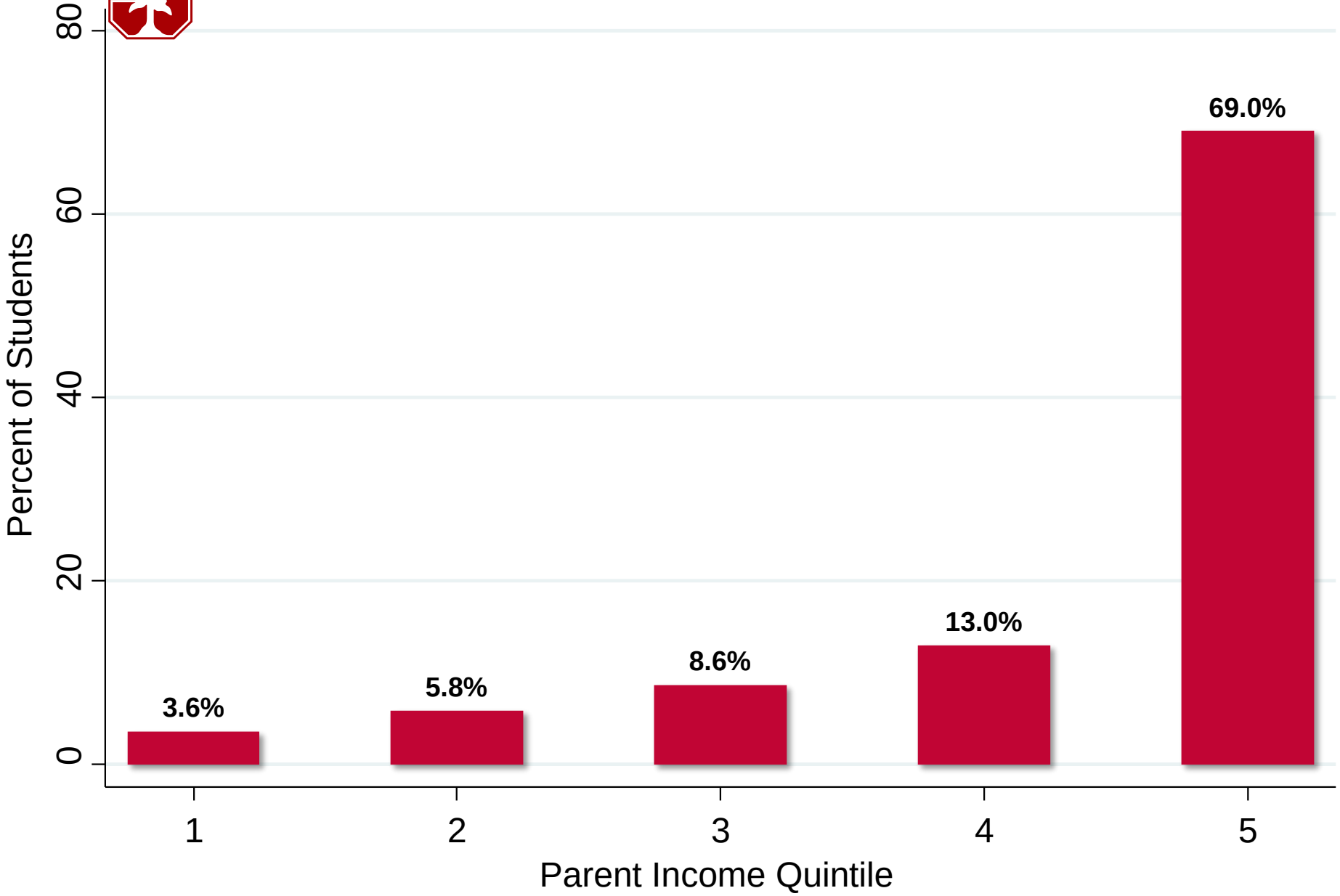
- Parent income: mean pre-tax household income during five year period when child is aged 15-19

- 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
20th Percentile = $25k
Median = $60k
60th Percentile = $74k
80th Percentile = $111k
99th Percentile = $512k
Density
0
100000
200000
300000
400000
500000
Parents' Annual Household Income when Child is Age 15-19 ($)

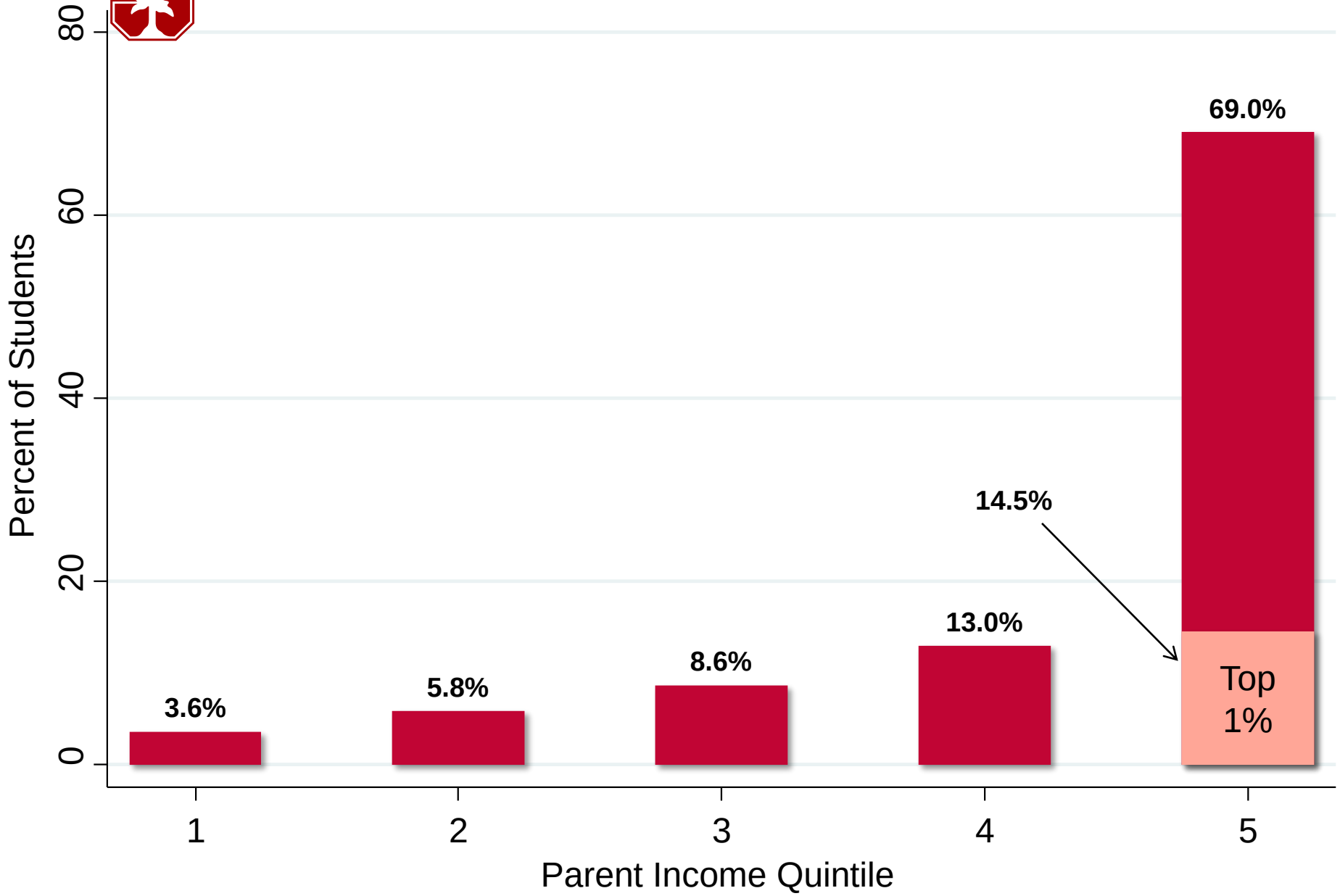
Parent Income Distribution

Stanford University



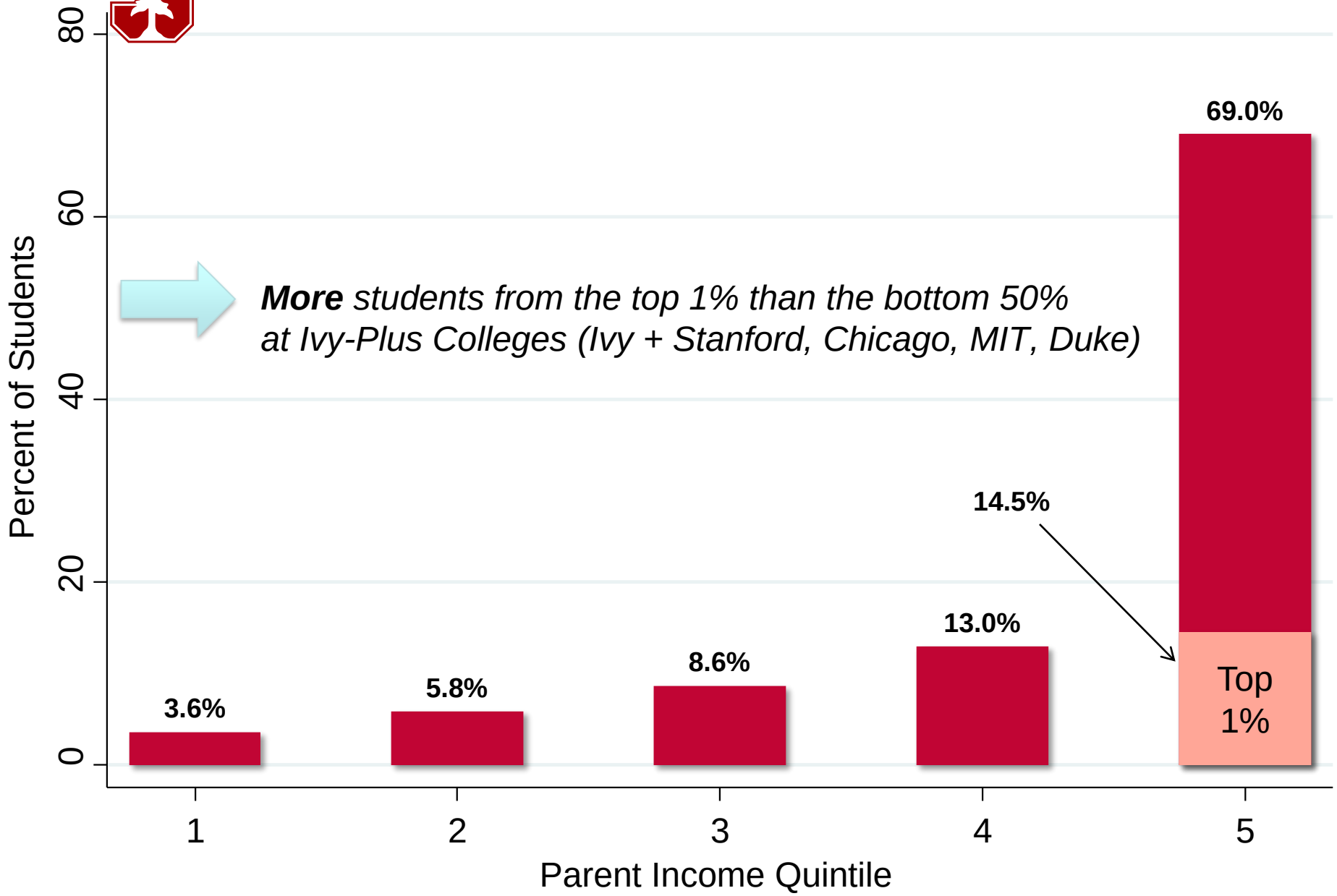
Parent Income Distribution

Stanford University



Parent Income Distribution

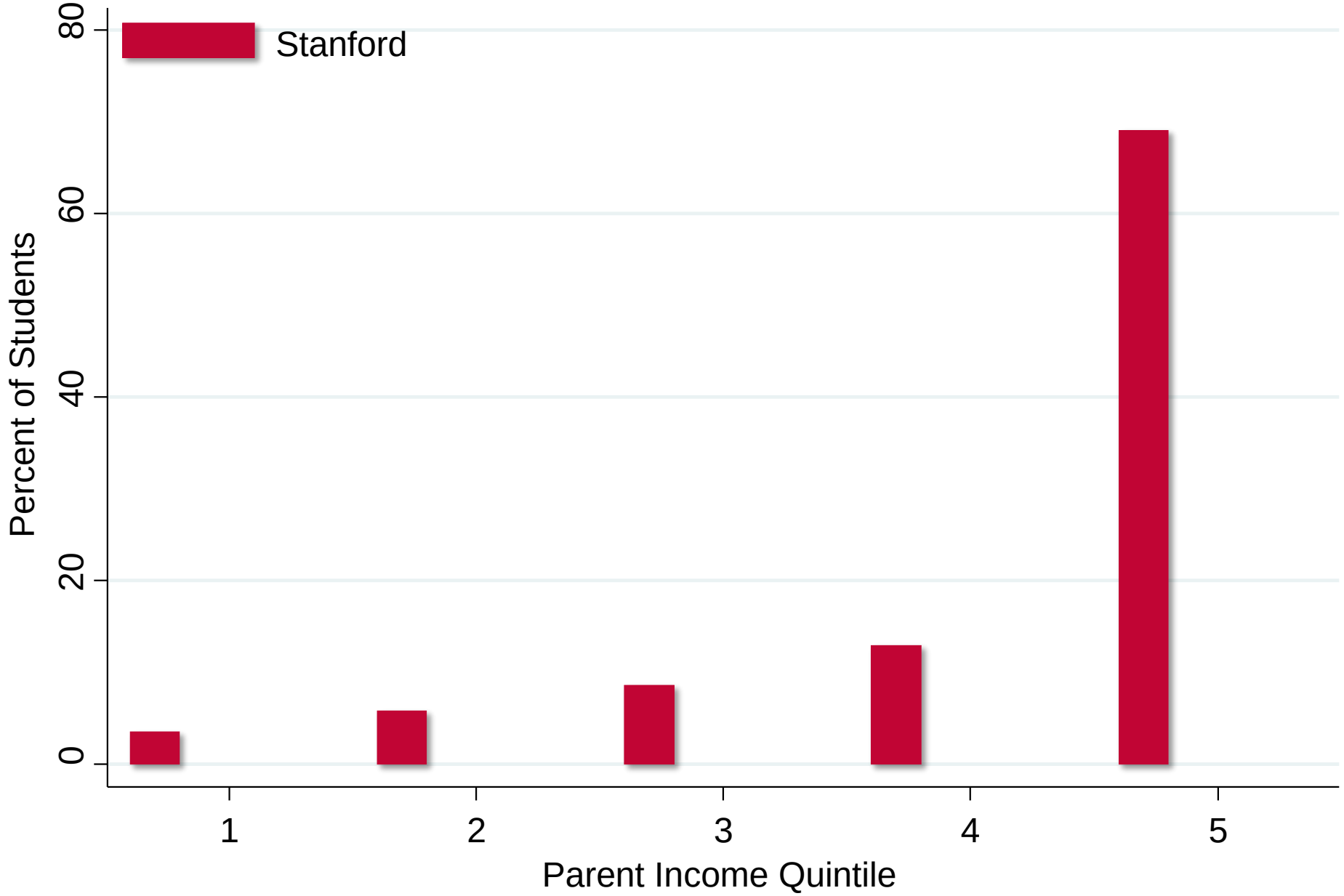
Stanford University



More *students from the top 1% than the bottom 50% at Ivy-Plus Colleges (Ivy + Stanford, Chicago, MIT, Duke)*

Parent Income Distributions by Quintile for 1980-82 Birth Cohorts

At Selected Colleges



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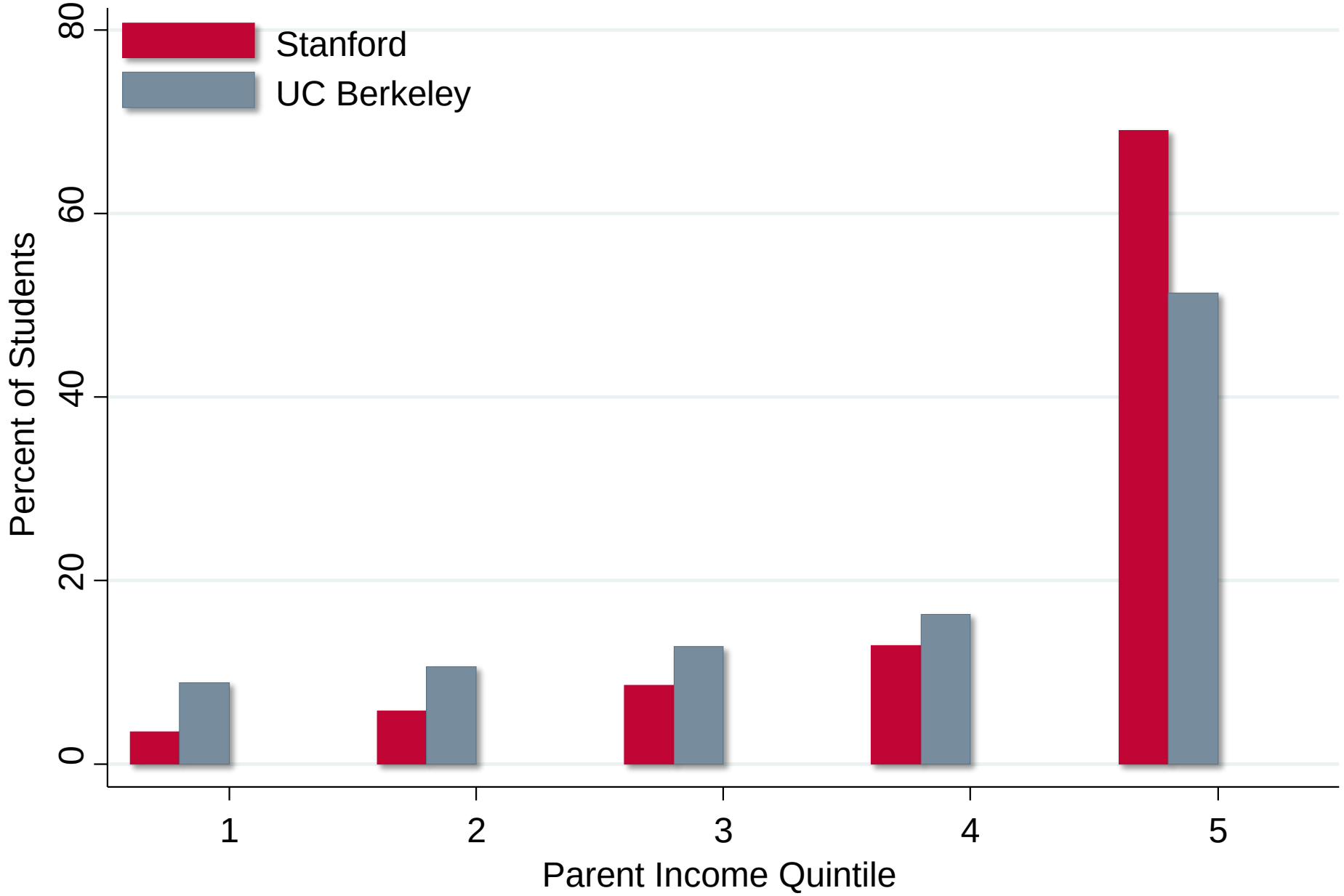

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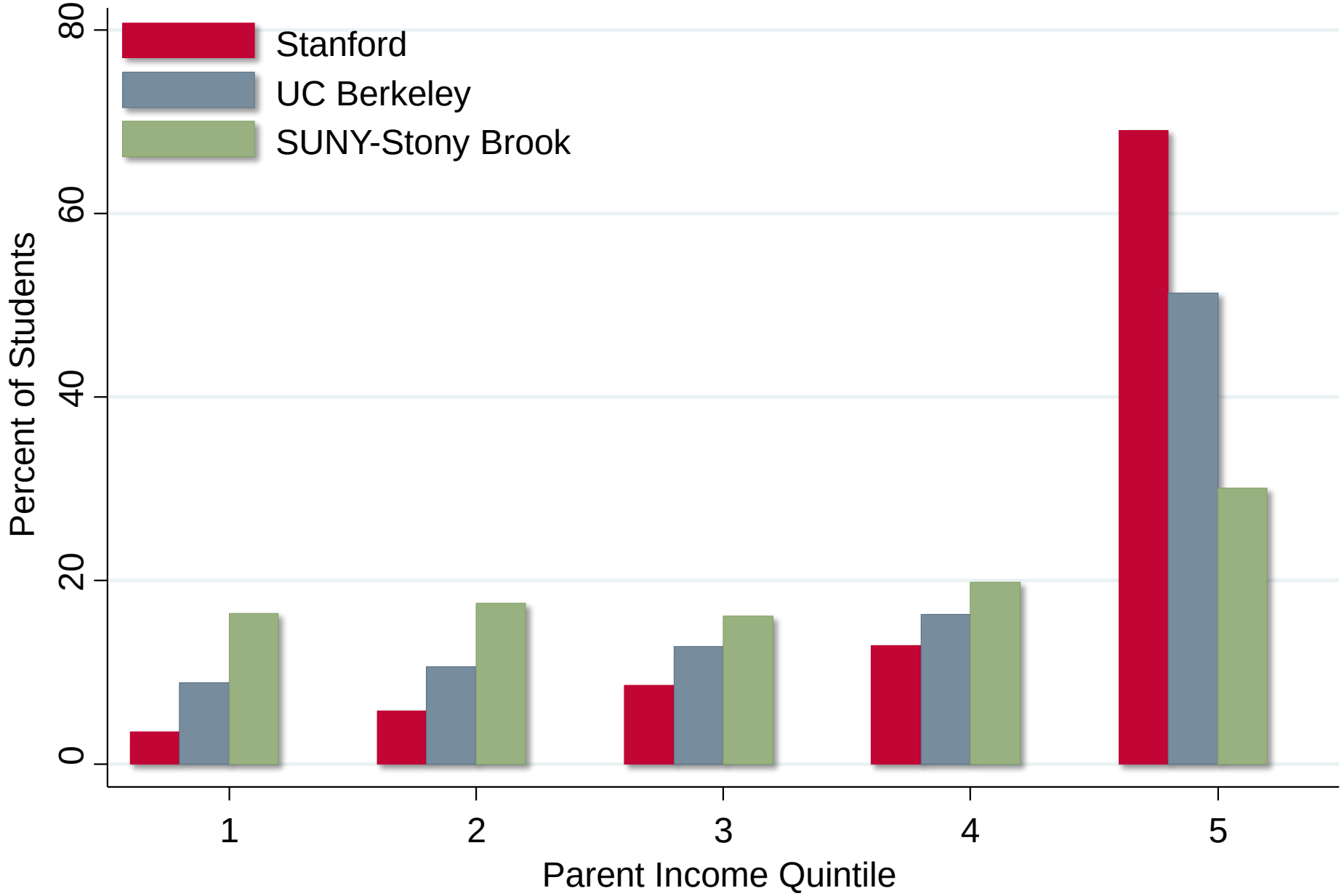
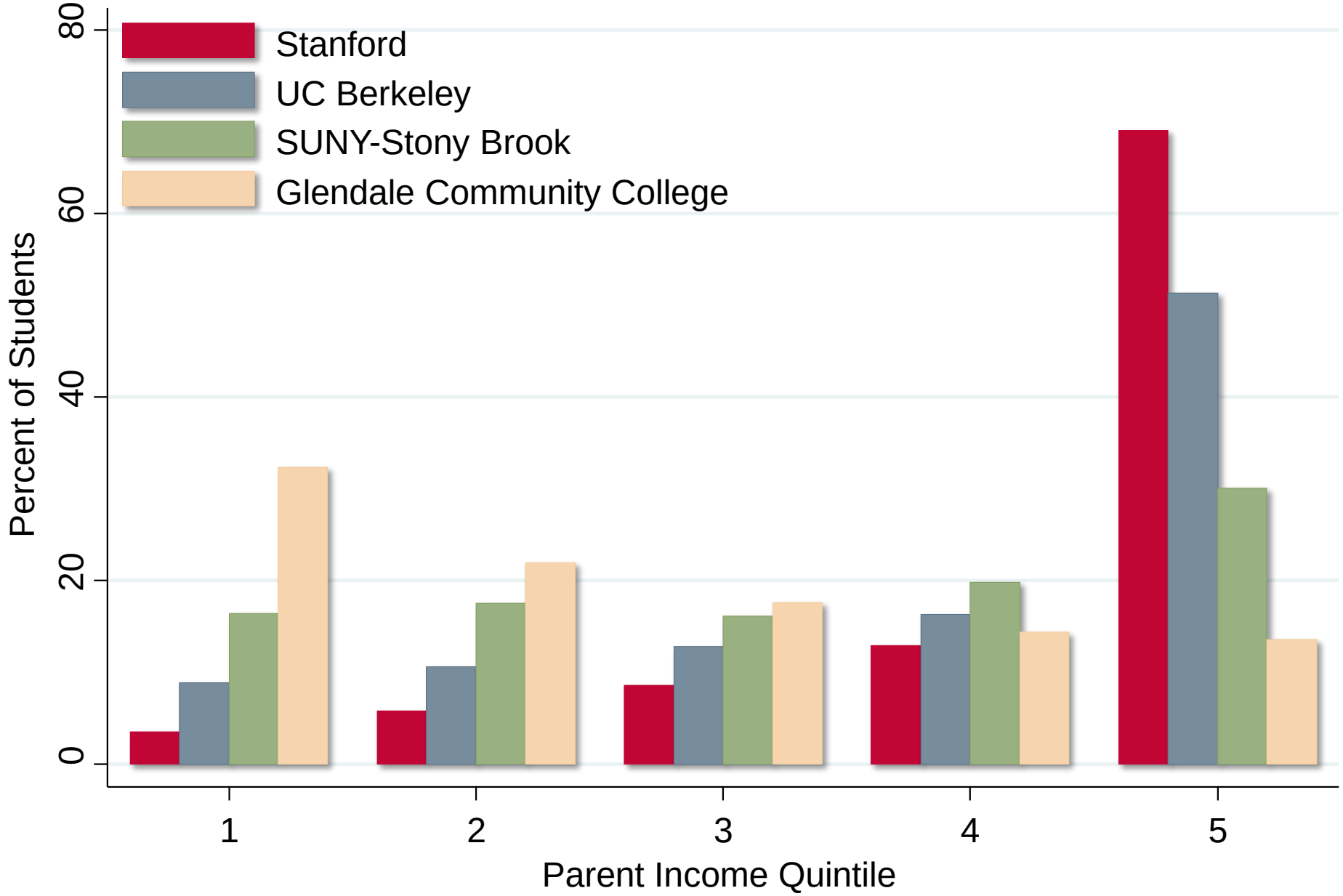


Parent Income Distributions by Quintile for 1980-82 Birth Cohorts

At Selected Colleges



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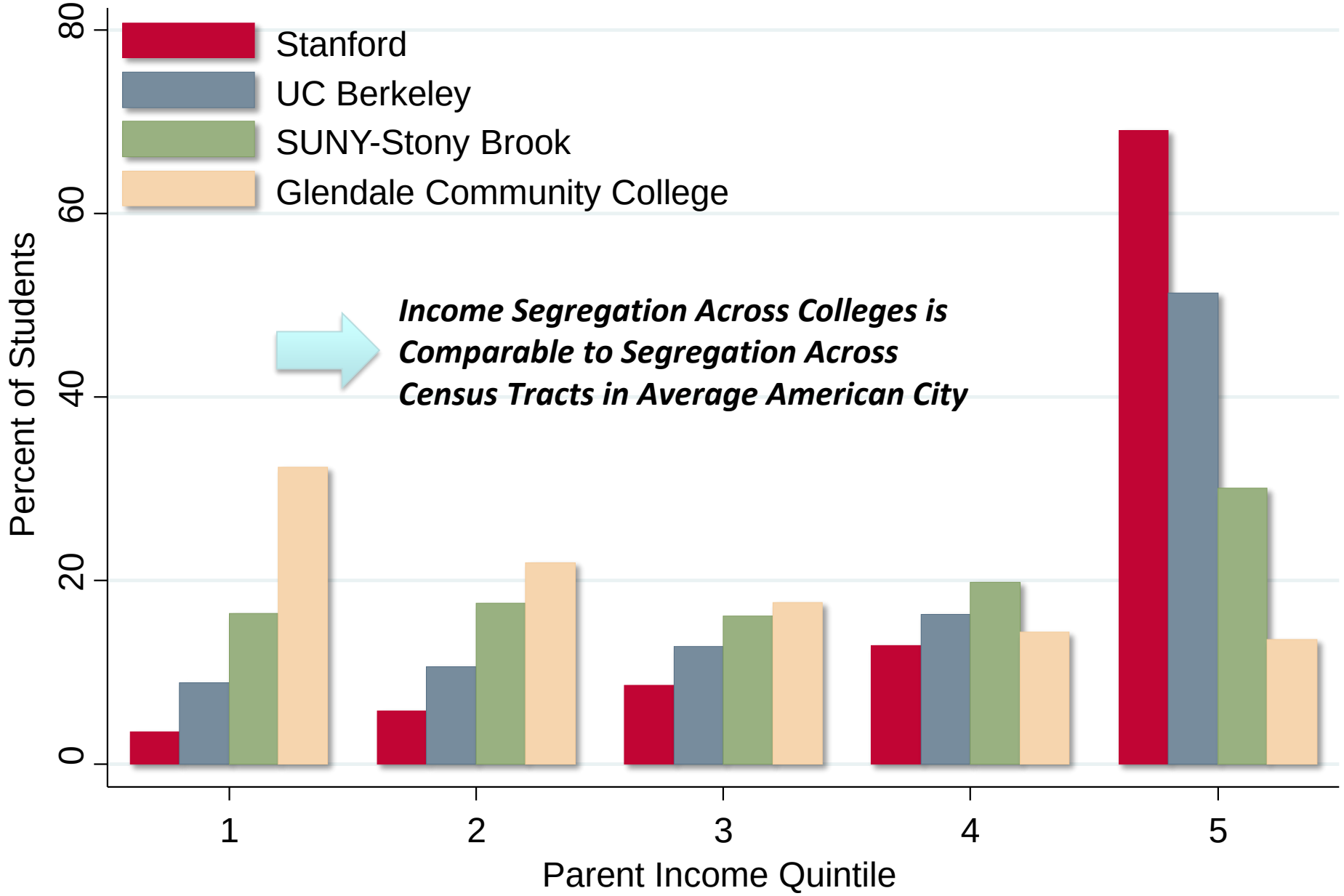
At Selected Colleges

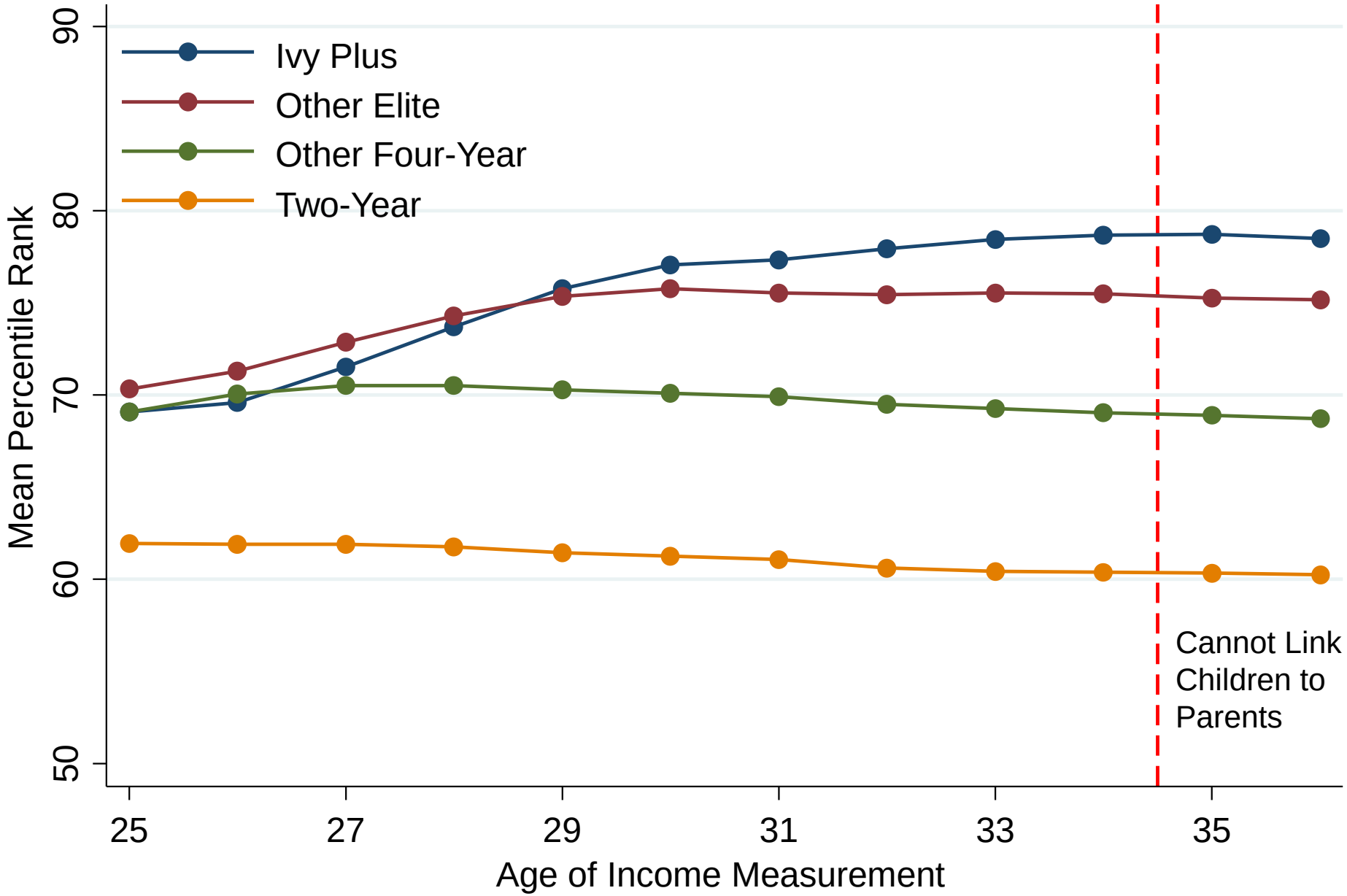


Outcomes: Students’ Earnings Distributions

Students' Outcomes

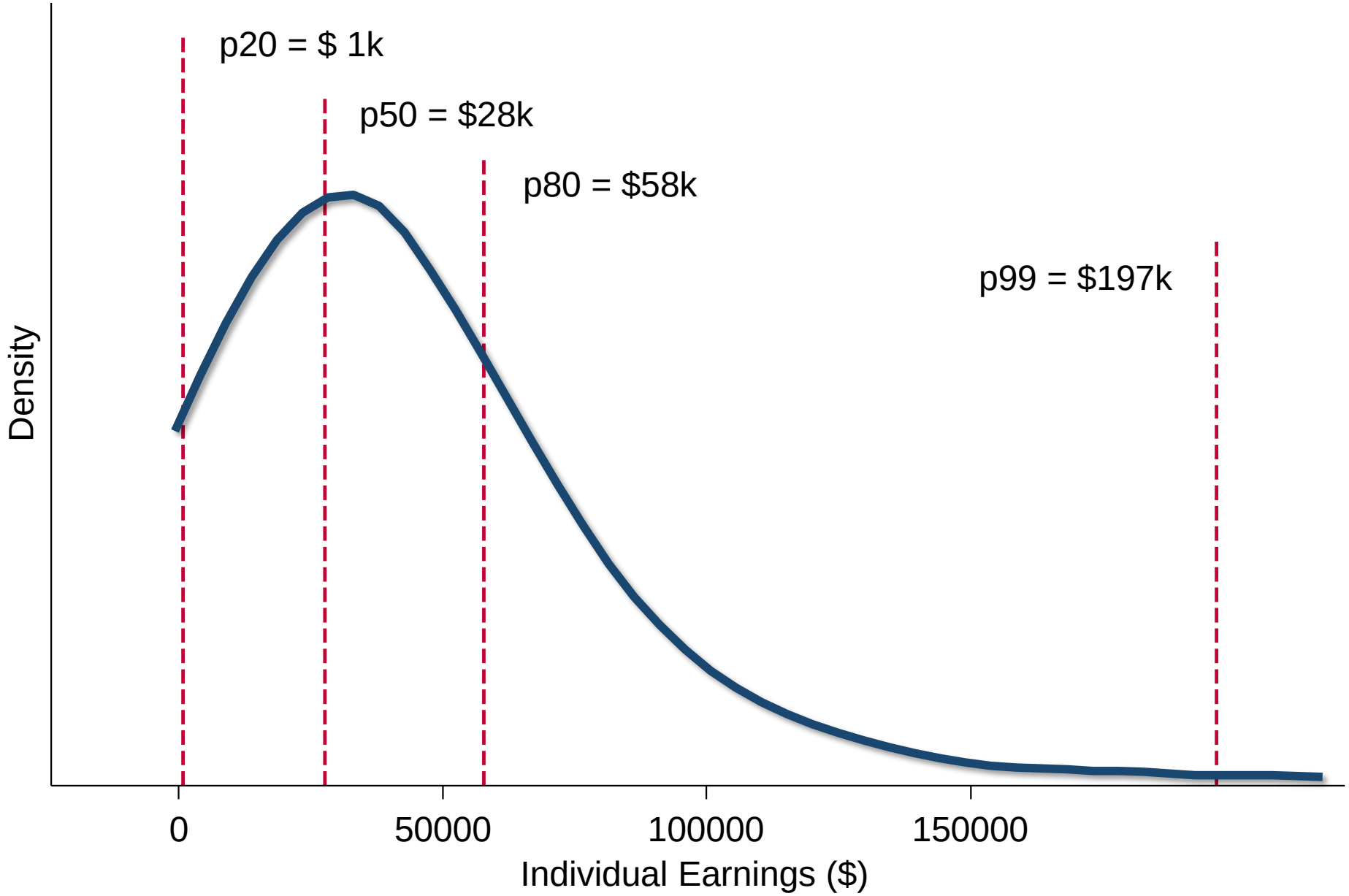
- Measure children's individual earnings in their mid-30s
  - Define percentile ranks by ranking children relative to others in same birth cohort
- Earnings *ranks* stabilize by age 30 even at top colleges

Mean Child Rank vs. Age at Income Measurement, By College Tier



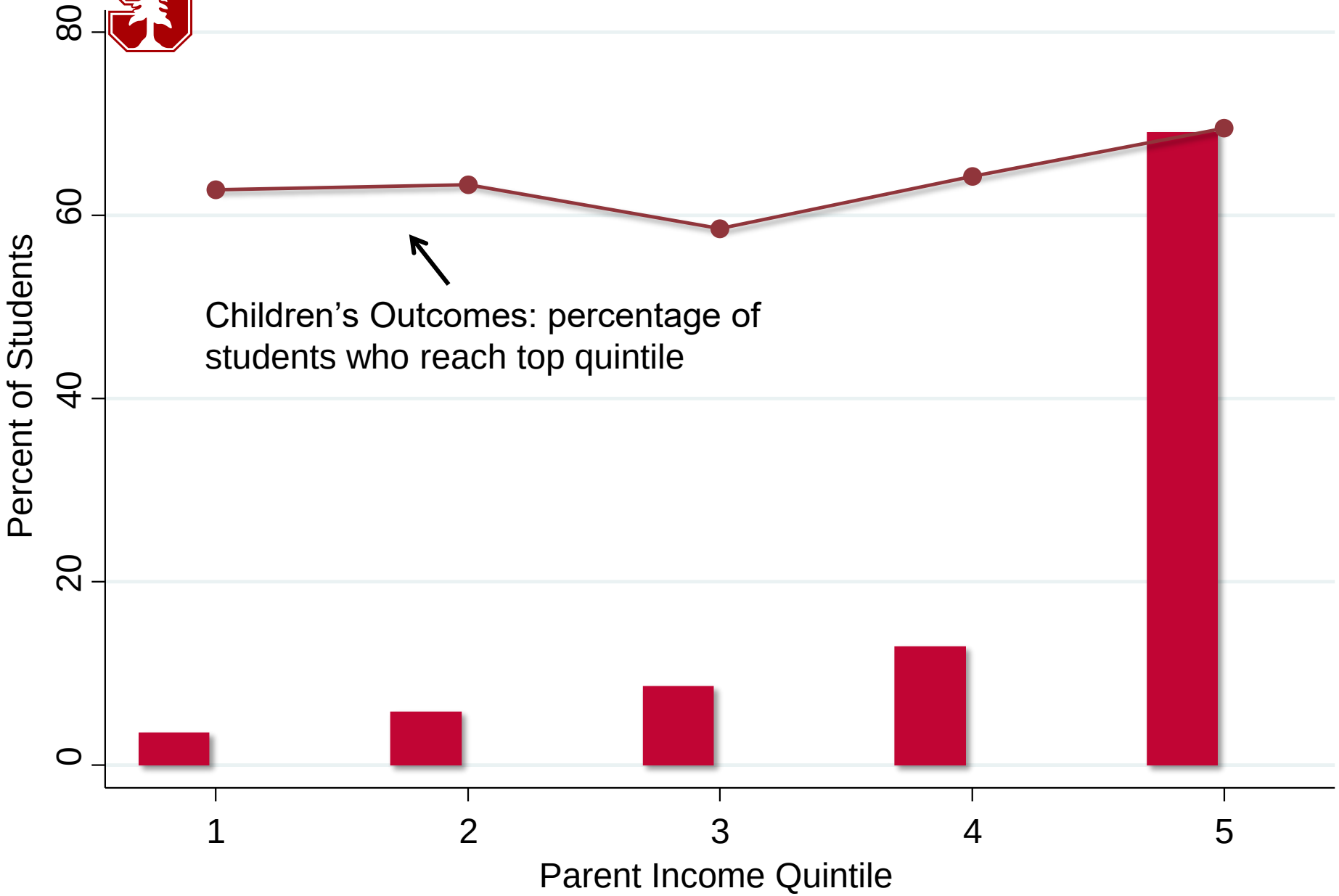
Distribution of Children's Individual Labor Earnings at Age 34

1980 Birth Cohort



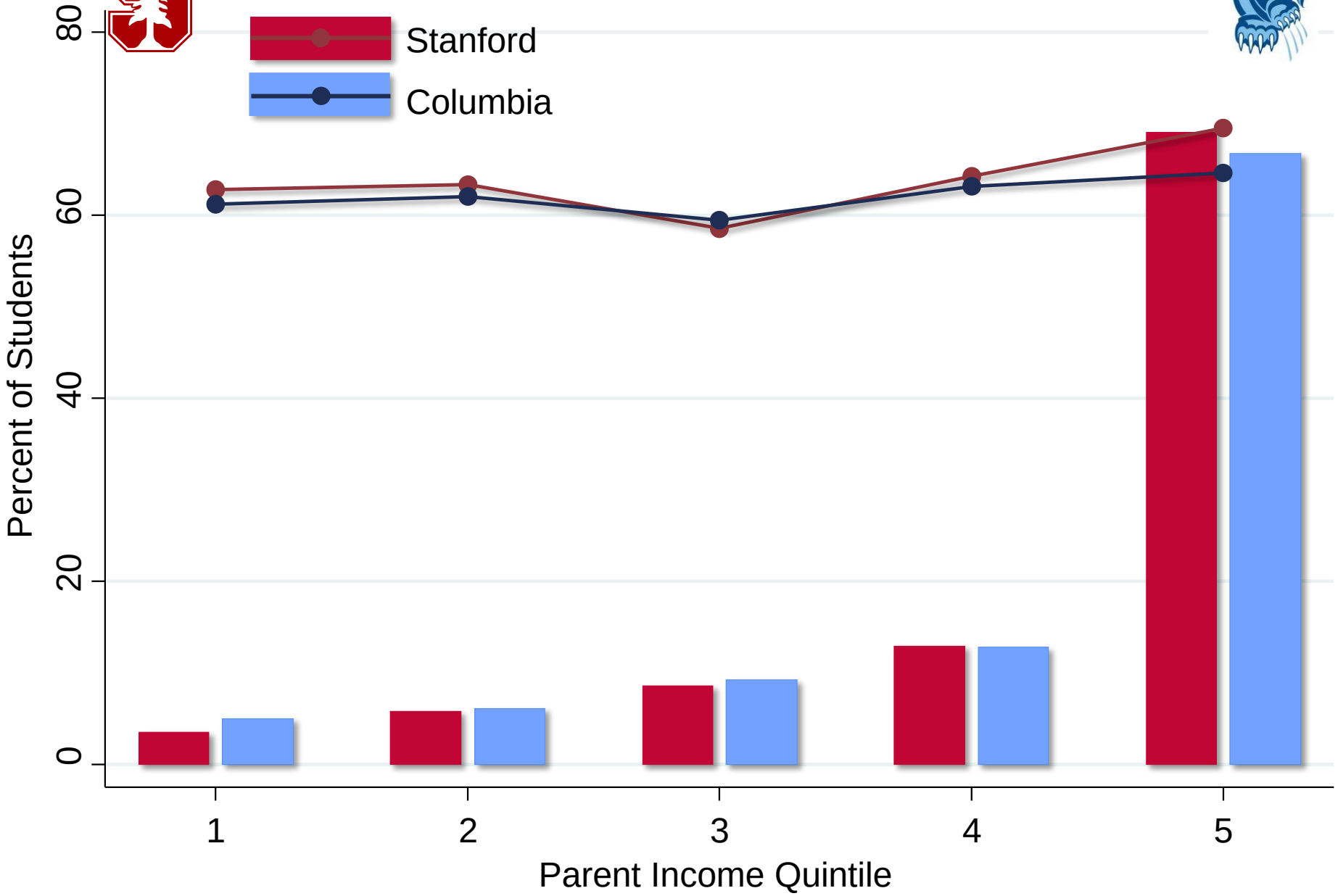
Student Outcomes

Stanford University



Student Outcomes

Stanford and Columbia



Students' Outcomes and the "Mismatch" Hypothesis

- At any given college, students from low- and high- income families have very similar earnings outcomes
  - Colleges effectively "level the playing field" across students with different socioeconomic backgrounds whom they admit
- No indication of "mismatch" of low-income students who are admitted to selective colleges under current policies

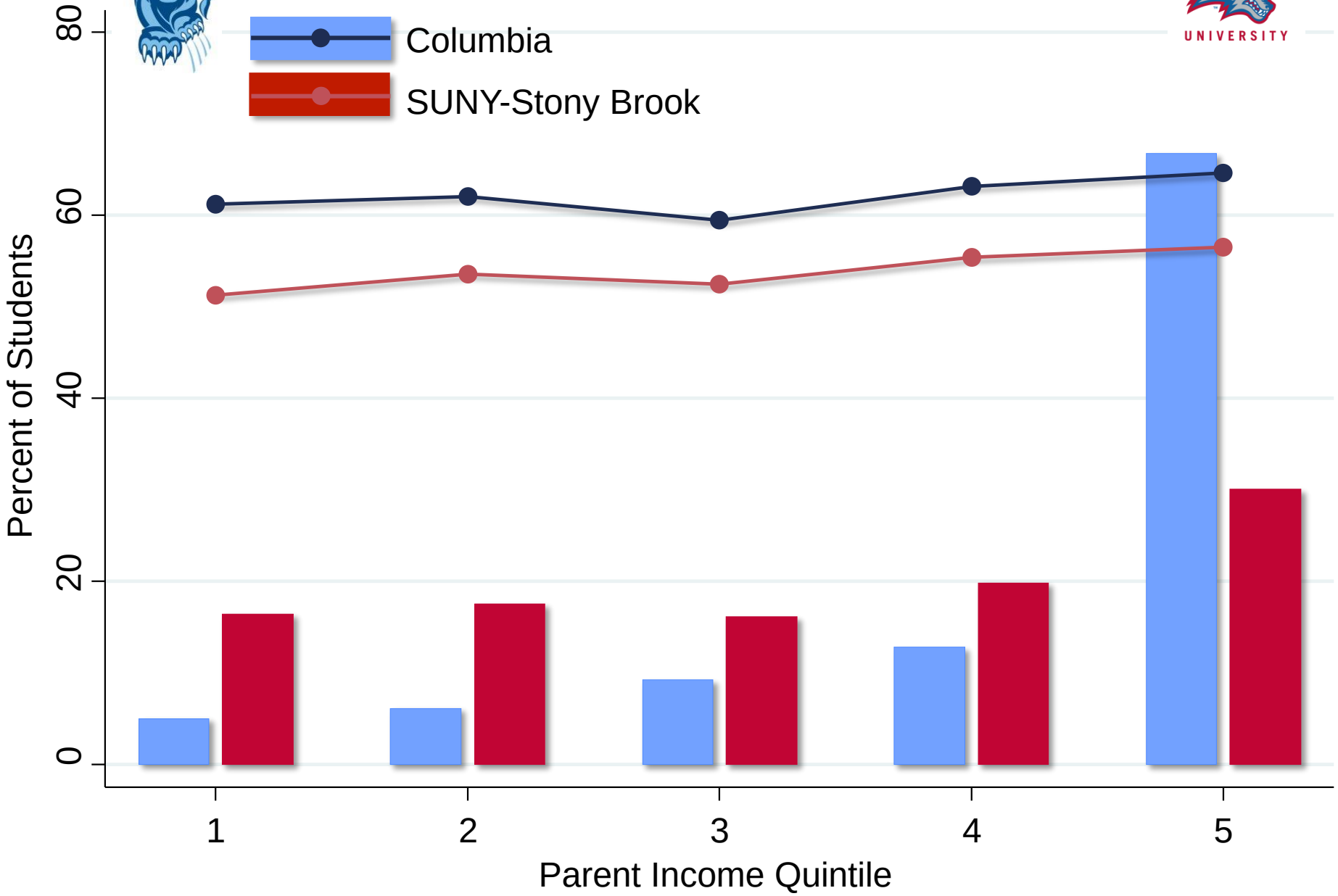
Differences in Mobility Rates Across Colleges

Mobility Report Cards

- 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?

Mobility Report Cards

Columbia vs. SUNY-Stony Brook



Mobility Report Cards

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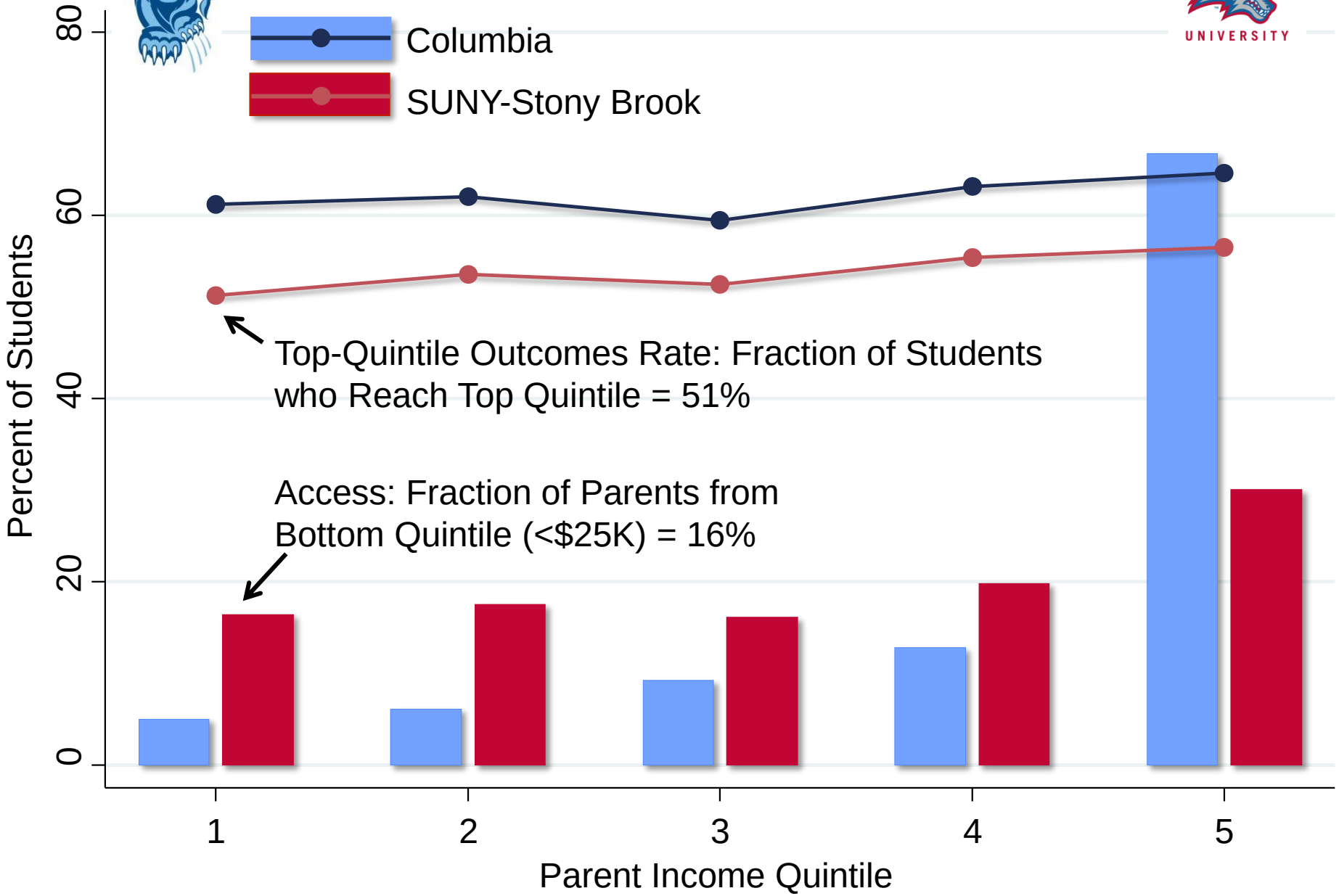
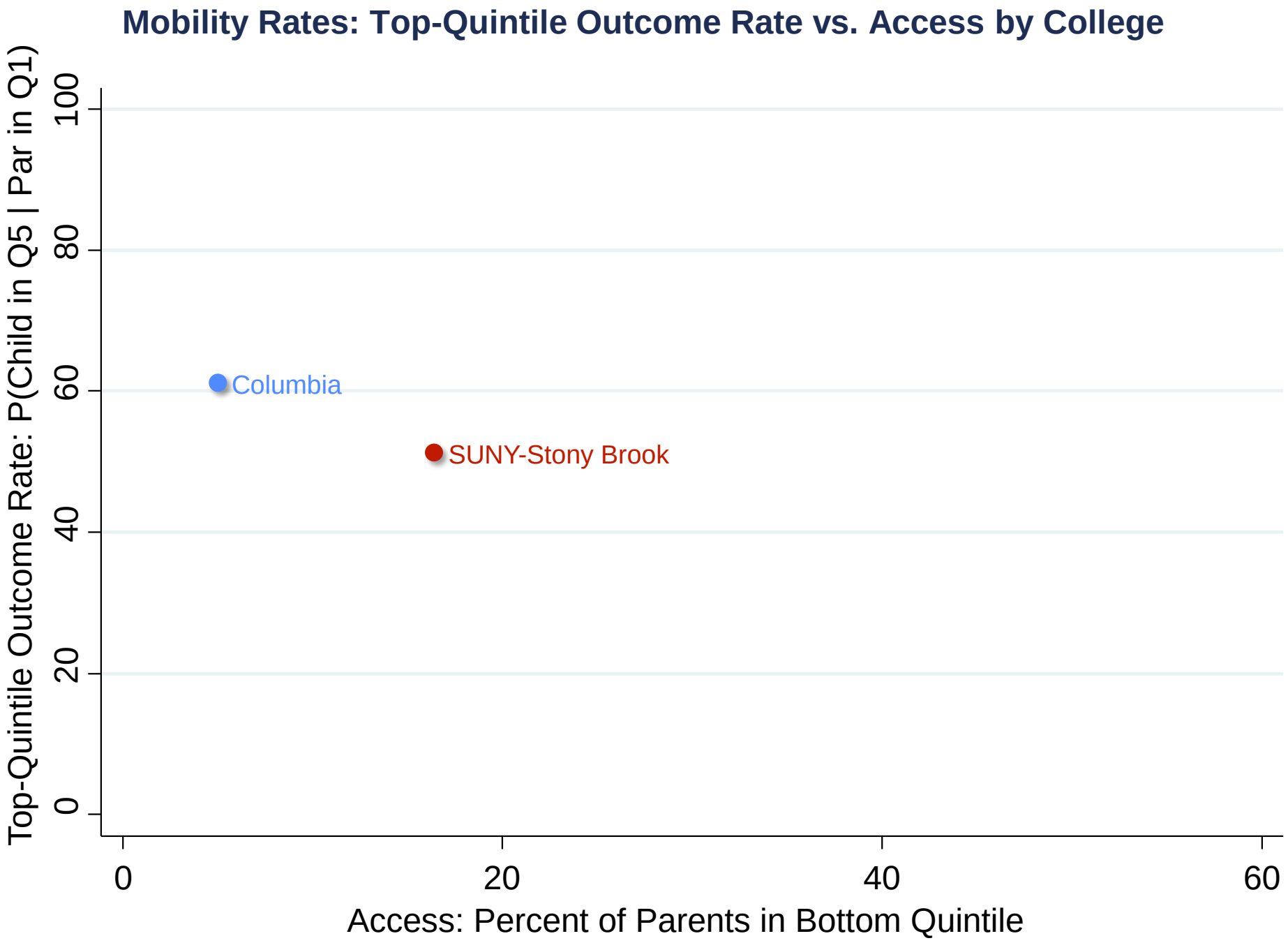


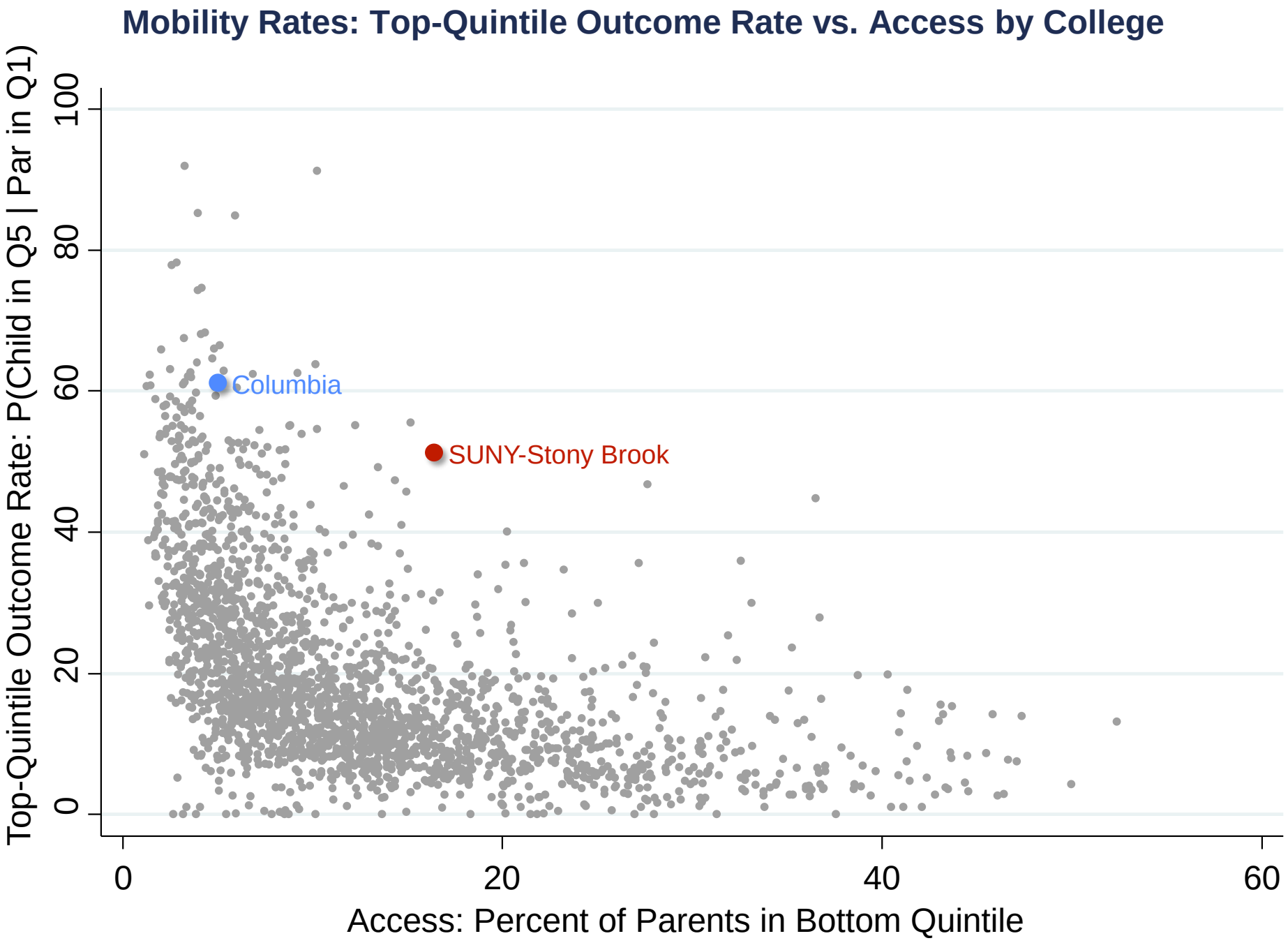
Mobility Rates

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

- Observe that:

	Mobility Rate	=	Access	x	Top-Quintile Outcome 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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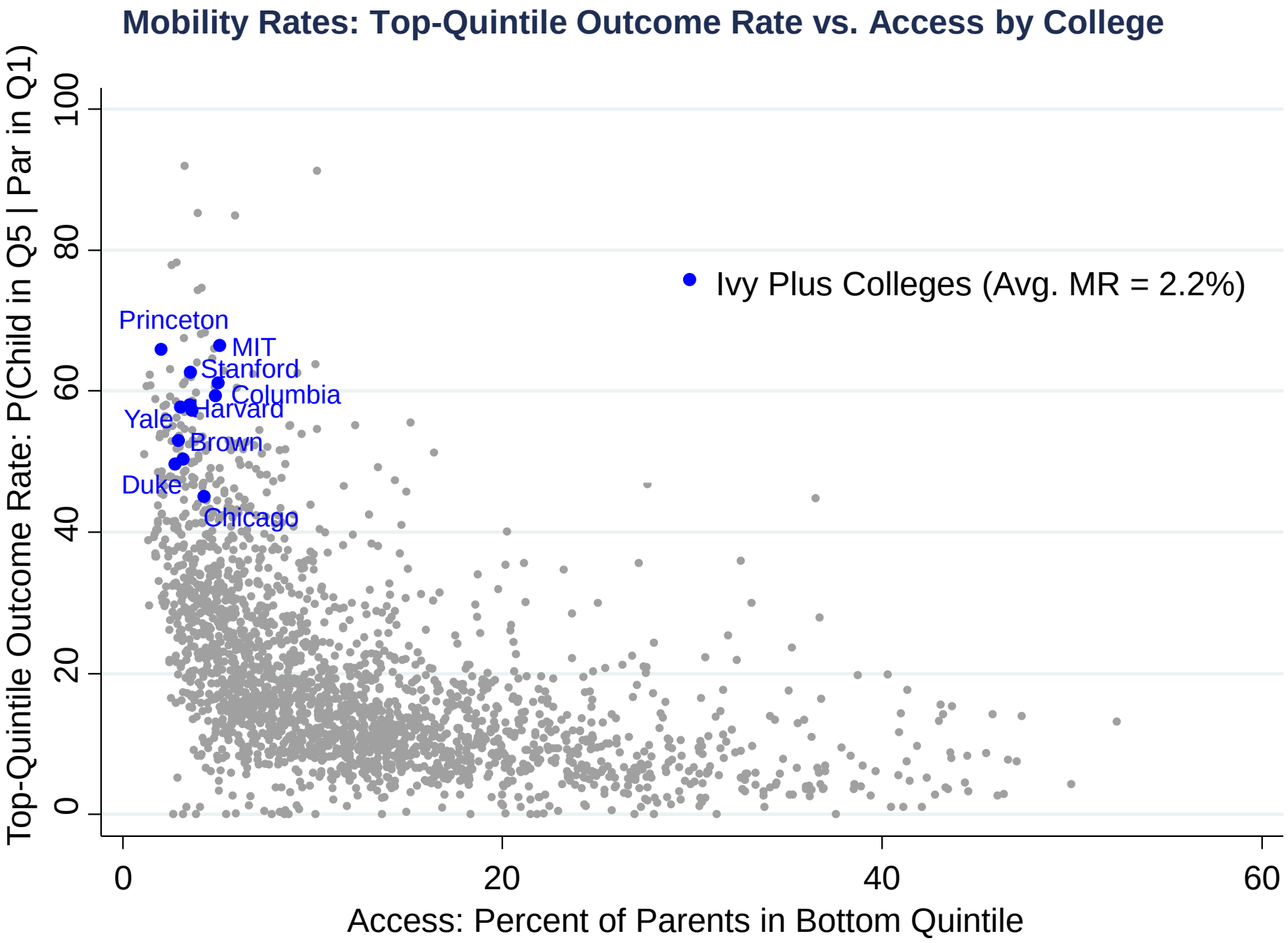
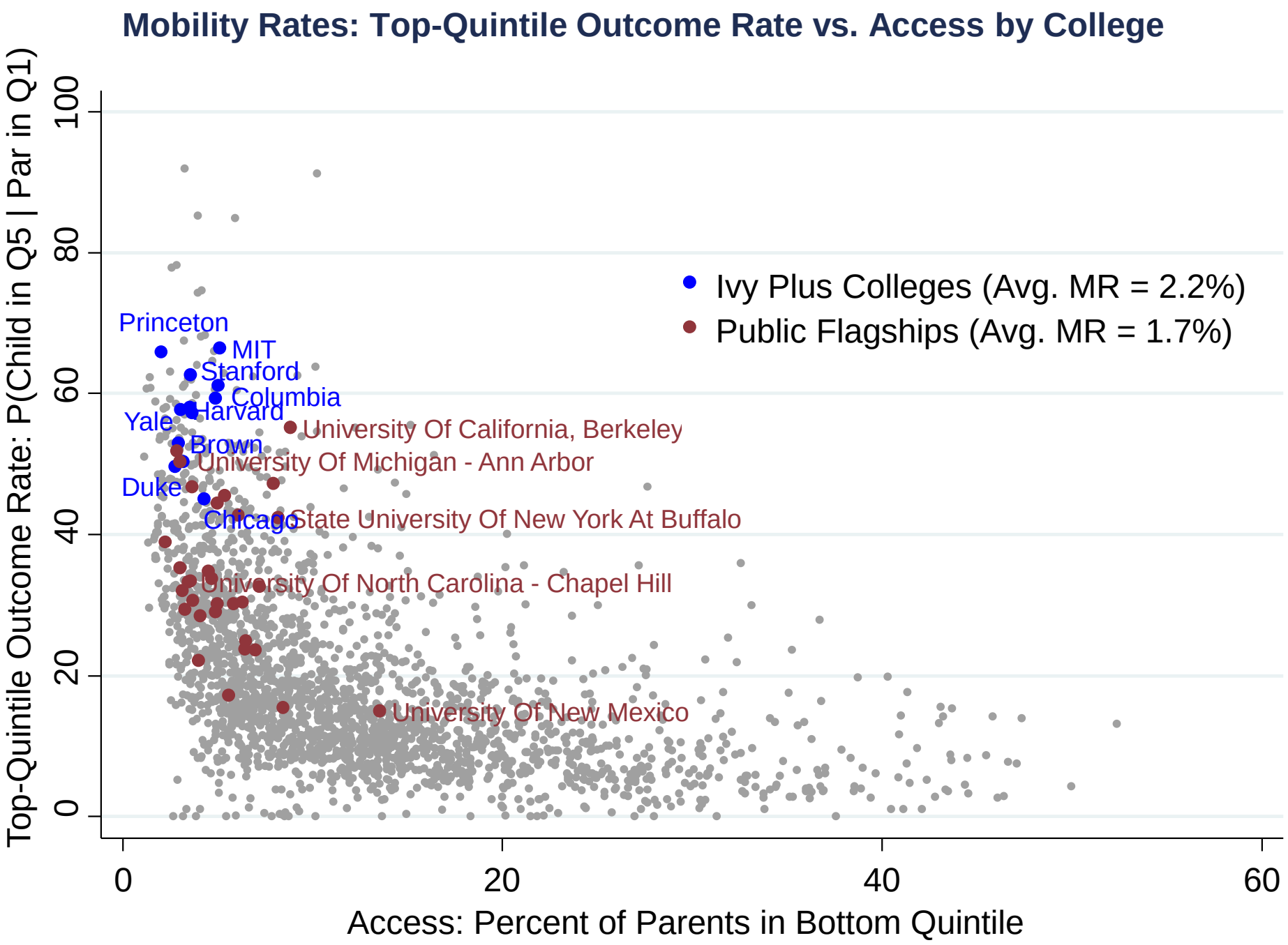
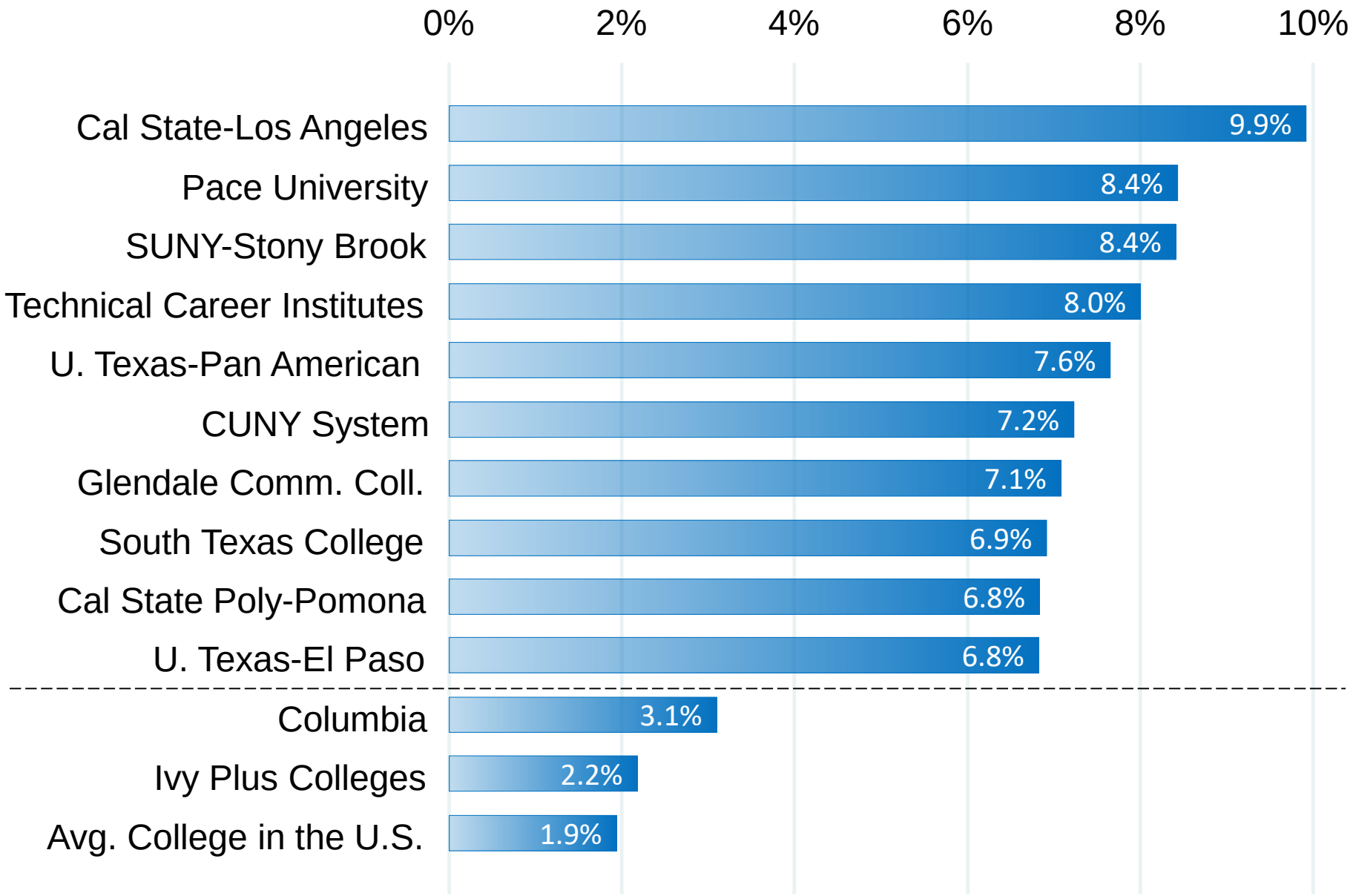

Mobility Rates: Top-Quintile Outcome Rate vs. Access by College
Top-Quintile Outcome Rate: P(Child in Q5 | Par in Q1)
0
20
40
60
80
100
Ivy Plus Colleges (Avg. MR = 2.2%)
Princeton
MIT
Stanford
Columbia
Harvard
Yale
Brown
Duke
Chicago
0
20
40
60
Access: Percent of Parents in Bottom Quintile


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%)
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

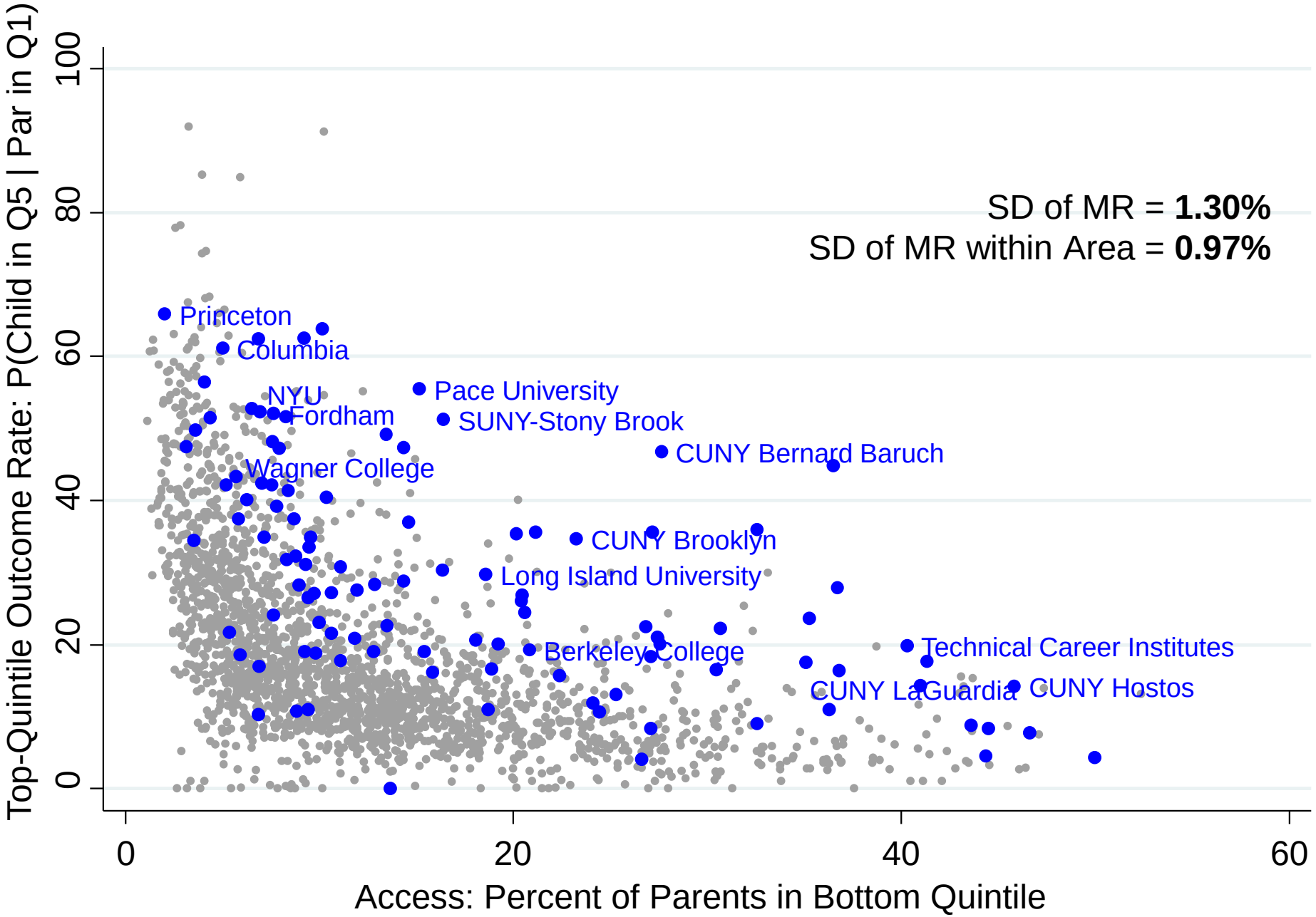
Fraction of Students who come from Bottom Fifth and End up in Top Fifth



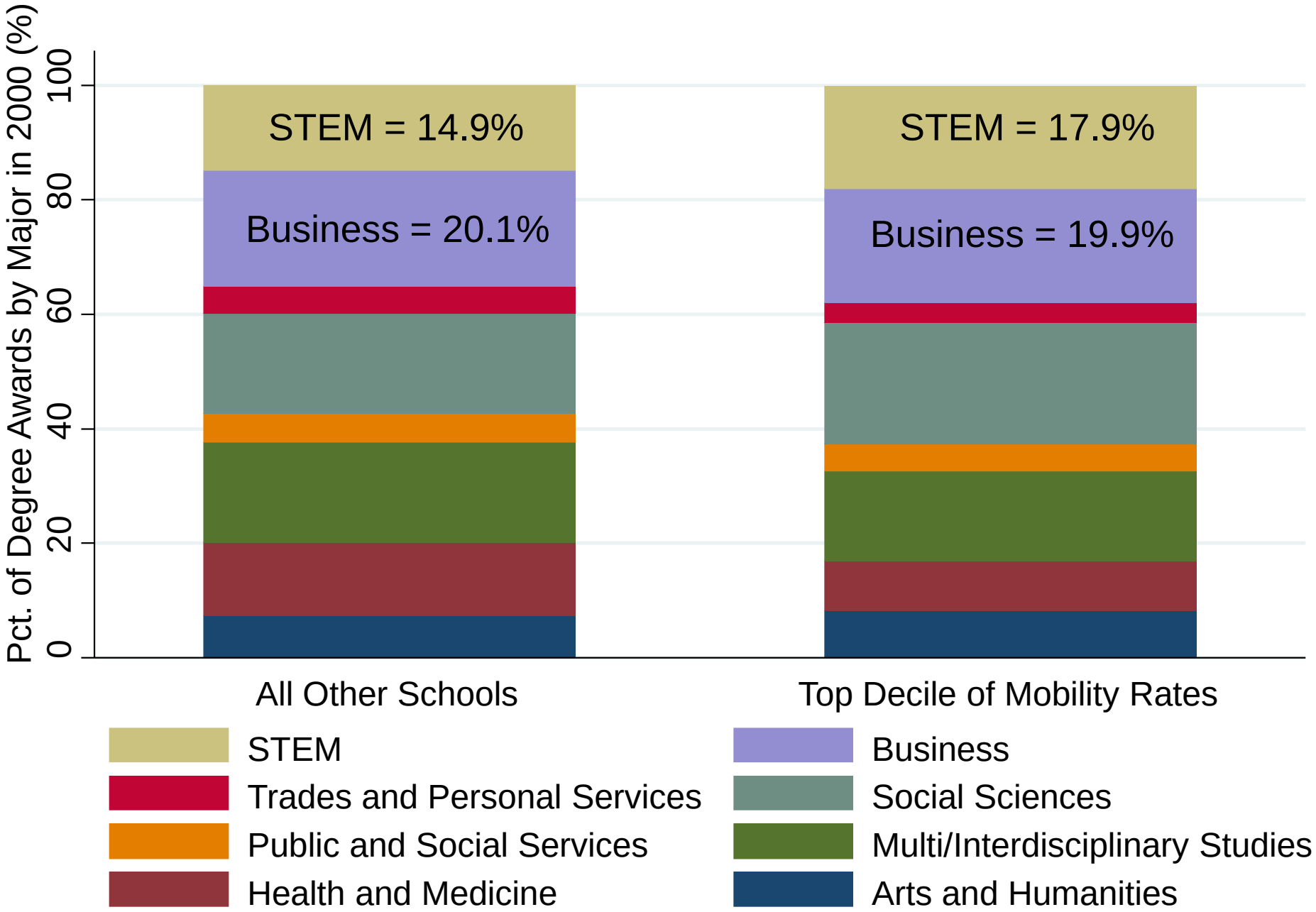
Characteristics of High-Mobility Rate Colleges

- Are there systematic differences between colleges with high vs. low mobility rates?
  - Examine correlations with a variety of college characteristics using data from Dept. of Education and other public sources

Mobility Rates: Colleges in the New York City Metro Area

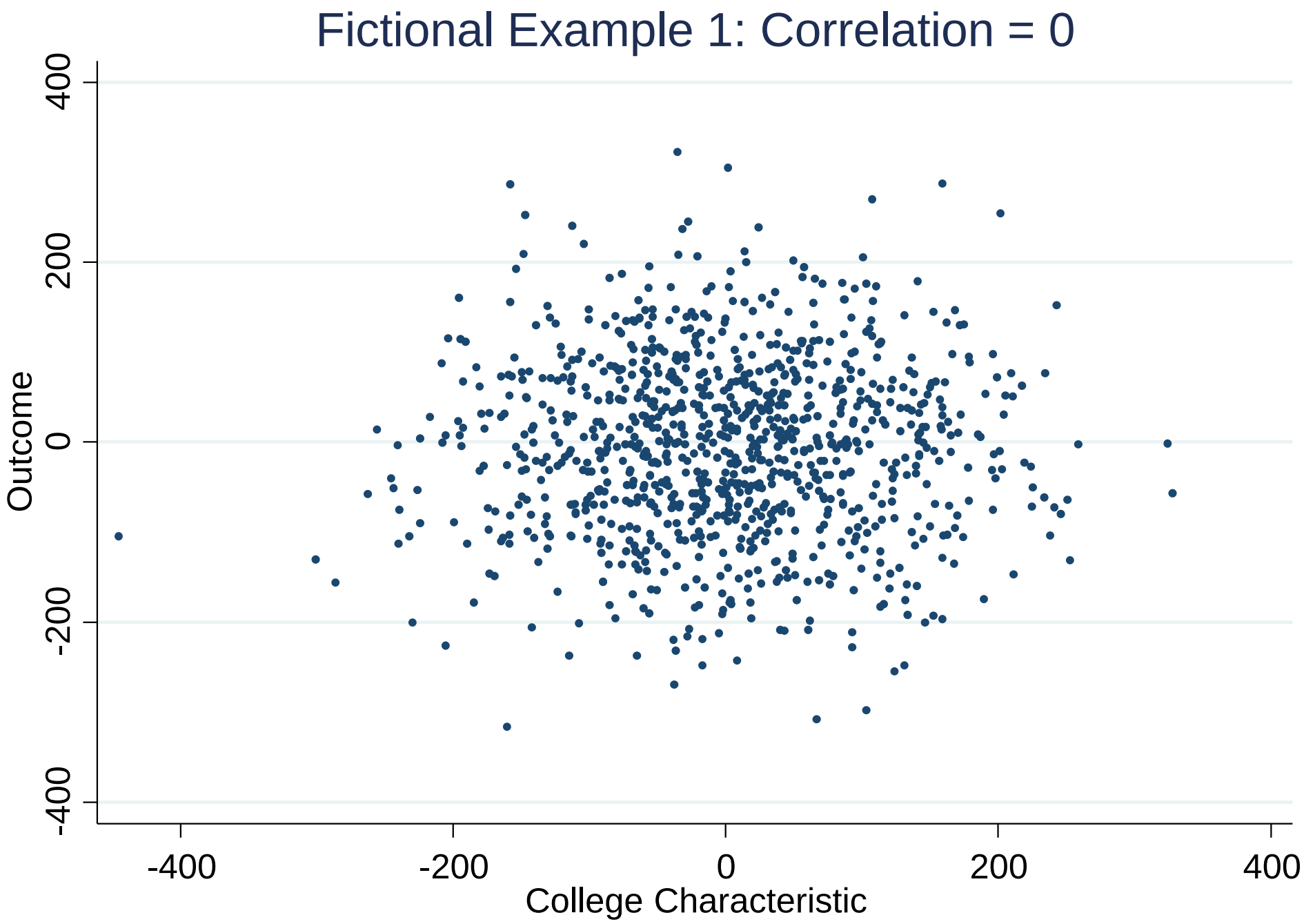


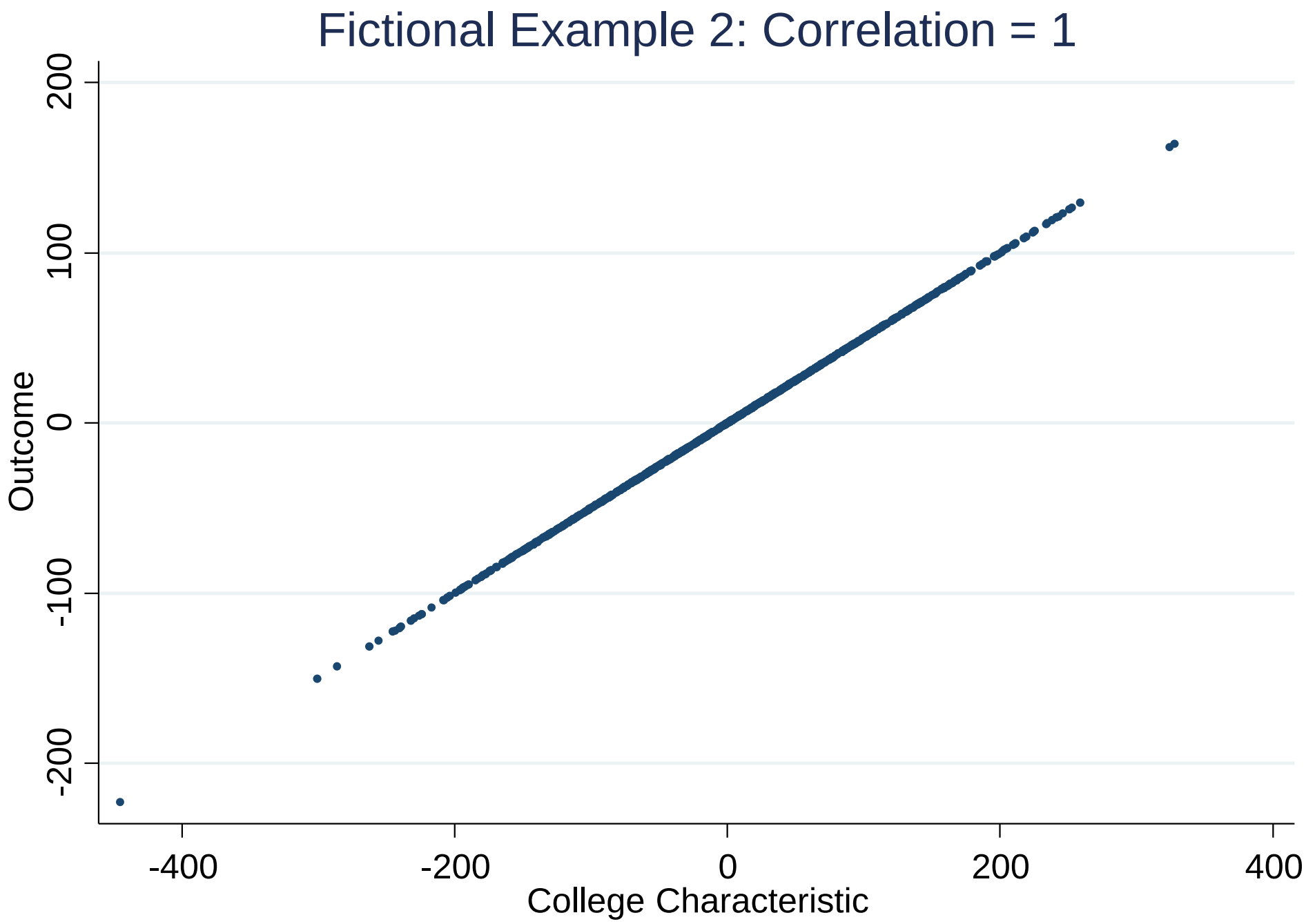
Share of Majors At Top Mobility Rate Schools vs. Other Schools

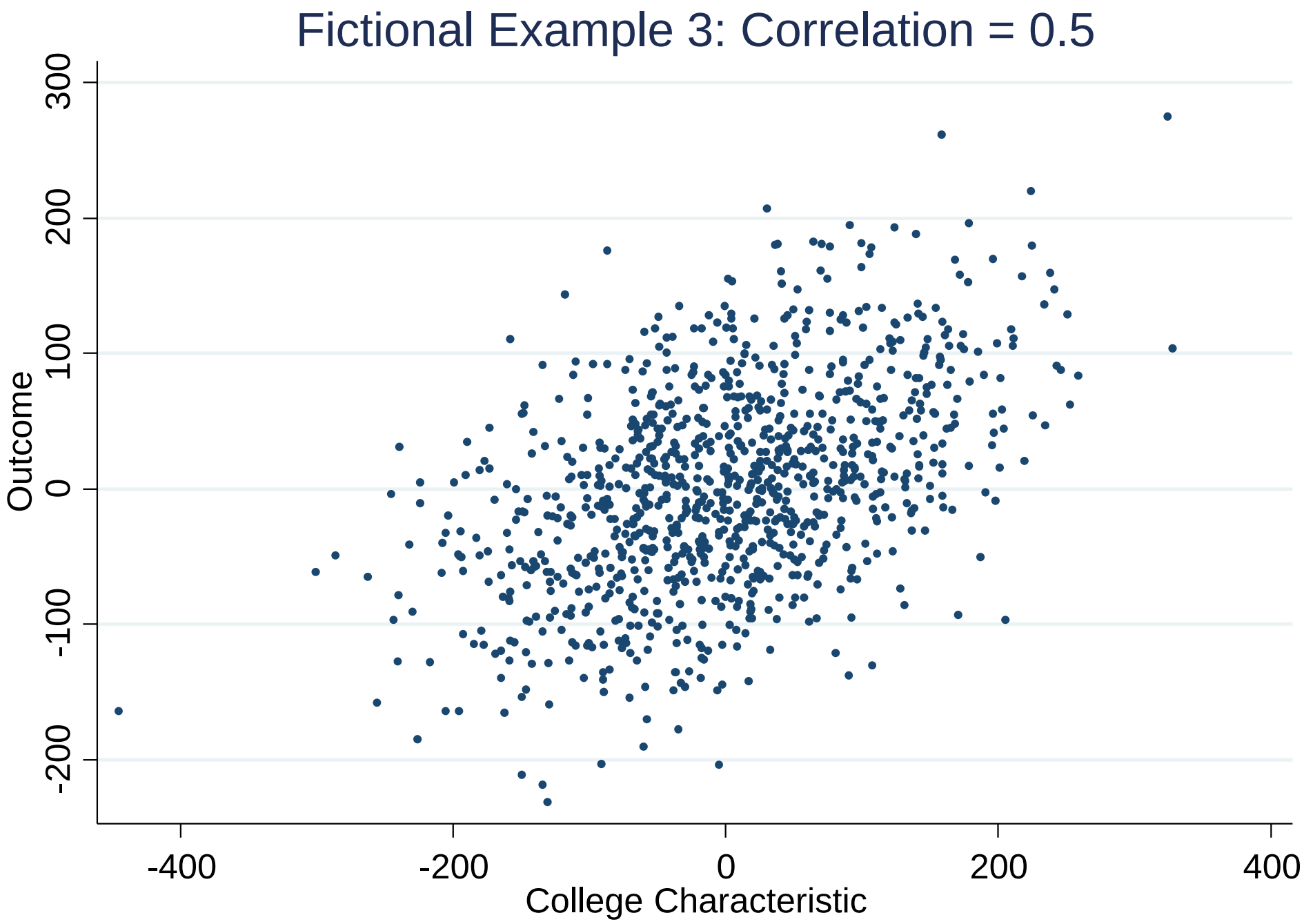


Characteristics of High-Mobility Rate Colleges

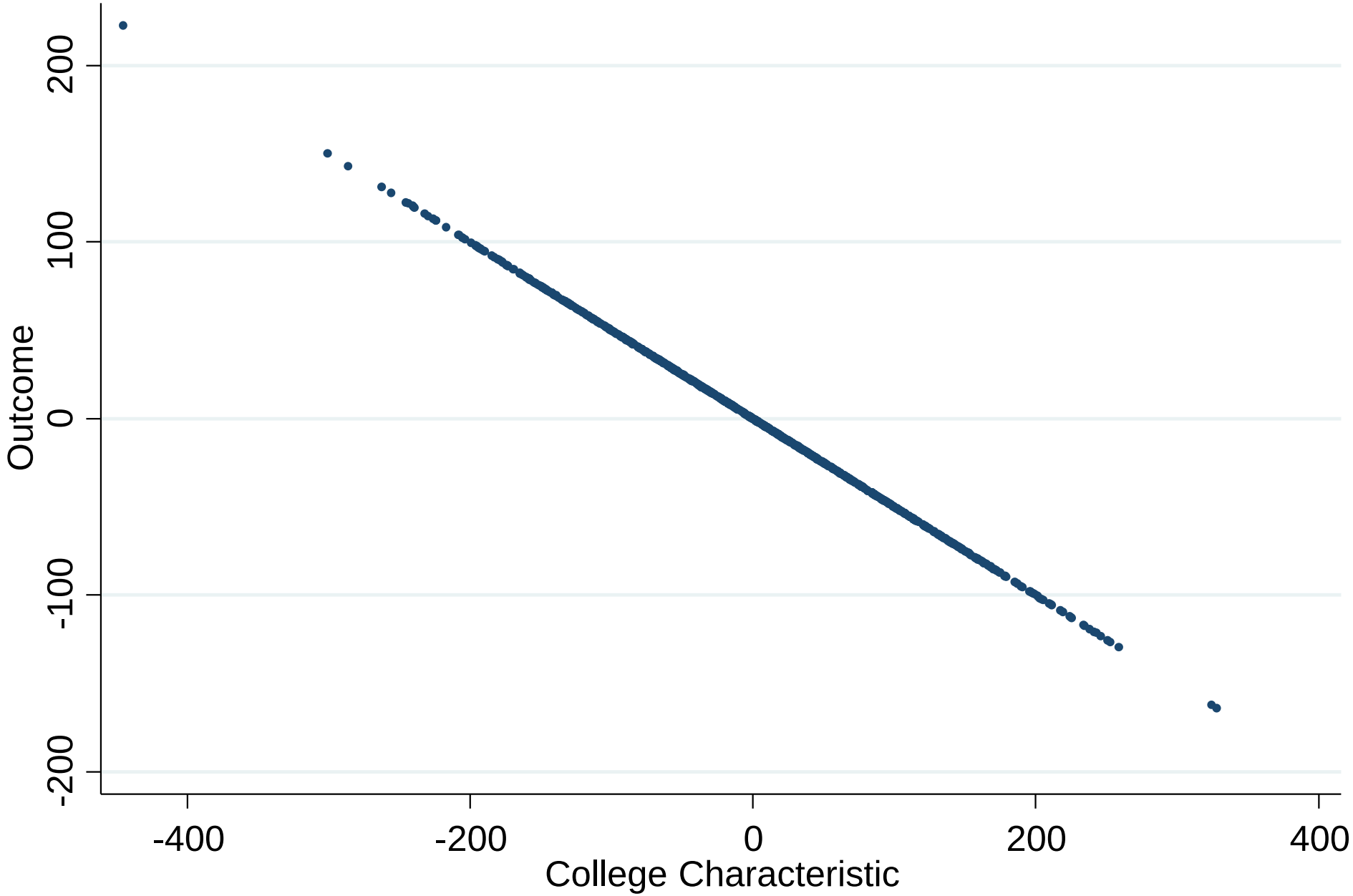
- Are there systematic differences between colleges with high vs. low mobility rates?
  - Examine correlations with a variety of college characteristics using data from Dept. of Education and other public sources
  - For other characteristics, quantify relationship using *correlation coefficient*


Fictional Example 1: Correlation = 0
Outcome
400
200
0
-200
-400
-400
-200
0
200
400
College Characteristic

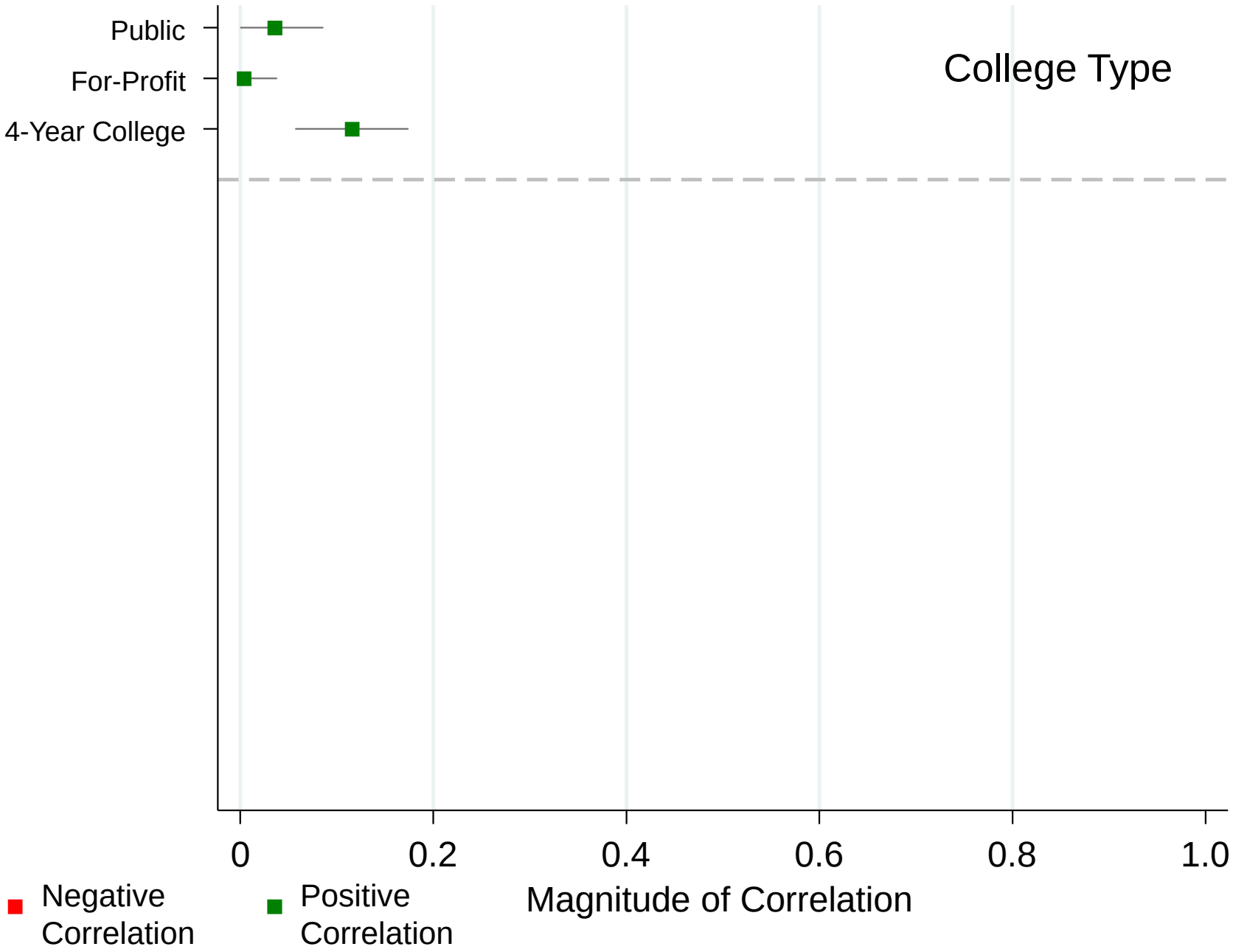

Fictional Example 2: Correlation = 1
Outcome
200
100
0
-100
-200
-400
-200
0
200
400
College Characteristic

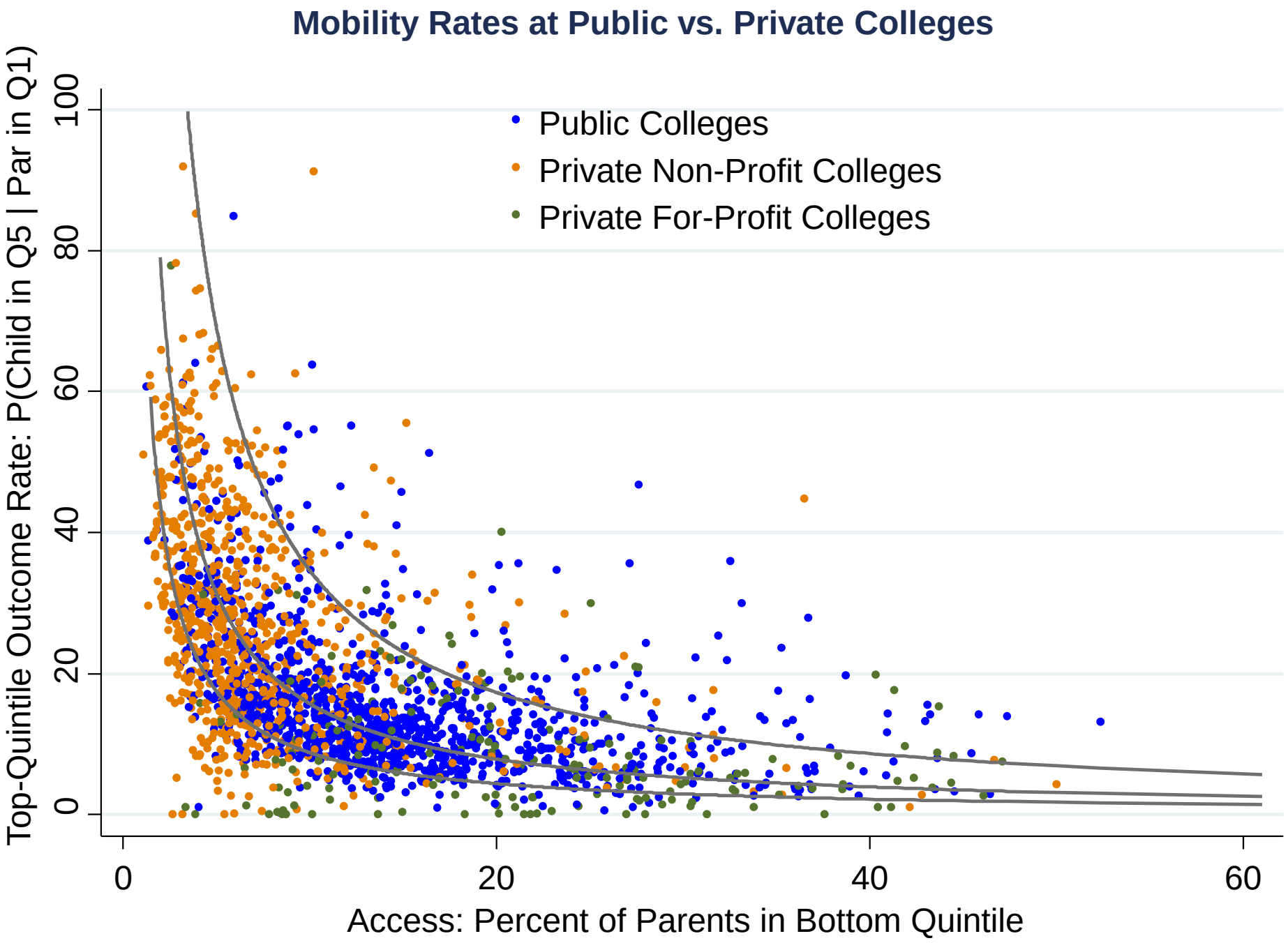

Fictional Example 3: Correlation = 0.5
Outcome
300
200
100
0
-100
-200
-400
-200
0
200
400
College Characteristic

Fictional Example 4: Correlation = -1

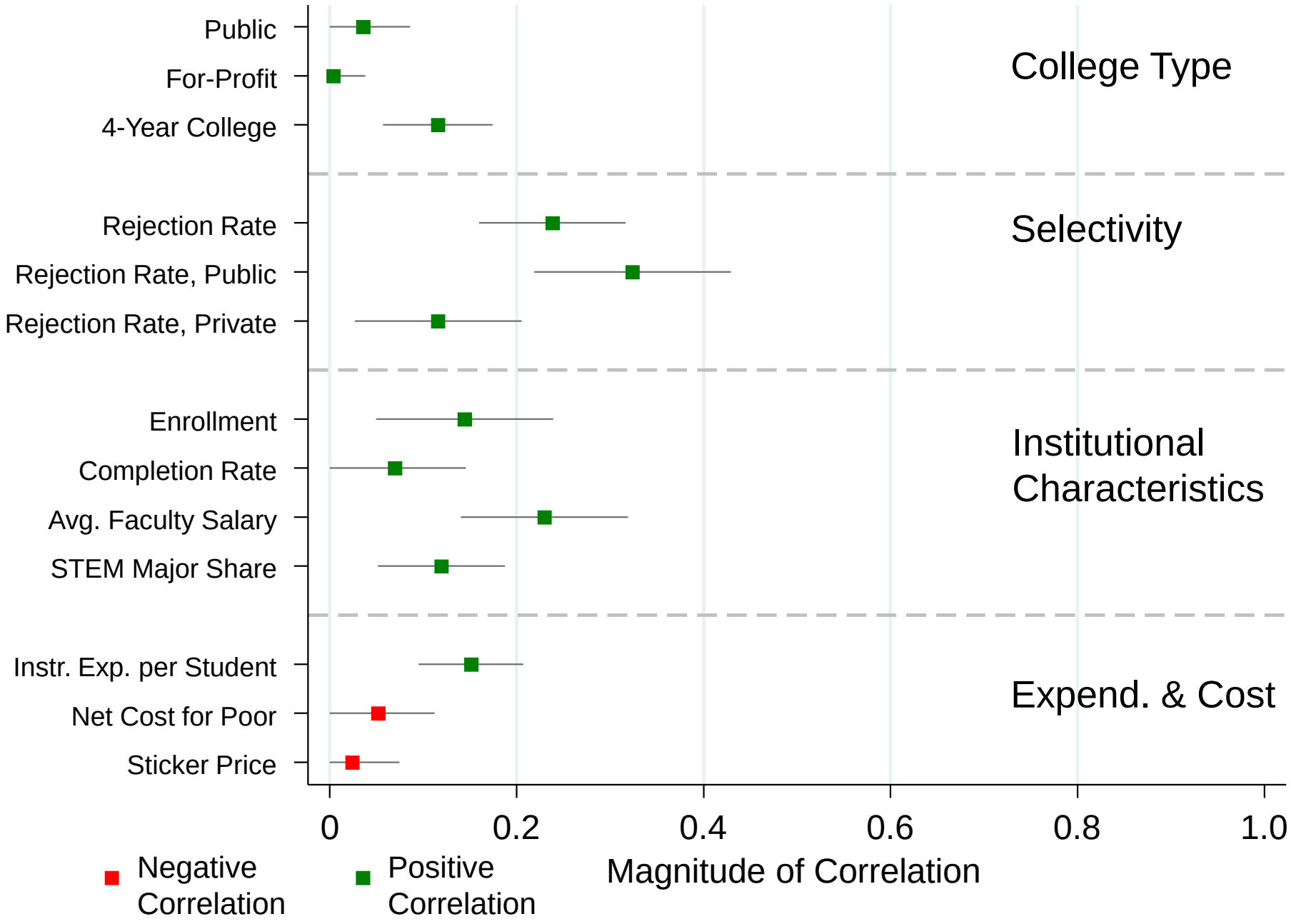


Correlates of Top 20% Mobility Rate




Mobility Rates at Public vs. Private Colleges
Public Colleges
Private Non-Profit Colleges
Private For-Profit Colleges
Top-Quintile Outcome Rate: P(Child in Q5 | Par in Q1)
0
20
40
60
80
100
0
20
40
60
Access: Percent of Parents in Bottom Quintile

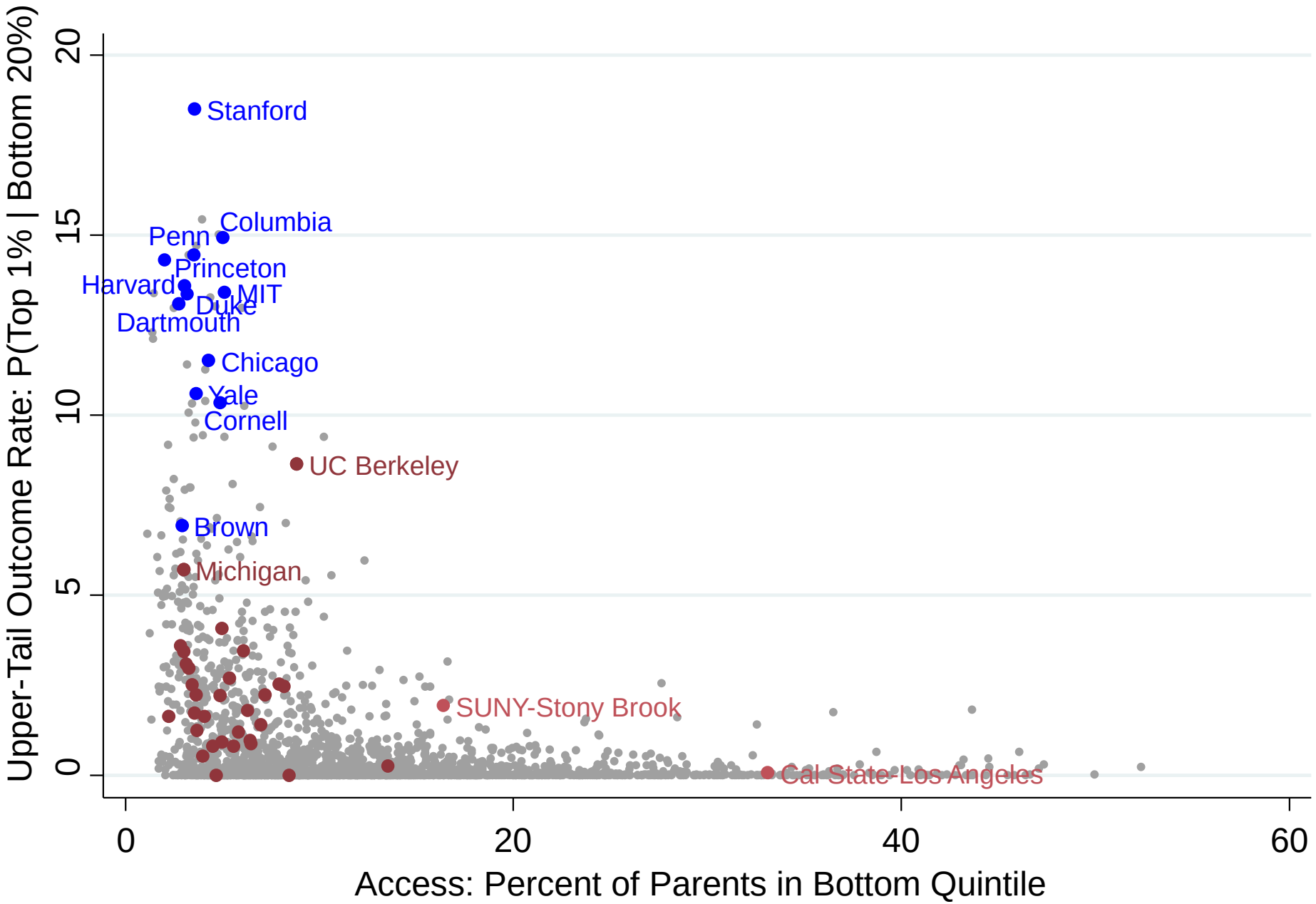
Correlates of Top 20% Mobility Rate



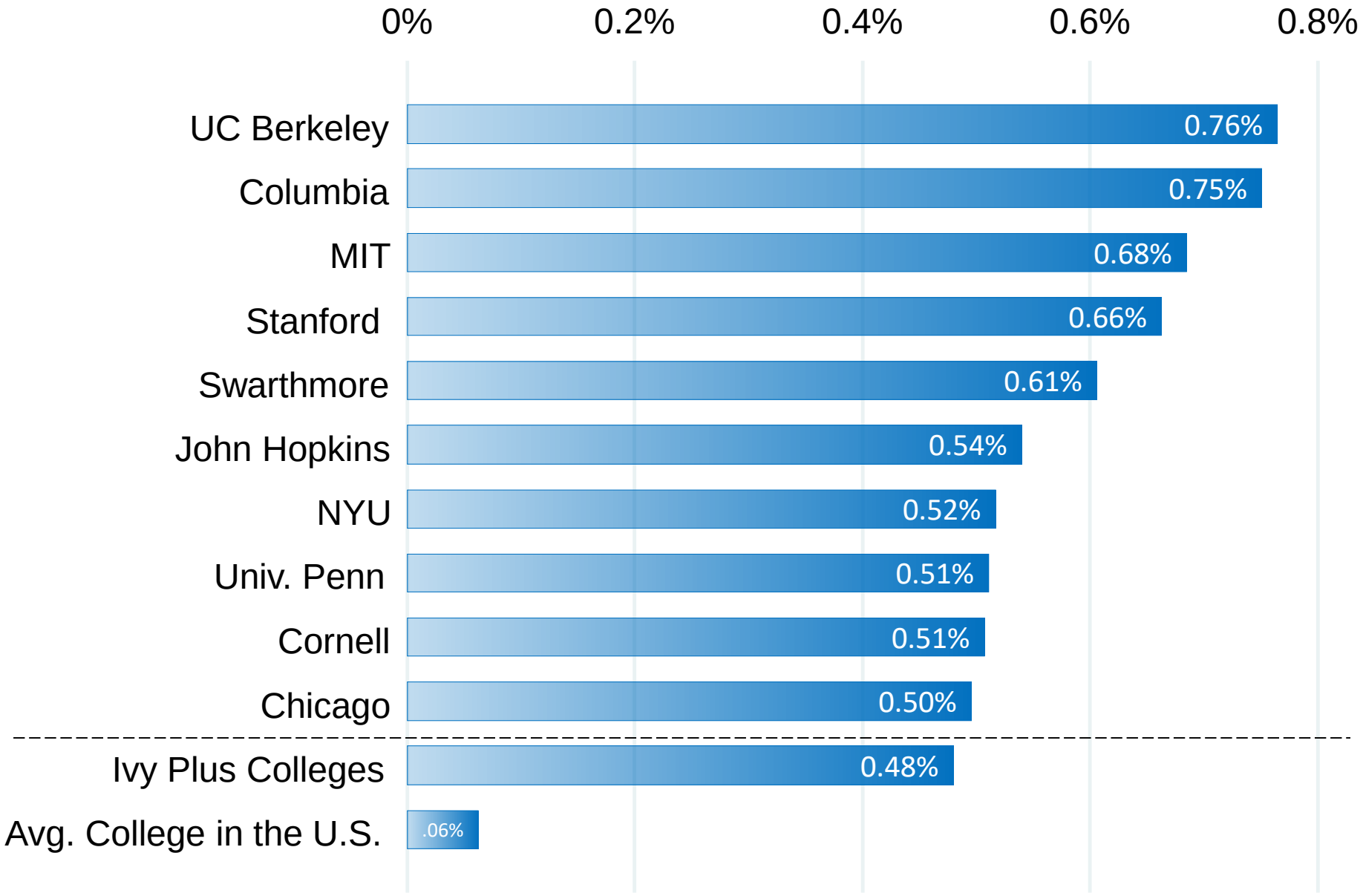
Upper-Tail Earnings Outcomes

- Now examine mobility rates for upper-tail outcomes: fraction of students who come from bottom quintile and reach top 1%
  - Obviously not the only measure of “success,” but a simple statistic that can be constructed with available data

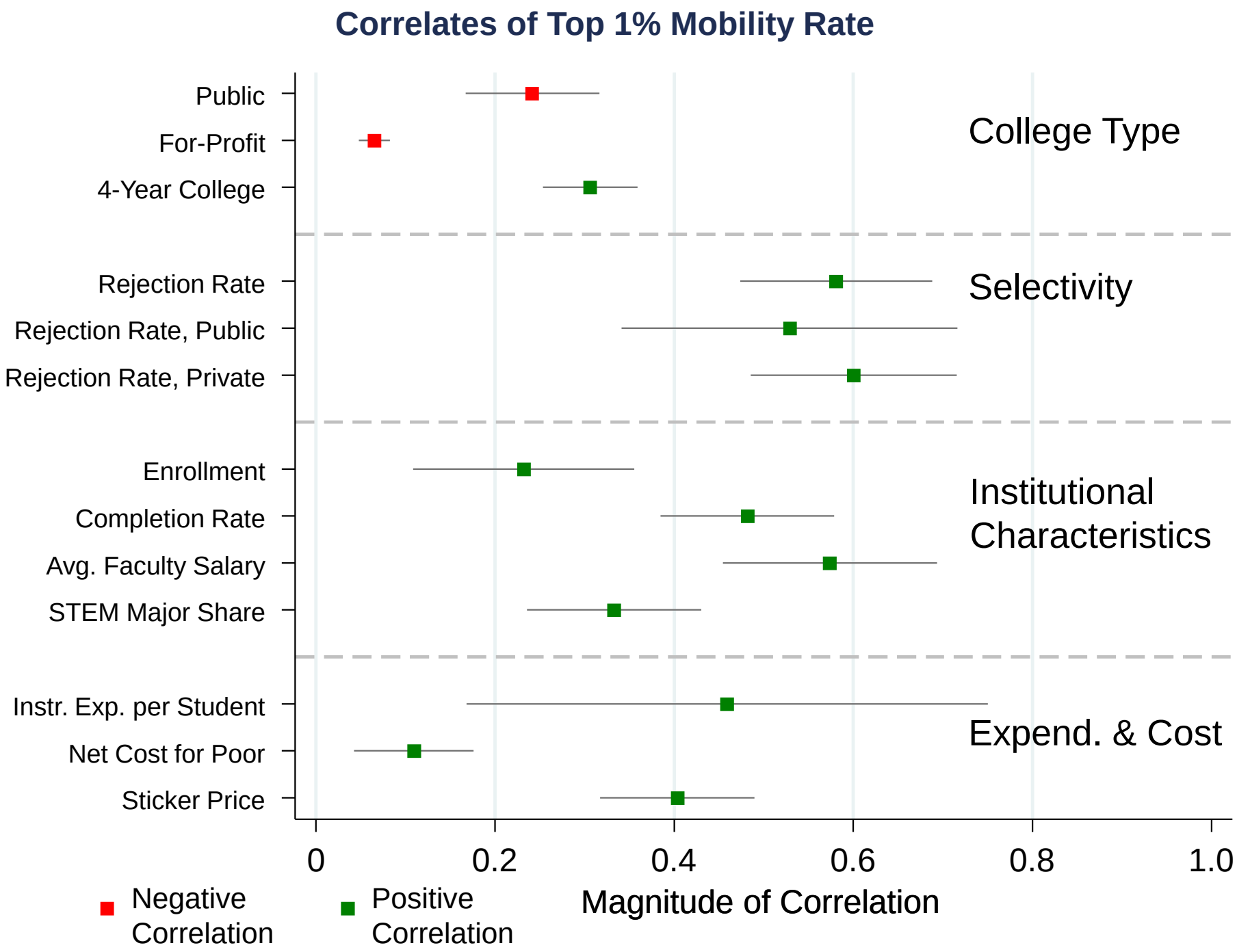
Access and Upper-Tail Outcomes Across Colleges



Top 10 Colleges in America By Upper-Tail (Top 1%) Mobility Rate



Note: Among colleges with 300 or more students per class


Correlates of Top 1% Mobility Rate
Public
For-Profit
4-Year College
College Type
Rejection Rate
Rejection Rate, Public
Rejection Rate, Private
Selectivity
Enrollment
Completion Rate
Avg. Faculty Salary
STEM Major Share
Institutional Characteristics
Instr. Exp. per Student
Net Cost for Poor
Sticker Price
Expend. & Cost
0
0.2
0.4
0.6
0.8
1.0
Magnitude of Correlation
Negative Correlation
Positive Correlation

Two Educational Models for Mobility

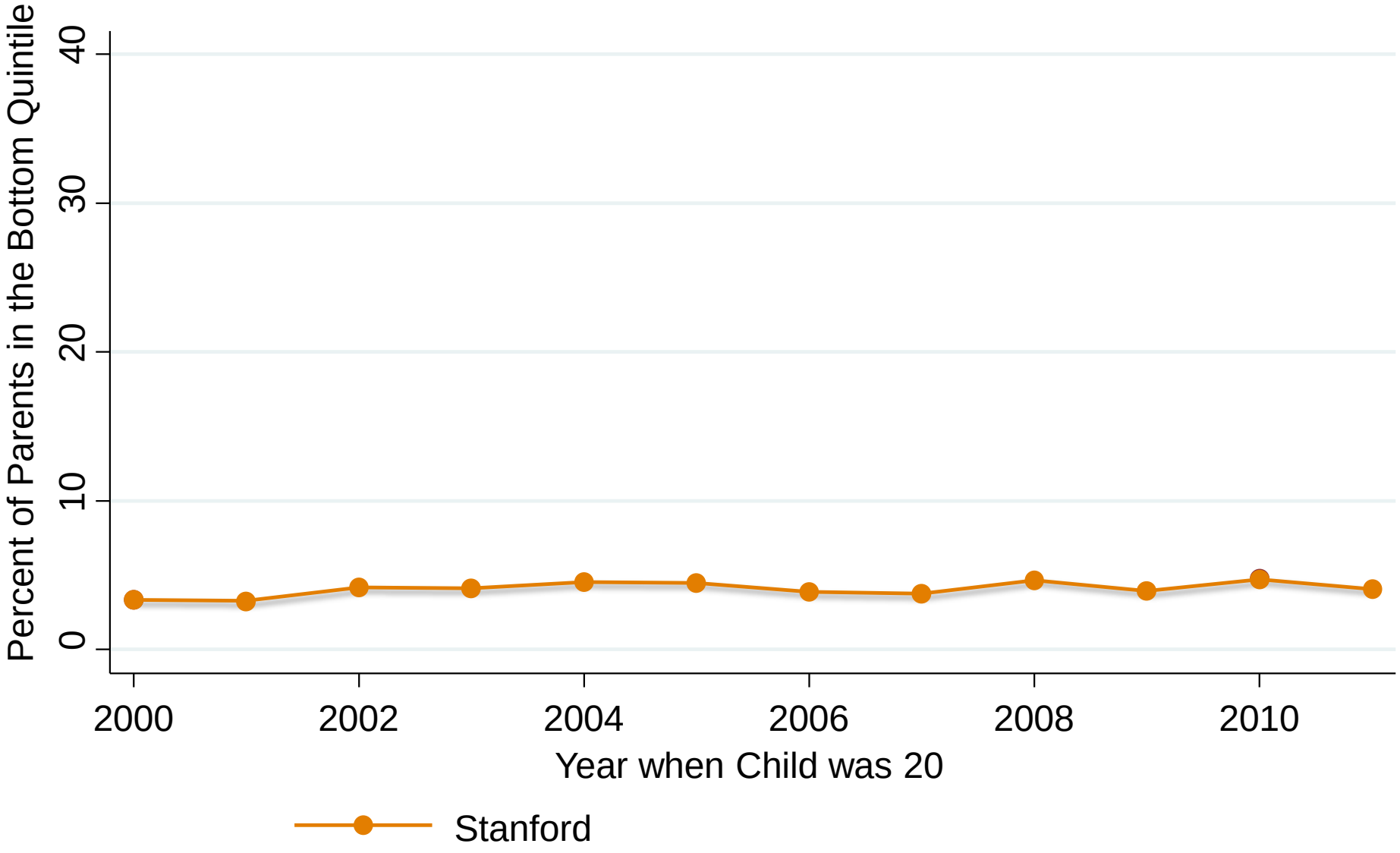
- Two distinct models associated with different types of mobility
  - Highest rates of top-quintile mobility: certain (but not all) mid-tier public schools, such as Cal-State and CUNY
  - Highest rates of upper-tail mobility: elite private colleges such as Stanford

Trends in Access

Changes Over Time

- Significant policy changes in higher education since 2000
  - Expansions in financial aid and low-income outreach at elite private colleges
  - Budget cuts and tuition increases at many public colleges
- Have these changes affected access?

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



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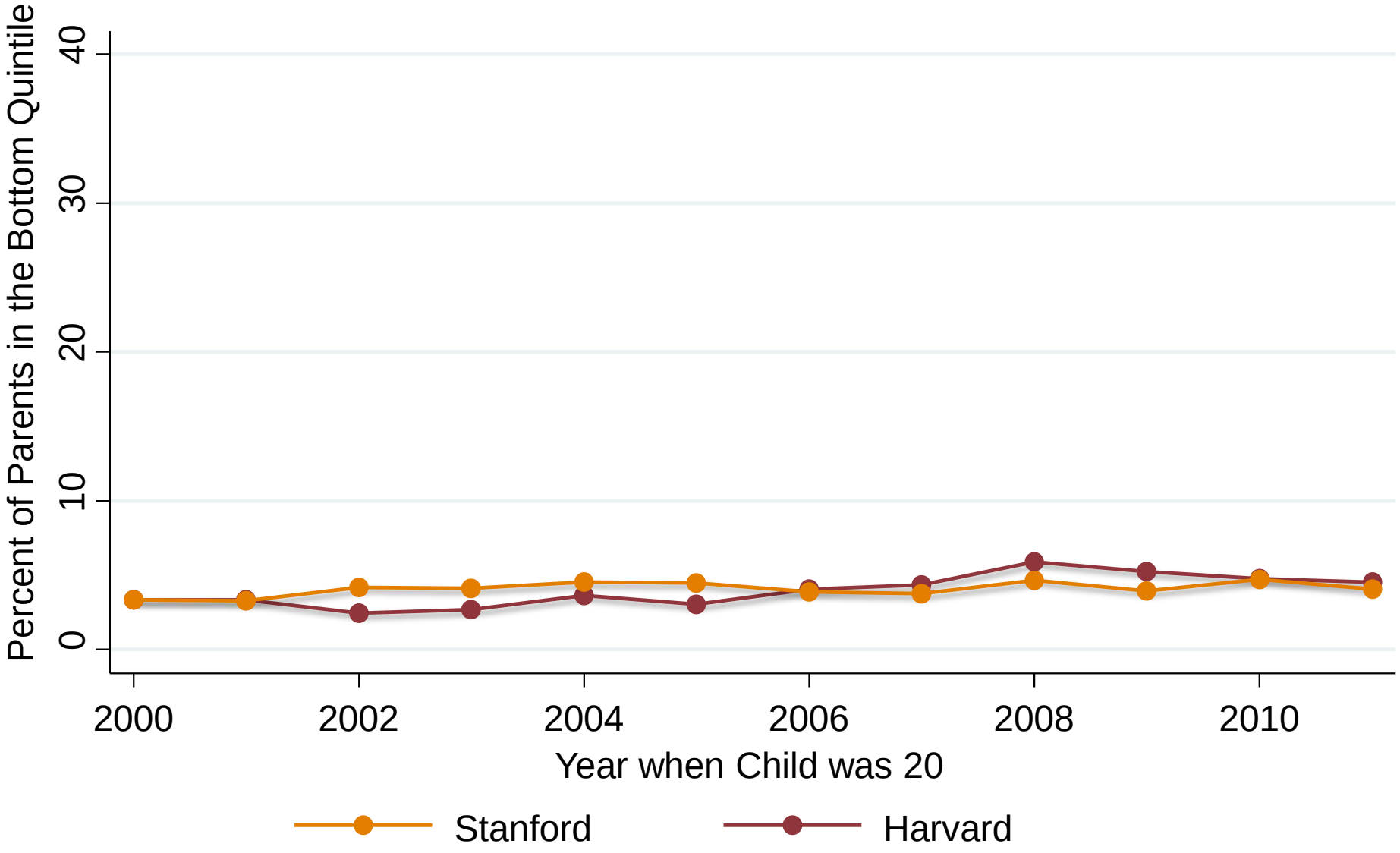

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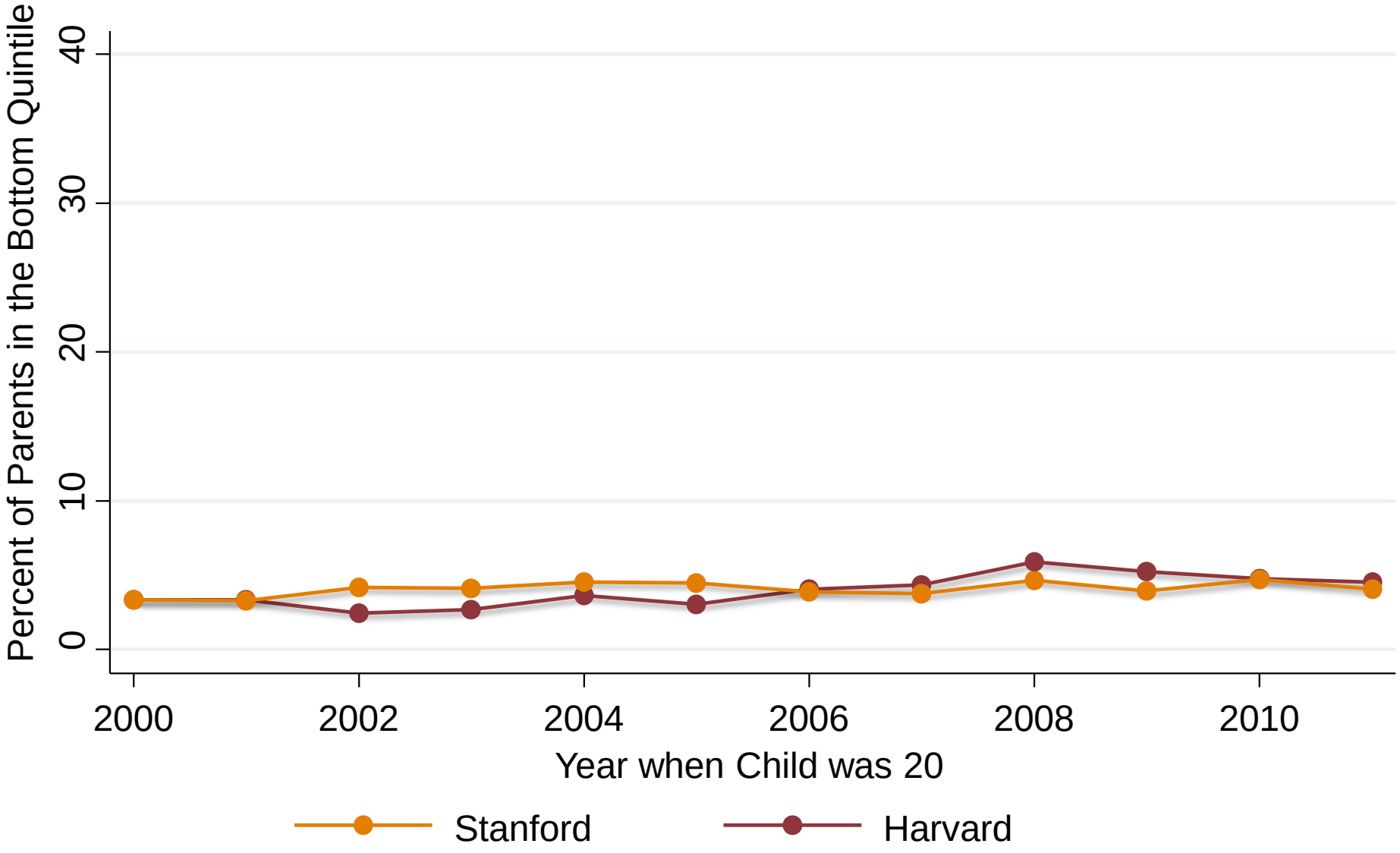

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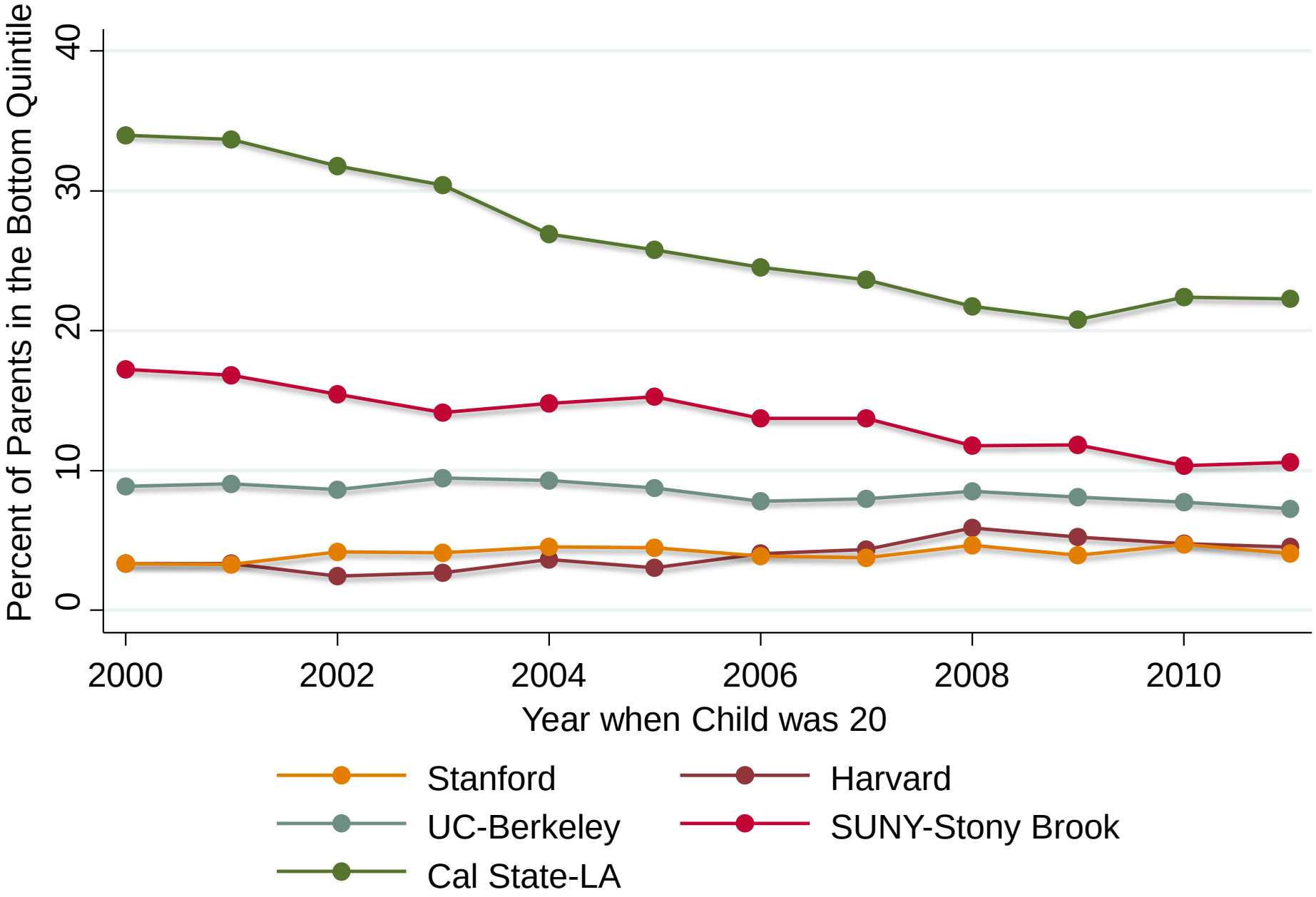
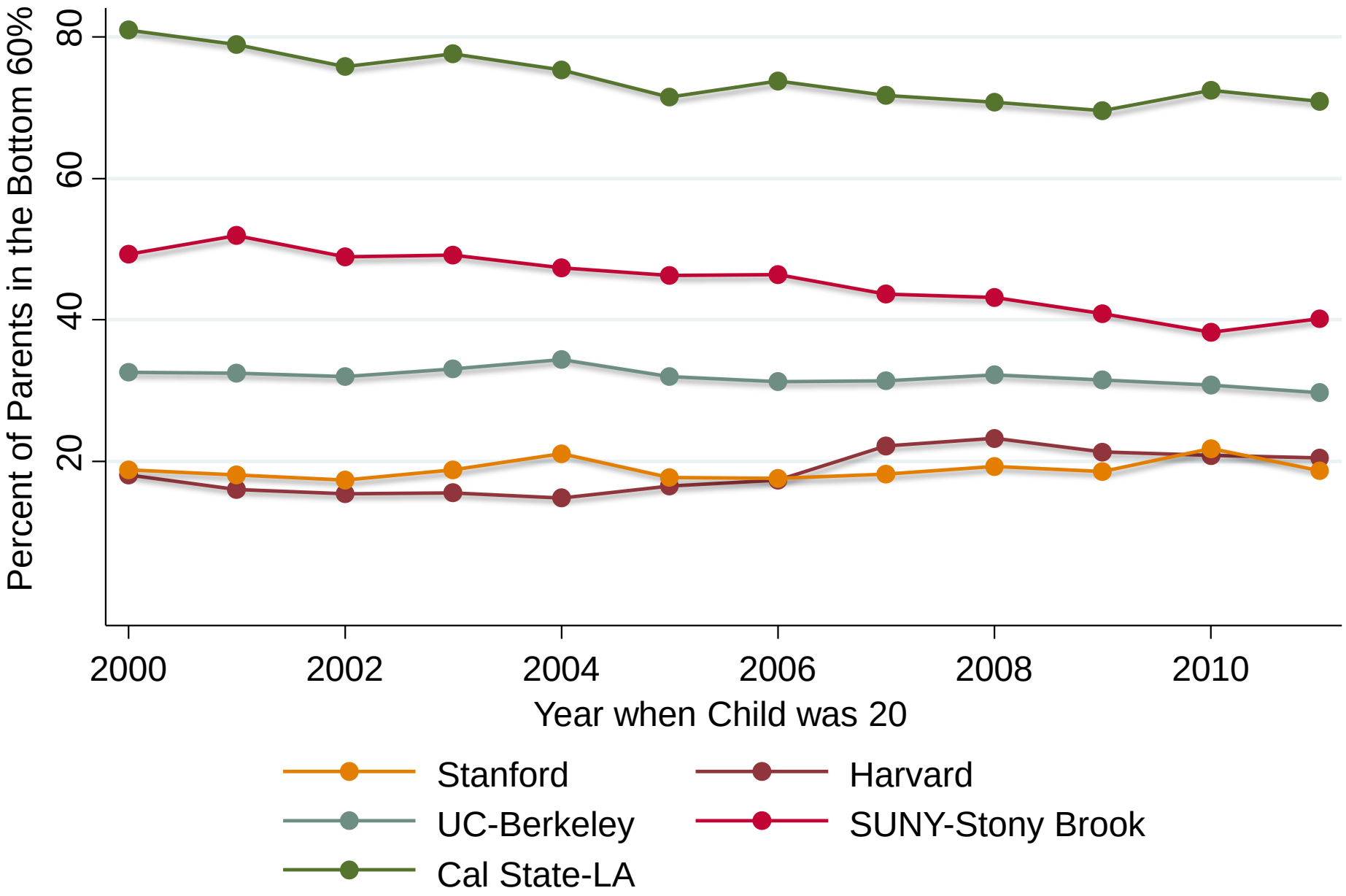


Trends in Bottom 60% Access from 2000-2011 at Selected Colleges



Mobility Report Cards: Lessons

1. Low-income students admitted to selective colleges do not appear over-placed, based on their earnings outcomes

   – Provides support for policies that seek to bring more such students to selective colleges

Mobility Report Cards: Lessons

1. Low-income students admitted to selective colleges do not appear over-placed, based on their earnings outcomes

2. Efforts to expand low-income access often focus on elite colleges

   – But the high-mobility-rate colleges identified here may provide a more scalable model for upward mobility, broadly defined

   – Median instructional expenditures: $87,000 at Ivy-Plus vs. $6,500 at highest-mobility-rate colleges

Mobility Report Cards: Lessons

1. Low-income students admitted to selective colleges do not appear over-placed, based on their earnings outcomes

2. Efforts to expand low-income access often focus on elite colleges

3. Elite colleges provide a unique pathway to upper-tail outcomes

   – Important to understand how to expand access to such institutions for talented students from low-income families

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2. Efforts to expand low-income access often focus on elite colleges

3. Elite colleges provide a unique pathway to upper-tail outcomes

4. Recent unfavorable trends in access call for a re-evaluation of policies at the national, state, and college level

   – Ex: changes in admissions criteria, expansions of transfers from the community college system, interventions at earlier ages