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Racial Diversity and Measuring Merit: Evidence from Boston's Exam School Admissions

[Running head: Racial Diversity and Measuring Merit]

Melanie Rucinski (corresponding author)
Harvard Kennedy School
79 JFK St. Cambridge, MA 02138
mrucinski@g.harvard.edu

Joshua Goodman
Boston University
2 Silber Way Boston, MA 02215
edecjosh@bu.edu

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Abstract
The impact of admissions process design on the racial diversity of schools and colleges has sparked heated debates. We study the pipeline into Boston's three public exam schools to understand racial gaps in enrollment. Admission to these schools has historically been based on a combination of GPA and a score on an optional test from a private developer. We document racial gaps in test-taking rates, test scores, GPAs, preferences for the most selective school, and ultimate admission rates to all three schools. These gaps persist even among students with similarly high baseline achievement as measured by the state's mandatory standardized test. Substantial numbers of high-achieving Black and Hispanic students do not apply to the exam schools and to the most selective school in particular. The choice of standardized test used to measure academic merit strongly affects who is admitted.

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

<A> Introduction

Recent events have sparked multiple heated debates about the design of admissions processes and racial diversity at elite institutions at both the secondary and postsecondary levels. Perhaps most prominently, Harvard University was sued by plaintiffs arguing that its admissions process led to discrimination against Asian-American applicants. In 2018, Mayor Bill de Blasio proposed to improve diversity at elite high schools in New York City by moving away from an admissions system based on a single test score, but the change was ultimately too widely criticized to pass in the state legislature. In these and other cases, the design of admissions processes appears intimately connected to the ultimate diversity of a given school or college's population.

We study the admissions process and its relationship to racial diversity in Boston's exam schools, three schools within the Boston Public Schools (BPS) that serve students in grades 7-12. Such schools exist in 30 states, with one percent of U.S. high schoolers, or 130,000 students, attending public schools that use test scores to at least partly determine admission (Finn and Hockett 2012). In descending order of selectivity, the Boston Latin School (BLS), Boston Latin Academy (BLA), and O'Bryant School of Math and Science (O'Bryant) together enroll 25 percent of BPS students in the eligible grades. During our study period, admission to the schools required that students take the Independent School Entrance Exam (ISEE) in the fall of 6th grade and later rank the three schools in order of their preferences. Admission to the schools was based on an equally weighted average of a student's ISEE score and GPA.

Boston's exam schools have recently been the subject of public scrutiny driven by their relative lack of racial diversity and claims that the school climate, particularly at BLS, is not supportive of Black students. Nearly 75 percent of BPS students are Black or Hispanic, but Black and Hispanic students comprise under 40 percent of overall exam school enrollment and only 20 percent of enrollment at BLS. Boston is not unusual in this regard; exam schools throughout the U.S. often have large racial and socioeconomic gaps in enrollment. In New York City, for example, Black and Hispanic students account for only 10 percent of exam school enrollment despite comprising 70 percent of overall public school enrollment.

Education Finance and Policy Just Accepted MS.
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In this paper, we track students through the exam school admissions pipeline to determine which aspects of the admissions process contribute most to racial gaps in exam school enrollment. We do so using longitudinal data on all BPS students across multiple cohorts. For these students, we observe whether they choose to take the ISEE and thus start the application process. For those who do take the ISEE, we observe the information contained in their exam school application, including ISEE scores, GPA, and ranking of the three schools. We observe students' admissions status and their ultimate enrollment choice. For students enrolled in BPS prior to taking the ISEE, we observe 5th-grade scores on the Massachusetts Comprehensive Assessment System (MCAS), the state's mandatory standardized test.

We find large racial gaps at each stage of the admissions process: ISEE-taking, ISEE scores, GPA, and exam school admission at all three schools. Black and Hispanic students are also substantially less likely than their White and Asian counterparts to rank BLS as their first choice for admission. Underlying gaps in MCAS scores do not fully explain gaps in diversity at the exam schools: the gaps we observe in the full sample persist when we restrict our analysis to the top 25 percent of the state test score distribution and compare students with identical 5th-grade MCAS scores. They shrink, but remain large and significant, when we compare students within schools. The only stages of the pipeline at which we do not see large racial gaps are at the end: Black and Hispanic students are as likely as White students to attend an exam school conditional on receiving an offer, and are as likely as White students to remain enrolled at the exam schools through 12th grade if they start at one of the schools in 7th grade.

Given our findings, we simulate admissions to the exam schools under several different potential changes to the admissions process. In general, closing racial gaps at individual stages of the admissions pipeline (ISEE-taking, ISEE scores, GPA, and preferences) in isolation does little to impact the diversity of students admitted to the schools in our simulations. Implementing a system in which students are invited to the exam schools based on their state test scores, however, has the potential to increase Black and Hispanic representation among students admitted to the exam schools overall from 38 to 42 percent, and those admitted to BLS from 21 to 31 percent. This result makes sense given that using MCAS scores rather than the current admissions system simultaneously addresses (though does not eliminate) gaps in

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

test-taking, test preparation, GPA, and preferences. We also find that extending admissions offers to the top students at each elementary school in the district, analogously to the Top 10% rule used in Texas college admissions, could increase Black and Hispanic representation to 49 percent of students admitted to all three schools and 38 percent of those admitted to BLS.

These results contribute to three related strands of the research literature. First and most broadly, we add to a growing body of evidence showing that the choice of test and administration details can affect applications and admissions to exclusive educational settings. Most work in this area focuses on higher education. Requiring students to take the SAT or ACT in high school increases college enrollment and diverts students from less selective to more selective institutions, which is likely to benefit them in the long run (Hurwitz et al. 2015; Klasik 2013; Goodman 2016). Students' SAT-taking and subsequent college enrollment are sensitive to the proximity of testing locations and to logistical barriers such as registration (Bulman 2015). In Virginia, many students with high PSAT scores fail to take the SAT in part due to gaps in access to the SAT (Cook and Turner 2019). Small procedural changes can have large effects on students. When the ACT changed its number of free score reports from three to four, low-income test-takers increased their applications and ultimately enrolled at more selective colleges (Pallais 2015). Goodman, Gurantz, and Smith (2020) find that retaking the SAT increases four-year college enrollment rates among low-income students and students of color, suggesting yet another way in which current admissions systems may fail to identify high-achieving students. Perhaps most relevant to our later simulations, Riehl (2019) shows that in Colombia, changing the content of college admissions exams dramatically affected how students were matched to institutions.

Second, we provide an example of a secondary school admissions process in which various frictions may exacerbate inequality in student outcomes. Again, such examples have come more frequently from college admissions. Hoxby and Avery (2013) find that high-achieving, low-income students are less likely to apply to selective colleges than students with similar levels of achievement, but higher socioeconomic status. The application gap is smaller for low-income students who go to school with more high-achieving peers or have mentors who attended selective schools. Recent work by

Education Finance and Policy Just Accepted MS.
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Dynarski et al. (2020) shows that providing students with simplified information about the availability of financial aid can increase students' application to and attendance at selective universities, suggesting that information barriers play a role in high-achieving disadvantaged students' education decisions. Altmejd et al. (forthcoming) and Barrios Fernández (2019) suggest that subtle information from family members and neighbors about educational options can affect college choices.

Third and finally, a smaller body of work has studied admissions mechanisms specifically in the setting of selective public high schools. Chicago's exam schools use a neighborhood-based, race-blind system with admissions tiers based on school poverty rates, a mechanism that increases diversity relative to ignoring school poverty as a factor but also lowers the achievement of students at the exam schools relative to explicitly race-based admissions (Ellison and Pathak 2016). Replacing New York City's exam schools' specialized entrance exam with state test scores or grades could increase representation of female, Hispanic, and White, though not Black, students at the schools (Corcoran and Baker-Smith 2018). Like Corcoran and Baker-Smith (2018), we find that the diversity of admitted students is maximized under a system that admits a certain percentage of students from each feeder school. Our simulations, however, find larger diversity impacts than Corcoran and Baker-Smith (2018) of replacing the current admissions system with admissions based on students' state test scores. In contrast to New York City, Boston's exam schools begin in a younger grade—7th rather than 9th—and serve 25 percent of students in eligible grades, compared to the only 2.5 percent of eligible students who attend exam schools in NYC. The greater availability of seats in Boston and the fact that achievement gaps tend to grow as students get older likely explain why basing admissions on state test scores could potentially increase diversity more in Boston than in New York.

Our work does not evaluate the impact of attending exam schools on student outcomes. To date, little evidence exists on the average treatment effect of attending an exam school. Prior regression discontinuity-based studies in Boston, New York, and Chicago suggest negligible effects of exam school attendance for students on the margin of admission (Abdulkadiroğlu, Angrist, and Pathak 2014; Dobbie

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

and Fryer 2014; Barrow, Sartain, and de la Torre 2020; Abdulkadiroğlu et al. 2017). One explanation for null findings in the RD context is that marginally rejected students may instead attend private schools or high-performing charter schools. In Boston, of high-scoring White exam school applicants who do not ultimately enroll at the schools, about 50 percent leave the district for a private or charter school. In contrast, about 30 percent of high-scoring Black and Hispanic applicants who do not attend an exam school leave the district.[1] If Black and Hispanic students have fewer outside options available to them, access to the exam schools may be more valuable. Rokkanen (2015) and Jackson et al. (2020) provide some support for this theory, finding that exam schools and high-quality schools more generally may have larger positive effects for more disadvantaged students.

Our findings matter even absent significant achievement effects of exam schools. First, as described above, that identification of merit is sensitive to the measure of merit being used is intimately tied to the way that various admissions systems have systematically excluded Black and Hispanic students from selective educational spaces, with implications that extend beyond test scores. Secondly, design of these admissions systems has substantial impacts on racial segregation across schools. Prior evidence suggests school integration benefits the educational outcomes of Black students and has positive or neutral impacts on White students (Guryan 2004; Reber 2010; Billings, Deming, and Rockoff 2014; Johnson 2015). Racial and socioeconomic integration can also reduce discriminatory attitudes and behaviors among members of more privileged groups (Van Laar et al. 2005; Boisjoly et al. 2006; Carrell, Hoekstra, and West 2019; Corno, La Ferrara, and Burns 2019; Rao 2019), a potential long-term benefit independent of short-term achievement effects.

In 2019, Boston Public Schools began changing details of the admissions test administration, in part in recognition of the challenges we document here. The ISEE had previously been administered each fall on a Saturday at a small number of locations. To lower one set of potential barriers to participation, in the fall of 2019, BPS began administering the ISEE on a weekday at every district school serving 6th-

[1]See Table A.1, available in a separate online appendix that can be accessed on *Education Finance and Policy*'s web site at www.mitpressjournals.org/efp.

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

graders. The test was also offered at a limited number of locations on a Saturday as before. An even more substantial change was announced in July 2020, when BPS revealed that it was replacing the ISEE with the Measures of Academic Progress (MAP) test administered by the Northwest Evaluation Association (NWEA). The district selected the new test in part based on the claim that the MAP is better aligned to Massachusetts state standards than the ISEE. In October 2020, the Boston School Committee voted to suspend the admissions test entirely for exam school admissions for the 2021-22 school year and instead admit students based on their GPA and ZIP code. We discuss in our conclusion how our simulations help predict the likely effect of these changes specifically, as well as how our results may speak more generally to similar reforms in other districts prompted by COVID-19.

<B> Context, Data, and Methods

<B>1. Context

Through the fall of 2019, priority in Boston exam school admissions was determined by an equally-weighted combination of students' 5th- and 6th-grade GPAs and their scores on the Independent School Entrance Exam (ISEE), a private test developed by the Educational Records Bureau and widely used for private and selective public school admissions. During the period covered by our study, the ISEE was administered at seven schools in Boston on a Saturday in early November. Any 6th-graders interested in applying to the exam schools took the test free of charge. As well as taking the ISEE, students had to submit a form ranking the three exam schools by February 1st of their 6th-grade year. BPS uses a neighborhood-based school choice system, and students rank the exam schools in combination with other public schools available to them, rather than through a separate process. Students are not required to rank all three exam schools. Students' schools report students' year-end 5th-grade and first semester 6th-grade GPAs in math and English, each measured on a 12-point scale. The district constructs a composite GPA for use in admissions.

If students choose to take the ISEE, they must prepare for the test. The material on the test is not particularly aligned to Massachusetts state standards, and therefore covers some material not likely to be included in BPS's fifth-grade curriculum. Students may not be aware of this misalignment. Although

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

some sample questions are made available online, learning the test material requires access to preparation books or private instruction that is likely to be differentially available to students of different races, especially to the extent that race and income are correlated among BPS students.

As well as registering and preparing for the test, students must be able to take the exam. Doing so requires not only knowledge of the test date, locations, and time, but also the means to get to one of the testing sites on the morning of the exam. Students whose parents work on weekends or who live in areas that are poorly serviced by public transit may face particular difficulties at this stage, another set of costs that may affect Black and Hispanic students more than White students.

To construct a student's overall admissions score, the district standardizes their ISEE scores within the four subsections of the test: verbal reasoning, quantitative reasoning, reading comprehension, and mathematics achievement. The final score is an equally-weighted average of a student's GPA and their overall ISEE performance, with each ISEE subtest score receiving equal weight. Admissions are run using serial dictatorship, as students are ranked and assigned to schools in order of their admissions scores and their preferences until all slots are filled. Students with higher scores who ranked a school second or third receive admissions preference over students who ranked the school first, but had lower scores. There is no waitlist for the exam schools. Instead, the district over-admits students to each school, anticipating (correctly) that some will not attend.

Beginning in the 1970s, the exam schools incorporated racial quotas into admissions that guaranteed that a minimum of 35 percent of students at each school would be Black or Hispanic. In the 1990s, a series of two lawsuits brought against the district resulted in race being entirely omitted from admissions. Following the lawsuits, the percentage of Black and Hispanic students enrolled at the exam schools fell steadily for several years, and has never recovered.[2]

<B>2. Data

We use data provided by the Boston Public Schools spanning the BPS 5th-grade classes of 2006-

[2] For more on this history, see https://www.wbur.org/edify/2020/03/05/boston-exam-school-admissions-history.

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

07 to 2012-13. Our data consist of a demographics and test score file containing only students in BPS and an ISEE file with data on all students who took the exam, including those in private and charter schools.

The demographics file contains data on race (identifying students as Black, White, Asian, Hispanic, Native American, Mixed, or Other) and gender (male or female), as well as whether a student received a limited English proficiency (LEP) classification or received free or reduced-price lunch (FRL) in a given year. We also observe the school students attend each year, their residential ZIP code, and their scaled scores on the state test, the Massachusetts Comprehensive Assessment System (MCAS), in math and reading. For many years, Boston has offered free lunch to all students; in the data, over 95 percent of students enrolled in BPS in 5th grade are indicated as free lunch recipients. To approximate student income, we therefore instead use a ZIP code-based measure indicating whether a student lives in a ZIP code with an average income in the bottom 50 percent of the sample. When used throughout the paper, "low income" refers to this measure.

The ISEE data includes students who took the ISEE as 6th-graders from fall 2007-2013 (students who were enrolled in 6th-grade from 2007-08 through 2013-14). We observe the gender and race of each student who took the ISEE, their scores on each subsection of the exam, their 5th- and 6th-grade GPA in math and reading, and their composite GPA calculated by BPS for use in exam school admissions. We also observe each student's preference ranking of the three exam schools, as well as their overall admissions rank to each exam school and which exam school (if any) they are ultimately invited to attend. About half of students who take the ISEE receive an invitation to one of the exam schools. Students receive an admissions offer from at most one school.

<B>3. Methods

We present both graphical and regression-based evidence on six stages in the exam school pipeline: (1) ISEE-taking, (2) ISEE scores, (3) GPA, (4) exam school preferences expressed by students, (5) exam school invitations, and (6) ultimate enrollment. To visualize the racial gaps at each of these six stages, we plot each outcome against students' 5th-grade MCAS percentile, the only measure of academic achievement universally available among public school students. Percentiles are constructed within test

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

years using a composite score generated by averaging students' math and reading MCAS scores. We use students' 5th-grade scores because they are the last baseline achievement measure available prior to when students take the ISEE. 5th-grade scores are also policy relevant, in that any admissions policy using MCAS would have to rely on them as the most recent scores available given the admissions timeline in spring of 6th grade. For visual simplicity, we plot Black and Hispanic students' average outcomes against White and Asian students' average outcomes. Our regressions show each of these groups separately.

For our regression analyses, we first estimate raw differences by race in the various outcomes described above, using all BPS students with non-missing 5th-grade MCAS scores and including fixed effects for the year students took the ISEE. Our first and simplest specification is therefore:

$$Y_i = \alpha_t + \beta_1 Black_i + \beta_2 Hispanic_i + \beta_3 Asian_i + \beta_4 Other_i + \varepsilon_i \quad (1)$$

where Y_i is the outcome of interest for student i. The independent variables are a set of mutually exclusive and exhaustive indicators for whether a given student is Black, Hispanic, Asian, or "Other", which includes multiracial and Native American students.[3] In all of our regressions, White students are the comparison group. The coefficients β can thus be interpreted as raw differences in outcomes between White students and the group indicated.

Because so many exam school students, and BLS students in particular, are drawn from the high end of the BPS achievement distribution, we focus our remaining regression analyses on the subset of students whose 5th-grade MCAS scores place them in the top 25 percent of BPS. Since the exam schools enroll about 25 percent of BPS students in the eligible grades, we consider this to be the sample of most interest to policymakers.[4] Our second specification is therefore identical to equation 1 but is limited to those high-achieving students. Coefficients in that specification can be interpreted as raw racial differences in outcomes among students with top MCAS scores.

[3] We do not report the coefficient on "Other" in our regression tables as students in this group comprise less than two percent of the analysis sample.
[4] About 3.5 percent of students with 5th-grade MCAS scores outside the top quartile are invited to the exam schools, compared to about 59 percent of students in the top quartile.

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

Our third specification accounts for racial differences in test scores even among the top 25 percent of students by controlling directly for 5th-grade MCAS scores. It takes the form:

$$Y_i = \alpha_t + \beta_1 Black_i + \beta_2 Hispanic_i + \beta_3 Asian_i + \beta_4 Other_i + \beta_5 MCAS5_i + \varepsilon_i \quad (2)$$

where the $MCAS5$ variable is constructed by standardizing the composite math and reading score within years. Here, coefficients can be interpreted as racial differences in outcomes between high-achieving students with similar MCAS scores.

Our fourth and final regression specification explores the extent to which differences across primary schools may explain some of the observed racial differences in exam school admissions. Schools may, for example, differ in their rates of encouraging students to take the ISEE and apply to exam schools. If school-level differences are correlated with school racial composition, school-level factors may explain some of these overall observed racial differences. Our fourth specification therefore adds a fixed effect for the school a student attended in 5th grade:

$$Y_i = \alpha_t + \delta_s + \beta_1 Black_i + \beta_2 Hispanic_i + \beta_3 Asian_i + \beta_4 Other_i + \beta_5 MCAS5_i + \varepsilon_i \quad (3)$$

The school fixed effect allows us to measure racial gaps that persist when we restrict our comparison to students within the same schools. Coefficients can thus be interpreted as racial differences in outcomes between high-achieving students with similar MCAS scores who attended the same primary school.

Appendix Table A.4 shows the results of equations 2 and 3 with added controls for students' LEP status and an indicator for whether they live in a low-income ZIP code, as defined above. In general, results of equation 3 are similar with or without controls. Including the controls in equation 2 makes the results look more similar to those of 3, presumably because low income status is measured at the ZIP code rather than the student level and may thus be correlated with school fixed effects. For this reason, our preferred specification does not include any controls beyond MCAS scores and cohort fixed effects.

<C> Results

<C>1. Summary Statistics

Though Black and Hispanic students comprise nearly 80 percent of BPS 5th-graders, they are less

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

than half as likely as their White counterparts to take the ISEE and less than one-fourth as likely to be invited to and enroll at one of the exam schools in 7th grade. Table 1 shows summary statistics on various stages of the exam school pipeline for the universe of BPS 5th-graders. Over 60 percent of White students and nearly 80 percent of Asian students take the ISEE, compared to 26-27 percent of Black and Hispanic students. Ultimately, 41 percent of White students and 53 percent of Asian students are invited to at least one exam school, compared to fewer than 10 percent of Black and Hispanic students. Across all subgroups of students, the matriculation rates among invited students are similar and exceed 80 percent, so that racial gaps in exam school enrollment rates are similar to those in invitation rates.

The large racial gaps in exam school enrollment are driven in part by large racial gaps in baseline academic achievement. As panel A of Table 2 shows, Black and Hispanic BPS 5th-graders score on average in the 43rd-45th percentile of the BPS score distribution on the state's MCAS exam. Their White and Asian counterparts score 20-30 percentiles higher. As panel B shows, this MCAS score gap is somewhat smaller among the subset of students who choose to take the ISEE. That panel also reveals that, among ISEE-takers, there are substantial racial gaps in both GPA (as of 5th and 6th grade) and scores on the ISEE itself. As panel C shows, the same gaps appear in the large pool of ISEE-takers from outside of BPS. These students are Boston residents who are enrolled in private or charter schools as of 6th grade.

Though there are large racial gaps in academic achievement, the majority of high-scoring BPS students are Black or Hispanic. As the last column of Table 2 shows, in the time period covered by our data, 3,100 Black and Hispanic BPS students had 5th-grade MCAS scores in the top quartile of the BPS distribution, compared to under 2,600 White and Asian students. Comparing these overall counts to the pool of ISEE-takers shows that nearly 1,000 top-quartile Black and Hispanic students never took the ISEE. Only about 300 White and Asian students in the top quartile did not take the ISEE. These raw numbers suggest substantial numbers of talented Black and Hispanic students never enter the exam school pipeline. We turn now to both figures and regression analyses to measure these gaps more precisely.

<C>2. Regression Analyses

Compared to their White counterparts, Black and Hispanic BPS students are much less likely to

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

take the ISEE, a gap only partly explained by differences in baseline academic achievement. As panel A, column 1 of Table 3 shows, Black and Hispanic students are 34 percentage points less likely than White students to take the ISEE, and Panel A of Figure 1 shows that these gaps persist even when comparing students with similar 5th grade MCAS scores. Columns 2 and 3 of Table 3 confirm this, showing that even among those with similar top-quartile MCAS scores, Black and Hispanic students are roughly 20 percentage points less likely than White students to take the ISEE. Baseline achievement differences therefore explain less than half of the racial gap in ISEE-taking. School-level factors explain roughly a third of the gap: column 4 shows that Black and Hispanic students are about 10 percentage points less likely to take the ISEE than their similarly high-achieving White peers from the same elementary school. Asian students are 18 percentage points more likely than White students to take the ISEE. That gap shrinks to six percentage points when comparing students of similar baseline achievement.

Black and Hispanic students score substantially lower on the ISEE than their White counterparts, even at the top of the MCAS distribution as shown in Panel B of Figure 1. Panel B, column 1 of Table 3 shows that Black and Hispanic students score 20 or more percentiles lower on the ISEE than White students. Even among those with similar top-quartile MCAS scores, shown in columns 2 and 3 of Table 3, Black and Hispanic students score more than 10 percentiles lower on the ISEE than their White peers. An 8-9 percentile score gap remains when comparing high-achieving students from the same primary schools. In contrast, Asian ISEE-takers score three percentiles lower than their White counterparts, even when comparing students of similar baseline achievement, and do not have significantly different scores from White students in their same elementary schools.

These results suggest that Black and Hispanic students' achievement or rank in the admissions process is deeply affected by which exam is used to measure it. This discrepancy may be driven by the fact that the topics assessed on the ISEE are substantially different from those assessed on the MCAS and therefore by BPS more generally.[5] Black and Hispanic students may attend schools or classrooms that, on

[5] For example, while the ISEE requires that students be able to "calculate mean, mode, median, range, and first and third quartiles of a set of data" and "calculate probabilities", these concepts do not appear in Massachusetts state

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

average, are less likely to cover ISEE-specific topics. There is also significant anecdotal evidence that many students receive out-of-school tutoring to help prepare for the ISEE. Black and Hispanic students may be less likely to receive additional exam preparation than White and Asian students, particularly given the financial costs associated with these services: Black and Hispanic students are about twice as likely as their White and Asian peers to live in low-income ZIP codes.

Black and Hispanic students have lower 5th and 6th grade GPAs than their White counterparts, a gap that is remarkably stable throughout the MCAS score distribution, as shown in Figure 2. On average, Black and Hispanic students' GPAs are over one point lower (on a 12-point scale) than White students' GPAs (Table 4, column 1). As shown in columns 2-4 of Table 4, this gap shrinks to 0.7 points when comparing students with similar top quartile MCAS scores, and to 0.5 points when comparing students within the same schools. These residual differences in GPA are hard to interpret. They may partly reflect real differences in academic performance, differential grading standards across schools or classrooms, differences in parental advocacy for students' grades, or implicit or explicit bias on the part of teachers.

Another striking disparity in the exam school pipeline is that Black and Hispanic ISEE-takers are much less likely to rank the most selective Boston Latin School as their first choice. As Table 5 shows, relative to their White counterparts, Black and Hispanic students are respectively 18 and 13 percentage points less likely to list BLS as their first choice. They are respectively 6 and 4 percentage points more likely to rank BLA first instead, and 10 and 8 percentage points more likely to rank O'Bryant as their first choice. Figure 3 and columns 2 and 3 of Table 5 show that these gaps remain substantial when comparing students with similar baseline achievement. The Black-White gap in preferences, however, shrinks substantially when comparing students within the same schools, suggesting that between-school differences are important determinants of Black students' preferences for BLS. The racial gaps in preferences for BLS may arise, among other reasons, from differences in perceived likelihood of

standards in math until 6th grade; thus many students in BPS may not be comfortable with these topics in November of their 6th-grade year.

Education Finance and Policy Just Accepted MS.
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admission to BLS[6] or in response to reports that the environment at BLS is hostile to Black and Hispanic students.[7,8]

The cumulative effect of racial gaps at each stage of the pipeline (ISEE-taking, ISEE scores, GPA, preference for BLS) is that Black and Hispanic students are much less likely than White and Asian students to be invited to any exam school and to BLS in particular. The gap in exam school invitation rates is almost entirely unexplained by differences in baseline academic achievement, as illustrated in Figure 4. Column 1 of Table 6 shows that Black and Hispanic students are about 32 percentage points less likely to receive an exam school invitation than White students, and 21 percentage points less likely to be invited to BLS. In column 3, we see that about 75 percent of the gap in overall exam school invitations persists when we compare students with similar MCAS scores in the top quartile of the MCAS distribution. The racial gap in BLS invitations is about 20 percent larger among high-achieving students, controlling for MCAS scores. Among students who attend the same schools in 5th grade, Black and Hispanic students are respectively 7 and 9 percentage points less likely than White students to receive an invitation to any exam school, and 17 and 19 percentage points less likely to be invited to BLS. Gaps between Asian and White students are smaller in magnitude and often positive.

Finally, because there are few racial differences in rates of acceptance of exam school invitations, Black and Hispanic students are much less likely than their White counterparts of the same academic ability to enroll at the exam schools. As seen in Figure 4 and Table 7, Black and Hispanic students are over 20 percentage points less likely to enroll at any exam school and at BLS in particular than their

[6] Under a serial dictatorship assignment mechanism, it is optimal for students to report their preferences truthfully even if they believe they have a low chance of admission to their first choice. Several studies, however, document suboptimal reporting in similar mechanisms by applicants ranging from college students to medical residency applicants (Hassidim, Romm, and Shorrer 2016; Rees-Jones 2018; Rees-Jones and Skowronek 2018; Shorrer and Sóvágó 2018). Thus, students may adjust their preference reporting according to beliefs about admissions likelihood even when it is not optimal to do so.
[7] For example, https://www.nytimes.com/2016/01/31/education/students-say-racial-hostilities-simmered-at-historic-boston-latin-school.html.
[8] In Tables A.2 and A.3, we also explore whether proximity to the exam schools may play a role in racial gaps in application behavior and preferences. In general, the results do not tell a clear story. We expect this arises due to (1) lack of precision in our distance measure, which is based at the ZIP-code level, and (2) Boston's famously extensive busing system, which may make distance less of a deterrent in this context.

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

similarly high-achieving White peers. Nearly all of the racial gap in BLS enrollment remains when comparing students from the same primary schools. Black and Hispanic students who do enroll at the exam schools in 7th grade are more likely than their White peers to remain enrolled through 12th grade, implying that the racial gaps in enrollment observed in later grades are also driven by barriers early in the pipeline, and not by racial gaps in retention (Figure A.1).

<D> Policy Simulations

In light of our findings, we simulate seven alternative scenarios that represent potential policy changes to increase racial diversity in the exam school pipeline. In this section, we describe the implementation and results of each simulation.

Increase ISEE-taking. In this scenario, we ask how many additional Black and Hispanic students might receive exam school invitations if they were as likely as White students to take the ISEE at each MCAS percentile. To do this, we first calculate how many additional Black or Hispanic students would have to take the ISEE to equalize their taking rates with White students at each percentile of the MCAS distribution. We then multiply this number of students by the probability of getting invited to an exam school for Black and Hispanic students at that MCAS percentile who did take the ISEE, implicitly accounting for racial gaps in GPA and preferences. We perform a similar analysis of universal ISEE-taking by assigning admissions probabilities based on race and MCAS scores to all students in BPS. In both scenarios, we assign non-BPS students their true admissions status. We then start at the top of the MCAS distribution and count all actual admitted students at each percentile, as well as the new admitted students generated by the simulation, as admitted. We repeat this process until the total simulated admitted student count from BPS and non-BPS is equivalent to the true number of admitted students.

Increase ISEE scores. Analogously to above, at each MCAS percentile and GPA combination we multiply the differences in invitation rates between White and Black and Hispanic students by the total number of Black and Hispanic students who took the ISEE to estimate the number of additional students who would receive an invitation if Black and Hispanic students were invited to the exam schools at the same rate as White students in the same MCAS percentile with the same GPA (i.e., if students' ISEE

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

scores did not differ by race conditional on MCAS percentile and GPA). To simulate admission to BLS specifically, we calculate the likelihood of getting invited to BLS for White students who ranked BLS as their first choice and apply this probability to Black and Hispanic students who ranked BLS first. The probability of admission to BLS for students who ranked it second or third is zero in the data.

Change student preferences. Although Black and Hispanic students are underrepresented across all three exam schools, the racial gaps in exam school enrollment are most pronounced at BLS. As discussed above, Black and Hispanic students are significantly less likely than White students to rank BLS as their top choice, which might explain their particularly low enrollment share at BLS relative to BLA and O'Bryant. In this simulation, we use ISEE-takers' ISEE scores and GPA to calculate their admissions rank as it is calculated for regular admissions, but assign students to schools solely based on their admissions rank, rather than using student preferences to inform school assignment.

Exclude GPA. During our work on this project, several district representatives suggested that grade inflation at private schools might be a barrier to racial equity at the exam schools. We also observe racial gaps in GPA in the data even once we control for MCAS scores. This simulation assigns exam school admission by ranking students within the existing applicant pool based solely on their ISEE scores, excluding GPA.

MCAS-based admissions: district overall. In this simulation, we first assign predicted MCAS scores to non-BPS students (who do not take the MCAS) using a regression of MCAS scores on ISEE scores within the sample of BPS students who take both tests. We then assign an admissions rank to all BPS and non-BPS students, including BPS students who did not apply to the exam schools in reality, with rank 1 being the highest-scoring student. In each year, we count the number of students actually admitted to BLS or any exam school, and count students as admitted in the simulation if their rank places them below the number of admitted students in the year they applied.

MCAS-based admissions: by school. Overall, about 7 percent of BPS 5th-graders in our data get

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

invited to BLS, and about 17 percent get invited to any of the three exam schools.[9] Using these values, we simulate racial diversity under an admissions rule that invites the top 17 percent of 5th-graders at each BPS school to attend the exam schools in 7th grade, with the top 7 percent receiving invitations to BLS. This admissions rule mirrors affirmative action policies such as the "Top 10%" rule for admission to state universities in Texas. In contrast to our district-wide MCAS-based simulation, in this simulation we assign non-BPS students their actual admissions status. This effectively sets BPS admissions to the exam schools at their current levels, and draws remaining students from charter and private schools. In practice, the district could vary the percentage of exam school invitations allotted to BPS 5th-graders. Since BPS students are significantly more diverse than students applying from private and charter schools, increasing (decreasing) the share of exam school seats reserved for BPS 5th-graders would increase (decrease) diversity at the schools.

Table 8 shows the results of our analysis for the exam schools overall and for Boston Latin School individually. We find that in general, alternative admissions schemes would either have no effect on racial diversity of admissions to the exam schools or increase the percentage of Black and Hispanic students admitted by only a few percentage points. We also find that increasing ISEE-taking in particular would dramatically reduce the percentage of students living in low-income ZIP codes invited to the exam schools. Of the options we test, switching to a school- and MCAS-based admissions system has the largest potential impact on diversity, increasing Black and Hispanic representation among students invited to the exam schools overall from 38 to 49 percent, and among those invited to BLS from 21 to 38 percent. Switching to an MCAS-based system alone has smaller but still substantial effects, increasing the percentage of students invited to the exam schools overall from 38 to 42 percent Black and Hispanic, and the percentage of students invited to BLS from 21 to 31 percent Black and Hispanic.

Importantly, our simulations consider exam school invitations, not enrollment. While there are currently essentially no racial gaps in rates of enrollment at the exam schools conditional on being

[9] This is lower than the 25 percent of BPS 7th- through 12th-graders enrolled in the exam schools since non-BPS students make up a considerable portion of exam school admissions.

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

invited, Black and Hispanic students may be less likely to accept offers to attend BLS if their lower preference for the school persists under a new admissions system. This would reduce diversity at BLS relative to what we have simulated here. Additionally, we do not model behavioral responses to a new admissions system, such as how state test scores might change if the test becomes higher-stakes for students or how students might re-sort between schools under a top percent rule. For these reasons, we expect that our simulations provide an upper bound on Black and Hispanic enrollment at the exam schools under each of the policies we test unless there is significant out-migration of White or Asian families either from BPS into private schools or from Boston into neighboring districts.

<E> Discussion

Our simulations help estimate the potential magnitude of changes in racial diversity that alternatives to the admissions process might induce. We have limited evidence on how to increase the number of Black and Hispanic students taking the ISEE, improve Black and Hispanic students' scores on the exam, or increase racial diversity at BLS without overriding students' choices. Our results also suggest that any one of these changes alone is unlikely to have a large impact, and that a truly successful intervention would have to address multiple stages of the pipeline at once. That BPS made ISEE testing much more widely available in the fall of 2019 provides a crude natural experiment for this hypothesis: offering the test at students' schools on a weekday dramatically increased the number of Black and Hispanic students taking the exam, but had essentially no impact on exam school admissions for those students.[10]

In July 2020, BPS announced plans to replace the ISEE with the NWEA MAP test for exam school admissions beginning in the fall of 2020. Our simulations suggest that had BPS proceeded with this plan, diversity at the exam schools would have been essentially unchanged. In our third simulation,

[10] See https://www.bostonglobe.com/2020/04/28/magazine/boston-latin-biggest-test-their-young-lives/: "The number of Black sixth-graders invited to attend declined from 41 in 2019 to 33 [in 2020], even though the number of Black students taking the test jumped dramatically. The number of Latino sixth-graders invited to Latin did increase from 54 last year to 60 in 2020. But the total number of Latino test takers went up far more—from 584 to 988—so the students' overall success rate actually dropped."

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

we ask how invitations to the exam schools would change if Black and Hispanic students scored equally well on the ISEE as White students with the same MCAS scores, providing an upper bound estimate of how much changing the exam is likely to change diversity at the exam schools. We find that completely eliminating racial gaps in scores on the admissions test has no effect on Black and Hispanic students' admissions to the exam schools overall, and increases their admissions to BLS by only 3 percentage points, from 21 percent to 24 percent.

In light of the COVID-19 pandemic, however, the Boston School Committee voted instead to replace the existing exam school admissions system with an allocation mechanism that will extend exam school invitations to students based on a combination of GPA and students' residential ZIP code. 20 percent of exam school invitations will be extended based on GPA ranking alone, with the remaining 80 percent of seats distributed among ZIP codes in the city based on each ZIP code's population of school-aged children. In concept, this is most similar to our school-based top percent invitation rule. The district's own simulations suggest that the proposed policy will increase the percentage of Black and Hispanic students among invited students to 46 percent, compared to 35 percent in the 2019-2020 school year. In the time period covered by our data, 38 percent of invitations were extended to Black and Hispanic students. Under our school-based top percent rule, this would increase to 49 percent, a result strikingly similar to that of the district.[11]

Also in response to the pandemic, other districts around the country have announced even more dramatic shifts in their admissions to selective schools. Lowell High School in San Francisco will admit students by lottery; New York City will suspend academic screening for middle schools (but not high schools); and Philadelphia and Chicago announced plans to incorporate test scores from earlier grades in

[11] See https://www.wbur.org/edify/2020/10/08/boston-scrap-exam for district projections. Because we only have data on GPA for students who applied to the exam schools, we are not able to directly simulate the district's new policy ourselves. The difference between the percent of invitations extended to Black and Hispanic students in the district's baseline calculation and in ours may reflect a true difference over time, but could also be due to differential recording of students who do not fall into the White, Black, Hispanic, or Asian race categories. BPS includes these students; we do not since students in this category account for less than 2 percent of our sample (an additional 11 percent of students have no race indicator).

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

admissions to their selective schools rather than administering an admissions test during lockdowns and remote learning. Selective schools in Fairfax and Loudoun County, VA have also modified admissions to rely less on test scores and increase equity in admissions rates across feeder schools. The changes in VA, like those in other districts, will be implemented for the first time in the 2020-21 admissions cycle, but the timing is a coincidence: the reforms are primarily a response to community advocacy (and, in the case of Loudoun County, an investigation by the state attorney general's office) and not to COVID specifically. While it seems likely that lottery admissions will increase diversity at selective schools, predicting the effects of changes to admissions tests without data from individual districts would be pure speculation.

As of this writing, the announced changes in Boston, Chicago, New York, Philadelphia, and San Francisco will apply only to students admitted to enter these schools in the fall of 2021; only Fairfax and Loudoun County have planned more permanent changes. It is impossible to say whether changes that are currently temporary will persist in light of ongoing concerns about diversity in selective educational settings and racial justice more generally across the U.S. As noted above, even our most "successful" simulation and the district's proposed plan in Boston fail to achieve Black and Hispanic enrollment at the exam schools that is more than two-thirds the district enrollment of 75 percent Black and Hispanic students. Achieving exam schools that are genuinely representative of district enrollment would thus require either substantial investment in closing racial achievement gaps that have emerged by 6th grade or a meaningful rethinking of exam schools themselves—one that it seems may already be underway.

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

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Table 1: Exam School Testing and Applications by Race among BPS Students

	N (Total)	Took ISEE	Invited to any exam school	Enrolled at any exam school	Enrolled (invited students only)
	(1)	(2)	(3)	(4)	(5)
All	24062	35.4	16.8	14.6	86.9
White	3115	60.4	41.0	34.3	83.8
Asian	2070	78.5	53.0	50.0	94.4
Black	9606	26.4	8.0	7.0	86.4
Hispanic	9271	26.6	9.8	8.1	82.7

Notes: Column 1 contains the total count of students enrolled in 5th grade in BPS from the 2006-07 through the 2012-13 school year. Columns 2-4 show the percentage of students from column (1) who respectively took the ISEE, received an invitation to attend any of the three exam schools, and enrolled at any of the exam schools in 7th grade. Column (5) shows the percentage of students who enrolled at an exam school in 7th grade conditional on being invited to attend one of the schools.

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

Table 2: Summary Statistics

	MCAS percentile	GPA	ISEE percentile	N (Total)	N in top 25% of MCAS
	Panel A: All 5th-grade BPS Students				
	(1)	(2)	(3)	(4)	(5)
White	65.8	.	.	3115	1449
Asian	72.8	.	.	2070	1187
Black	43.2	.	.	9606	1441
Hispanic	45.4	.	.	9271	1629
	Panel B: 5th-grade BPS Students, ISEE-Takers Only				
	(1)	(2)	(3)	(4)	(5)
White	79.6	10.0	63.1	1882	1270
Asian	79.4	10.0	59.7	1625	1108
Black	63.5	8.4	37.2	2539	947
Hispanic	66.2	8.7	40.7	2466	1051
	Panel C: Non-BPS ISEE-Takers				
	(1)	(2)	(3)	(4)	(5)
White	.	9.8	63.8	2371	.
Asian	.	9.6	68.8	543	.
Black	.	8.1	38.1	1744	.
Hispanic	.	8.8	44.7	775	.

Notes: MCAS and ISEE composite percentiles are constructed by adding students' scaled subtest scores and calculating percentiles within test years. The MCAS subtests are reading and math. The ISEE subtests are verbal reasoning, quantitative reasoning, reading comprehension, and mathematics achievement. Students' composite GPA is calculated by BPS based on students' grades from all of 5th grade and the fall of 6th grade.

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

Table 3: ISEE Taking and Scores

	Panel A: Took ISEE			
		Top 25% of 5th-grade MCAS Scorers		
	(1)	(2)	(3)	(4)
Black	-0.339***	-0.214***	-0.179***	-0.088***
	(0.009)	(0.015)	(0.015)	(0.017)
Hispanic	-0.340***	-0.235***	-0.204***	-0.122***
	(0.009)	(0.014)	(0.015)	(0.016)
Asian	0.181***	0.058***	0.055***	0.063***
	(0.013)	(0.016)	(0.015)	(0.018)
Observations	24473	5809	5809	5807
MCAS score controls	N	N	Y	Y
Elementary school FE	N	N	N	Y
	Panel B: ISEE Percentile			
		Top 25% of 5th-grade MCAS Scorers		
	(1)	(2)	(3)	(4)
Black	-25.9***	-19.3***	-13.4***	-9.1***
	(0.802)	(0.932)	(0.812)	(0.908)
Hispanic	-22.4***	-16.5***	-11.7***	-7.8***
	(0.806)	(0.903)	(0.784)	(0.828)
Asian	-3.4***	-3.0***	-3.2***	-1.2
	(0.892)	(0.890)	(0.763)	(0.868)
Observations	8673	4460	4460	4457
MCAS score controls	N	N	Y	Y
Elementary school FE	N	N	N	Y

Notes: The outcome in Panel A is whether a student took the ISEE, and in Panel B is composite ISEE percentile. The composite ISEE percentile is constructed by summing students' scaled subtest scores and calculating percentiles within years. Panel B is restricted to students who took the ISEE. White students are the omitted category. All models use cohort fixed effects. Columns 2-4 limit the sample to the top quarter of the 5th-grade MCAS distribution. Heteroskedasticity robust standard errors are in parentheses (* p<.10 ** p<.05 *** p<.01).

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

Table 4: Composite 5th- and 6th-grade GPA

		Top 25% of 5th-grade MCAS Scorers		
	(1)	(2)	(3)	(4)
Black	-1.537***	-1.039***	-0.704***	-0.487***
	(0.065)	(0.074)	(0.070)	(0.082)
Hispanic	-1.262***	-0.907***	-0.634***	-0.459***
	(0.065)	(0.072)	(0.068)	(0.075)
Asian	0.005	-0.154**	-0.163**	0.222***
	(0.072)	(0.071)	(0.066)	(0.078)
Observations	8673	4460	4460	4457
MCAS score controls	N	N	Y	Y
Elementary school FE	N	N	N	Y

Notes: White students are the omitted category. All models use cohort fixed effects. Columns 2-4 limit the sample to the top quarter of the 5th-grade MCAS distribution. Heteroskedasticity robust standard errors are in parentheses (* p<.10 ** p<.05 *** p<.01).

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

Table 5: First Ranked Exam School Among ISEE-takers

	Panel A: Likelihood of Ranking BLS First			
		Top 25% of 5th-grade MCAS Scorers		
	(1)	(2)	(3)	(4)
Black	-0.180***	-0.161***	-0.129***	-0.047**
	(0.014)	(0.017)	(0.017)	(0.020)
Hispanic	-0.127***	-0.135***	-0.109***	-0.079***
	(0.014)	(0.017)	(0.017)	(0.018)
Asian	0.037**	0.011	0.010	0.023
	(0.015)	(0.016)	(0.016)	(0.019)
Observations	8673	4460	4460	4457
MCAS score controls	N	Y	Y	Y
Elementary school FE	N	N	Y	Y
	Panel B: Likelihood of Ranking BLA First			
		Top 25% of 5th-grade MCAS Scorers		
	(1)	(2)	(3)	(4)
Black	0.063***	0.066***	0.048***	-0.006
	(0.012)	(0.015)	(0.015)	(0.018)
Hispanic	0.041***	0.055***	0.040***	0.031**
	(0.012)	(0.015)	(0.015)	(0.016)
Asian	-0.055***	-0.023	-0.023	-0.027
	(0.014)	(0.015)	(0.014)	(0.017)
Observations	8673	4460	4460	4457
MCAS score controls	N	N	Y	Y
Elementary school FE	N	N	N	Y
	Panel C: Likelihood of Ranking O'Bryant First			
		Top 25% of 5th-grade MCAS Scorers		
	(1)	(2)	(3)	(4)
Black	0.106***	0.082***	0.070***	0.045***
	(0.009)	(0.010)	(0.010)	(0.012)
Hispanic	0.083***	0.074***	0.064***	0.042***
	(0.009)	(0.009)	(0.009)	(0.011)
Asian	0.021**	0.014	0.014	0.006
	(0.010)	(0.009)	(0.009)	(0.011)
Observations	8673	4460	4460	4457
MCAS score controls	N	N	Y	Y
Elementary school FE	N	N	N	Y

Notes: White students are the omitted category. All models use cohort fixed effects. Columns 2-4 limit the sample to the top quarter of the 5th-grade MCAS distribution. Heteroskedasticity robust standard errors are in parentheses (* p<.10 ** p<.05 *** p<.01).

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

Table 6: Exam School Invitations

	Panel A: Invitation to Any Exam School				
		Top 25% of 5th-grade MCAS Scorers			
	(1)	(2)	(3)	(4)	(5)
Black	-0.328***	-0.342***	-0.254***	-0.145***	-0.101***
	(0.007)	(0.017)	(0.016)	(0.019)	(0.020)
Hispanic	-0.313***	-0.336***	-0.259***	-0.162***	-0.093***
	(0.007)	(0.017)	(0.016)	(0.017)	(0.018)
Asian	0.121***	0.050***	0.044***	0.097***	0.054***
	(0.010)	(0.018)	(0.017)	(0.019)	(0.019)
Observations	24473	5809	5809	5807	4457
MCAS score controls	N	N	Y	Y	Y
Elementary school FE	N	N	N	Y	Y

	Panel B: Invitation to BLS				
		Top 25% of 5th-grade MCAS Scorers			
	(1)	(2)	(3)	(4)	(5)
Black	-0.215***	-0.366***	-0.260***	-0.172***	-0.176***
	(0.005)	(0.016)	(0.014)	(0.016)	(0.020)
Hispanic	-0.209***	-0.359***	-0.266***	-0.191***	-0.192***
	(0.005)	(0.015)	(0.014)	(0.015)	(0.018)
Asian	0.016**	-0.061***	-0.069***	0.010	-0.012
	(0.007)	(0.016)	(0.015)	(0.017)	(0.019)
Observations	24473	5809	5809	5807	4457
MCAS score controls	N	N	Y	Y	Y
Elementary school FE	N	N	N	Y	Y

Notes: White students are the omitted category. All models use cohort fixed effects. Columns 2-5 limit the sample to the top quarter of the 5th-grade MCAS distribution. Column 5 limits the sample to students who took the ISEE. Heteroskedasticity robust standard errors are in parentheses (* p<.10 ** p<.05 *** p<.01).

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Table 7: Exam School Enrollment

	Panel A: Enrolled at any exam school in 7th grade				
		Top 25% of 5th-grade MCAS Scorers			
	(1)	(2)	(3)	(4)	(5)
Black	-0.273***	-0.287***	-0.206***	-0.110***	-0.067***
	(0.007)	(0.017)	(0.017)	(0.019)	(0.022)
Hispanic	-0.263***	-0.296***	-0.223***	-0.145***	-0.091***
	(0.007)	(0.017)	(0.016)	(0.018)	(0.020)
Asian	0.157***	0.118***	0.112***	0.153***	0.121***
	(0.009)	(0.018)	(0.017)	(0.020)	(0.021)
Observations	24473	5809	5809	5807	4457
MCAS score controls	N	N	Y	Y	Y
Elementary school FE	N	N	N	Y	Y

	Panel B: Enrolled at BLS in 7th grade				
		Top 25% of 5th-grade MCAS Scorers			
	(1)	(2)	(3)	(4)	(5)
Black	-0.198***	-0.341***	-0.243***	-0.162***	-0.166***
	(0.005)	(0.015)	(0.014)	(0.016)	(0.020)
Hispanic	-0.193***	-0.335***	-0.248***	-0.184***	-0.187***
	(0.005)	(0.015)	(0.014)	(0.015)	(0.019)
Asian	0.029***	-0.030*	-0.038***	0.035**	0.017
	(0.006)	(0.016)	(0.014)	(0.017)	(0.020)
Observations	24473	5809	5809	5807	4457
MCAS score controls	N	N	Y	Y	Y
Elementary school FE	N	N	N	Y	Y

Notes: White students are the omitted category. All models use cohort fixed effects. Columns 2-5 limit the sample to the top quarter of the 5th-grade MCAS distribution. Column 5 limits the sample to students who took the ISEE. Heteroskedasticity robust standard errors are in parentheses (* p<.10 ** p<.05 *** p<.01).

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Table 8: Diversity under Different Admissions Systems

	Actual invitations	Universal ISEE-taking	Equalized ISEE-taking	Equalized ISEE scores	Rank only	ISEE only	Top X% (District)	Top X% (School)
	Panel A: All Exam Schools							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Black	0.20	0.21	0.21	0.20	0.20	0.19	0.21	0.26
Hispanic	0.18	0.19	0.20	0.18	0.18	0.17	0.21	0.23
Asian	0.21	0.19	0.20	0.21	0.21	0.21	0.20	0.15
White	0.42	0.40	0.40	0.41	0.41	0.42	0.38	0.36
Low income	0.37	0.22	0.22	0.33	0.37	0.36	0.41	0.50
	Panel B: Boston Latin School							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Black	0.10	0.11	0.11	0.11	0.12	0.11	0.14	0.18
Hispanic	0.11	0.12	0.12	0.13	0.12	0.12	0.17	0.19
Asian	0.25	0.24	0.24	0.25	0.23	0.26	0.25	0.19
White	0.54	0.53	0.52	0.51	0.52	0.51	0.44	0.44
Low income	0.28	0.15	0.15	0.20	0.29	0.29	0.36	0.48

Notes: Column 1 contains actual student invitations to the exam schools over the 2007-2013 period. Columns 2 and 3 respectively measure potential invitations if all 6th-graders took the ISEE and if Black and Hispanic 6th-graders took the ISEE at the same rate as White students with similar MCAS scores. Column 4 simulates invitations if rates of ISEE-taking were unchanged, but Black and Hispanic students scored as well on the exam as their White peers with similar MCAS scores and GPA. Column 5 simulates invitations if students were assigned to schools based solely on their admissions rank, not taking into account reported preferences. Column 6 simulates invitations if students were ranked solely based on the ISEE and not on GPA. Column 7 simulates invitations if BPS students were invited to the exam schools on the basis of MCAS alone. Column 8 simulates invitations if the percentage of BPS students invited to the exam schools were unchanged, but students were invited to the schools solely based on being in that top percentage of the MCAS distribution at their school.

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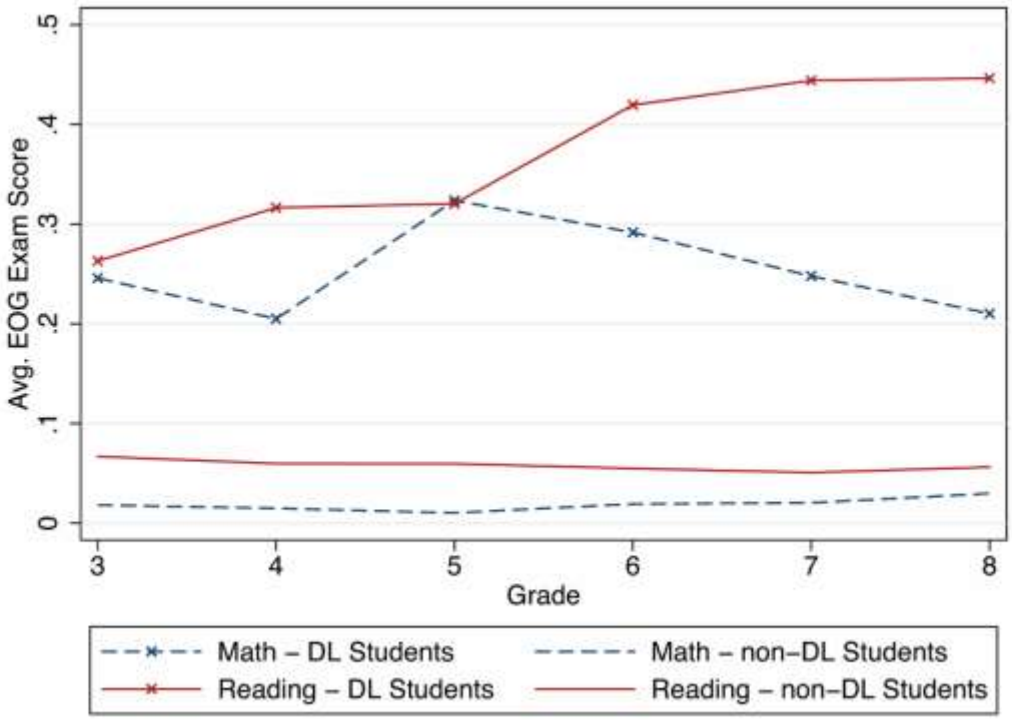
Figure 1: ISEE Test-Taking and Scores



Notes: Panel A plots the percentage of students taking the ISEE by race and 5th-grade MCAS percentile. Panel B plots students' composite ISEE percentile by race and 5th-grade MCAS percentile. For both ISEE and MCAS scores, composite percentiles are constructed by adding students' scaled subtest scores and calculating percentiles within test years. The MCAS subtests are reading and math. The ISEE subtests are verbal reasoning, quantitative reasoning, reading comprehension, and mathematics achievement.

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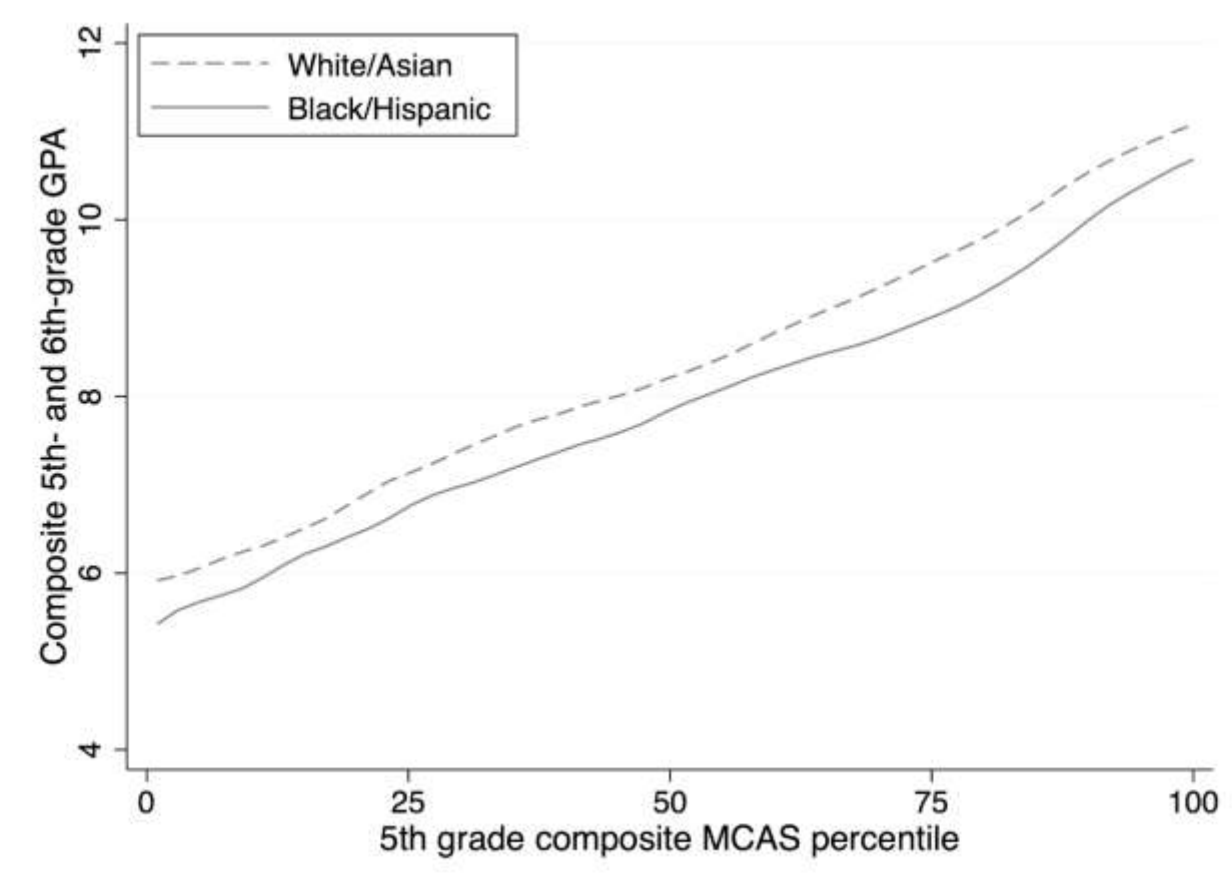
Figure 2: GPA by MCAS Percentile



Notes: Figure plots students' composite GPA by race and 5th-grade MCAS percentile. Composite GPA is calculated by the district on a 12-point scale and incorporates grades from 5th grade and the fall of 6th grade. MCAS composite percentiles are constructed by adding students' scaled subtest scores in reading and math and calculating percentiles within test years.

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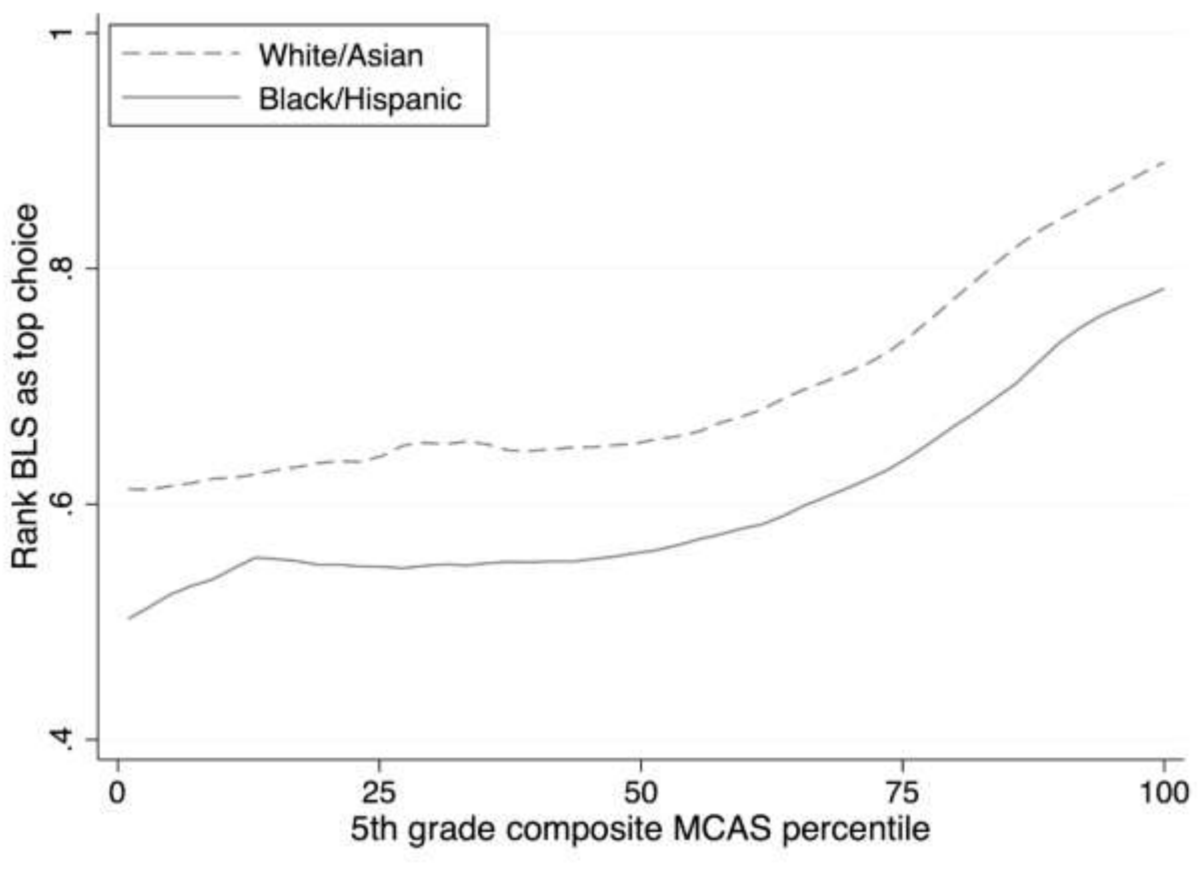
Figure 3: Exam School Preferences: BLS



Notes: Figure plots the proportion of ISEE test-takers ranking BLS as their first choice exam school by race and 5th-grade MCAS percentile. MCAS composite percentiles are constructed by adding students' scaled subtest scores in reading and math and calculating percentiles within test years.

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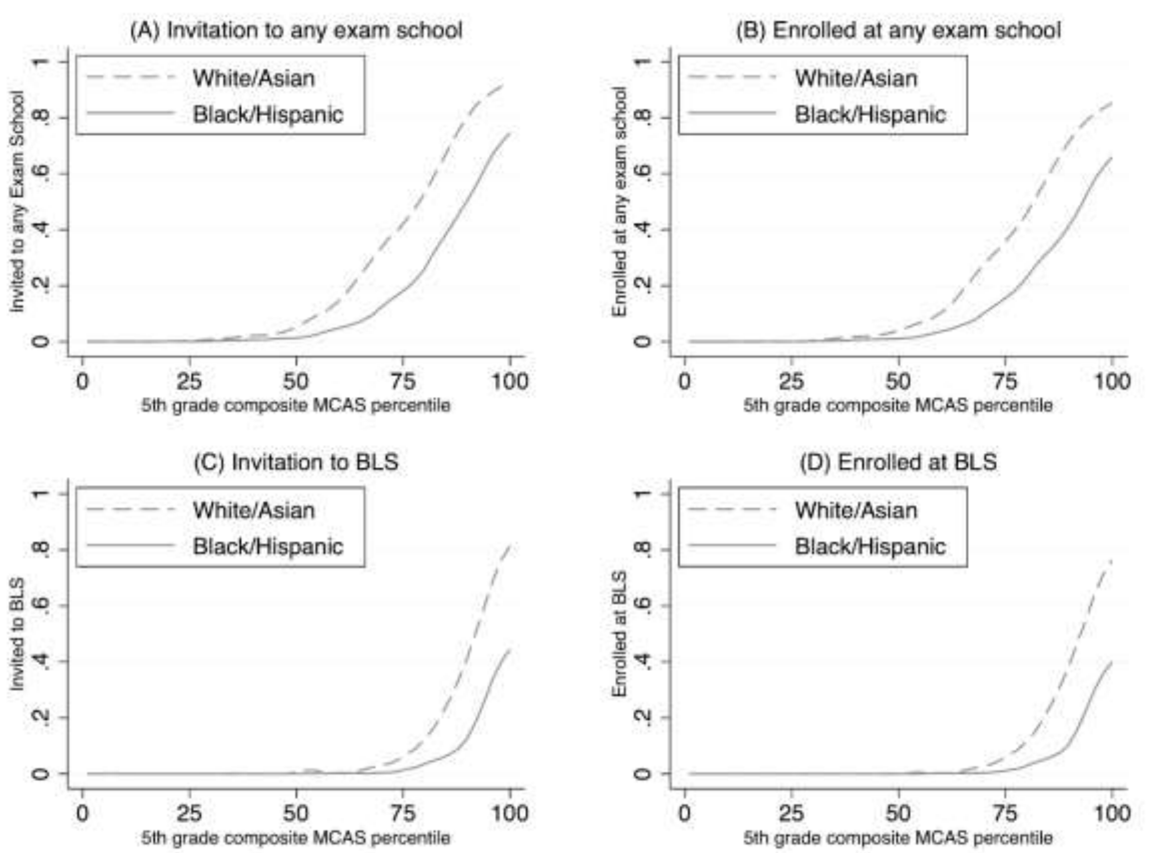
Figure 4: Exam School Invitations and Enrollment



Notes: Panels A and B plot the percentage of ISEE-takers invited to attend any exam school and the percentage of ISEE-takers enrolled at any exam school in 7th grade by race and 5th-grade MCAS percentile. Panels C and D plot the percentage of ISEE-takers invited to attend BLS and the percentage of ISEE-takers enrolled at BLS in 7th grade by race and 5th-grade MCAS percentile. ISEE-takers may be invited to attend at most one of the three exam schools. MCAS composite percentiles are constructed by adding students' scaled subtest scores in reading and math and calculating percentiles within test years.

Education Finance and Policy Just Accepted MS.
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Table A.1: Student Enrollment in 7th Grade

	Enrolled in 5th grade	Enrolled at exam school	Enrolled at trad. public school	Enrolled out of district
	Panel A: Top 25% of 5th-grade MCAS Scores			
	(1)	(2)	(3)	(4)
White	1449	65.08	16.63	18.29
Black	1441	35.67	39.14	25.19
Hispanic	1629	35.73	45.12	19.15
Asian	1187	76.75	16.85	6.40
	Panel B: Top 25% of MCAS, Took ISEE			
	(1)	(2)	(3)	(4)
White	1270	74.17	12.28	13.54
Black	947	54.07	34.21	11.72
Hispanic	1051	55.19	34.54	10.28
Asian	1108	82.13	14.17	3.70

Notes: Table shows the distribution of enrollment over exam schools, other public schools, and non-district schools for students enrolled in BPS in 5th grade. Both panels restrict to the top 25% of the 5th-grade MCAS distribution. Panel B restricts to students who took the ISEE. Column (4) includes students who live in Boston, but attend private or charter schools, as well as students who leave the district entirely between 5th and 7th grade; we are unable to distinguish among these groups in the data.

Education Finance and Policy Just Accepted MS.
https://doi.org/10.1162/edfp_a_00343

Table A.2: Heterogeneity by Exam School Proximity

	Took ISEE		Rank first	
	ZIP within 2 miles	ZIP outside 2 miles	ZIP within 2 miles	ZIP outside 2 miles
	Panel A: Boston Latin School			
	(1)	(2)	(3)	(4)
Black	-0.126**	-0.084***	-0.077	-0.112***
	(0.052)	(0.019)	(0.060)	(0.021)
Hispanic	-0.113**	-0.123***	-0.110**	-0.158***
	(0.051)	(0.017)	(0.058)	(0.019)
Asian	0.073	0.061***	0.159***	0.059***
	(0.049)	(0.019)	(0.056)	(0.022)
Observations	889	4904	889	4904
	Panel B: Boston Latin Academy			
	(1)	(2)	(3)	(4)
Black	-0.113***	-0.074***	-0.060**	-0.004
	(0.035)	(0.020)	(0.029)	(0.017)
Hispanic	-0.142***	-0.118***	-0.043	0.019
	(0.034)	(0.018)	(0.028)	(0.015)
Asian	0.060	0.067***	-0.120***	0.018
	(0.039)	(0.020)	(0.032)	(0.017)
Observations	1662	4135	1662	4135
	Panel C: O'Bryant School			
	(1)	(2)	(3)	(4)
Black	-0.104*	-0.078***	0.059*	0.029***
	(0.059)	(0.019)	(0.033)	(0.010)
Hispanic	-0.146**	-0.117***	0.080**	0.019**
	(0.058)	(0.017)	(0.033)	(0.009)
Asian	0.086	0.065***	0.012	0.009
	(0.059)	(0.019)	(0.033)	(0.010)
Observations	1051	4748	1051	4748

Notes: White students are the omitted category. All models are restricted to the top 25% of the 5th-grade MCAS distribution and include controls for 5th-grade MCAS scores and elementary school fixed effects. Heteroskedasticity robust standard errors are in parentheses (* p<.10 ** p<.05 *** p<.01).

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Table A.3: Application Rates and Preferences by Exam School Proximity

	Took ISEE		Rank BLS first	
	Home min. distance	School min. distance	Home dist. to BLS	School dist. to BLS
	(1)	(2)	(3)	(4)
Black	-0.111***	-0.104***	-0.121***	-0.079***
	(0.021)	(0.021)	(0.026)	(0.026)
Hispanic	-0.133***	-0.102***	-0.133***	-0.067***
	(0.021)	(0.021)	(0.025)	(0.026)
Asian	0.090***	0.183***	0.126***	0.293***
	(0.028)	(0.030)	(0.035)	(0.037)
Distance	-0.002	0.022***	-0.002	0.027***
	(0.006)	(0.006)	(0.006)	(0.006)
Black X distance	0.012*	-0.010	0.012*	-0.017**
	(0.006)	(0.006)	(0.007)	(0.007)
Hispanic X distance	0.010	-0.020***	0.008	-0.027***
	(0.006)	(0.006)	(0.006)	(0.007)
Asian X distance	0.012	-0.020*	-0.002	-0.051***
	(0.010)	(0.011)	(0.010)	(0.011)
Observations	24473	23963	24473	23963

Notes:White students are the omitted category. All models are restricted to the top 25% of the 5th-grade MCAS distribution and include controls for 5th-grade MCAS scores and school year fixed effects. Columns 1 and 3 contain school fixed effects.The distance measures are: (1) minimum distance from a student's residential ZIP code to any of the three exam schools, (2) minimum distance from a student's 5th-grade school ZIP code to any of the three exam schools, (3) distance from a student's residential ZIP code to BLS, and (4) distance from a student's school ZIP code to BLS. Heteroskedasticity robust standard errors are in parentheses (* p<.10 ** p<.05 *** p<.01).

Education Finance and Policy Just Accepted MS.
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Table A.4: Regressions with Low Income and LEP Controls

	Took ISEE	ISEE Score	GPA	Ranked BLS first	Invited to Any	Invited to BLS
	Panel A: No School Fixed Effects					
	(1)	(2)	(3)	(4)	(5)	(6)
Black	-0.084***	-8.940***	-0.460***	-0.045**	-0.141***	-0.171***
	(0.017)	(0.916)	(0.083)	(0.021)	(0.019)	(0.016)
Hispanic	-0.115***	-7.298***	-0.429***	-0.078***	-0.150***	-0.186***
	(0.016)	(0.826)	(0.075)	(0.019)	(0.017)	(0.015)
Asian	0.067***	-0.497	0.241***	0.024	0.106***	0.017
	(0.018)	(0.862)	(0.078)	(0.019)	(0.019)	(0.017)
Observations	5807	4457	4457	4457	5807	5807
	Panel B: School Fixed Effects					
	(1)	(2)	(3)	(4)	(5)	(6)
Black	-0.083***	-9.025***	-0.453***	-0.044**	-0.140***	-0.170***
	(0.017)	(0.913)	(0.083)	(0.021)	(0.019)	(0.016)
Hispanic	-0.116***	-7.252***	-0.431***	-0.076***	-0.150***	-0.185***
	(0.016)	(0.823)	(0.075)	(0.019)	(0.017)	(0.015)
Asian	0.068***	-0.456	0.244***	0.025	0.107***	0.016
	(0.018)	(0.859)	(0.078)	(0.019)	(0.019)	(0.017)
Observations	5807	4457	4457	4457	5807	5807

Notes: Panels A and B respectively replicate columns 3 and 4 of Table 3, Panels A and B; Table 4; Table 5, Panel A; and Table 6, Panels A and B. White students are the omitted category. All models use cohort fixed effects. Low income status is defined at the ZIP code level. Students are indicated as low income if they live in a ZIP code with an average income below the median ZIP code income experienced by their cohort. LEP status is taken in 5th grade and equals 1 if a student is indicated as LEP in 5th grade and 0 otherwise, including if they were indicated as LEP in a prior year. All columns limit the sample to the top 25% of the 5th-grade MCAS distribution. Columns 2, 3, and 4 are restricted to students who took the ISEE (due to missing data for non-applicants). Columns 5 and 6 are not. Heteroskedasticity robust standard errors are in parentheses (* p<.10 ** p<.05 *** p<.01).

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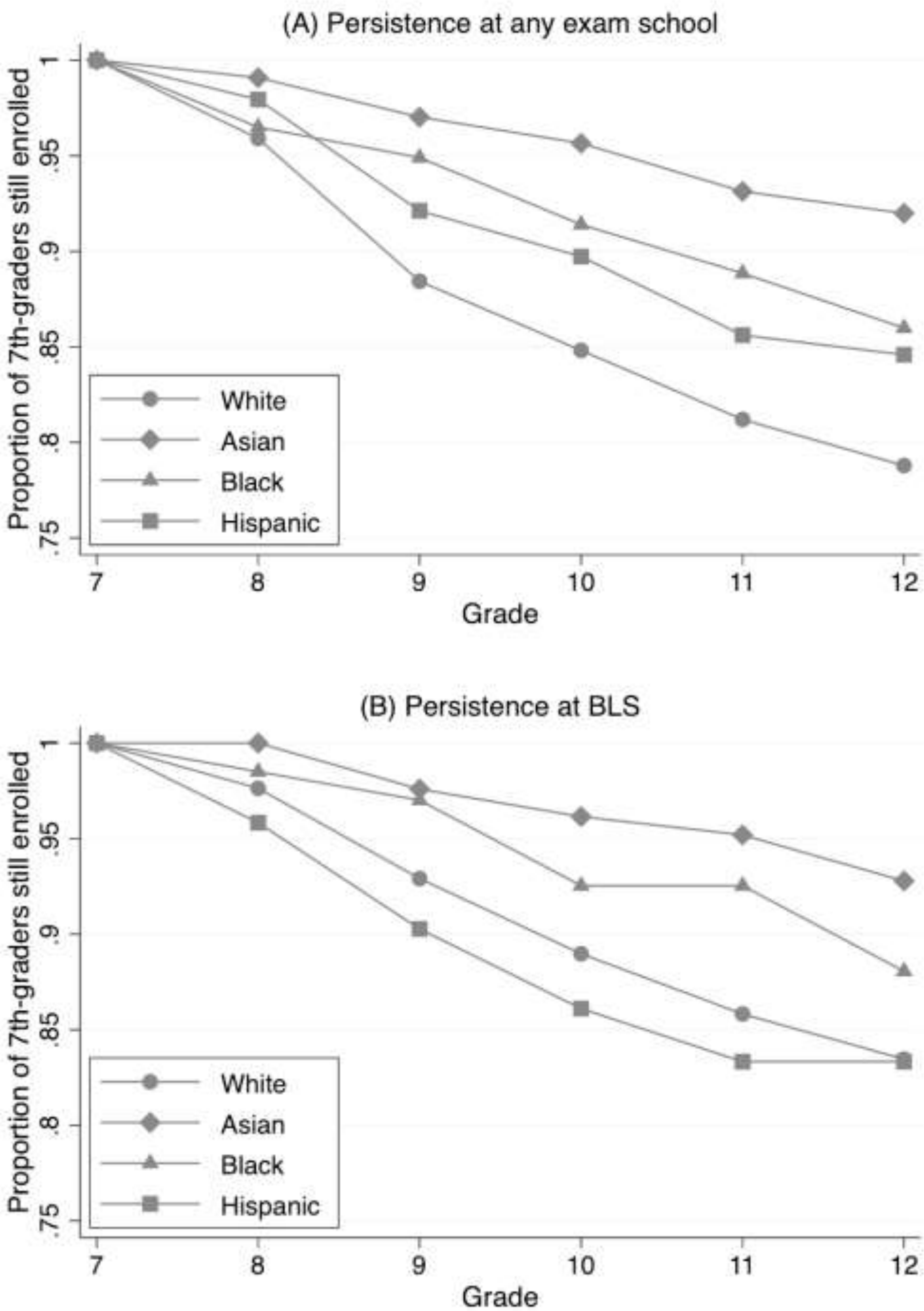
Figure A.1: Exam School Persistence



Notes: Panel A plots retention of students enrolled at any exam school in 7th grade by race. Panel B plots retention of students enrolled at BLS in 7th grade by race.