



The Determinants of Income Segregation and Intergenerational Mobility Across Colleges: Using Test Scores to Measure Undermatching

Raj Chetty, John N. Friedman, Emmanuel Saez, Nicholas Turner, and Danny Yagan

IN a paper released in 2017 ([“Mobility Report Cards: The Role of Colleges in Intergenerational Mobility”](#)), we used anonymized data from the federal government to publish statistics for each college in the U.S. on the distribution of students’ earnings in their thirties and their parents’ incomes. We then documented three facts that emerged from those statistics. First, the degree of segregation by parental income is very high across colleges, similar to levels of segregation across neighborhoods in the average American city. Second, children from low- and high-income families who attend the same college go on to have relatively similar levels of earnings in adulthood. Third, colleges with high levels of student earnings (e.g., Ivy League colleges) typically have few students from low-income families, limiting their scope to serve as ladders for upward mobility.

Building on these earlier findings, in this paper we study how much of the difference in the types of colleges that children from low vs. high-income families attend is explained by differences in their qualifications when they apply to college. We then analyze the extent to which changes in the college application and admission process could reduce segregation by parental income across colleges and increase intergenerational income mobility.

We study these questions by using data on students’ ACT and SAT test scores as a proxy for their pre-college qualifications. Although test scores do not capture all aspects of students’ qualifications, they are strong predictors of student earnings, even for students from the same socioeconomic background, and hence serve as a simple, summary measure of pre-college credentials.

Our latest analysis yields four findings.

Finding 1: Low- and middle-income students attend selective schools at lower rates than their peers from richer families, even when comparing students with the same test scores.

The left panel of Figure 1 shows the fraction of students by parental income quintile who attend selective (i.e., non-open-enrollment) colleges, among students who have an SAT score of exactly 1080 (the median score among students who attend selective colleges). Children from lower-income families are under-represented relative to children from high-income families despite having the same test scores.

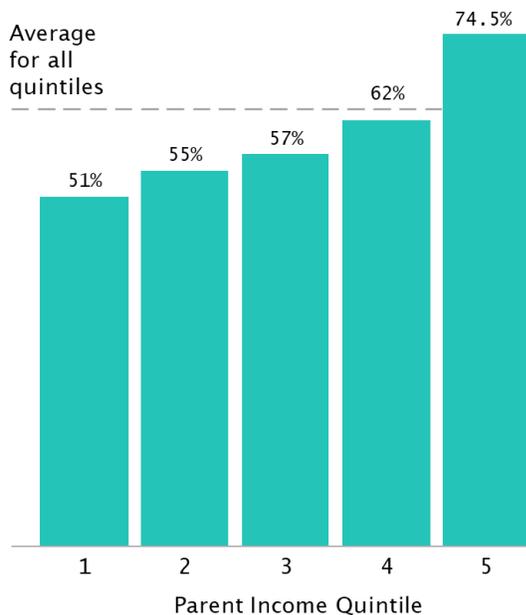
Building on this simple result, we quantify how much of the parental income differences we see across colleges can be explained by pre-college differences in preparation and achievement. To do so, we construct a hypothetical “income-neutral” student allocation process in which students with comparable SAT/ACT scores attend

each college at the same rate, irrespective of their parents’ incomes. Intuitively, if all students at a given college had an SAT score of 1080, then this counterfactual would simply be the parental income distribution of students with a test score of 1080. In practice, since students' SAT scores vary within a given college, we take an average of the parental income distribution in proportion to the frequency of students with each SAT score in each college. We further hold the distributions of home state and the racial composition at each college fixed. The resulting hypothetical student allocation provides a natural benchmark to gauge the extent to which student bodies are representative of the underlying pool of academically qualified students.

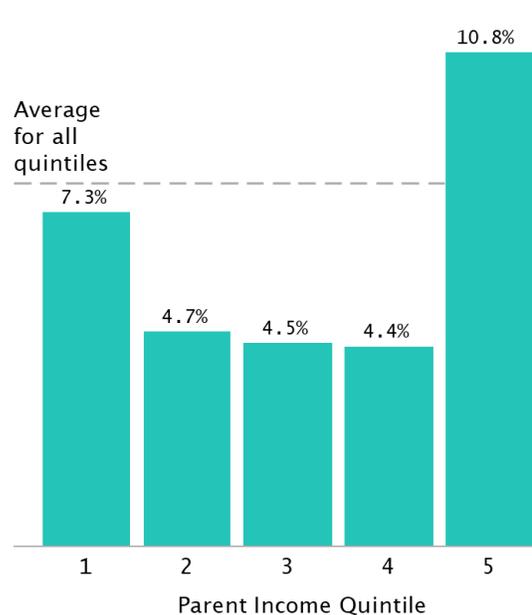
High-income students are 34% more likely to attend selective colleges than low-income students with the same test scores

Figure 1: Fraction who Attend Selective Colleges by Parental Income Level

Attend Any Selective College Given SAT = 1080



Attend an Ivy-Plus College Given SAT = 1400

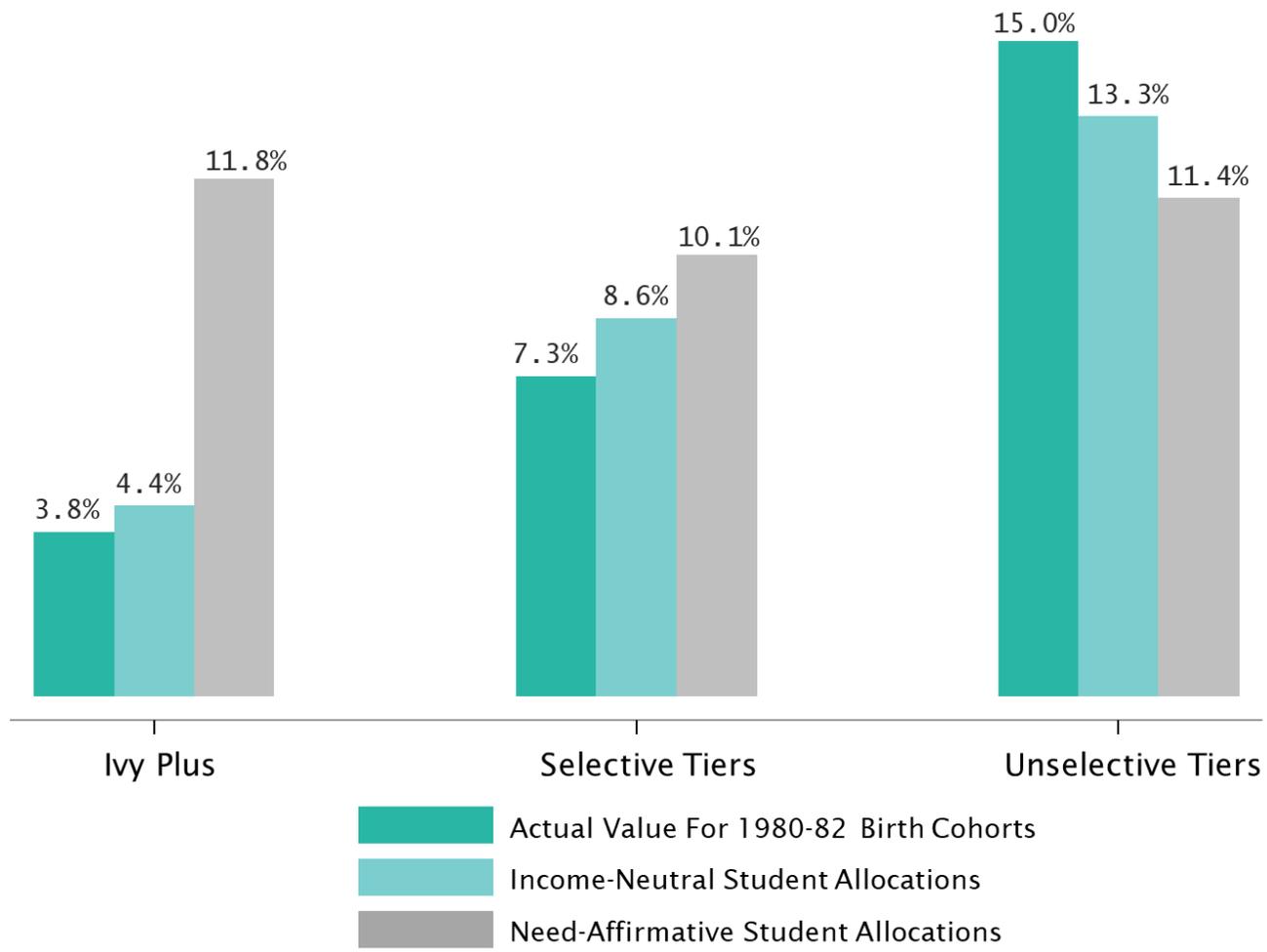


We find that economic diversity at selective schools would rise significantly if students attended colleges in an income-neutral manner, holding their test scores fixed. The fraction of students from the bottom parent income quintile would rise from 7.3% to 8.6% at selective colleges (Figure 2). Since 10.7% of all college students in the US come from bottom-quintile families, this scenario would close one-third of the gap relative to what one would expect if attendance patterns were completely unrelated to parent income. The representation of middle-class students would also rise significantly across selective colleges.

Finding 2: The middle class is heavily under-represented at elite private colleges relative to others with the same test scores, but children from the lowest-income families are not.

The right panel of Figure 1 shows how the fraction of students who attend elite private colleges (the Ivy-League plus Chicago, Duke, MIT, and Stanford) varies with parental income, among students who scored exactly a 1400 on the SAT (the median score among Ivy-Plus students). We find that middle-class students are especially underrepresented at Ivy-plus colleges (a “missing middle”). Under the income-neutral benchmark, the fraction of

Figure 2: Share of Students from Bottom-Quintile Families Under Alternative College Attendance Scenarios

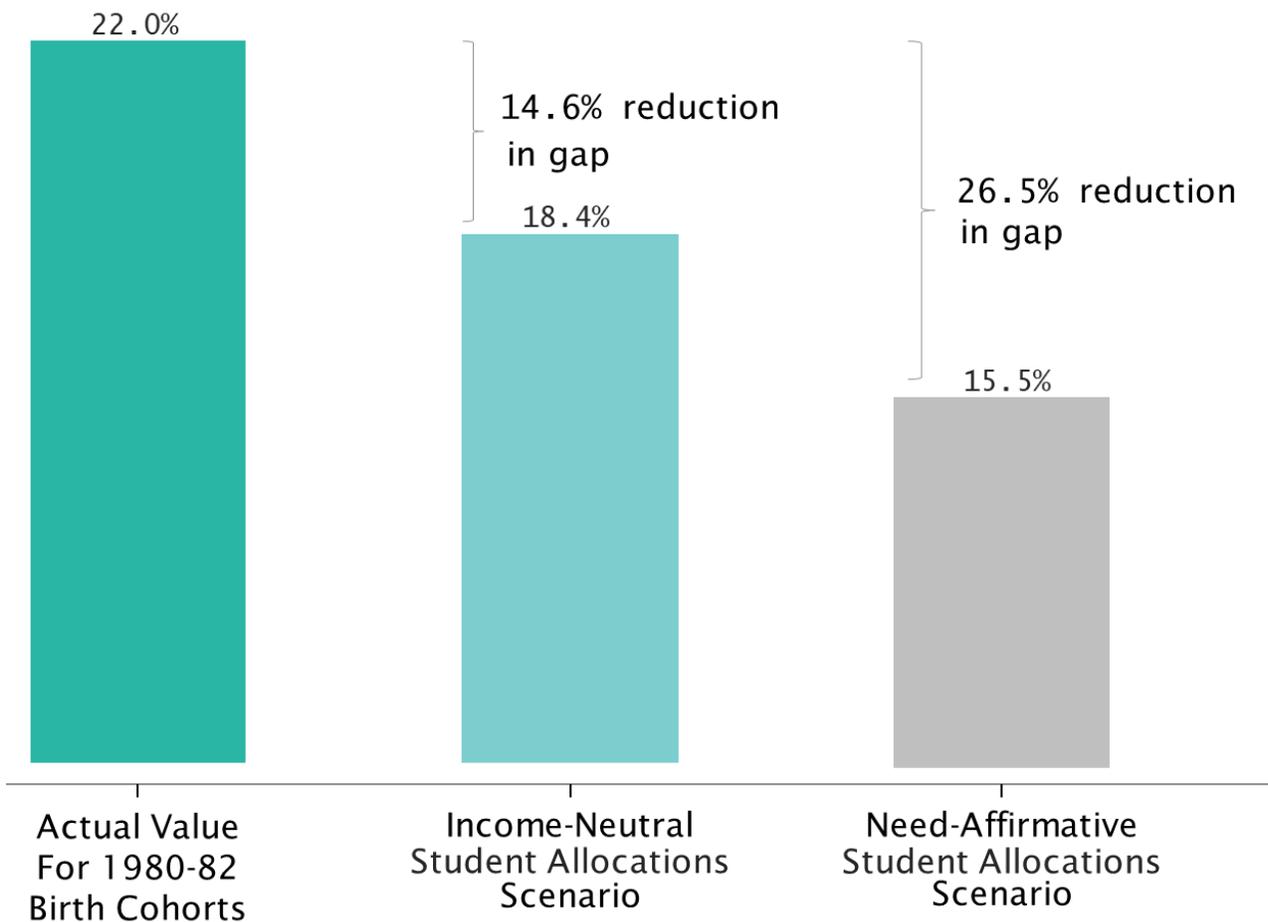


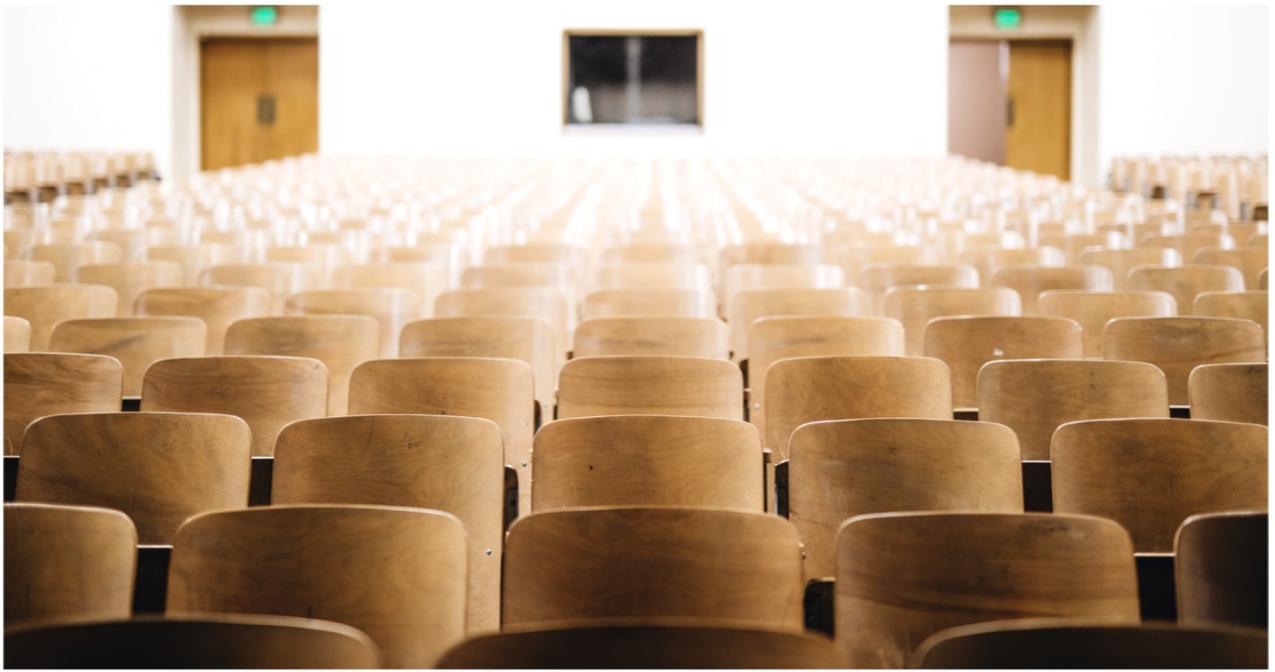
students from the middle class (the 2nd, 3rd, and 4th parent income quintiles) would rise by more than one-third, from 28% to 38%.

Perhaps surprisingly, students from the lowest income (bottom quintile) families are only slightly under-represented at elite private colleges. The fraction of students from the poorest parent income quintile would only increase from 3.8% to 4.4% under an income-neutral benchmark. This is because there are unfortunately relatively few students from low-income families who have sufficiently high SAT/ACT scores to be admitted to Ivy-Plus institutions. Prior research suggests that children from low-income families have fallen behind by the end of high school in large part because of disparities in schools, neighborhoods, and other environmental factors that cumulate since birth.

Overall, our findings that low- and middle-income students are under-represented at selective colleges (relative to what one would expect given their test scores) are broadly consistent with seminal work by Hoxby and Avery (2013) and others on “undermatching” of low-income students to colleges. However, our findings about the scarcity of very high-achieving (e.g., SAT>1300) students from the lowest-income (bottom quintile) families contrasts with their conclusions, which find a much larger number of low-income students with very high test scores. One reason for the difference is that we directly measure parental income at the individual level from income tax records, whereas Hoxby and Avery impute income based on students’ Census tracts. There are many high-scoring students who live in *neighborhoods* that have relatively low average incomes, but further examination reveals that those high-scoring students typically come from higher-income families in those neighborhoods.

Figure 3: Rich-Poor Gap in Fraction of Children Who Reach Top Quintile Under Alternative College Attendance Scenarios





Finding 3: If low-income students were given a preference in the application and admissions process similar to that given to children of alumni at elite private colleges, the fraction of low-income students would be similar across colleges.

Further increasing the fraction of low-income students at selective colleges beyond the income-neutral benchmark would require policies that induce low-income students to attend highly selective colleges at higher rates than higher-income students with comparable test scores. This would require either better childhood environments that improve pre-college credentials or changes to the application and admissions process.

If low-income students attended colleges comparable to high-income students with 160-point higher SAT scores (on the 1600-point scale), the fraction of low-income students would be roughly similar across all college selectivity tiers, including the Ivy-Plus tier, as shown in Figure 2. For instance, the fraction of bottom-quintile students in the Ivy-Plus would rise to 11.8% — similar to that currently at community colleges — and the fraction of students from the bottom 60% of

parent incomes (roughly equivalent to the Pell share) would rise to 44.5%.

What would such a scenario entail in practice? At Ivy-plus institutions, it would mostly require increasing attendance rates for low-income students whose scores already put them in a plausible range for admission. For instance, in our data, just 7.3% of low-income students scoring a 1400 on the SAT currently attend Ivy-plus colleges; our need-affirmative scenario would raise the Ivy-plus attendance rate for these students to 25.8%. This increment is very similar in magnitude to the preference in admissions given to legacy students, recruited athletes, and underrepresented minorities at elite colleges, who are admitted at higher rates than other students with similar qualifications.

Changing the colleges that students attend could increase social mobility substantially even without addressing disparities that emerge before students apply to college

Finding 4: Increasing the representation of low- and middle-income students at selective colleges could substantially increase inter-generational income mobility in the United States.

How would the changes in segregation across colleges discussed above affect intergenerational income mobility in the U.S.? To answer this question, we first estimate the share of variation in earnings due to causal effects of colleges using the methodology of Dale and Krueger (2002), who compared outcomes between students who applied to the same set of colleges but attended different colleges. We estimate that 80% of the difference in earnings premia across colleges conditional on parental income, race, and test scores is due to colleges' causal effects ("value-added").

Using this estimate, we show that income-neutral student allocations would reduce the gap in chances of reaching the top quintile among college students from bottom vs. top quintile families by 15%, as shown in Figure 3. Need-affirmative allocations would reduce the gap by 25%. These are substantial effects, given that children's outcomes in adulthood are shaped by an accumulation of environmental factors starting from birth.

We conclude that changing the colleges that students attend could substantially increase intergenerational mobility, even without changing colleges' educational programs or addressing disparities before students apply to college. We are now studying how one can change the colleges that students from low- and middle-income families attend – changes in applications, admissions, or matriculation rates – to identify scalable policy solutions.

Want to learn more?

Read the [full paper](#) or presentation [slides](#)

[Download](#) the new data

*All materials are publicly and freely available
for use with citation*



www.opportunityinsights.org

Opportunity Insights, an institute based at Harvard University, identifies barriers to upward mobility and develops scalable solutions that will empower people throughout the United States to rise out of poverty and achieve better life outcomes.