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Race and Stratification in College Enrollment Over Time

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We measure college enrollment selectivity gaps by race-ethnicity using a novel method that is sensitive to both the level (2- vs. 4-year) and selectivity of the college in which students enroll. We find that overall Hispanic–White and Black–White enrollment selectivity gaps closed in the United States between 1986 and 2014. This overall closing of gaps appears to be related to the closing of high school graduation gaps. However, this contraction was driven almost entirely by students at the margin between no college and college enrolling in non-degree-granting programs. Among students who enrolled in degree-granting schools, Black students have enrolled at increasingly less selective institutions than White students, whereas Hispanic–White gaps remained relatively unchanged over the nearly 30 years of our study. These gaps are concerning because of their implications for long-term economic inequality.

Keywords: *college enrollment gaps, college selectivity, race gaps*

Americans have long recognized that education is one of the great drivers of social mobility; a bachelor's degree provides one of the best chances for an economically secure life (Torche, 2011). And the more selective the college a student attends, the higher the potential economic returns, particularly for students from disadvantaged backgrounds (Dale & Krueger, 2011; Hoekstra, 2009). Yet we do not have a clear view of access at these different levels of the higher education system. Although it has been easy to track race-based gaps in overall college enrollment or at particular types of colleges (e.g., 2- vs. 4-year colleges), we lack a summary measure of racial disparities in college enrollment that takes into account differences in both *whether* and *where* students enroll.

In other words, the level and selectivity of a student's postsecondary destination are important predictors of later-life outcomes, but this nuance has not been fully accounted for in discussions of college enrollment trends. Rather than tracking indicators of inequality by focusing on questions like "Did a greater percentage of White students than Black students enroll in college?" or even "Did a greater percentage of White students than Black students enroll in a selective college?" scholars and policymakers need to attend to the full spectrum of postsecondary education destinations.

We regularly observe, for example, that access to selective colleges does not appear equal between groups—minority and low-income students attend selective colleges at disproportionately low rates (Alon & Tienda, 2007; Astin & Oseguera, 2004; Bowen & Bok, 1998; Engberg, 2012; Posselt, Jaquette, Bielby, & Bastedo, 2012; Reardon, Baker, & Klasik, 2012). However, these findings do not help us understand the overall distribution of minority and low-income students in American higher education. If, concurrent to downward trends at the most selective colleges, minority enrollment is increasing at colleges that are moderately selective, then it may be that overall gaps in college destinations are closing, indicating that progress is being made in college access for underrepresented groups, if not at the most selective levels. Measuring these *enrollment selectivity gaps* is difficult because the American higher education system has a complex hierarchical structure, and access may increase at colleges of some levels and decrease at others. As a result, it has been difficult to say succinctly whether disparities in access have been increasing or decreasing over time.

We work to make such an assessment in this article. Specifically, we address four research questions: (a) How big are the gaps in the selectivity of college attended by White and traditionally underrepresented racial-minority students? (b) Within which levels of college selectivity are these gaps largest? and (c) How have these gaps changed over time? The ability to track changes in overall college enrollment selectivity gaps alongside other broad demographic and education trends—like changes in race-based

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gaps in income or high school graduation—can help identify important correlates of the gaps. Thus, we also ask, (d) How are trends in college enrollment selectivity gaps related to trends in race-based gaps in high school graduation, achievement, income, and parental education?

In answering these questions, we make three contributions to the understanding of racial stratification in postsecondary schooling over time. First, our measurement of enrollment selectivity gaps succinctly quantifies the extent of racial stratification across all levels of postsecondary education. This technique is helpful because it is difficult to simultaneously track changes in enrollment gaps across multiple levels of postsecondary type and selectivity. Second, in contrast to earlier work that typically examines enrollment gaps using national samples of high school students collected decades apart, we use data that capture nearly the complete populations of students enrolled in postsecondary education annually. Finally, we are among the first to look at macrolevel trends in gaps other than college enrollment to identify potential explanations for enrollment selectivity gaps. In this endeavor, we update and expand the work started by Kane (1994, 2004).

The Importance of College Choice

As college enrollment rates have grown, where—as opposed to if—a student attends college has become increasingly important (Hoxby, 2004). U.S. higher education is distinctly hierarchical, with many low-status, broad-access institutions at the bottom and relatively few high-status, exclusive-access universities at the top (Labaree, 2017). Students who attend more-selective colleges enjoy larger tuition subsidies, more-generous college resources, and more faculty attention (Hoxby, 2009; Hoxby & Avery, 2012). A growing body of research indicates that selective college attendance leads to higher average earnings (Black & Smith, 2004; Hoekstra, 2009; M. Long, 2008), and the largest benefits may accrue to minority and other disadvantaged students (Dale & Krueger, 2011).

But it is not only among the most prestigious schools that selectivity matters. Enrollment at less competitive schools, even those that are marginally selective, affects several important outcomes. College selectivity is related to the probability of completion both overall and for academically marginal and racial-minority students (Cohodes & Goodman, 2014; Goodman, Hurwitz, & Smith, 2017; Kurlaender, Carrell, & Jackson, 2016; B. Long & Kurlaender, 2009; Melguizo, 2006; Smith & Stange, 2015), and the probability of completing has implications for labor market outcomes and for the ability to manage student loan debt (e.g., Dynarski, 2015). Selectivity, across the full distribution of schools, is also related to initial earnings and earnings growth (MacLeod, Riehl, Saavedra, & Urquiola, 2015; Scott-Clayton, 2016) and even provides a premium to already-lucrative majors, like business and the sciences (Eide, Hilmer, & Showalter, 2016). However, racial-minority students are less likely to choose high-paying majors (Carnevale, Strohl, & Melton, 2013), which—although we do not track majors in this article—suggests that the economic implications of enrollment selectivity gaps are likely only exacerbated by differences in major choice.

Thus, one step toward improving racial economic equality is to promote greater parity in selectivity of college enrollment between race groups. Comparable levels of college enrollment between race and ethnicity groups makes it more likely these groups will see comparable economic outcomes. For this reason, it is important to track enrollment selectivity gaps.

Improving on Prior Higher Education Student Stratification Research

Despite recent absolute increases in the percentage of Black and Hispanic students enrolling in college (Perna, 2000), a greater share of White students than Black and Hispanic students attend college (see, e.g., Berkner & Chavez, 1997; Kane, 1994, 2004; Perna, 2000). In addition to these general enrollment gaps, Black and Hispanic students are also much less likely than White students to be enrolled in 4-year colleges in general (Bozick & Lauff, 2007; Dalton, Ingels, & Fritch, 2015) and more-selective colleges in particular (Bowen & Bok, 1998; Hearn 1991; Reardon et al., 2012). Longitudinal studies of admission to "very competitive" 4-year colleges have shown increasing underrepresentation of minority students (Alon & Tienda, 2007; Engberg, 2012; Karen, 2002; Posselt, et al., 2012). We aim to add to this literature by measuring gaps in a way that is sensitive to all college types and levels simultaneously.

Most of these earlier studies have typically drawn conclusions about the racial composition of colleges using samples of students from the National Longitudinal Survey of 1972, High School and Beyond 1980, National Educational Longitudinal Study of 1988, and Educational Longitudinal Study of 2002. This data choice is problematic for two main reasons. First, these data sources are collected from cohorts that are each almost a decade apart, limiting their precision in tracking trends over time. Second, they are sampled to be representative of high school students but not college students or college students at any particular level of selectivity. Thus, college enrollment analyses are sometimes supported by sparse observations for specific racial groups at particular levels of higher education. In contrast, we primarily use data from the Integrated Postsecondary Education Data System (IPEDS), which gives us a nearly complete census of annual postsecondary enrollment. Although it has limitations that we note below, IPEDS gives us a much more complete picture of postsecondary stratification and its evolution over time, freeing us from the pitfalls of having to extrapolate

from potentially small subsamples or potentially anomalous cohorts of students.[1]

We analyze these data with a variation of the *V*-statistic methodology developed by Ho and Reardon (2012). This method was first used to measure gaps on achievement tests in which only ordered, categorical score thresholds (e.g., fail, low pass, pass, high pass), rather than continuous scores, were available. Such data make it difficult to present easily digestible statistics that can be tracked over time (such as "White children score 10 points higher than Black children, on average"). Ho and Reardon use the *V*-statistic methodology to recover such test gaps by measuring the distribution of test scores implied by the percentage of students of each race group that scores above certain proficiency thresholds.

The *V*-statistic has also been used to describe income gaps (Reardon, Townsend, & Fox, 2017) and differences in student test engagement (Soland, in press). Here we use the method to quantify enrollment selectivity gaps using fixed, ordinal levels of selectivity rather than test thresholds. In effect, the *V*-statistic approach quantifies the difference in the selectivity of college enrolled in by students from different race-ethnicity groups (akin to the average difference in tests scores between groups), improving upon prior approaches that examine group differences in the percentage of students who enrolled in any one level of college (akin to difference in the percentage of students deemed proficient by a given test).

This technique is helpful because it is difficult to simultaneously track changes in enrollment differences across multiple levels of postsecondary level and selectivity. As a basic example of this challenge, consider a scenario in which 20% of college-age Black individuals enrolled in community colleges, 15% in nonselective 4-year colleges, and 3% in the most selective colleges, but 5 years later, these percentages were 22%, 11%, and 5%, respectively. In this example, what should we conclude about the relative representation of Black students relative to hypothetically unchanged White enrollment patterns? The answer is difficult to give because Black students in this example gain ground in some areas but lose it in others. Additionally, in a more realistic example, the proportion of White students enrolled in different levels would change too. The question becomes more complicated in the present study because we examine nine different levels of postsecondary enrollment per race-ethnicity over 28 years. The technique we use simplifies the enrollment selectivity gap measurement to a single number per year. To demonstrate the utility of such data simplification, consider the methods and figures in Appendix A, which illustrate the difficulty of presenting the constituent data of our analysis an easily interpretable way.

Although our primary interest is in describing overall enrollment selectivity gaps, we also look at how trends in enrollment selectivity gaps change conditional on enrollment at certain levels of college. Different trends in enrollment selectivity gaps between different conditional analyses help determine the postsecondary levels at which the change in gaps have been most dramatic.

Concurrent Trends

To the extent that we find trends in college enrollment selectivity gaps over time, it is important to understand why they change. We lay the foundation for future work in this area by considering concurrent trends that may be related to observed changes in college enrollment selectivity gaps. Although there are many possible explanations for trends in enrollment selectivity gaps, we focus on academic and familial factors.

Academic factors. Both academic achievement and high school graduation likely play a role in determining whether and where students enroll in college. Race-based academic achievement gaps have been slowly closing over time (Jencks & Phillips, 1998; Reardon, Robinson-Cimpian, & Weathers, 2015). If relative increases in academic performance by minority students are reflected in students' postsecondary enrollment choices, the narrowing of achievement gaps would predict the closing of enrollment selectivity gaps.

Although achievement plays a large role in selective colleges, most postsecondary institutions have relatively minimal admissions criteria or accept the majority of students who apply (Klasik, Proctor, & Baker, 2015). For students considering these options, high school graduation is the major academic milestone they must reach. Although race-based high school graduation gaps have narrowed over the past few decades (Murnane, 2015), as of 1999, the closing of these gaps, as well as the shrinking of gaps in academic achievement, did not appear to be related to gaps in college enrollment (Kane, 2004).

Family factors. A student's family plays many roles in the admissions process, but for our exploratory purposes we focus on two: a family's income and whether a student's parents went to college. These two factors have been found to be related to undermatching (Dillon & Smith, 2017; Smith, Pender, & Howell, 2013), in which a student enrolls in a college that is less selective than one might expect given the student's academic background (Bowen & Bok, 1998; Roderick, Nagaoka, Coca, & Moeller, 2008) a phenomenon that itself may be related to enrollment selectivity gaps.

In the United States, postsecondary tuition/fees are positively correlated with admissions selectivity.[2] Because Hispanic and Black families, on average, earn less than White families (Fryer, 2011; Patten, 2016), some of the disparities in college destinations by race could therefore be the result of differences in (perceived or actual) ability to pay or other admissions benefits that are associated with

coming from a higher-income background (Reardon, Kasman, Klasik, & Baker, 2016). There is some evidence that income gaps are slowly narrowing, especially for women (Kochhar & Fry, 2014; Patten, 2016), which may predict increasing parity in college enrollment selectivity between groups.

We also focus on gaps in whether parents of college-age children attended college themselves. Having a parent who went to college is a common indicator of social capital—sources of information and support—and, in general, students with access to more sources of social capital are more likely to enroll in college (Ellwood & Kane, 2000; Hossler, Schmit, & Vesper, 1999; McDonough, 1997; Perna, 2006; Perna & Titus, 2005). There are notable differences by race in terms of access to social capital (McDonough, 1997; Perna, 2006; Perna & Titus, 2005), so changes in access to social capital may also explain trends in enrollment selectivity gaps. Kane (1994) documented trends in Black–White gaps in whether parents graduated from high school, noting that the closing of these gaps was associated with the closing of college enrollment gaps into the late 1980s, but to our knowledge, race gaps in parental postsecondary educational attainment have not previously been documented. Because parental education strongly predicts the likelihood of college enrollment, we hypothesize that any closing of parental educational attainment gaps would lead to closing of college enrollment selectivity gaps.

Other factors. We chose to look at academic and familial factors because they are supported by theory and because they lend themselves to our primary goal of measuring and comparing nationwide enrollment selectivity gaps over time. Despite this focus, we note that these factors are not an exhaustive account of the forces that shape students' enrollment choices. Indeed, any policy or characteristic that would lead students to make differential enrollment choices in ways that vary by race has the potential to affect enrollment selectivity gaps. State-level policy is a particularly rich area for such policies: From setting tuition to banning affirmative action, states engage in many activities that likely affect enrollment choices differentially by race. It may also be that cohort sizes or relative changes in net tuition between higher- and lower-selectivity institutions may also have a role to play, although it is unclear whether these changes would lead to different enrollment choices by race. The variation in enrollment selectivity gaps that result from this extended list of explanations—in terms of either local, in-state gaps or broader, national gaps—is not a topic we can do justice to in this study and is a limitation of our work. However, we believe that our work is a useful starting point for thinking about state-specific issues and hope our approach has value for future research in this area.

Data

The *V*-statistic approach requires data on the percentages of each race-ethnicity group enrolled at each of the nine categories of level/selectivity of postsecondary destination that we consider. IPEDS, our primary data source, gives the count of students by race at nearly every postsecondary institution. Non-4-year colleges are classified by their level of offering (non-degree or 2-year), and we classify 4-year colleges by their admissions competitiveness as defined by the *Barron's Profile of American Colleges*. To convert the count of students enrolled at each level to percentages of the total cohort, we use U.S. Census estimates of population size by race and age to calculate the total size of each race-ethnicity group that is of college-going age (which also allows us to calculate the percentage of each cohort that is not enrolled in any postsecondary destination). We describe these data in detail below.

IPEDS

The enrollment data in the IPEDS database are collected annually by the National Center for Education Statistics (NCES) from every college, university, and technical and vocational institution that participates in federal student financial aid programs. These data give enrollment rates by race from 1986 to 2014. Although IPEDS confers many important advantages that allow us to fill gaps in prior work, it also presents notable challenges. These include determining which students to include in our enrollment counts, unstable race categories, and a changing population of schools. We outline these concerns, and our approach to addressing them, in brief below and in detail in Appendix B. In short, each of the data complications does not appear to affect the magnitude or trend of our estimated gaps in any appreciable way.

Count of students in each postsecondary destination. Our main analyses focus on full- and part-time, first-time postsecondary students using IPEDS fall enrollment counts, which count first-time degree- or certificate-seeking students enrolled in the fall term. IPEDS did not include the "degree- or certificate-seeking" qualifier in its 2000 survey, so we drop this year from our analysis. By capturing only first-time students, we avoid double-counting students over time: If students were to transfer or stop out of college and then reenter, their enrollment would count in the population proportions of two cohorts of students.[3] By focusing on full- and part-time students, we avoid undercounting students in community colleges and less selective 4-year colleges, where part-time enrollment is more common. The trade-off to using all, rather than only full-time, students is the potential to double-count students who are enrolled at multiple institutions in their first term of attendance. We believe the prevalence of double enrollment is relatively small and find

little change in our results when we repeat the analysis using only full-time students.

Institutions report the number of first-time students to IPEDS only in the fall. Because of this schedule, students who enroll for the first time in the spring semester are not counted in our primary data. If race groups first enroll in fall or spring at different rates, this could affect our estimated gaps. We address this concern by reestimating our gaps using 12-month enrollment counts (which include all students, not just first-time enrollees) and find only minor changes in the magnitude, but not trend, of our gaps.

Race groups. The race categories available in IPEDS are not constant across years. Between 2008 and 2010, IPEDS disaggregated Asians and Pacific Islanders and added a reporting category for students who self-identified as being a member of two or more race groups. During the transition period, institutions used either the original seven- or revised nine-category system, so we report gaps based on total Black, Hispanic, and White students reported in either system and indicate the lack of categorical clarity by a change of formatting in our figures. In Appendix B we bound the possible implications of the race category changes by reestimating gaps after recategorizing multiracial students to different race groups.

Population of colleges. Not all colleges are present in every year of IPEDS data. This irregularity is due to two main factors. First, some schools did not exist for all years—there were many new entrants to the postsecondary sector in this time, and some schools closed. We are not concerned with this issue because the opening and closing of schools, or even the expansion and contraction of enrollment at individual institutions, represent changes in the supply of enrollment opportunities and may be an important element of changes in enrollment selectivity gaps. Indeed, we know that there was expansion in the supply of seats in most sectors of higher education but greater expansion at 2-year colleges and "competitive" 4-year colleges over this time (Hurwitz & Kumar, 2015; Kelly, 2016). However, we cannot say whether these changes happened in response to student demand or whether students altered their enrollment choices to fill these newly created seats. More importantly, it is not clear that these capacity changes should differentially impact the enrollment choices of students by race or ethnicity.

A second concern about the irregular appearance of some institutions in the IPEDS data is that reporting to IPEDS was not mandatory for all institutions that are eligible to receive federal Title IV funds (the major source of federal student aid) until 1993 (Fuller, 2011). We indicate the potential incompleteness of this population with special formatting in our figures and find in Appendix B that the use of data from only institutions present in all years of data makes our gap estimates slightly larger.

Additionally, students who attend non–Title IV institutions are undercounted by IPEDS, as data reporting for these schools is voluntary (Cellini & Goldin, 2012). Non–Title IV institutions are predominantly non-degree-granting schools, and many are for profit. Undercounting students in these schools could bias our estimates of overall enrollment selectivity gaps, as these noncounted students would be attributed to the "no-college" category. However, as this sector enrolls a relatively small proportion of students, this bias should not dramatically affect our results. Additionally, this undercounting is less of a problem at more selective colleges, so this bias will be reduced when we condition our analyses on different levels of enrollment selectivity.

Although we cannot examine this issue directly using the IPEDS data, we investigate potential implications two ways. First, we measure enrollment selectivity gaps with and without for-profit schools. The differences between these two measures can give us a sense of the direction of the bias induced by undermeasurement of non–Title IV enrollment. Second, we compare gaps computed using the longitudinal NCES longitudinal data sets popular in earlier research. These data include the postsecondary destinations of all students in the sample, so undercounting enrollment at non–Title IV schools is minimized.

Census Population Estimates

To examine the proportion of each cohort that does not enroll in a postsecondary destination, we combined the IPEDS data with annual census population estimates to determine the size of the entire cohort of potential college students of each race-ethnicity group, regardless of their postsecondary enrollment status. We use the estimated population size of 18-year-olds—the age of the traditional 1st-year college student. Because of the increasingly varied age of students at their first college entry, the decision to use 18-year-olds as the cohort denominator could affect measures of enrollment selectivity gaps. In Appendix B, we demonstrate that neither the size nor trend of our gaps qualitatively change when we instead use an average of the size of the cohort of 18- to 24-year-olds as our denominator.

Barron's *Admissions Competitiveness Data*

The selectivity ratings of colleges and universities come from *Barron's Profiles of American Colleges. Barron's* classifies 4-year colleges and universities on a scale from 1 to 6, where 1 is the most selective and 6 is the least selective.[4] These ratings are based on the high school grade point averages, high school class ranks, and SAT/ACT scores of enrolled students as well as on the proportion of applicants the schools admit. Although *Barron's* ratings have changed over time, the discussion of our results uses the 2008 rankings so that the group of colleges in each selectivity category

is constant.[5] We create separate categories for 2-year colleges and non-degree-granting postsecondary institutions, which *Barron's* does not rate. Additionally, there are some (roughly 360) 4-year colleges that are not rated by *Barron's*. In our main analyses, we impute these ratings using publicly available data. In Appendix B we demonstrate that our gap estimates do not qualitatively change when we drop these 4-year institutions that do not have *Barron's* ratings rather than impute their selectivity .

Other Data Sources

We draw on data from numerous other sources to compare the trends we observe in college enrollment selectivity to gap trends in high school graduation, achievement, income, and parental education.

High school graduation. To examine gaps in high school graduation rates by race, we primarily use data collected by Murnane (2015). He uses data from Census 1990, Census 2000, American Community Survey 2010, and General Education Development (GED) Testing Service. These data, in combination, address concerns in calculations of graduation rates (such as differences in coverage, categorization of recent immigrants, and treatment of students who earn a GED) that are present in a number of data sources. These data include graduation rates by race for students who were 18 in 1986 to 2006.

We add data from the American Community Survey to track gaps in graduation rates for the 2007-to-2014 cohorts (Ruggles, Genadek, Goeken, Grover, & Sobek, 2016). In doing this, we replicated the procedure described by Murnane (2015), adjusting for GED recipients and recent immigrants.

Achievement gaps. Data on achievement gaps by race come from the National Assessment of Educational Progress (NAEP). The NAEP Long-Term Trend tests are administered roughly every 4 years in mathematics and reading to a nationally representative sample of 9-, 13-, and 17-year-old students. We use data from 13-year-olds (adjusted by 5 years to match age of college enrollment) because the composition of the older cohort might be biased by differential high school dropout rates by race.

Income. Data on income gaps by race come from the Current Population Survey (CPS) as aggregated in the Integrated Public Use Data Series (Flood, King, Ruggles, & Warren, 2016). Because the CPS surveys individuals living in households, we look at the income of the parents of 14- to 17-year-olds (before students have moved out to enroll in college) from 1984 to 2012 and apply those gap estimates to cohorts 2 years later, when those children could be enrolled in college. We use the seven income categories reported in the CPS (<$15,000, $15,000–$24,999, $25,000–$34,999, $35,000–$49,999, $50,000–$74,999, $75,000–$99,999, and >$100,000).

Parental education. Data on the parental education of college-age students also come from the CPS (Flood et al., 2016). As with income, we look at the education levels of the parents of 14- to 17-year-olds and apply those gap estimates to cohorts 2 years later, when those children could be enrolled in college.

Method

The Measurement of Gaps With Ordinal Data

We quantify the disparities in enrollment by race across nine ordinal categories of postsecondary enrollment by type and selectivity. Specifically, we categorize enrollments according to whether students are not enrolled in college, enrolled in a non-degree-granting college, enrolled in a 2-year college, or enrolled in any of the six *Barron's* selectivity levels of 4-year colleges.

One useful measure to capture differences in the distribution of enrollments between two groups of students using ordinal data is to look at the probability that a student from group *a* is enrolled at a higher level than a student from group *b* ($p_{a>b}$). An alternative to $p_{a>b}$ is the *V* statistic, a monotonic transformation of $p_{a>b}$ that expresses the difference in selectivity as the standardized difference between the mean enrollment selectivity of two groups (Cohen's *d*) if the selectivity of colleges were transformed into a metric in which both groups' enrollment selectivity pattern were normally distributed (Ho & Reardon, 2012; Reardon, Kalogrides, & Shores, 2016). We use $p_{a>b}$ in our analysis because of its relative ease of interpretability, but our results are largely unchanged if we use *V*.[6]

The calculation of $p_{a>b}$ is intuitively illustrated with a probability-probability (PP) plot, which graphs the relative cumulative distribution functions of, for example, Black and White students enrolled at a given level of education or lower. The area under the curve of a PP plot gives the probability that a randomly chosen White student is enrolled in a postsecondary destination at a higher level of selectivity than a randomly chosen Black student ($p_{w>b}$; Ho & Reardon, 2012). PP plots are analogous to the well-established method for graphically displaying income inequality, the Lorenz curve.

An example of the PP plot for Black and White student college enrollment in 2010 is given in Figure 1. Each point of the plot represents the percentage of students from each of the two race groups that is enrolled in a given level of postsecondary education or lower. Note that if Black and White students were equally represented at all levels of postsecondary education, the PP plot would trace a 45-degree line and the area under the curve would be 0.5. That is, there would be a 50% chance that a randomly chosen Black

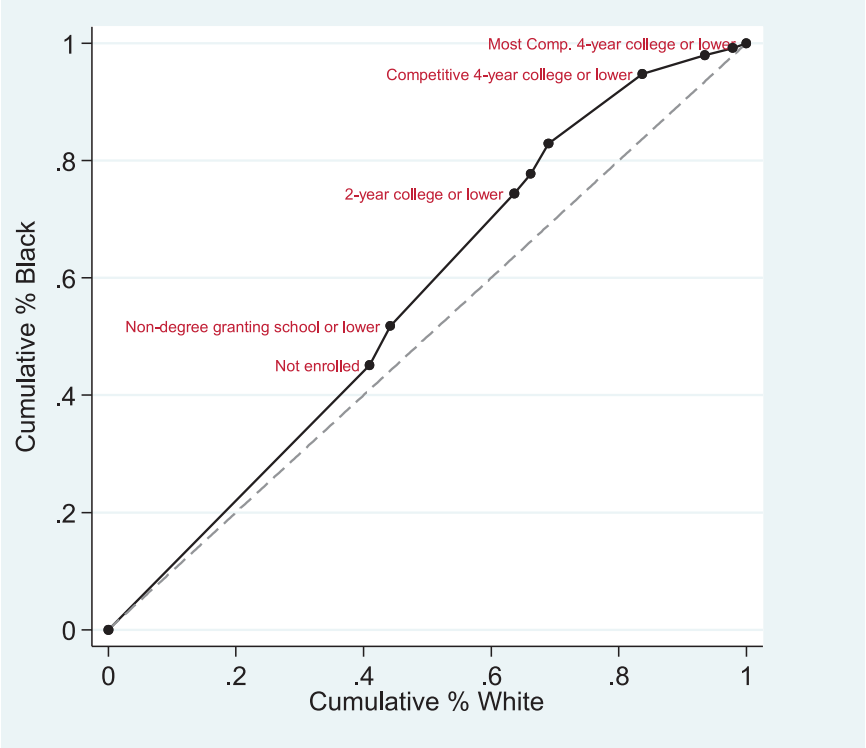

FIGURE 1. *Probability-probability plot of Black–White postsecondary enrollment, 2010.*
Note. The *y*-coordinate of each point indicates the percentage of Black students that is enrolled at that postsecondary destination or lower. The *x*-coordinate of each point indicates the percentage of white students that is enrolled at that postsecondary destination or lower. The dashed line indicates the 45-degree line.

student would be enrolled in a lower level of selectivity than a randomly selected White student.

Although $p_{a>b}$ is equal to the area under a PP curve, and can be computed directly from these plots, in this paper we use the methods described in Ho and Reardon (2012) and Reardon and Ho (2015) to calculate V using maximum-likelihood methods and then transform V to $p_{a>b}$ according to the function

$$p_{a>b} = \Phi\left(\frac{V}{\sqrt{2}}\right) \quad (1)$$

The calculation of V using the maximum-likelihood method fits a smooth curve through the points in the PP plot, which formalizes the assumption that there is some ordering of the two groups even within an ordinal category (which, in this case, is akin to assuming that there is some ranking of colleges even within a category). In contrast, directly computing the area under the curve from a PP plot assumes that all people in a given category are tied in the ranking of their colleges.

Thus $p_{a>b}$ is a single measure of college enrollment selectivity gaps between students from different race groups that accounts for differences in representation across ordinal categories of college level and selectivity. In fact, only this ordinal property is important for determining $p_{a>b}$; it does not rely on any interval-scale properties of underlying college selectivity.

Conditional gaps. Additionally, we limit our analysis to students who attend a college above a given level of selectivity. Specifically, we examine enrollment selectivity gaps conditional on enrollment in (a) any postsecondary education (between 41% and 53% of all 18-year-olds in the years of study), (b) a degree-granting institution (between 41% and 50%), (c) a 4-year college (between 28% and 33%), and (d) a very competitive (*Barron's* rating 3) college (between 12% and 14%). These analyses allow us to determine at which levels of college selectivity racial enrollment selectivity gaps are the largest or whether the trends differ by selectivity level. For example, small Black–White gaps for the entire population coupled with large Black–White gaps conditional on enrollment in a 4-year college would indicate that Black and White students are attending college at similar rates but that they are attending very different 4-year schools.[7]

Concurrent Trends

We use three methods to compute racial gaps in concurrent trends (high school graduation, family income, parental

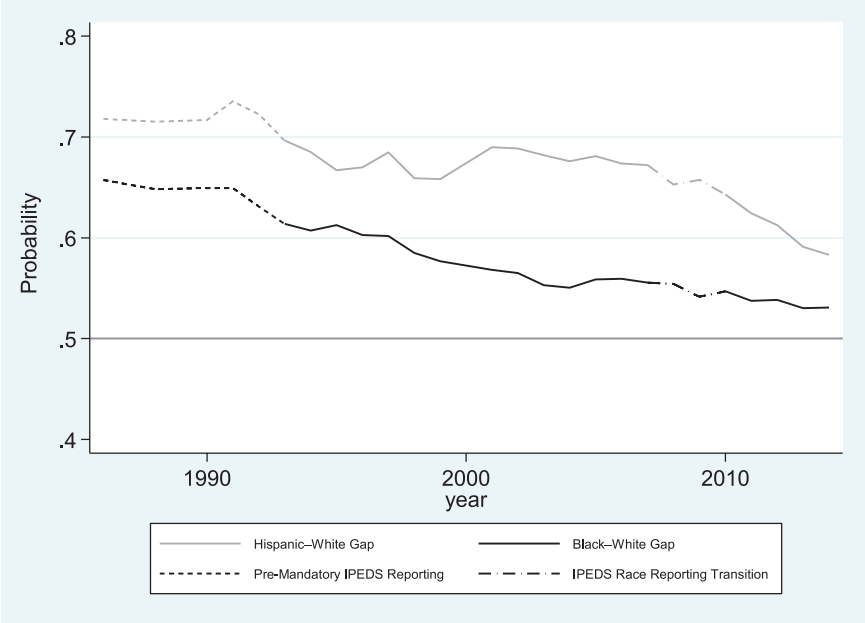

FIGURE 2. *Black–White and Hispanic–White postsecondary enrollment selectivity gaps.*
Note. The level of each line indicates the probability that a randomly chosen White student is enrolled in a more selective postsecondary destination than a randomly chosen Black/Hispanic student. Integrated Postsecondary Education Data System enrollment reporting was not mandatory at all schools prior to 1993. Prior to 2008, all institutions reported race in seven categories. After 2010, all institutions used a nine-category system. Between 2008 and 2010, institutions could report enrollment by race under either system. We use the total Black, Hispanic, and White students regardless of reporting method.

education, and academic achievement). For data that are reported by category (e.g., income), we calculate $p_{a>b}$ according to the method above. For binary measures, we compute a standardized difference in means (akin to V) and then convert the result to probability units according to Equation (1), ensuring all gaps are on the same scale. We accomplish this either by direct calculation (for graduation rates) or by estimating a probit regression of the outcome variable controlling only for indicators of race, omitting the indicator for White students (for parental education). The coefficients on each race-ethnicity indicator give the gap in parental education. Finally, for continuous data (NAEP scores), we compute a standardized difference in group means, which we also convert to probability units according to Equation (1).

We calculate bivariate correlations between each of these concurrent gaps and our enrollment selectivity gaps (both the overall gap and each of the enrollment selectivity gaps conditional on given levels of enrollment). These correlations provide simple evidence of how changes in college enrollment selectivity gaps might be related to changes in gaps in precollege measures. Because of the small number of time points we observe each gap, we use $\alpha = .1$ to assess statistical significance of these correlations.

Although these simple correlations provide a sense of which gaps tend to trend together, they could be misleading; they do not account for the correlation between various concurrent trends (for example, income gaps are likely related to both test score gaps and enrollment selectivity gaps), and they do not account for potentially spurious correlations because of underlying time trends (Granger & Newbold, 1974). To address these concerns, we also examine these relationships using more-robust methods that allow us to make explicit assumptions about which time series trends are related to each other. Specifically, we use structural vector autoregression (SVAR; Sims, 1980) to predict enrollment selectivity gaps using all other concurrent trends, lagged versions of these trends, and the lagged dependent variable. Our data greatly limit our ability to make robust conclusions from these analyses (namely, we have measured test gaps for only 11 of the 28 years, reducing our already limited power), so we briefly discuss where the results from these models align with our bivariate correlations in the Results section and present the full set of results in Appendix C. Whether interpreting our correlations or the SVAR analyses, the results should be taken as descriptive rather than causal.

Results

Enrollment Selectivity Gaps

Figure 2 gives the change in college enrollment selectivity gaps from 1986 to 2014 for both Black and Hispanic students relative to White students. This figure accounts for all possible postsecondary destinations, including not enrolling in any further education. With some variation, both Black and Hispanic students have seen their overall college enrollment selectivity gaps shrink relative to White students (recall that

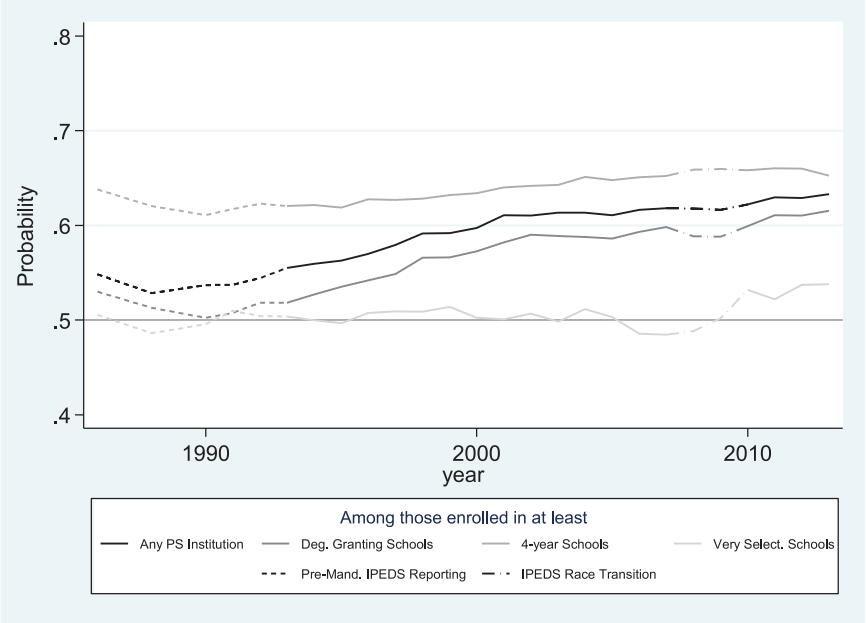

FIGURE 3. *Black–White postsecondary enrollment selectivity gaps, conditional enrollment at specified levels, 1986 to 2014.*
Note. The level of each line indicates the probability that a randomly chosen white student is enrolled in a more selective postsecondary destination than a randomly chosen Black student. Integrated Postsecondary Education Data System enrollment reporting was not mandatory at all schools prior to 1993. Prior to 2008, all institutions reported race in seven categories. After 2010, all institutions used a nine-category system. Between 2008 and 2010, institutions could report enrollment by race under either system. We use the total Black and White students regardless of reporting method.

gaps closer to a probability of 0.50 indicate greater parity between race groups). The Black–White gap has shrunk from $p_{w>b}$ = .66 to .53. That is, in 1986 there was a 66% chance that a randomly chosen White student was in a higher selectivity postsecondary destination than a randomly chosen Black student. In 2014 this had dropped to a 53% chance, indicating that postsecondary destinations for these groups have been increasingly similar over this period. Over the same time period, the Hispanic–White gap shrunk from $p_{w>h}$ = .72 to .58. White students on average still attend more selective institutions, particularly relative to Hispanic students.

The story of an overall decrease in college enrollment selectivity gaps for Black and Hispanic students shifts when we examine gaps that are conditional on enrollment at specified levels (for example, gaps among students enrolled in 4-year colleges). This change is seen in Figures 3 and 4, which give, respectively, the Black–White and Hispanic–White college enrollment selectivity gaps over time using only (a) students enrolled in any postsecondary destination, (b) students enrolled in a degree-granting college, (c) students enrolled in 4-year colleges, and (d) students enrolled in very selective colleges.

First, in Figure 3 (Black–White gaps), enrollment selectivity gaps conditional on attending any postsecondary institution have grown over time; among students enrolled in any postsecondary destination, the probability that a randomly chosen White student is attending a higher-selectivity postsecondary destination than a randomly chosen Black student has increased. This contrast from the decrease in gaps seen in Figure 2 appears to be a consequence of the only population of students in Figure 2 not included in Figure 3: students not enrolled in college. In other words, it appears that nearly all the relative gains in Black postsecondary enrollment have occurred at the margin of attendance.

We see a similar marginal enrollment story when we condition on enrollment in a degree-granting institution. As recently as 1990, the enrollment selectivity gap between Black and White students in this group was essentially zero ($p_{w>b}$ = .50). Since then, however, this gap has grown to where $p_{w>b}$ is nearly .61. The fact that the Black–White gap among students attending degree-granting schools is consistently smaller than the gap among students attending any postsecondary institution (including certificate programs) is a sign that Black students are increasingly more likely than White students to enroll in non-degree-granting programs and that Black and White students are likely enroll in 2-year colleges at similar rates to each other. Indeed, in 1990, among all White students enrolled in any postsecondary institution, 3.6% attended a non-degree-granting school. This had increased to 5.6% by 2010. The corresponding increase was much sharper for Black students; in 1990, 5.6% of all Black college students attended a non-degree-granting institution, and by 2010, this had increased to over 11%.[8]

Black–White enrollment selectivity gaps conditional on 4-year college attendance are the largest of the gaps we examine. This gap has hovered with $p_{w>b}$ around .64 for the

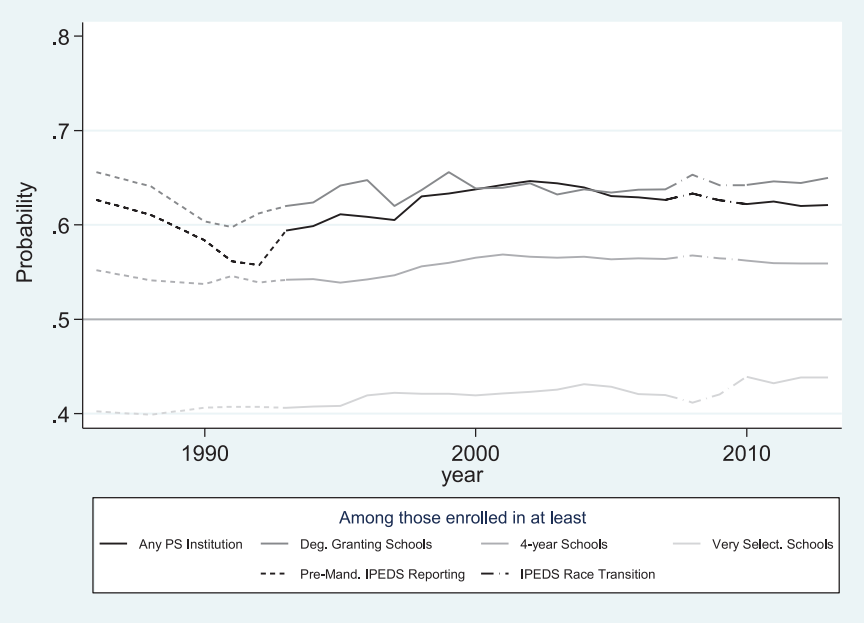

FIGURE 4. *Hispanic–White postsecondary enrollment selectivity gaps, conditional on enrollment at specified levels, 1986 to 2014.*
Note. The level of each line indicates the probability that a randomly chosen White student is enrolled in a more selective postsecondary destination than a randomly chosen Hispanic student. Integrated Postsecondary Education Data System enrollment reporting was not mandatory at all schools prior to 1993. Prior to 2008, all institutions reported race in seven categories. After 2010, all institutions used a nine-category system. Between 2008 and 2010, institutions could report enrollment by race under either system. We use the total Hispanic and White students regardless of reporting method.

past 30 years. Enrollment selectivity gaps have been similarly stable at the most selective colleges (*Barron's* ratings 1–3) but very small, with $p_{w>b}$ close to .50. However, it should be emphasized that this final gap is calculated using the relatively few Black students who enroll in these schools at all.

Figure 4 gives the analogous trends for the Hispanic–White gaps. These trends tell a different story. Like Black students, Hispanic students saw a relative minimum in their enrollment selectivity gaps relative to White students in the early 1990s, but over the nearly 30 years covered by the figure, their enrollment selectivity gap with White students has remained broadly unchanged, no matter which subset of students we examine. Unlike with the Black–White gaps, the largest gaps are among the populations that include non-degree enrollment and enrollment at 2-year colleges. This consistently large gap is an indication that although Hispanic students are attending college at rates that are increasingly similar to White students, they are attending less selective schools, including non-degree-granting programs and 2-year schools, at much higher rates.

Enrollment selectivity gaps between Hispanic and White students are smallest among 4-year college enrollees. These gaps are much smaller than Black–White gaps among 4-year enrollees. This indicates that Hispanic students who enroll in 4-year colleges are distributed more like White students across levels of selectivity than Black students are.

Conditional on attendance at the most selective colleges (*Barron's* ratings 1–3), Hispanic students enroll at *more-selective* colleges than White students, although this gap has shrunk over the past 30 years. This is in contrast to Black students enrolled in the most selective colleges, who attend schools that are of similar selectivity to White students. However, it should again be emphasized that this gap is calculated using the relatively few Hispanic students who enroll in these schools at all.

College Enrollment Selectivity Gaps and Concurrent Trends

To identify macrolevel trends in gaps of precollege measures that covary with enrollment selectivity gap trends, we compare the enrollment selectivity gap trends to concurrent trends in gaps in high school graduation, achievement, family income, and parental education using correlational analyses. The graphical presentations of these overall gaps in selectivity of enrollment, gaps in selectivity of enrollment conditional on 4-year enrollment, and concurrent gaps (all presented as $p_{w>b/h}$) are found in line graphs in Figures 5 and 6 for Black–White and Hispanic–White gaps, respectively, and the bivariate correlations are found in Table 1. Note in Figures 5 and 6 that nearly all the concurrent gaps (except graduation) are larger than the enrollment selectivity gaps. This pattern suggests that despite persistent college enrollment selectivity gaps, these gaps are in fact narrower than at other points in students' life course.

One common pattern among these results is that estimated relationships (using both bivariate correlations and

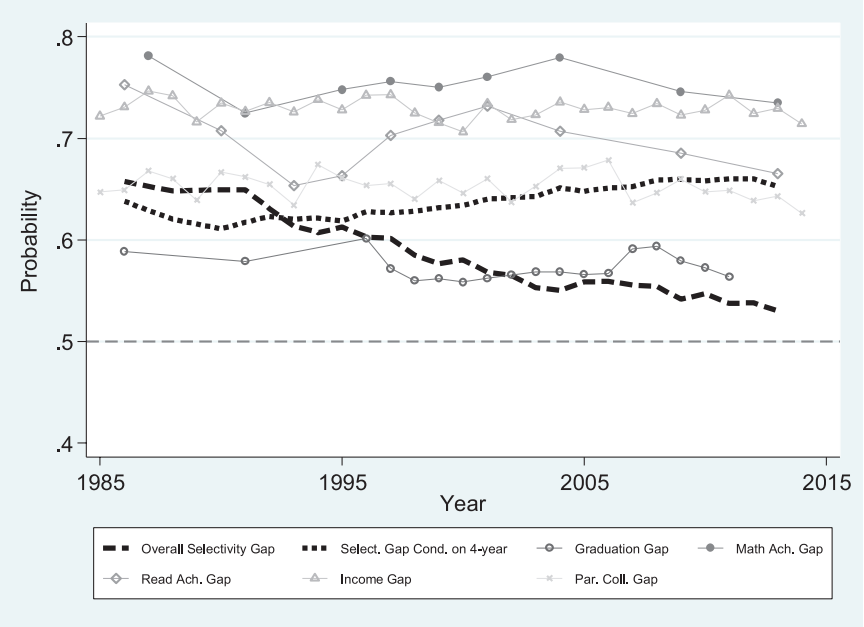

FIGURE 5. *Black–White postsecondary enrollment selectivity gap compared to other gaps, 1986 to 2014.*
Note. The level of each line indicates the probability that a randomly chosen White student has a superior outcome (higher test score, higher family income, more selective postsecondary destination) to a randomly chosen Black student.

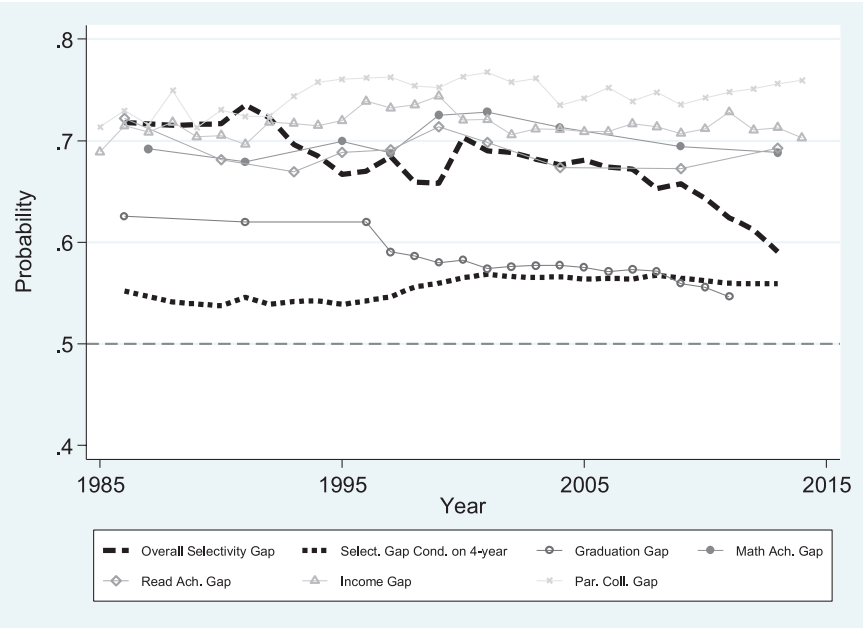

FIGURE 6. *Hispanic–White postsecondary enrollment selectivity gap compared to other gaps, 1986 to 2014.*
Note. The level of each line indicates the probability that a randomly chosen White student has a superior outcome (higher test score, higher family income, more selective postsecondary destination) to a randomly chosen Hispanic student.

the more sophisticated SVAR models) tend to flip signs between overall gaps and conditional gaps. This is expected, given that overall gaps in enrollment selectivity are decreasing but that nearly every gap that conditions on a minimum level of enrollment is increasing.

In our bivariate correlation analysis, Black–White high school graduation gaps are significantly correlated with overall enrollment selectivity gaps ($r = .449$) and enrollment selectivity gaps conditional on enrollment in selective 4-year colleges ($r = –.389$). These correlations appear mostly driven

TABLE 1

Correlations Between Postsecondary Enrollment Selectivity Gaps and Other Concurrent Gaps, by Race-Ethnicity

	Conditional enrollment selectivity gap		
Concurrent Gap	Overall	4-year	Selective college
Black–White			
High school graduation	.449*	−.199	−.389*
Reading	.290	.105	−.193
Math	−.379	.320	−.285
Family income	.242	−.126	−.076
Parental education	.203	−.210	−.336*
Hispanic–White			
High school graduation	.730*	−.873*	−.847*
Reading	.067	.132	−.129
Math	−.041	.593	.168
Family income	−.210	−.131	.046
Parental education	−.355*	.202	.278

*$p < .1$.

by the shrinking graduation gaps in the late 1990s and between 2005 and 2010 (Figure 5). The SVAR analysis provides some support for the relationship between graduation gaps and enrollment selectivity gaps. As shown in Appendix Table C1, we find a significant, positive relationship between Black–White high school graduation gaps and overall selectivity gaps and a significant negative relationship between graduation gaps and enrollment selectivity gaps conditional on enrollment in a 4-year college. The estimate of this relationship is larger for enrollment selectivity gaps conditional on selective college enrollment; however, this relationship does not reach conventional levels of significance.

The correlational analysis also indicates a negative relationship between Black–White gaps in whether students' parents went to college and enrollment selectivity gaps conditional on enrollment at a selective college. The SVAR confirms this relationship between these two variables with respect to enrollment selectivity gaps conditional on enrollment at a 4-year college; however, it suggests a positive relationship between parental education gaps and enrollment selectivity gaps conditional on enrollment at a selective college, indicating there may be a complicated relationship between gap trends that is not captured in our correlational analysis.

Trends in Hispanic–White enrollment selectivity gaps and concurrent gaps are shown in Figure 6 with the bivariate correlations between gaps in Table 1. Here we see two sets of statistically notable correlations: (a) a negative correlation between high school graduation gaps and enrollment selectivity gaps among those students who attend a 4-year college and a positive relationship between high school graduation gaps and overall Hispanic–White selectivity gaps and (b) a negative correlation between gaps in parental college enrollment and overall enrollment selectivity gaps. The graduation gap correlations are also present in both the overall and the conditional SVAR results. As with the Black–White gaps, the SVAR results also indicate a relationship between parental college gaps and enrollment selectivity gaps, but the story is more consistent—larger Hispanic–White gaps in terms of the proportion of students whose parents have a college education are associated with larger enrollment selectivity gaps both overall and conditional on enrollment in a selective college.

Estimates from the SVAR models also suggest a positive relationship between income gaps and both overall enrollment gaps (for Black students) and gaps at selective college admissions (for Hispanic students). Although not apparent in the correlation analysis, this relationship goes in expected direction in that larger income gaps are associated with larger enrollment gaps.

Conclusion

A growing body of evidence supports the fact that a student's likelihood of graduation as well as his or her long-term economic outcomes is determined not just by *whether* he or she enrolls in college but *where*. Because of this connection between the level and selectivity of postsecondary enrollment and issues of economic equity, we present a comprehensive way of measuring college enrollment selectivity gaps that is sensitive to these important distinctions in postsecondary destinations. This approach improves on earlier methods of measuring enrollment gaps that could look at only one type of enrollment at a time.

In short, we find that overall Black–White and Hispanic–White gaps in college enrollment selectivity shrunk considerably between 1986 and 2014, but White students still attend, on average, more-selective postsecondary destinations than their Black and Hispanic peers. On their face, these narrowing gaps are encouraging, particularly since it appears that shrinking enrollment selectivity gaps are related to shrinking high school graduation gaps; efforts to improve high school graduation rates may have longer-term benefits in terms of opening access to postsecondary education.

However, this rosy view of closing enrollment selectivity gaps is tempered by our finding that the closing of gaps for both Black and Hispanic students appears to be driven entirely by more of these students making the choice to enroll in non-degree-granting postsecondary programs rather than not enroll in college at all. Indeed, once we remove these marginal postsecondary enrollees from our analysis, over the past three decades, enrollment selectivity gaps have been consistently growing for Black students and growing, albeit more gradually, for Hispanic students. Thus, although closing graduation gaps may be associated with

greater access to postsecondary education for Black and Hispanic students, these gains appear to be reflected only in marginal enrollment choices, and Black and Hispanic students are still falling behind their White peers in the rate at which they are able to access more-selective levels of higher education.

Of the traditionally underrepresented students who successfully enroll at the most-selective colleges, Black students do so at selectivity levels similar to, and Hispanic students, greater than, their White peers. However, this finding obscures the fact that not many Black and Hispanic students enroll at these levels at all (Posselt et al., 2012; Reardon et al., 2012). Indeed, in 2014, 6%, 7%, and 18% of Black, Hispanic, and White students were enrolled in these colleges, respectively.

Often, successful graduation from high school is all that is needed to access the majority of postsecondary options in the United States—those institutions that are essentially open access. Thus, it seems intuitive that the closing of Black–White high school graduation gaps is associated with closing of overall enrollment selectivity gaps. However, the rest of our findings about the relationship between graduation gaps and enrollment selectivity gaps do not provide such easy explanations. Indeed, the relationship between Black–White high school graduation gaps and enrollment selectivity gaps conditional on various levels of college attendance suggests that the closing of graduation gaps has been accompanied by an increasing advantage of White students over Black students in terms of their postsecondary destinations. The same story is true for Hispanic and White students. Thus, we may be demonstrating evidence of effectively maintained inequality (Lucas, 2001)—as the competition for seats at open-access institutions has become more even, White students appear to be marshaling other resources to preserve their enrollment selectivity advantage.

This explanation may also result from another trend that we do not explicitly address in this article: The early 1990s represented a low point in the size of the college-age population, but by 2010, the college-age population reached a relative peak. This population growth means that, over the course of most of our analysis, competition for seats in college was increasing. Although the supply of enrollment options increased as well, most of this expansion happened in the 2- rather than the 4-year sector (Kelly, 2016). Our enrollment selectivity gaps are consistent with a story in which there has been an absolute increase in access to postsecondary education for all groups but little relative change in access to different levels of selectivity—privileged groups stay one step ahead.

We also want to highlight that Black and Hispanic students do not appear to be following the same path in terms of enrollment selectivity gaps, either in terms of the relative magnitude of their gaps with White students or in the rate at which the gaps are changing. Neither do the potential explanatory gaps appear to be related to enrollment selectivity gaps in the same way for these two race groups. For example, although there is alignment in terms of the general findings about the relationship between graduation gaps and enrollment selectivity gaps, the Black and Hispanic stories diverge with respect to the relationship between gaps in whether students have parents who attended college and enrollment selectivity gaps. Here, our evidence points to a minimal, and perhaps negative, relationship between these two gaps for Black students, whereas it leans positive for Hispanic students, particularly at more-selective colleges, when we add the additional controls of the SVAR models. Thus, college attendance for Black parents does not appear to convey the same field-leveling benefits in terms of their children's higher education as it does for Hispanic parents. This perspective on the differing intergenerational returns to higher education adds more evidence to research that has described the value of parental educational attainment for Latino families (Ovink & Kalogrides, 2015) and its weakness for Black families relative to White families (D. Long, Kelly, & Gamoran, 2010).

Gaps in college enrollment selectivity have important implications for equity and career outcomes. Measuring these gaps in a way that reflects the diversity of postsecondary options creates a valuable metric that allows us to judge whether reform efforts are leading us toward greater educational parity. Our efforts to document the relationships between academic and socioeconomic gaps and enrollment selectivity gaps should support the development of new research on policies that are targeted at increasing equity in educational outcomes.

Appendix A

Other Representations of College Selectivity Gaps

The benefit of using the *V*-statistic method (and related probability-of-superior-outcome measures) to illustrate changes in enrollment selectivity gaps is that it effectively collapses a large amount of information into a single number. In this appendix we present three other ways of displaying the same information without using the *V* statistic in order to illustrate how difficult the task is. Each of these representations improves upon the last, but each still has significant limitations.

In Figures A1 and A2 we present stacked bars that show the percentage of Black and Hispanic students, respectively, enrolled in each of the nine different postsecondary destinations we consider in this paper compared to the rate of enrollment in these destinations for White students. This is the simplest way of looking at these data, and these figures illustrate the challenges in examining trends. For example, although we can see that enrollment in 2-year schools has grown for all three race groups, it is difficult to tell for which

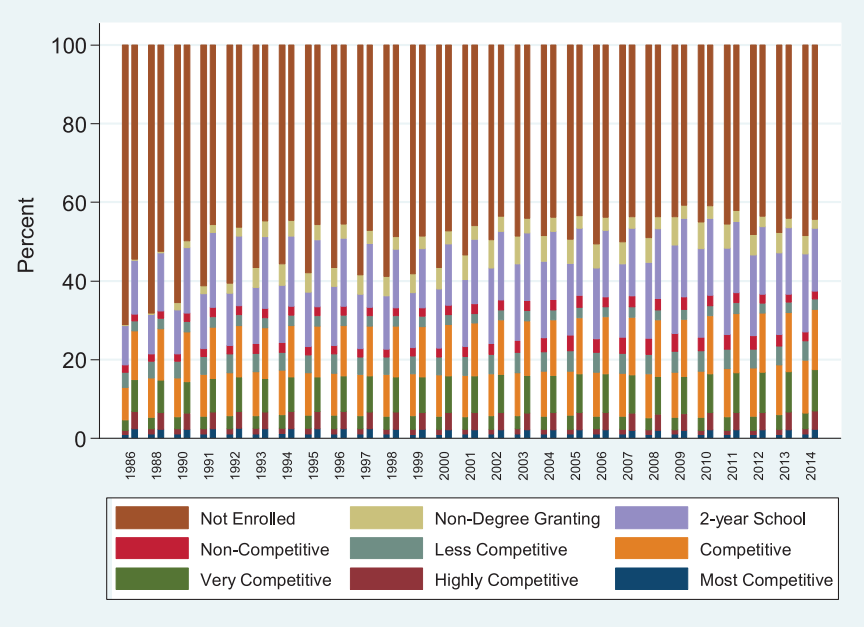

FIGURE A1. *Postsecondary destinations of Black (left bar) and White (right bar) students, 1986 to 2014.*
Note. Data come from Integrated Postsecondary Education Data System and the U.S. Census. The selectivity of 4-year schools is based on *Barron's Profile of American Colleges*. For each year, the left bar gives the percentage of Black students at each type of postsecondary destination, and the right bar gives the same information for White students.

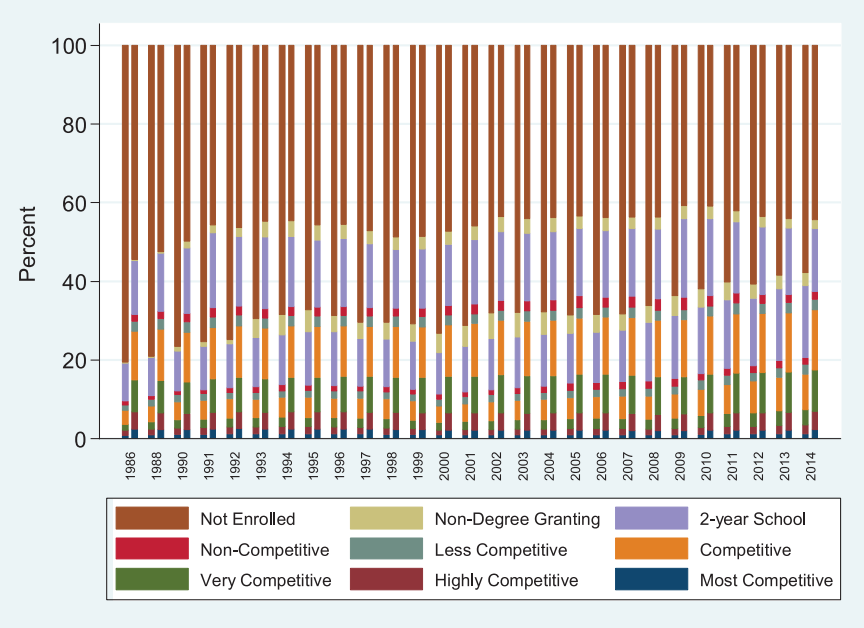

FIGURE A2. *Postsecondary destinations of Hispanic (left bar) and White (right bar) students, 1986 to 2014.*
Note. Data come from Integrated Postsecondary Education Data System and the U.S. Census. The selectivity of 4-year schools is based on *Barron's Profile of American Colleges*. For each year, the left bar gives the percentage of Black students at each type of postsecondary destination, and the right bar gives the same information for White students.

group 2-year enrollment has grown the most and how this compares to growth in other sectors. And importantly, in these figures it is hard to assess how *overall* changes in enrollment have evolved.

In Figures A3 through A5, we present the percentage of students who are enrolled in *at least* each level of selectivity for each race. By examining the area between each pair of lines, we can track growth in particular sectors. For example,

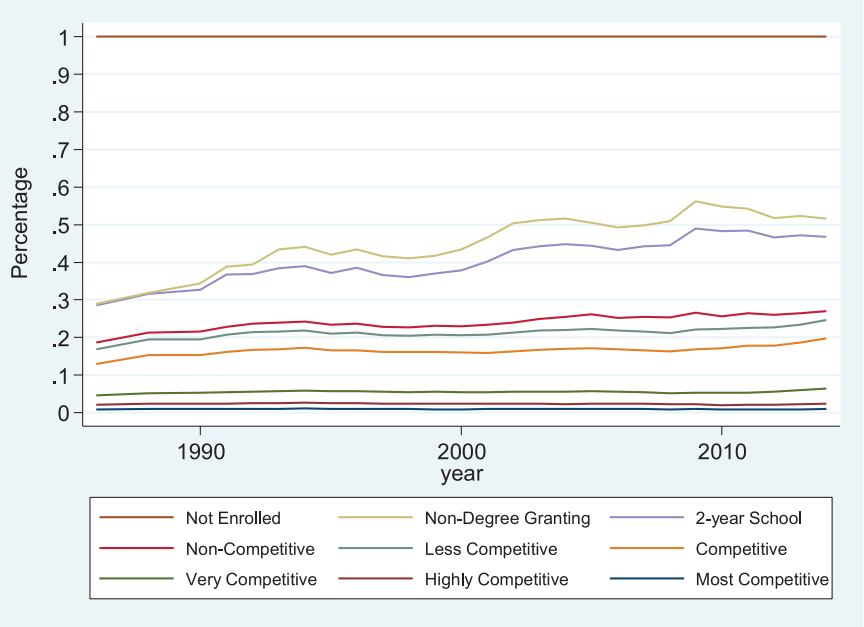

FIGURE A3. *Percentage of Hispanic students enrolled in each postsecondary destination or higher.*
Note. Data come from Integrated Postsecondary Education Data System and the U.S. Census. The selectivity of 4-year schools is based on *Barron's Profile of American Colleges*. Each line indicates the percentage of Hispanic students enrolled in a postsecondary destination that is at least that selective. For example, the height of the *competitive* line indicates the percentage of Hispanic students enrolled in 4-year colleges that are ranked as competitive, very competitive, highly competitive, or most competitive each year.

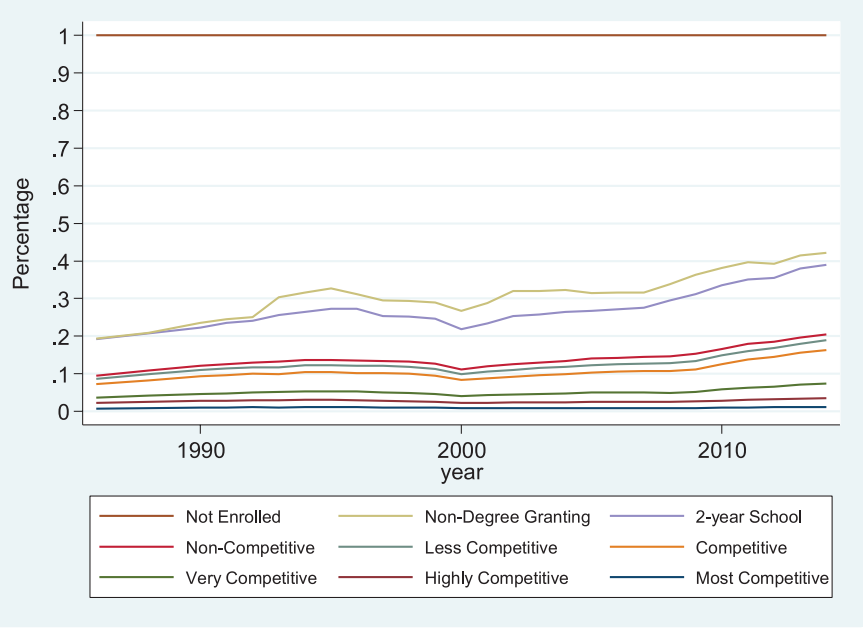

FIGURE A4. *Percentage of Black students enrolled in each postsecondary destination* or *higher.*
Note. Data come from Integrated Postsecondary Education Data System and the U.S. Census. The selectivity of 4-year schools is based on *Barron's Profile of American Colleges*. Each line indicates the percentage of Black students enrolled in a postsecondary destination that is at least that selective. For example, the height of the *competitive* line indicates the percentage of Black students enrolled in 4-year colleges that are ranked as competitive, very competitive, highly competitive, or most competitive each year.

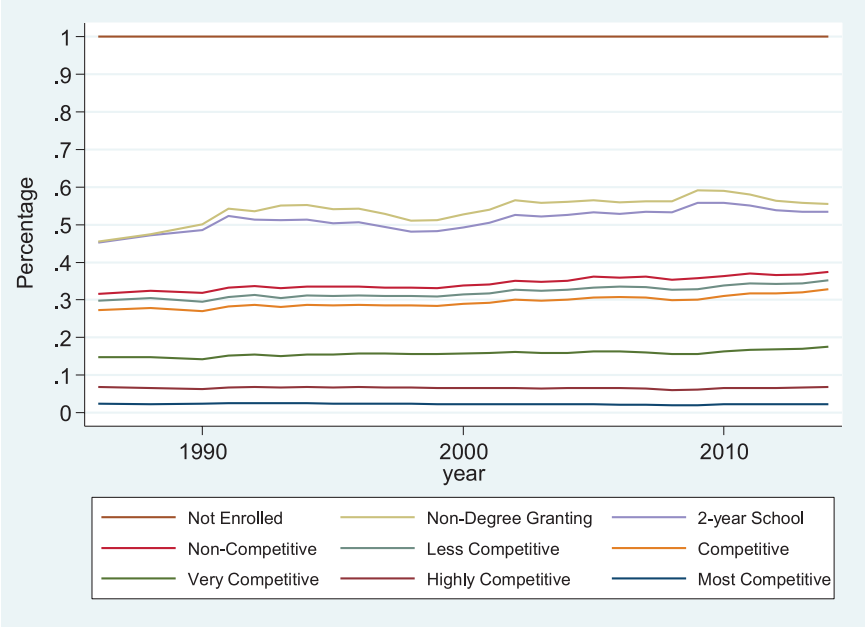

FIGURE A5. *Percentage of White students enrolled in each postsecondary destination or higher.*
Note. Data come from Integrated Postsecondary Education Data System and the U.S. Census. The selectivity of 4-year schools is based on *Barron's Profile of American Colleges*. Each line indicates the percentage of White students enrolled in a postsecondary destination that is at least that selective. For example, the height of the *competitive* line indicates the percentage of White students enrolled in 4-year colleges that are ranked as competitive, very competitive, highly competitive, or most competitive each year.

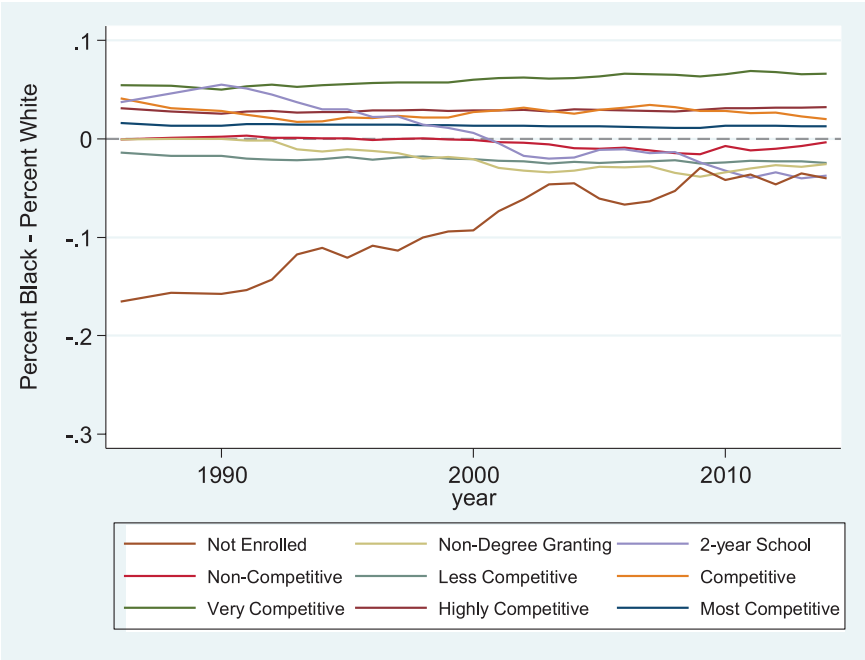

FIGURE A6. *Difference in rates of enrollment between White and Black students, by level and selectivity of postsecondary destination from 1986 to 2014.*
Note. Data come from Integrated Postsecondary Education Data System and the U.S. Census. The selectivity of 4-year schools is based on *Barron's Profile of American Colleges*. The level of each line indicates the percentage of Black students enrolled in a given postsecondary destination minus the percentage of White students enrolled at the same level; negative values indicate a greater proportion of White students enroll in the given level than Black students.

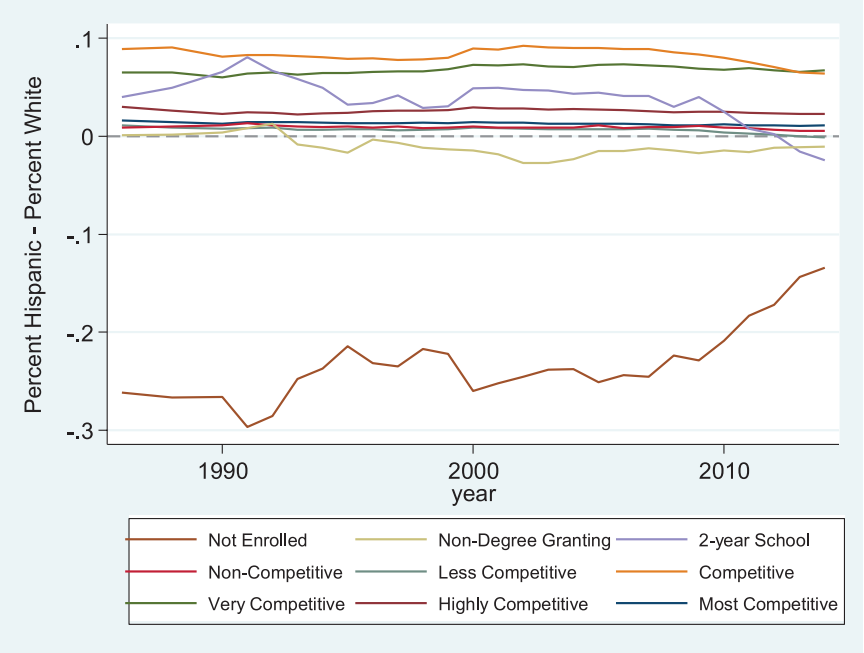

FIGURE A7. *Difference in rates of enrollment between White and Hispanic students, by level and selectivity of postsecondary destination from 1986 to 2014.*

Note. Data come from Integrated Postsecondary Education Data System and the U.S. Census. The selectivity of 4-year schools is based on *Barron's Profile of American Colleges*. The level of each line indicates the percentage of Hispanic students enrolled in a given postsecondary destination minus the percentage of White students enrolled at the same level; negative values indicate a greater proportion of White students enroll in the given level than Hispanic students.

by looking at the area between the non-degree-granting and 2-year school lines, we can see the growth in the non-degree-granting sector for all races. This representation is helpful in that it clearly shows growth trends in enrollment for a given race in a given sector. However, there are two main limitations to this representation. First, like the previous representation, it is difficult to assess trends in overall enrollment. Second, these graphs do not allow us to compare across races in one figure.

Finally, in Figures A6 and A7 we reduce the data slightly and give lines that track the *difference* in percentage of White students relative to Black and Hispanic students enrolled in each postsecondary destination. Here we can see some of the trends we note in the paper—notably, the closing margin of not attending college at all. However, it is still difficult to weight the overall trends in enrollment, particularly without additional information about the relative number of students enrolled at each level. What we lose in this approach is a sense of the proportion of students at each level. We may see trends at different levels of selectivity running in opposite directions, but without knowing the proportion of total enrollments at each level (and for each year), it is difficult to make claims about overall changes in gaps. For example, although the closing of the gap in nonenrollment is striking in both figures, it is difficult to know how important this is without knowing what percentage of students fall into this category. This representation again does not allow us to ascertain how changes in enrollment gaps in one particular sector affect enrollment gaps overall.

Appendix B

Sensitivity Analyses

The following work demonstrates the robustness of our results to various data decisions and limitations.

Full-Time Versus Part-Time Students

In our main analyses, we use the Integrated Postsecondary Education Data System (IPEDS) counts of all first-time degree-/certificate-seeking students enrolled at each postsecondary institution. Here we reestimate selectivity gaps using only full-time first-time degree-/certificate-seeking students, which should reduce the potential to double-count students who are enrolled at multiple institutions in their first term of attendance. Because relatively few students enroll in more than one college—somewhat fewer than 2% of all students enrolled in any postsecondary institution are enrolled in more than one institution (National Student Clearinghouse Research Center, 2015), these results are not substantively different from the results presented in Figure B1.

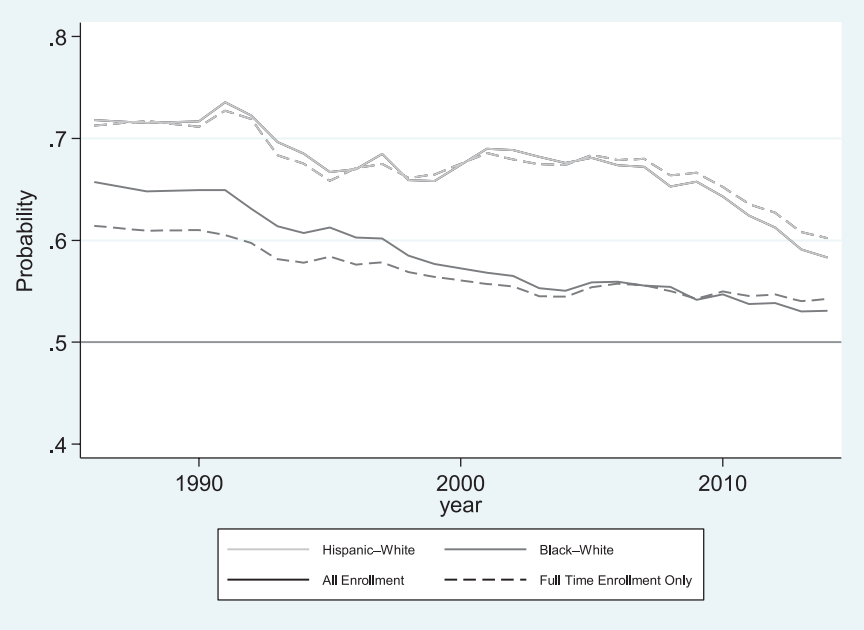

FIGURE B1. *Black–White and Hispanic–White postsecondary enrollment selectivity gaps calculated using all enrollment versus just full-time enrollment, 1986 to 2014.*

Note. The level of each line indicates the probability that a randomly chosen White student is enrolled in a more selective postsecondary destination than a randomly chosen Black or Hispanic student. The solid lines indicate gaps estimated using all enrolled students. The dashed lines indicate gaps estimated using only students who are enrolled full time. Integrated Postsecondary Education Data System enrollment reporting was not mandatory at all schools prior to 1993. Prior to 2008, all institutions reported race in seven categories. After 2010, all institutions used a nine-category system. Between 2008 and 2010, institutions could report enrollment by race under either system, and we use the total Black, Hispanic, and White students regardless of reporting method.

Fall Versus 12-Month Enrollment

Institutions report the number of first-time students to IPEDS only in the fall. Because of this schedule, students who enroll for the first time in the spring semester are not counted in our primary data. If race groups first enroll in fall versus spring at different rates, this could affect our estimated gaps. There is no available data source to satisfactorily address this concern, as IPEDS' 12-month enrollment counts include all enrolled students: freshman to seniors, first-time and otherwise. Thus, these 12-month data conflate college enrollment with college persistence—differential persistence by race may exaggerate or attenuate differential enrollment selectivity gaps by race. For the sake of robustness, but given this caveat, we compare gaps computed using first-time fall enrollment with gaps computed using the 12-month data. In Figure B2 we compare Black–White and Hispanic–White postsecondary enrollment selectivity gaps using both fall and 12-month enrollment data conditional on attending at least a moderately selective 4-year school (*Barron's* 1–5), as this balances concerns about conflating persistence and access with including as many students as possible. In these comparisons, the choice of enrollment type does not alter the trend of the gaps and only modestly changes the magnitude of the gaps.

Changes in Race Categorization

Between 2008 and 2010, IPEDS changed the race categories that schools were asked to use when reporting enrollments. Prior to 2008, schools could categorize students using seven race categories (nonresident alien, race and ethnicity unknown, Black non-Hispanic, American Indian/Alaskan Native, Asian/Pacific Islander, Hispanic, or White non-Hispanic). In the 2008–2009 and 2009–2010 collection years, schools could report using the previous seven categories or the new nine IPEDS reporting categories (nonresident alien, race and ethnicity unknown, Hispanic of any race, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or other Pacific Islander, White, or two or more races). In 2010 and after, all schools had to use the nine new categories.

The main difference of consequence to our analysis is the introduction of the multirace category. In the main analyses, we report gaps using only students identified as from one of the major race-ethnicity groups (that is, we do not include students who report that they are two or more races). In this appendix, we report three methods for including these students. The first recodes each multirace student as White. This method will exaggerate race gaps in favor of the higher-performing group (make Black–White and Hispanic–White gaps larger and more negative). The second method is to

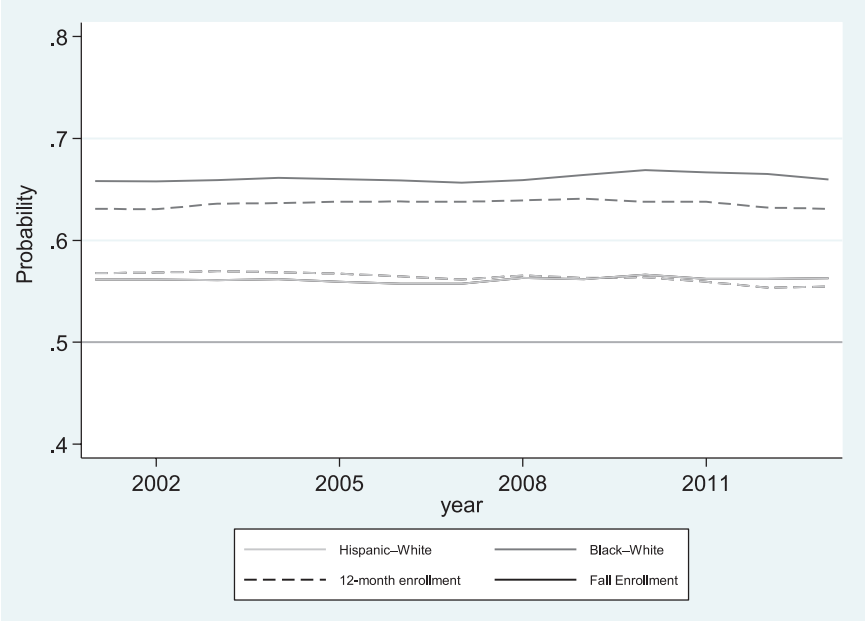

FIGURE B2. *Black–White and Hispanic–White postsecondary enrollment-selectivity gaps calculated using all fall enrollment versus 12-month enrollment conditional on attending at least a* Barron's *5 institution, 1986 to 2014.*

Note. The level of each line indicates the probability that a randomly chosen White student is enrolled in a more selective postsecondary destination than a randomly chosen Black or Hispanic student. The solid lines indicate gaps estimated using first-time fall enrollments reported to the Integrated Postsecondary Education Data System (IPEDS). The dashed lines indicate gaps estimated using 12-month enrollments (all students, not just freshmen) reported to IPEDS. IPEDS enrollment reporting was not mandatory at all schools prior to 1993. Prior to 2008, all institutions reported race in seven categories. After 2010, all institutions used a nine-category system. Between 2008 and 2010, institutions could report enrollment by race under either system, and we use the total Black, Hispanic, and White students regardless of reporting method.

recode each multirace student as Hispanic or Black. This should attenuate estimated gaps (bias them in favor of the underrepresented group). Finally, we recode multirace students according to the race proportions present in our data. This represents our "best guess."

The results, presented in Figures B3 (Black–White gaps) and B4 (Hispanic–White gaps), show that our results are sensitive to these different treatments of multirace students. However, recoding all students who select multirace as one specific race (particularly the races that represent a small proportion of the population, such as Black) is likely an unreasonable upper bound. Recoding these students according to population proportions does not meaningfully affect the results we present in the main analyses. However, these results do highlight the need to create uniform data-reporting structures that more accurately reflect changing demographics and nuanced racial categories.

Population of Institutions

In our main analyses, we use enrollment counts from all colleges, regardless of whether the institution was present in all years of our data. Although we think this is the most appropriate analysis, as it accurately reflects the changing supply of college seats available, we examine the sensitivity of our results to focusing only on the schools that existed in all years in this test. The results, presented in Figure B5, are not qualitatively different overall, but there are a few notable differences. Namely, we note that the White–Hispanic gap is smaller when we include all schools than when we rely only on schools that were present in every year since 1986. This trend is also apparent, though less stark, for the Black–White gap. These trends suggest that Hispanic and Black students were more likely than White students to attend schools that opened in the past 30 years; these new entrants disproportionately served traditionally underrepresented groups.

As noted in the main text, IPEDS reporting was not mandatory for all schools prior before 1994. As a result, we note that our estimates are suggestive, but not definitive, prior to 1994.

Cohort Age

Because of the increasingly varied age of students at their first college entry, the decision to use 18-year-olds as the cohort denominator is consequential and could bias measures of enrollment selectivity gaps. We are particularly concerned by the co-occurrence of uneven growth of racial-ethnic groups relative to each other and a differential likelihood of these same groups to delay first college

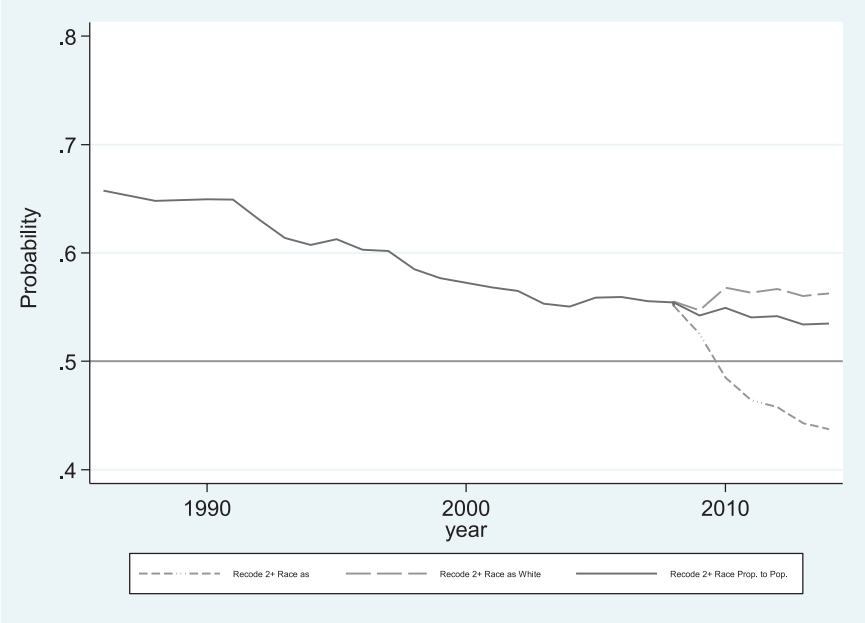

FIGURE B3. *Black–White postsecondary enrollment selectivity gaps accounting for the inclusion of multiracial students, 1986 to 2014.*
Note. The level of each line indicates the probability that a randomly chosen White student is enrolled in a more selective postsecondary destination than a randomly chosen Black student. The two dashed lines indicate gaps estimated by recoding students who self-identify as multiracial as either Black or White. Integrated Postsecondary Education Data System enrollment reporting was not mandatory at all schools prior to 1993. Prior to 2008, all institutions reported race in seven categories. After 2010, all institutions used a nine-category system. Between 2008 and 2010, institutions could report enrollment by race under either system, and we use the total Black, Hispanic, and White students regardless of reporting method.

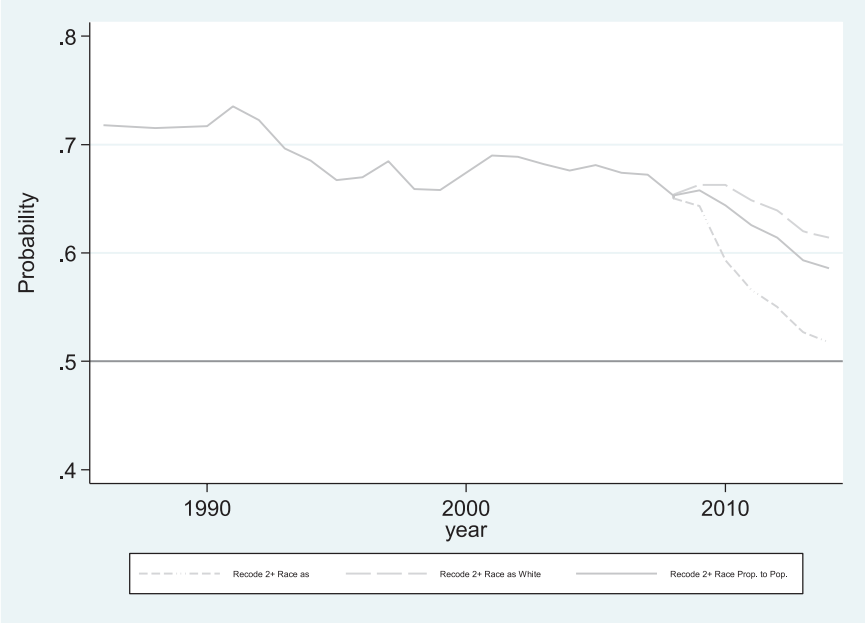

FIGURE B4. *Hispanic–White postsecondary enrollment selectivity gaps accounting for the inclusion of multiracial students, 1986 to 2014.*
Note. The level of each line indicates the probability that a randomly chosen White student is enrolled in a more selective postsecondary destination than a randomly chosen Hispanic student. The two dashed lines indicate gaps estimated by recoding students who self-identify as multiracial as either Hispanic or White. Integrated Postsecondary Education Data System enrollment reporting was not mandatory at all schools prior to 1993. Prior to 2008, all institutions reported race in seven categories. After 2010, all institutions used a nine-category system. Between 2008 and 2010, institutions could report enrollment by race under either system, and we use the total Black, Hispanic, and White students regardless of reporting method.

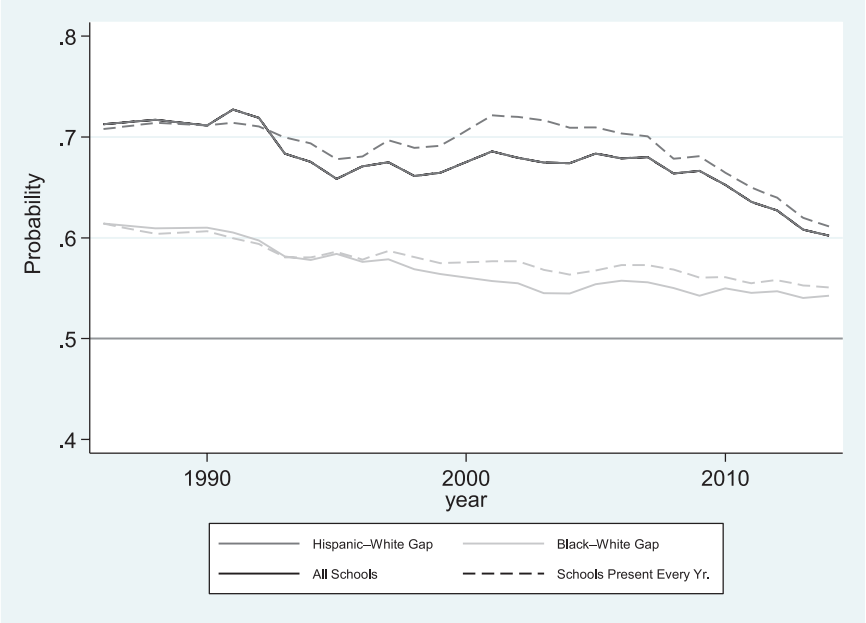

FIGURE B5. *Black–White and Hispanic–White postsecondary enrollment selectivity gaps calculated using all institutions versus only institutions present in every year of data, 1986 to 2014.*

Note. The level of each line indicates the probability that a randomly chosen White student is enrolled in a more selective postsecondary destination than a randomly chosen Black or Hispanic student. The dashed lines indicate gaps estimated by including only schools that were present in every year of analysis. The solid lines indicate gaps that were estimated using all available schools. Integrated Postsecondary Education Data System enrollment reporting was not mandatory at all schools prior to 1993. Prior to 2008, all institutions reported race in seven categories. After 2010, all institutions used a nine-category system. Between 2008 and 2010, institutions could report enrollment by race under either system, and we use the total Black, Hispanic, and White students regardless of reporting method.

enrollment relative to other groups. For example, imagine that across all racial groups, 75% of all high school graduates eventually enroll in college. If the population of Asians in the United States is growing significantly more quickly than other racial groups *and* Asians tend to delay college enrollment by 10 years, it will look like Asians enroll at much lower rates than other groups (75% of all 28-year-olds will be less than the 75% of 18-year-olds). We investigate the potential upper bound of this bias by using an average of 18- to 24-year-olds as the measure of the size of each cohort. The results of this analysis are presented in Figure B6 and do not qualitatively change the size or trend of Black–White and Hispanic–White selectivity gaps.

Missing Barron's *Ratings*

Approximately 360 degree-granting 4-year institutions are missing a *Barron's* selectivity rating. In these cases, we attempted to estimate the rating based on publicly available data (e.g., percentage of applicants admitted, average SAT scores, etc.) and *Barron's* criteria for determining college selectivity. To check the sensitivity of our results to this imputation, we repeat our analyses by dropping these schools from the analysis. Our results, as presented in Figure B7, are not sensitive to this imputation of data.

Comparison to National Center for Education Statistics (NCES) Longitudinal Data

Although the NCES longitudinal data sets are not ideal for our analyses for the reasons we outline in the paper, they are not subject to some of the concerns we have with the IPEDS data and are helpful for checking the robustness of our results. In this section we present the gaps for the national samples in three data sets (National Educational Longitudinal Study [NELS], Educational Longitudinal Study [ELS], and High School Longitudinal Study [HSLS]). These longitudinal data sets are representative of the population of students in late middle school or early high school (eighth grade for NELS, 10th grade for ELS, and ninth grade for HSLS), so the types of students who would drop out before the base year collection are not represented. Because of this, we calculate and present the results for gaps conditional on any postsecondary enrollment. Additionally, because these data sets include a relatively small sample, they often contain small numbers of underrepresented minority students at particular levels of enrollment, and sample weights cannot account for whether these particular observations are outliers.

We find the results from the NCES longitudinal data largely in line with our IPEDS estimates. The trends are qualitatively similar (widening Black–White gaps and widening then leveling Hispanic–White gaps), although the

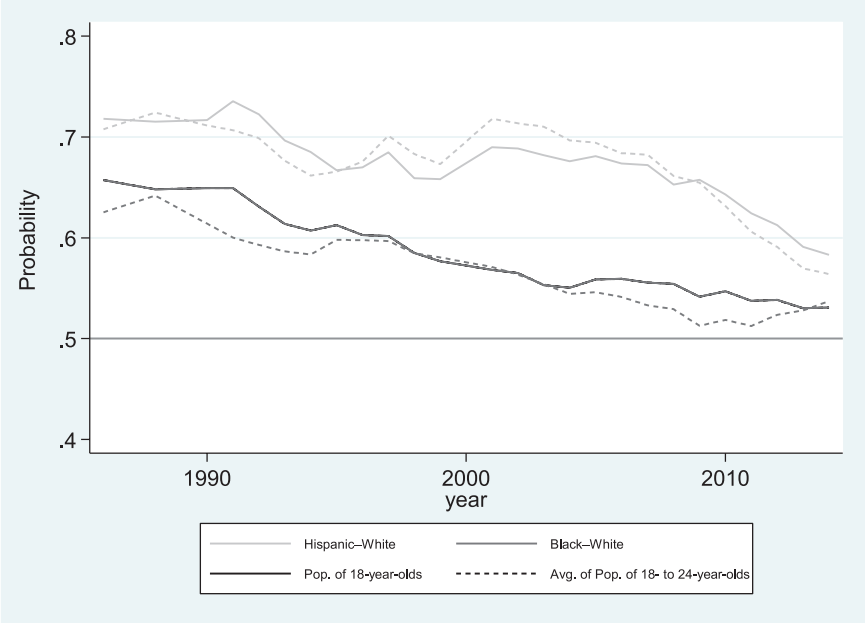

FIGURE B6. *Black–White and Hispanic–White postsecondary enrollment selectivity gaps calculated using a base cohort of 18-year-olds compared to average size of the 18- to 24-year-old population, 1986 to 2014.*

Note. The level of each line indicates the probability that a randomly chosen White student is enrolled in a more selective postsecondary destination than a randomly chosen Black or Hispanic student. The dashed lines indicate gaps estimated by using the average size of cohorts of 18- to 24-year-olds. The solid lines indicate gaps that were estimated using the size of the 18-year-old cohort. Integrated Postsecondary Education Data System enrollment reporting was not mandatory at all schools prior to 1993. Prior to 2008, all institutions reported race in seven categories. After 2010, all institutions used a nine-category system. Between 2008 and 2010, institutions could report enrollment by race under either system, and we use the total Black, Hispanic, and White students regardless of reporting method.

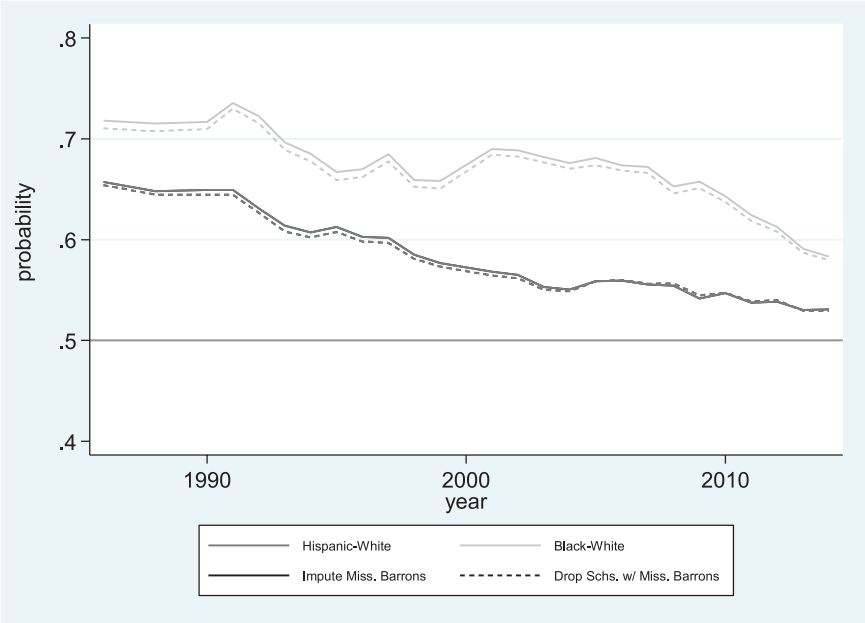

FIGURE B7. Black–White and Hispanic–White postsecondary enrollment selectivity gaps calculated with imputed *Barron's* ratings versus dropping institutions with missing *Barron's* ratings, 1986 to 2014.

Note. The level of each line indicates the probability that a randomly chosen White student is enrolled in a more selective postsecondary destination than a randomly chosen Black or Hispanic student. The dashed lines indicate gaps estimated by dropping schools that do not have a *Barron's* rating. The solid lines indicate gaps that were estimated by imputing missing *Barron's* ratings. Integrated Postsecondary Education Data System enrollment reporting was not mandatory at all schools prior to 1993. Prior to 2008, all institutions reported race in seven categories. After 2010, all institutions used a nine-category system. Between 2008 and 2010, institutions could report enrollment by race under either system, and we use the total Black, Hispanic, and White students regardless of reporting method.

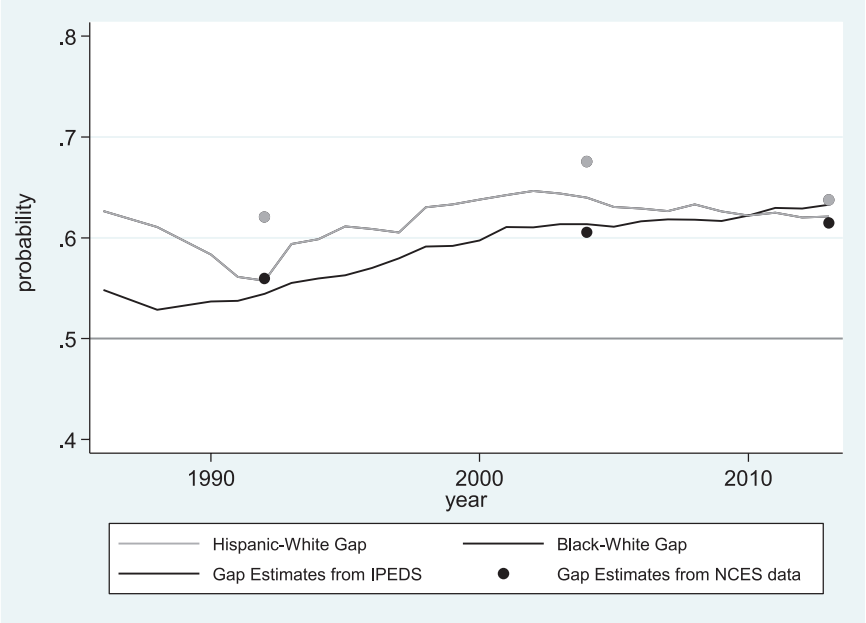

FIGURE B8. *Black–White and Hispanic–White postsecondary enrollment selectivity gaps calculated using Integrated Postsecondary Education Data System (IPEDS) and U.S. Census data compared to gaps estimated using data from National Center for Education Statistics (NCES) longitudinal data sets.*

Note. The level of each line and dot indicates the probability that a randomly chosen White student is enrolled in a more selective postsecondary destination than a randomly chosen Black or Hispanic student. The solid lines indicate gaps that were estimated using IPEDS and U.S. Census data. The dots indicate gaps that were estimated using NCES longitudinal data sets. Integrated Postsecondary Education Data System enrollment reporting was not mandatory at all schools prior to 1993. Prior to 2008, all institutions reported race in seven categories. After 2010, all institutions used a nine-category system. Between 2008 and 2010, institutions could report enrollment by race under either system, and we use the total Black, Hispanic, and White students regardless of reporting method.

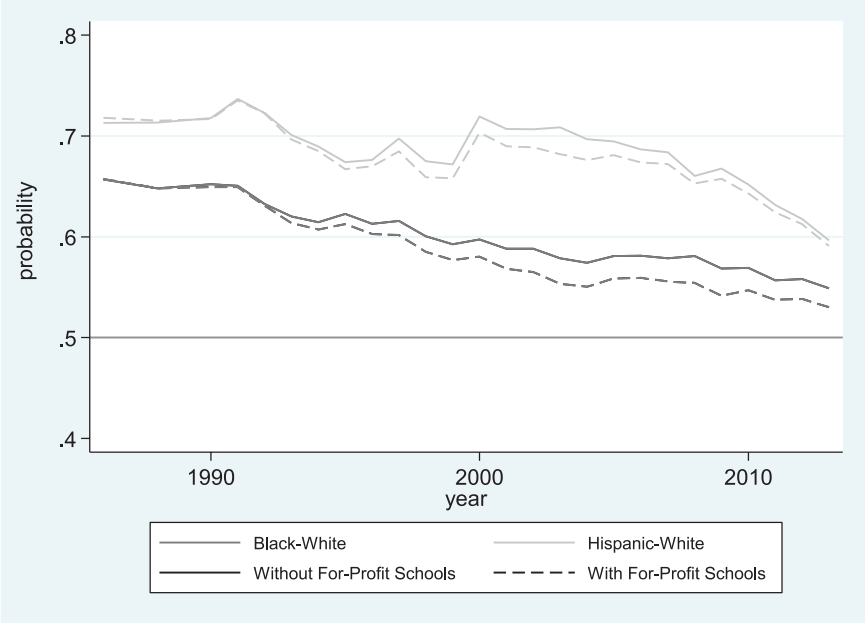

FIGURE B9. *Black–White and Hispanic–White postsecondary enrollment selectivity gaps calculated including for-profit schools versus dropping for-profit schools, 1986 to 2014.*

Note. The level of each line indicates the probability that a randomly chosen White student is enrolled in a more selective postsecondary destination than a randomly chosen Black or Hispanic student. The solid lines indicate gaps that were estimated dropping for-profit schools. The dashed lines indicate gaps that were estimated using data from all schools. Integrated Postsecondary Education Data System enrollment reporting was not mandatory at all schools prior to 1993. Prior to 2008, all institutions reported race in seven categories. After 2010, all institutions used a nine-category system. Between 2008 and 2010, institutions could report enrollment by race under either system, and we use the total Black, Hispanic, and White students regardless of reporting method.

Hispanic–White gaps estimated using the NCES data are larger than those using IPEDS shown in Figure B8.

Exclusion of For-Profit Schools

The for-profit sector is an increasingly important player in higher education in the United States, and examining race gaps in selectivity of enrollment with and without for-profit schools can help us understand the role these institutions might play in the sorting of students into colleges by race. Black and Hispanic students are more likely to enroll in for-profit schools than their White peers (Deming, Goldin & Katz, 2013). This trend, combined with the fact that most for-profit schools tend to be less selective and the number of seats in for-profit institutions has grown rapidly during the years we study (Tierney & Hentschke, 2007), may help explain the closing enrollment selectivity gaps we observe. Thus, to explore the extent to which the trends we describe can be explained in part or in full by the for-profit sector, we recalculated our gaps excluding enrollments from for-profit institutions. Figure B9 shows that both the Black–White and Hispanic–White gaps are bigger when we do not include for-profit schools. This is especially true for the Black–White gap. Thus, for-profit schools are important actors in the overall closing of gaps, but are not entirely responsible for this closing.

However, for-profit schools are more expensive than similar alternatives (Cellini, 2012), they tend to have lower graduation rates than similar nonprofit schools (Lynch, Engle & Cruz, 2010), and research has found that the economic returns to attending a for-profit college are insignificant or lower than other, similar sectors (Darolia, Koedel, Martorell, Wilson, & Perez-Arce, 2015; Cellini & Chaudhary, 2014; Lang & Weinstein, 2013). Thus, the fact that for-profit schools seem to drive a nontrivial amount of the shrinking race gap in college selectivity is not an entirely positive finding.

Appendix C

Structural Vector Autoregression (SVAR) Results

We estimated SVARs of the relationship between enrollment selectivity gaps and gaps in students' achievement and socioeconomic status in a way that is more sensitive to complex interrelationships between the gaps than the bivariate correlations we present in the main body of this article. SVAR models are a variant of vector autoregression (VAR). VAR models compute a set of regressions for each dependent and independent variable in the model using every other variable in the system as well as each variable's lagged values and a control. This approach both accounts for underlying time trends and helps calculate standard errors to account for potential autocorrelation (Stock & Watson, 2001). SVAR extends these models by allowing one to make explicit assumptions about which time-series trends influence each other. For example, although family income gaps and high school graduation gaps might affect gaps in the selectivity of enrollment, we do not expect that high school graduation gaps will affect contemporaneous family income gaps. SVAR models allow us to explicitly set some relationships to zero while estimating other relationships.

Although this approach provides the potential for a more defensible account of the relationship between enrollment selectivity gaps and other gaps, our data greatly limit our ability to make robust inferences (and, given the lack of exogenous variation, certainly not causal inferences) from these analyses. Namely, test gaps were measured for only 11 of the 28 years we study and have math *and* reading scores for only eight of those years. In order to estimate these models, we thus make significant assumptions. Specifically, we use only one test score gap (math) and impute the math gap using the reading gap in years that the National Assessment of Educational Progress (NAEP) was administered in reading but not math. As NAEP was administered irregularly, we also imputed missing test scores using the nearest available year (using both forward and backward imputation). Thus, the test scores we use to estimate these models are noisy measures of true test score gaps, and estimated coefficients should be interpreted with caution.

Because we are using data from multiple sources, we also had to make decisions about the timing of gaps. We use measures of gaps from within a cohort. For example, we use the 2003 eighth-grade test score and family income gaps (for parents of 14- to 17-year-olds) from 2007 gaps to predict 2008 college enrollment selectivity gaps.

We set the following parameters when estimating the models. We allowed enrollment selectivity gaps to be a function of each of the contemporaneous trends (graduation gaps, test score gaps, parental income gaps, and parental college enrollment gaps) but did not allow the contemporaneous trends to be a function of enrollment selectivity gaps. We allow graduation gaps to be a function of income gaps, parental college attendance gaps, and test score gaps; test score gaps to be a function of parental college and income gaps; and income gaps to be a function of parental college attendance gaps. All other terms are set to zero. We include 3 years of lags (of the dependent variable and all independent variables) in each model, which is the most we could include given the data that we have.

The results of our SVAR analyses of the relationship between enrollment selectivity gaps and potential explanatory gaps are presented in Table C1. One common trend among many of these findings is that estimated relationships tend to flip signs between overall gaps and conditional gaps. This makes sense, given that overall gaps in enrollment selectivity are decreasing (trending toward zero) but that nearly every gap that conditions on a minimum level of enrollment goes in the opposite direction.

TABLE C1

Structural Vector Autoregression of the Relationship Between Enrollment Selectivity Gaps and Potential Explanatory Gaps

	Black–White Gaps			Hispanic–White Gaps		
		Gaps conditional on enrollment at			Gaps conditional on enrollment at	
	Overall gap	4-year college	Selective school	Overall gap	4-year college	Selective school
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Graduation gap	.797**	−.202**	−.423	.451†	−.419†	−2.521**
	(.030)	(.053)	(.321)	(.218)	(.218)	(0.218)
Test gap	−.149**	.049*	.033	−.218	.246	3.004**
	(.007)	(.020)	(.75)	(.218)	(.256)	(0.306)
Income gap	.510**	.082	−.568	.036	−.345	0.836**
	(.019)	(.062)	(.377)	(.324)	(.251)	(0.259)
Parental education gap	−.220**	−.085†	.356*	.609*	.079	2.440**
	(.010)	(.036)	(.171)	(.226)	(.269)	(0.316)
Observations	21	21	21	21	21	21

Note. Standard errors in parentheses. Each model includes three lags of all independent variables and of the dependent variable.
†$p < .1$. *$p < .05$. **$p < .01$.

There are some common relationships across the two race categories we examine. High school graduation gaps are positively related to overall gaps and negatively (although not always significantly) related to enrollment selectivity gaps conditional on either 4-year enrollment or on enrollment in a selective college. Test score gaps are negatively related to overall enrollment selectivity gaps for both race gaps that we examine (although significantly only for Black–White gaps).

The most important difference that we see is that there is a positive relationship between parental education gaps and overall selectivity gaps for the Hispanic–White gaps, but this relationship is negative for Black–White gaps. For both race groups, this relationship is positive when we examine gaps conditional on enrollment in a selective school.

Although the SVAR models are a considerable improvement over the bivariate correlations we present in the main text of the paper, and it is reassuring that the SVAR results echo some of our bivariate conclusions, we hesitate to draw any strong conclusions from these models given the limitations we described above.

Acknowledgments

This work benefited greatly from the thoughtful feedback of the faculty and students at Stanford University's Center for Education Policy Analysis. Rachel Baker received support from the Stanford Predoctoral Training Program in Quantitative Education Policy Research, funded by the Institute of Education Sciences (IES Award R305B090016). The opinions expressed here do not represent those of the funding agencies. All errors are our responsibility.

Notes

1. For example, the National Educational Longitudinal Study data are anomalous because it followed a cohort of students that was among the smallest of any since the mid-'60s (National Center for Education Statistics [NCES], 2014). Given the relative rarity of universities deciding to shrink their enrollment, this small cohort faced less competition for existing seats at selective colleges, making it more likely that students with lower academic credentials could gain admission to these selective schools. As a result, we may see increases in representation of racial and ethnic minorities in this cohort at more-selective schools separate from any underlying change in access to educational opportunity or changes in university policies.

2. There is, of course, an important distinction between an institution's listed tuition and fees, and the average amount students actually pay to attend. Conditional on family income and after financial aid has been accounted for, many of the most selective 4-year schools actually have *lower* net tuition than other selective 4-year schools (Hoxby, 2009). However, many students are not aware that sticker price can differ significantly from net price, or they have difficulty finding net price information (Hoxby & Turner, 2015), so the positive correlation between selectivity and price generally holds.

3. To the extent the college from which one graduates is more important than the school(s) at which one took classes (an argument that signaling is more important than human capital development), and the extent to which students from different racial groups exhibit significantly different patterns of transfer, using first school of enrollment could produce biased results. If anything, we are likely understating potential graduation gaps as, conditional on attendance, White students are more likely to transfer from 2-year schools to 4-year schools than Black and Hispanic students (NCES, 2011, Table S1-B).

4. *Barron's* also assigns a ranking of 7, which indicates "specialty" schools, such as divinity schools or the military academies. Because these schools use different admissions criteria and draw from a specialized applicant pool, we exclude these schools from our analysis.

5. In the analyses we present in this paper, we use the 2008 *Barron's* rankings for all years. In reality, in the years of our analyses, *Barron's* selectivity increases for a small subset of institutions in our data, but the relative selectivity of schools is largely stable. We conducted sensitivity analyses using time-varying (2004, 1992, and 1982, as opposed to constant 2008) measures of selectivity and find no appreciable changes in results (these results are available upon request). We thus present only findings using 2008 *Barron's* rankings, consistent with the decisions of past researchers (e.g., Bastedo & Jaquette, 2011).

6. Figures presented with *V* statistics are available from the authors upon request.

7. Although it is possible to calculate confidence intervals for our measures, we chose not to present them for two reasons: (a) Our data is not a sample; it captures the full population of interest, so the interpretation of confidence intervals is not clear. (b) Our large number of observations generates confidence intervals that are quite small (and not visible when graphed). Indeed, if we were to consider our population as a sample, these minute standard errors mean that even the very small changes that we report are "statistically significant." Although not presented, confidence intervals are available from the authors upon request.

8. Examples of non-degree-granting schools are Central Mass School of Massage and Therapy, Rob Roy Academy, and Giumenta School of Real Estate.

References

Alon S., & Tienda, M. (2007). Diversity, opportunity, and the shifting meritocracy in higher education. *American Sociological Review*, *72*, 487–511.

Astin, A. W., & Oseguera, L. (2004). The declining "equity of American higher education. *Review of Higher Education*, *27*(3), 321–341.

Barron's Profile of American Colleges of 2008 (and 1982, 1992, and 2004). Barron's Educational Series. Hauppauge, NY.

Bastedo, M. N., & Jaquette, O. (2011). Running in place: Low-income students and the dynamics of higher education stratification. *Educational Evaluation and Policy Analysis*, *33*, 318–339.

Berkner, L., & Chavez, L. (1997). *Access to postsecondary education for the 1992 high school graduates*. Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.

Black, D., & Smith, J. (2004). How robust is the evidence on the effects of college quality? Evidence from matching. *Journal of Econometrics*, *121*, 99–124.

Bowen, W. G., & Bok, D. C. (1998). *The shape of the river: Long-term consequences of considering race in college and university admissions*. Princeton, NJ: Princeton University Press.

Bozick, R., & Lauff, E. (2007). *Education Longitudinal Study of 2002: A first look at the initial postsecondary experiences of the high school sophomore class of 2002* (NCES 2008-308). Washington, DC: U.S. Department of Education.

Carnevale, A. P., Strohl, J., & Melton, M. (2013). *What's it worth? The economic value of college majors*. Washington, DC: Georgetown University Center on Education and the Workforce.

Cellini, S. R. (2012). For-profit higher education: An assessment of costs and benefits. *National Tax Journal*, *65*(1), 153–180.

Cellini, S. R., & Chaudhary, L. (2014). The labor market returns to a for-profit college education. *Economics of Education Review*, *43*, 125–140.

Cellini, S. R., & Goldin, C. (2012). *Does federal student aid raise tuition? New evidence on for-profit colleges* (NBER Working Paper w17827). Cambridge, MA: National Bureau of Economic Research.

Cohodes, S., & Goodman, J. (2014). Merit aid, college quality, and college completion: Massachusetts' Adams Scholarship as an in-kind subsidy. *American Economic Journal: Applied Economics*, *6*(4), 251–285.

Dale, S., & Krueger, A. B. (2011). *Estimating the return to college selectivity over the career using administrative earnings data* (NBER Working Paper w17159). Cambridge, MA: National Bureau of Economic Research.

Dalton, B., Ingles, S.J., & Fritch, L. (2015). *High School Longitudinal Study of 2009 (HSLS:09) 2013 update and high school transcript study: A first look at fall 2009 ninth-graders in 2013*. Washington, DC: National Center for Education Statistics.

Darolia, R., Koedel, C., Martorell, P., Wilson, K., & Perez-Arce, F. (2015). Do employers prefer workers who attend for-profit colleges? Evidence from a field experiment. *Journal of Policy Analysis and Management*, *34*(4), 881–903.

Deming, D., Goldin, C., & Katz, L. (2013). For-profit colleges. *The Future of Children*, *23*(1), 137–163.

Dillon, E. W., & Smith, J. A. (2017). Determinants of the match between student ability and college quality. *Journal of Labor Economics, 35*(1), 45–66.

Dynarski, S. M. (2015). *An economist's perspective on student loans in the United States* (CESifo Working Paper Series No. 5579). Washington, DC: Brookings Institution.

Eide, E. R., Hilmer, M. J., & Showalter, M. H. (2016). Is it where you go or what you study? The relative influence of college selectivity and college major on earnings. *Contemporary Economic Policy*, *31*(1), 37–46.

Ellwood, D. T., & Kane, T. J. (2000). Who is getting a college education? Family background and the growing gaps in enrollment. In S. Danziger & J. Waldfogel (Eds.), *Securing the future: Investing in children from birth to college* (pp. 283–324). New York, NY: Russell Sage Foundation.

Engberg, M. E. (2012). Pervasive inequality in the stratification of four-year college destinations. *Equity & Excellence in Education*,*45*(4), 575–595.

Flood, S., King, M., Ruggles, S., & Warren, J. R. (2016). Integrated Public Use Microdata Series, Current Population Survey: Version 4.0 [Data set]. Minneapolis: University of Minnesota.

Fryer, R. G. (2011). Racial inequality in the 21st century: The declining significance of discrimination. *Handbook of Labor Economics*, *4*, 855–971.

Fuller, C. (2011). *The history and origins of survey items for the Integrated Postsecondary Education Data System*. Washington,

DC: U.S. Department of Education, National Postsecondary Education Cooperative.

Goodman, J., Hurwitz, M., & Smith, J. (2017). Access to 4-year public colleges and degree completion. *Journal of Labor Economics*, *35*(3), 829–867.

Granger, C. W. J., & Newbold, P. (1974). Spurious regressions in econometrics. *Journal of Econometrics*, *2*, 111–120.

Hearn, J. C. (1991). Academic and nonacademic influences on the college destinations of 1980 high school graduates. *Sociology of Education*, *64*, 158–171.

Ho, A., & Reardon, S. (2012). Estimating achievement gaps from test scores reported in ordinal "proficiency" categories. *Journal of Educational and Behavioral Statistics*, *37*(4), 489–517.

Hoekstra, M. (2009). The effect of attending the flagship state university on earnings: A discontinuity-based approach. *Review of Economics and Statistics*, *91*(4), 717–724.

Hossler, D., Schmit, J., & Vesper, N. (1999). *Going to college: How social, economic, and educational factors influence the decisions students make*. JHU Press.

Hoxby, C. (2004). *College choices: The economics of where to go, when to go, and how to pay for it*. Chicago, IL: University of Chicago Press.

Hoxby, C. (2009). The changing selectivity of American colleges. *Journal of Economic Perspectives*, *23*(4), 95–118.

Hoxby, C., & Avery, C. (2012). *The missing "one-offs": The hidden supply of high-achieving, low income students* (NBER Working Paper w18586). Cambridge, MA: National Bureau of Economic Research

Hoxby, C., & Turner, S. (2015). *What high achieving low income students know about college* (NBER Working Paper w20861). Cambridge, MA: National Bureau of Economic Research

Hurwitz, M., & Kumar, A. (2015). *Supply and demand in the higher education market: College admission and college choice*. Washington, DC: College Board.

Jencks, C., & Phillips, M. (1998). *The Black–White test score gap*. Washington, DC: Brookings Institution.

Kane, T. (1994). College entry by Blacks since 1970: The role of college costs, family background, and the returns to education. *Journal of Political Economy*, *102*(5), 878–911.

Kane, T. J. (2004). College-going and inequality. In K. Neckerman (Ed.), *Social inequality* (pp. 319–354). New York, NY: Russell Sage Foundation.

Karen, D. (2002). Changes in access to higher education in the United States: 1980–1992. *Sociology of Education*, *75*(3), 191–210.

Kelly, A. P. (2016). The supply side of college match: Where are the seats? In A. P. Kelly, J. S. Howell, & C. Sattin-Bajaj (Eds.), *Matching students to opportunity: Expanding college choice, access, and quality* (pp. 99–120). Cambridge, MA: Harvard Education Press.

Klasik, D., Proctor, K., & Baker, R. (2015). A research framework for U.S. higher education. In M. Stevens, & M. Kirst (Eds.), *Remaking college: The changing ecology of higher education* (pp. 261–272). Stanford, CA: Stanford University Press.

Kochhar, R., & Fry, R. (2014). *Wealth inequality has widened along racial, ethnic lines since end of Great Recession*. Washington, DC: Pew Research Center.

Kurlaender, M., Carrell, S., & Jackson, J. (2016). The promises and pitfalls of measuring community college quality. *Russell Sage Foundation Journal of the Social Sciences*, *2*(1), 174–190.

Labaree, D. F. (2017). *A perfect mess: The unlikely ascendancy of American higher education*. Chicago, IL: University of Chicago Press

Lang, K., & Weinstein, R. (2013). The wage effects of not-for-profit and for-profit certifications: Better data, somewhat different results. *Labour Economics*, *24*, 230–243.

Long, B. T., & Kurlaender, M. (2009). Do community colleges provide a viable pathway to a baccalaureate degree? *Educational Evaluation and Policy Analysis*, *31*, 30–53.

Long, D. A., Kelly, S., & Gamoran, A. (2012). Whither the virtuous cycle? Past and future trends in black-white inequality in educational attainment. *Social Science Research*, *41*(1), 16–32.

Long, M. C. (2008). College quality and early adult outcomes. *Economics of Education Review*, *27*(5), 588–602.

Lucas, S. R. (2001). Effectively maintained inequality: Education transitions, track mobility, and social background effects. *American Journal of Sociology*,*6*(6), 1642–1690.

Lynch, M., Engle, J., & Cruz, J. L. (2010). *Subprime opportunity: The unfulfilled promise of for-profit colleges and universities*. Washington, DC: Education Trust.

McDonough, P. M. (1997). *Choosing colleges: How social class and schools structure opportunity*. Albany: State University of New York Press.

MacLeod, W. B., Riehl, E., Saavedra, J. E., & Urquiola, M. (2015). *The big sort: College reputation and labor market outcomes* (NBER Working Paper w21230). Cambridge, MA: National Bureau of Economic Research.

Melguizo, T. (2006). Quality matters: Assessing the impact of attending more selective institutions on college completion rates of minorities. *Research in Higher Education*, *49*, 214–236.

Murnane, R. J. (2015). U.S. high school graduation rates: Patterns and explanations. *Journal of Economic Literature*, *51*(2), 370–422.

National Center for Education Statistics. (2011). *Community college student outcomes* (NCES 2012-253). Washington, DC: U.S. Department of Education.

National Center for Education Statistics. (2014). *Table 201.20: Enrollment in Grades 9 through 12 in public and private schools compared with population 14 to 17 years of age: Selected years, 1989–90 through fall 2014*. Washington, DC: U.S. Department of Education.

National Student Clearinghouse Research Center. (2015). *Current term enrollment estimates fall 2015*. Herndon, VA: Author.

Ovink, S. M., & Kalogrides, D. (2015). No place like home? Familism and Latino/a–White differences in college pathways. *Social Science Research*, *52*, 219–235.

Patten, E. (2016). *Racial, gender wage gaps persist in U.S. despite some progress*. Washington, DC: Pew Research Center. Retrieved from http://www.pewresearch.org/fact-tank/2016/07/01/racial-gender-wage-gaps-persist-in-u-s-despite-some-progress/

Perna, L. W. (2000). Differences in the decision to attend college among African Americans, Hispanics, and Whites. *Journal of Higher Education*, *71*, 117–141.

Perna, L. W. (2006). Studying college choice: A proposed conceptual model. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. 21, pp. 99–157). New York, NY: Springer.

Perna, L. W., & Titus, M. A. (2005). The relationship between parental involvement as social capital and college enrollment: An examination of racial/ethnic group differences. *Journal of Higher Education*, *76*, 485–518.

Posselt, J. R., Jaquette, O., Bielby, R., & Bastedo, M. N. (2012). Access without equity longitudinal analyses of institutional stratification by race and ethnicity, 1972–2004. *American Educational Research Journal*, *49*(6), 1074–1111.

Reardon, S. F., Baker, R., & Klasik, D. (2012). *Race, income, and enrollment patterns in highly selective colleges, 1982–2004*. Stanford, CA: Center for Education Policy Analysis, Stanford University.

Reardon, S. F., & Ho, A. D. (2015). Practical issues in estimating achievement gaps from coarsened data. *Journal of Educational and Behavioral Statistics*, *40*(2), 158–189.

Reardon, S. F., Kalogrides, D., & Shores, K. (2016). *The geography of racial/ethnic test score gaps* (CEPA Working Paper 16-10). Stanford, CA: Center for Education Policy Analysis, Stanford University.

Reardon, S. F., Kasman, M., Klasik, D., & Baker, R. (2016). Agent-based simulation models of the college sorting process. *Journal of Artificial Societies and Social Simulation*, *19*(1), 8.

Reardon, S. F., Robinson-Cimpian, J., & Weathers, E. (2015). Patterns and trends in racial/ethnic and socioeconomic academic achievement gaps. In H. Ladd & M. Goertz (Eds.), *Handbook of research in education finance and policy* (pp. 497–516). New York, NY: Routledge.

Reardon, S. F., Townsend, J., & Fox, L. (2017). A continuous measure of the joint distribution of race and income among neighborhoods. *RSF: The Russell Sage Foundation Journal of the Social Sciences*, *3*(2), 34–62.

Roderick, M., Nagaoka, J., Coca, V., & Moeller, E. (2008). *From high school to the future: Potholes on the road to success*. Chicago, IL: Consortium on Chicago School Research.

Ruggles, S., Genadek, K., Goeken, R., Grover, J., & Sobek, M. (2016). Integrated Public Use Microdata Series: Version 6.0 [data set]. Minneapolis: University of Minnesota

Scott-Clayton, J. (2016). *Early labor market and debt outcomes for bachelor's degree recipients: Heterogeneity by institution type and major, and trends over time* (CAPSEE Working Paper). New York, NY: Center for Analysis of Postsecondary Education and Employment.

Sims, C. A. (1980). Macroeconomics and reality. *Econometrica*, *48*(1), 1–48.

Smith, J., Pender, M., & Howell, J. (2013). The full extent of student-college academic undermatch. *Economics of Education Review*, *32*, 247–261.

Smith, J., & Stange, K. (2015). *A new measure of college quality to study the effects of college sector and peers on degree attainment* (NBER Working Paper w21605). Cambridge, MA: National Bureau of Economic Research.

Soland, J. (in press). Are achievement gap estimates biased by differential student test effort? Putting an important policy metric to the test. *Teachers College Record*.

Stock, J. H., & Watson, M. W. (2001). Vector autoregressions. *Journal of Economic Perspectives*, *15*(4), 101–115.

Tierney, W. G., & Hentschke, G. C. (2007). *New players, different game: Understanding the rise of for-profit colleges and universities*. Baltimore, MD: Johns Hopkins University Press.

Torche, F. (2011). Is a college degree still the great equalizer? Intergenerational mobility across levels of schooling in the United States. *American Journal of Sociology*,*117*(3), 763–807.

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