Breaking rank? An investigation of families' preferences for schools and their causal moderators

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Abstract

I estimate preferences for schools revealed by families' applications to traditional and choice public options in a large urban school district, which uses a unified enrollment system to determine student assignment. Like prior research, I find that school quality, demographic composition, and proximity to home correlate with families' application behaviors. I then leverage the district's unique longitudinal application data to provide the first evidence on the stability of families' school preferences over time and to test potential causal moderators for these revealed preferences. Families' top ranked middle and high schools share similar characteristics, but preferences for school quality are less stable than those for demographic composition and proximity. Using experimental variation generated by the random assignment of students to oversubscribed schools through the district's unified enrollment system, I find little evidence that being assigned to a higher quality (more racially diverse) middle school causes families to prefer higher quality (more racially diverse) high schools. My results demonstrate that families' preferences for schools can both support and challenge educational policymakers' goals, such as increasing student access to high quality schools or reducing racial isolation. However, our understanding of what moderates these preferences remains limited.

Keywords: school choice, school lottery, unified enrollment, charter schools, school quality, school segregation

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INTRODUCTION

Student assignment to K-12 schools in the U.S. has historically depended on where families live. But over the past several decades, policymakers in education have weakened the link between schools and neighborhoods by significantly expanding available alternatives. Many states now provide vouchers to help families pay for tuition at private schools, and students' access to public non-neighborhood options like charter and magnet schools has substantially increased. Some school districts have even established systems where students can apply for enrollment at some or potentially all district schools besides those in their neighborhood. The growth of these "school choice" reforms has left an indelible impact on public elementary and secondary education. In 2016, approximately one fifth of students ages five through 17 reported attending a public school that was not their residentially assigned school, and 41 percent of students enrolled in grades 1 through 12 reported having some form of public school choice available to them (Wang, Rathbun, & Musu, 2019).

Advocates argue that students benefit from school choice because families can select schools that better match their needs, and because increased competition incentivizes neighborhood schools to be more productive (Chubb & Moe, 1990; Friedman, 1962; Hoxby, 2003). Yet the empirical evidence is mixed on the benefits of public school choice policies (for a review of the competitive impacts of private school voucher programs, see Egalite & Mills, 2021). For example, several lottery-based studies find that charter schools—arguably the most discussed and controversial public choice alternative—substantially improve their students' outcomes (Abdulkadiroğlu et al., 2011; Cohodes & Parham, 2021). Many studies also show that

students from historically marginalized communities in particular benefit on key measures such as test scores (e.g., Angrist et al., 2012; Walters, 2018). But these gains occur primarily in urban school districts (Angrist, Pathak, & Walters, 2013) and the systemwide competitive effects of public school choice appear context dependent, as well: Overall, research finds a small benefit from charter school expansion, but individual studies have identified detrimental spillovers from expansion on students' test scores. Opponents of school choice also express concern over how families sort into alternatives. Though research does not convincingly show that only the "best" students gain access to non-neighborhood schools (i.e., cream skimming; Cohodes & Parham, 2021), recent quasi-experimental evidence depicts increased within-district school segregation by race and ethnicity because of charter schools (Monarrez, Kisida, & Chingos, 2021).

Variability across studies may be expected, as how school choice aids (or challenges) educational policymakers' efforts towards achieving these commonly-held goals—expanded student access to high quality schools and reduced racial and socioeconomic isolation—depends on factors beyond what the policies themselves can stipulate. State and district leaders can empower families by providing alternatives to the traditional options tied to place of residence. However, families cannot be forced to leverage these opportunities, nor can they be compelled to choose the schools that could help achieve different educational objectives. Ultimately, the success of school choice depends in part on families' tastes for schools. But though extant research provides a nascent understanding of what these preferences are (e.g., Glazerman & Dotter, 2017; Harris & Larsen, 2015; Hastings, Kane, & Staiger, 2005), we have limited knowledge of what might shape them. Furthermore, attempts to shift families' tastes—for example, towards schools with higher academic performance and/or a more diverse student

body—may be misguided as we do not yet know the extent to which preferences are stable across contexts and/or over time.

In this study, I investigate families' preferences for schools in a large urban school district (LUSD) to help address these limits in our understanding. In the 2011/2012 school year, the district implemented a unified enrollment system (UES). With UES, families can complete a single application to apply for enrollment in any public school within its boundary, including charter and magnet schools, as well as traditional neighborhood options. Using data on families' school applications from UES in conjunction with student- and school-level administrative data, I answer the following research questions:

1) What school characteristics predict whether families *include* schools in their UES applications? How does this vary by applicant subgroup?

2) What school characteristics predict how families *rank* schools in their UES applications? How does this vary by applicant subgroup?

3) How stable are these preferences for schools over time within applicant?

4) How do the characteristics of the schools that applicants are assigned to impact their preferences in subsequent UES applications?

The main contributions of my study to the school choice literature leverage the unique longitudinal nature of UES application data from LUSD. Many districts now employ similar unified enrollment policies, but UES has been around longer than most. This permits me to analyze families' application behaviors over time across several points of students' K-12 careers when they are most likely to use school choice (i.e., the transition from elementary to middle school and from middle to high school). With this longitudinal data, I provide the first evidence on how stable preferences are for specific school attributes within families. I find that applicants'

top ranked high schools generally look like their top ranked middle schools. For example, families' preferred school racial/ethnic composition in sixth grade strongly correlates with their preferred school racial/ethnic composition in ninth grade. However, the taste for school quality is less stable and substantial variation in the relationship between families' top ranked middle and high schools remains unexplained, which suggests that school preferences may be malleable.

The ability to track application behaviors in LUSD over time, in conjunction with UES' assignment process of students to schools, further allows me to contribute to the limited research that identifies causal factors that shape families' preferences for schools in the first place. Applicants in the district using unified enrollment receive a lottery number, which determines who ultimately gets placed in schools with limited seats. Those with the same exact applications in terms of what schools they include, how they rank these schools, and their "priorities" at these schools (e.g., factors that add extra weight in the school assignment process such as living within a school's "attendance zone" or having a sibling at the school) thus can only be assigned different schools through UES by chance. Using this exogenous variation, I find that the characteristics of middle schools that students are ultimately assigned to generally do not cause changes to families' application behaviors for high schools. For example, I do not find any evidence in LUSD that students who are randomly assigned to more diverse and/or highly performing schools prefer similar schools in the future.

These results are surprising, as the characteristics of students' assigned schools could elicit different preferences in subsequent UES applications through several theoretical channels. Prior research highlights how informational barriers may affect families' decisions when using school choice (Corcoran & Jennings, 2019; DeArmond et al., 2014). School choice policies may consequently fail to support policymakers' goals, such as increasing student enrollment at higher

quality schools, because families may not know which schools improve academic outcomes or because they are hampered by the complexity of how to decide between a multitude of options. The schools that students are ultimately assigned to may more clearly demonstrate the value of different school attributes like impacts on achievement and simplify the decision-making process. Relatedly, assignment to a school serving a more diverse student body may impel families to prefer more racially diverse schools in the future. Contact theory from psychology suggests that the increased interaction between students from different racial backgrounds in more integrated settings can improve outgroup racial attitudes and proxies for these attitudes (Allport, 1954), such as placing a higher value on diversity.

In the literature most relevant to my exploration of the sources for families' school preferences, Watts and colleagues (2020) find that students who participated in an intervention that aimed to improve the quality of Head Start classrooms were less likely enroll in their neighborhood high school and were more likely to attend schools with better academic outcomes. But other studies on the causal moderators of applicants' school choice behaviors focus primarily on the effects of providing more information to families, with mixed results. Hastings and Weinstein (2008) find that supplying details on school test scores led to greater numbers of lower-income families choosing higher performing schools. Valant and Loeb (2014) found this effect for middle school choices but not high school choices. This suggests that ultimately, whether the removal of informational barriers shifts preferences likely depends on other contextual factors; proximity, for example, again appears to influence the success of such interventions. Hastings and Weinstein (2008) find that families with more information choose better schools when these schools are closer. Corcoran and colleagues (2018), who specifically developed their school choice informational intervention to highlight to students higher quality

but also proximate schools, similarly find increased families' match rates at better high schools in New York City. Unlike this exploration, these studies notably do not focus on how programs might influence parents to select more diverse schools.

My study's final contributions build on existing work exploring the characteristics of schools that families choose when presented several options. I find that proximity matters on both the "extensive" and "intensive" margins of application behavior in LUSD. Families are more likely to include schools that are closer to home in UES applications and to rank these schools as a top choice. This taste for geographic convenience does not appear to strongly vary by applicant race/ethnicity. I also demonstrate that quality matters for how families choose and rank schools in their applications, especially when they are considering high school options. Schools that score higher on the state's *School Performance Framework* (SPF) are more likely to be included in applications and as a top choice, though I find evidence of decreasing marginal importance as quality increases (i.e., a quadratic relationship between SPF scores and application patterns). Similarly, though applicants—especially White applicants—generally prefer schools serving more students of their own race/ethnicity, the importance of demographic composition also appears non-linear.

The majority of related studies investigating families' tastes for different school attributes either: (1) ask families about these preferences directly through surveys (for a review, see Corcoran & Jennings, 2019), so results may be affected by social-desirability bias (e.g., Schneider & Buckley, 2002; Weiher & Tedin, 2002), or (2) evaluate the revealed preferences in districts similar to LUSD where families can also submit applications for enrollment to schools beyond their residentially assigned option (Glazerman & Dotter, 2017; Harris & Larsen, 2015; Hastings et al., 2005). Investigations typically find that though families on average prefer schools

that perform better on measures of quality (e.g., test performance and growth), non-academic factors also weigh significantly. Families tend to rank more highly the schools closer to home and those that serve a larger population of students sharing a similar racial or socioeconomic background (Glazerman & Dotter, 2017; Hastings et al., 2005). Prior work also reveals heterogeneity across applicant subgroups' tastes for school attributes; Burgess and colleagues (2015) for example find that lower socioeconomic status applicants have weaker preferences for school quality (see also, Harris & Larsen, 2015; Hastings et al., 2009). In many contexts, however, families from more disadvantaged backgrounds lack convenient transportation to non-neighborhood options, live where higher performing schools are farther away, or face barriers to obtaining full information on all available options (Corcoran & Jennings, 2019; DeArmond, Jochim, & Lake, 2014; O'Brien et al., 2018).

Families' school rankings in LUSD largely mirror those from this prior work on revealed preferences. Even the non-linear relationships I observe in application behaviors mirror some findings from Glazerman and Dotter (2017), who identify "bliss points" for applicants' preferred school demographic composition. But in my study, I also investigate whether families choose different non-residential options at all. How policies like LUSD's universal enrollment program affect the distribution of students across schools depends on families' tastes, but these tastes inform both the decision to first apply for alternatives as well as the decision to then rank certain schools more highly. Yet most research analyzing application data from districts with open enrollment processes focus on the latter decision—the intensive margin of application behaviors. I find that, like families' top choices in their UES applications, the schools that families list in their applications also tend to be closer to home, of higher quality, and with more students of the same race than those excluded.

My findings all together present both encouraging and discouraging evidence to policymakers on whether programs that expand families' non-neighborhood school options can help achieve different educational goals, such as increasing the number of students at higher quality schools and decreasing levels of segregation between schools. It is encouraging that families in LUSD value higher quality schools, as seen by the generally positive relationship between schools' SPF scores and UES application behaviors on the extensive and intensive margins. This relationship holds even after accounting for other important school attributes (e.g., distance from home), and shows that the interaction between the district's unified enrollment system and families' tastes can result in more students attending higher quality schools and potentially pressure systemwide improvements in school productivity overall. On the other hand, families' school demographic preferences may challenge efforts to integrate schools by race. Furthermore, though my results suggest that these tastes may be malleable, it is discouraging that families who are assigned schools that are more diverse and/or of higher quality do not demonstrate any differences in attitudes towards similar schools in later UES applications. The search for understanding what motivates families' school preferences thus continues.

In what follows, I review the details of the LUSD context and its UES policy. I then describe the data and methodology I use to investigate families' tastes and the causal moderators for these tastes. I conclude by presenting and discussing the results, and then consider the policy implications of my findings.

DISTRICT CONTEXT

LUSD is the largest public K-12 school district in its state, and among the largest districts in the country. In January of the 2011/2012 school year, LUSD implemented the UES unified

enrollment system. Before UES, families in the city could access several alternatives to their neighborhood public school, including both charter and magnet options. However, those interested in non-neighborhood options had to submit separate applications to participate in over 60 choice procedures, with application timelines often varying from site to site. With numerous application processes running simultaneously and in isolation, students could receive offers to enroll in multiple schools—or not receive any at all. This result led to confusion and delays across the entire system as school staff waited for families to make enrollment decisions before filling remaining seats with students on waitlists. Reports also suggested that access to schools was unclear and potentially inequitable, as several students, often White and of higher socioeconomic status, appeared to obtain seats at schools outside of the formal application process (Klute, 2012).

LUSD leaders aspired to solve these issues and simplify the school choice process with UES. Under the unified enrollment system, families submit just a single application with up to five ranked schools to enroll in neighborhood options as well as charter and magnet schools.[1] Students in the district are then assigned to schools based on their preferences (i.e., their school rankings), the number of available seats at schools, admission priorities (e.g., preferences for students from a certain geography, discussed in more detail below), and a randomly assigned lottery number. UES' "deferred-acceptance" algorithm (Abdulkadiroğlu, Pathak, & Roth, 2009) specifically takes these data and matches students to their highest ranked choice. If applications outnumber capacity at a given school, the lottery number solely determines which students are allocated a seat, ensuring equitable access to options in higher demand. Students who "lose" this lottery are placed on a waitlist for the school in case seats become available (i.e., if students who

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[1] Starting with UES applications to enroll in schools for the 2019/2020 school year, families could rank up to 12 options.

"win" decline to enroll). Spaces at other schools for already matched students then open up, and the process repeats for families' subsequently ranked choices until all UES applicants are matched to a school. In sum, the unified enrollment system's algorithm attempts to place students at their most preferred schools with capacity and should disincentivize strategic behavior besides the truthful reporting of preferences in the application (Abdulkadiroğlu, Angrist, Narita, & Pathak, 2009).

UES also harmonizes choice processes across schools in LUSD into a single timeline. Families submit their school applications in the spring semester of the school year for enrollment the following year. Applications do not need to be submitted by district students who wish to remain in their schools and are not in a transition grade. After the application period closes, the district runs the student-school matching algorithm and releases all matches to families. Later in the spring semester a second round of UES begins, which allows families to apply for schools if they did not participate in the earlier round or if families wish to change their enrollment decisions.[2] Finally, as families decide whether to matriculate into assigned schools, seats may open up for waitlisted students.

What happens if those using unified enrollment do not get one of their choice schools? State law guarantees that all LUSD students participating in UES have access to some district school based on where they live. Students specifically can either enroll in a *boundary* school, because they live within a specific school's established catchment, or to an *enrollment zone* school, because they live in a geographic area where students have priority to at least one school among a set. Even those who choose not to submit a UES application, but who would otherwise

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[2] Because UES only uses the deferred-acceptance algorithm for the first round of applications, I do not use data from the second round in my analyses.

"need" to select an option (i.e., students in transition grades), are automatically assigned to one of these geographically proximate options.

DATA

School-level data

To investigate families' preferences for schools in LUSD and their causal moderators, I leverage data from several sources. Longitudinal school-level information come from the National Center for Education Statistics' Common Core of Data (CCD) and from the state Department of Education (SDE). The CCD specifically provides for schools: demographic composition (e.g., proportion of students by race/ethnicity); location (i.e., latitude and longitude); and status (i.e., charter school, Title 1 school, new or closed).

From the SDE data, I extract a measure of school quality: performance on the state *School Performance Framework* (SPF). Schools were first evaluated using the state's SPF in the 2009/2010 academic year, following the implementation of the state's Education Accountability Act of 2009, SB-09-163. The goal of the evaluation system was to assess school (and district) performance on a common set of metrics across the state and to use these metrics to identify educational agencies in need of additional support.

Between the 2009/2010 and 2013/2014 academic years, schools' SPF scores were determined by their performance on four different indicators: student academic achievement on state assessments, academic growth on these assessments, academic growth for specific student subgroups ("Growth Gaps"), and, for high schools only, a measure of postsecondary and workforce readiness focused on ACT scores and graduation/dropout rates. Starting in 2015/2016, schools continued to be evaluated on academic achievement, growth, and postsecondary and

workforce readiness. The earlier "Growth Gaps" indicator was diversified and subsumed within the three other indicators; in addition to subgroup-specific growth, schools are now also evaluated on the academic achievement and graduation rates of English learners, students eligible for free- or reduced-price lunch, minority students, and students with disabilities.[3] Furthermore, the postsecondary and workforce readiness indicator now also comprises SAT scores and postsecondary matriculation rates in addition to PSAT scores and graduation/dropout rates. Schools score points for performance on each indicator and receive a single score capturing the percentage of total (possible) points earned. I use this percentage (*SPF score*) as my measure of school quality.[4]

Student-level data

LUSD provided longitudinal student-level administrative data that I also use in my analyses. These data fall into three main categories: enrollment information, demographic and background information, and UES applications. Enrollment information I consider captures where LUSD students go to school over time. Demographic and background information describe the following about students: gender; English language learner, gifted, and/or disability status; race/ethnicity; age; Census block group (CBG) of residence; and performance on the state mathematics assessment (rescaled as a *z*-score within grade and school year). With students' CBG of residence, I determine using the 2006-2010 5-year American Community Survey the median household income of the neighborhood for where students live and the CBG's latitude and longitude at its center of population in 2010.

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[3] Schools are not evaluated on subgroup indicators if enrollment counts for that subgroup are sufficiently small.
[4] In the 2014/2015 school year, the SDE did not produce performance frameworks because of a transition in state assessments. Thus, for this school year, I assign schools their most recent SPF score prior to 2014/2015.

Students' UES application data contain several vital fields for my analyses. First, it includes the schools that families applied to, how these schools were ranked, and the school that was ultimately assigned following implementation of the student-school matching algorithm. Second, it includes information on a student's highest priority at each school applied to. Priorities capture whether: the student's place of residence helps determine enrollment at the school; the student is a child of a full-time staff member at the school; the student has a sibling at the school; and whether the student is a city resident (as non-city residents can also use the unified enrollment program). Though students can have multiple priorities at the schools they apply to, only the highest one ultimately helps determine student assignment; schools with limited capacity consider applicants with higher priorities first when allocating seats. Finally, the application data provides each student's lottery number in the unified enrollment system and an ID that links members of the same family using UES in the same cycle; siblings receive the best lottery number in the family when applying to the same school.

EMPIRICAL STRATEGY

The first two research questions I tackle consider how school characteristics predict families' extensive and intensive UES application behaviors, i.e., whether schools end up on applications and how included schools end up being ranked, respectively.[5] To answer these questions, I leverage the data described above and use ordinary least squares (OLS) to estimate a series of linear regression models of the following form:

$$Y_{ist} = \boldsymbol{X'_{st}}\boldsymbol{\theta} + \delta_t + \varepsilon_{ist} \qquad\qquad (1)$$

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[5] As noted above, UES applications could include up to 12 ranked options (as opposed to 5) beginning for the 2019/2020 school year. Thus, when investigating families' extensive application behaviors, I do not include data from this cycle of school choice.

In this model, i indexes students, s indexes schools, and t indexes school years (at the time of UES application). The outcome, Y_{ist}, is a dichotomous variable that captures whether a student applied to a given LUSD school or, if s/he did, whether the school was his or her top choice. I focus on top choice behaviors because, as I show below, over 80 percent of students in my sample participating in UES are ultimately assigned their first choice. I also control for school year of application fixed effects, δ_t.

I include in my model a vector of school characteristics that vary by year, X'_{st}. I am thus most interested in the corresponding vector of regression coefficients, $\boldsymbol{\theta}$, which describe the relationships between different attributes of schools and families' UES application behaviors. These characteristics include schools' charter school and Title 1 status, racial/ethnic composition, SPF score, and the geodesic ("as the crow flies") distance from the school to each students' place of residence. Because new schools that open in LUSD are "missing" these data in the academic year prior to opening (i.e., when students would be applying for enrollment), I set values for these measures for new schools using the values from their first year of operation and include a dummy variable indicating new school status. Standard errors are clustered at the school-academic year level.

The third and fourth research questions I answer focus on families' UES application behaviors over time—specifically between applications in fifth grade (i.e., for middle school) and applications in eighth grade (i.e., for high school). To explore the stability of families' tastes for schools across application cycles, I again estimate a series of OLS regression models:

$$GRADE8\_Y_{ist} = \boldsymbol{GRADE5\_X'_{st}\theta} + \delta_t + \varepsilon_{ist} \qquad (2)$$

The outcome this time, $GRADE8\_Y_{ist}$, captures some school characteristic of the top ranked school s in the UES application for student i submitted in eighth grade in academic year t. In my

model, I include the same school-academic year level characteristics used in equation (1) but focus specifically on these characteristics for students' top ranked school in their fifth grade UES applications, $\boldsymbol{GRADE5\_X'_{st}}$. To identify the stability of preferences, I interpret the corresponding vector of regression coefficients, $\boldsymbol{\theta}$, which describe the relationships between the attributes of families' top middle school choices and those of their top high school choices. I cluster standard errors at the top ranked fifth grade school-academic year level.

Finally, to identify the causal moderators of families' school preferences in LUSD, I estimate a slight variation of the model represented by equation (2):

$$GRADE8\_Y_{isr} = \boldsymbol{ASGN\_GRADE5\_X'_{st}}\boldsymbol{\theta} + \tau_r + \varepsilon_{isr} \tag{3}$$

In this model, instead of predicting the attributes of families' top choice in the UES application for high schools with characteristics of their top choice in middle school, I predict the former with characteristics of their *assigned* middle school, $\boldsymbol{ASGN\_GRADE5\_X'_{st}}.$ Another key difference between the models represented by equation (2) and (3) is that, in the place of school year of application fixed effects, δ_t, are risk set fixed effects, τ_r.

I next provide additional explanation for these alterations to the model. As described in the introduction, extant work has not studied in-depth what shapes families' preferences for schools. In this study, I seek causal evidence for my prediction that the schools that students attend affect their future choices. But simple naïve regressions of preferences on the characteristics of past schools may be biased because families' tastes for past schools themselves are not random. For example, two students who express divergent preferences for high school who also enrolled in separate middle or elementary schools may do so because of differences between families and not because of the attributes of these past schools.

Risk set fixed effects help overcome this potential source of bias. Specifically, by including these controls, I compare high school preferences only between students who apply to the same middle schools in LUSD and who have the same priorities at these middle schools. Differences in where students go to middle school thus ultimately depend on random chance, i.e., if applied-to schools are oversubscribed and students' randomly assigned UES lottery numbers determine the allocation of seats.[6] With risk set fixed effects, the vector of regression coefficients on the characteristics of students' assigned middle schools from UES, $\boldsymbol{\theta}$, can recover the causal impact of middle school characteristics on the attributes of families' top choices for high school. Standard errors for this model are clustered at the risk set level.

Because UES participants can rank up to five schools in their applications and because applicants can have a different priority at each of these schools, the number of potential risk sets in any given LUSD school choice cycle is very large, and each individual risk set may contain very few students. Many of these risk sets may also have no variation in middle school characteristics at all because every student in the risk set is assigned the same school. To increase variation without significantly introducing bias into estimates, I leverage the fact that approximately 93 percent of students applying to middle schools in the district are assigned one of their top two choices. I define students in the same risk set as those who share the same exact top two choices in UES and have the same priorities at these two choices.[7] The identifying

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[6] Through UES, families rank schools that they wish to enroll in. However, schools may reserve a number of seats for students from certain subgroups, such as those who receive a subsidized lunch. UES identifies students that meet the criteria for reserved seats at applied-to schools and creates separate "buckets" for these students when the student-school matching algorithm is implemented. Thus, my risk set fixed effects more specifically leverage variation in school attributes between students who apply to the same schools in middle school, are placed in the same buckets at these schools, and have the same priorities within these buckets.

[7] 96 percent of students are assigned one of their top three choices in middle school, so I also re-estimate my models defining risk sets as including students with the same exact top three choices and priorities at these schools. My results are robust to this sensitivity check and can be found in the Appendix.

assumption is that variation in middle school attributes is random after accounting for differences between families who have different top two choices and priorities at these choices.[8]

Because families may switch schools after assignment through UES, my estimates on the impact of middle school characteristics on high school application behaviors are intent-to-treat estimates. The regression coefficients of interest reflect the effects of being assigned to middle schools with certain attributes, not necessarily of attending a school with those attributes. Below I show how well students "comply" with their school assignments. Finally, I stress that my empirical strategy does not rely on random variation in school attributes, but random variation in schools *that possess* certain school attributes—a subtle, but important distinction. The school characteristics included in my models may proxy for other excluded characteristics that actually influence families' application behaviors. Despite the potential for omitted variable bias to affect the interpretation of my results, I am confident that the extensive number of attributes I control for in models are important and sufficiently varied, and I further attend to this limitation in the discussion section.

SAMPLE

Because the majority of families using UES in LUSD do so in transition grades, I explore school applications for seats in the sixth and ninth grades. I do not consider kindergarten choices because, for most of these students, I lack baseline demographic information, such as place of residence. Furthermore, because fewer school years elapse between applications for middle and

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[8] As noted above, when siblings use UES in the same cycle to apply for the same schools, both students receive the higher lottery number in the family. As such, I drop these siblings from my sample when focusing on longitudinal school application behaviors.

high school, I can incorporate data from a greater number of families when focusing on fifth-to-eighth grade UES application behaviors.

In Table 1, I provide descriptive statistics for LUSD students enrolled in fifth or eighth grade between the 2011/2012 and 2018/2019 school years and who are either Black, Hispanic, or White—the three largest student subgroups by race/ethnicity. I split this population into students who are in my main analytic sample and those who are not.

[Insert Table 1 about here.]

My analytic sample includes only students who use the unified enrollment system.[9] In the table I show that in-sample students comprise about 71 and 56 percent of LUSD students enrolled in fifth and eighth grade, respectively.

I observe several significant differences between the included and excluded populations. In general, those using UES score higher on traditional measures of advantage. Students using unified enrollment live in CBGs where the median household income is higher, are more likely to be classified as gifted, more likely to be White, less likely to have a disability, and score higher on the state's summative mathematics assessment. These results, which largely mirror those seen in prior research (e.g., Cullen, Jacob, & Levitt, 2005), limit the generalizability of my findings specifically to populations who choose to use UES or similar school choice policies. In the table I also provide descriptive statistics on the application behaviors and outcomes for those in my sample. Students in LUSD using UES rank approximately three schools in their applications on average, and (as alluded to earlier) nearly all are assigned one of their top two choices.

[Insert Figure 1 about here.]

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[9] Over 96 percent of students in this sample of UES users have complete data on key controls, i.e., race/ethnicity and CBG of residence. Because of this coverage, I drop those missing data from my sample.

In Figure 1, I plot histograms of the key continuous characteristics of schools that students apply to across UES cycles.[10] From the histograms, I observe that schools in the district generally serve larger proportions of Hispanic students. Very few schools are majority Black or White. Finally, the range of school quality in LUSD, represented by SPF scores, approximates a normal distribution. The bulk of middle and high schools score between .5 and .8 on the SPF scale, which can range from .25 to 1.

RESULTS

What school characteristics predict whether families include schools on their UES applications?
How does this vary by applicant subgroup?

I first investigate what school characteristics influence LUSD families' application behaviors to schools on the extensive margins. Hypothetically, families can apply to enroll at any middle or high school in the district with the unified enrollment program. In reality, it is unlikely that every possible school will be under genuine consideration. To create a smaller, more plausible set of alternatives for each student, I restrict options based on schools' distances from students' homes.

[Insert Figure 2 about here.]

Figure 2 shows that whether students apply to a given school depends substantially on proximity. Application rates to middle and high schools five miles away from home are approximately two and seven percent, respectively. The marginal importance of distance beyond five miles, however, appears to diminish. I thus assign for students a choice set of potential

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[10] 98 percent of all school-school year observations have complete data. Because of this coverage, I drop those missing data from my sample.

schools that includes all schools that they actually applied to and all schools within five miles of their home.

[Insert Figure 3 about here.]

In Figure 3, I plot simple bivariate relationships, by grade and by student race/ethnicity, for application rates to schools in these choice sets against key school characteristics. I find that, for all student subgroups, application rates typically drop as proximity to home decreases. This relationship is linear but also slightly weaker for high schools—especially for White and Black students.

I observe a more complicated association between application rates and school demographic composition. For middle schools, White and Hispanic students submit more applications to schools serving a larger share of students of the same race; the relationship is generally linear for both subgroups of students, but stronger for White students. Black students also exhibit stronger preferences for schools with a greater proportion of own race students, but for schools that are approximately 40 percent Black, application rates begin decreasing. However, as seen in Figure 1, there are very few schools with this specific demographic composition. For high schools, racial composition does not appear to matter very much for Hispanic students but does strongly relate to application behaviors for White and Black students—and much more so than in their applications to middle schools. For both subgroups of students, application rates increase quickly as schools serve greater proportions of own race students, but only up to a certain point. For White students, application rates drop for schools at approximately 50 percent White, and for Black students this drop occurs for schools at approximately 25 percent.

I observe nonlinear relationships between application behaviors and school quality as well. The figure shows that, in middle school, students from all racial/ethnic backgrounds tend to apply to options scoring higher on the SPF metric. This correlation is even stronger in high school, but application rates appear highest for schools that receive approximately 70 percent of possible points on the SPF scale.

[Insert Table 2 about here.]

In Table 2, I present the regression coefficients from my estimation of models represented by equation (1). These models control for the multiple school characteristics concurrently when predicting families' application behaviors in UES, which allows me to investigate if certain attributes still matter after accounting for the importance of other factors. I find that, after controlling for school status (i.e., charter school or Title 1 school status), demographic composition, and quality, proximity continues to matter significantly in sixth-grade applications for all student subgroups. Every additional mile of distance to a middle school is associated with approximately a four-, six-, and one-percent decrease in application rates for White, Hispanic, and Black students, respectively. In high school, distance matters less, with Black families surprisingly exhibiting an increased likelihood of applying to schools farther away (but still in their choice sets, i.e., schools within 5 miles of home), after accounting for other school characteristics.

The nonlinear relationships between school demographics, quality, and application rates seen in the simple bivariate figures largely replicate in the multivariate regressions. White (Black) students demonstrate significantly higher application rates to schools with more White (Black) students, and this relationship is stronger for high schools than for middle schools. But, as the significant coefficient on the quadratic terms signify, the importance of school

demographics exhibits diminishing returns. Applications rates to high schools are also higher but diminishing when considering school quality for all student subgroups. For middle school applications, I observe that SPF score is less important.

Finally, I find that White students are less likely to apply to charter schools in their choice sets, but charter school application patterns for Black and Hispanic students are less consistent across grade levels. Similarly, after controlling for other school attributes, Hispanic students are more likely to apply to Title 1 schools, but no observable significant differences emerge for White or Black students using unified enrollment in LUSD.

What school characteristics predict how families rank schools on their UES applications? How does this vary by applicant subgroup?

Next, I investigate how families' preferences for schools translate to application behaviors on the intensive margins, i.e., whether schools are ranked as a top choice among all schools ranked. Again, I plot the simple bivariate relationships first, but this time between school attributes and the rates at which families rank a school as their top choice. I then test whether the observed relationships persist after controlling for all school attributes simultaneously.

[Insert Figure 4 about here.]

[Insert Table 3 about here.]

In Figure 4 and in the results presented in Table 3, I show that distance continues to relate to families' intensive application behaviors in UES. Across grades and race/ethnic subgroups, more proximal schools among those that families rank are more likely to be their most preferred options. However, this link is again weaker for Black applicants.

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The simple bivariate figures also suggest that families more frequently rank as a top choice higher performing schools on the SPF metric, though this correlation again emerges more demonstratively in high school applications—and with diminishing returns. Interestingly, when considering all school attributes concurrently, schools' SPF scores predict top ranking only in Black and Hispanic students' applications in eighth grade (see Table 3). When considering the regression coefficients on school demographic composition, I find some evidence that for White families, instead of school quality driving application behaviors on the intensive margins, the proportion of White students in schools leads to more top rankings. This importance of own race representation is also consistently true for Black students, but to a lesser extent. Finally, all students tend to avoid ranking charter schools number one in their UES applications after controlling for all other factors, but White students are more likely to consider Title 1 schools at the top.

How stable are preferences for schools over time within applicant?

To investigate families' tastes for schools longitudinally in LUSD, I focus on the subsample of those who used UES in both fifth and eighth grade (i.e., for the transitions to middle and high school, respectively). In Figure 5, I plot the attributes of these families' top ranked schools in eighth grade against those of their top ranked schools in fifth grade. I then estimate regression models represented by equation (2) to explore how these simple bivariate relationships change after accounting for top school choice attributes concurrently. The coefficients from these models can be seen in Table 4.

[Insert Figure 5 about here.]

[Insert Table 4 about here.]

Applicants' tastes for schools are fairly stable over time. Figure 5 shows that families who prefer schools that are farther away (closer) for middle school tend to also prefer schools that are farther away (closer) for high school. The same can be said about the racial/ethnic makeup of schools' student populations. Though the quality of families' top ranked middle school predicts the quality of their top ranked high school, this relationship in particular appears weaker than those between application behaviors and proximity or demographic composition.

Results in the table help to contextualize those presented in Figure 5. For example, I show that one additional mile of distance between home and families' top school choice in fifth grade is associated with an average top high school choice that is .4 miles farther away. For each 10 percentage point difference in top middle school choice percent Black, White, and Hispanic, I find families' top high school choices to be six, four, and eight percentage points more Black, White, and Hispanic, respectively. Converging with the visual evidence presented in Figure 5, preferences for school quality are relatively less stable; for each 10 percentage point difference in top middle school choice SPF score, families' top high school choice score on average one percentage point higher on the same metric. Finally, if a UES applicant's top choice in fifth grade is a charter or Title 1 school, the applicant's top choice in eighth grade is 27 and 24 percentage points more likely to be a charter or Title 1 school, respectively.

How do the characteristic of the schools that applicants are assigned to impact their preferences in subsequent UES applications?

My results indicate that those using UES tend to apply to similar middle and high schools, based on distance from home, school demographic composition, and school quality. However, Figure 5 above also shows that substantial variation remains unexplained in families'

tastes over time. The need to understand what shapes preferences informs my study's attempt to next identify how the attributes of UES applicants' assigned schools impact their preferences expressed later on.

[Insert Table 5 about here.]

In Table 5, I show results from this exploration and provide in each column the regression coefficients for separate estimations of the model represented by equation (3). For each estimation, the dependent variable is a different characteristic of the top choice high school for those using unified enrollment in LUSD. These outcomes are predicted by the attributes of families' assigned middle schools in the district.

In panel A of the table, I present the regression coefficients from estimations without risk set fixed effects. As noted above, these fixed effects are necessary to arrive at causal estimates of the impact of the characteristics of students' assigned middle schools on later application behaviors in UES. Without these fixed effects, variation may be attributable to the self-selection of families into schools with different levels of quality, for example. I use the results in panel A as a comparison point for what estimates might look like when they are not purged of this bias. In general, attributes of families' assigned middle schools predict the same attribute of their top choice high schools when risk set fixed effects are not included in the model. UES applicants in fifth grade who are assigned to higher quality schools, schools serving large proportions of Black, White, or Hispanic students, schools farther away from home, charter schools, or Title 1 schools are more likely to rank as their top choice in eighth grade choice applications schools exhibiting those same traits.

When I make comparisons between applicants who experience different assigned schools by quasi-random chance, i.e., when I include risk set fixed effects in model estimations, the

impact of assigned school attributes on later application behaviors substantially attenuates. For example, in panel B when focusing on the impact of assigned middle school SPF score, I find that families assigned to middle schools that are of higher quality are not any more likely to value higher quality high schools. For every 10 percentage point difference in assigned school SPF score, the average top high school choice of families has an SPF score less than a percentage point higher—and this difference is neither significant nor close to the relationship observed when removing risk set fixed effects seen in panel A. The same pattern can be seen for assigned schools' demographic composition and charter school status.

However, I do find that families who are quasi-randomly assigned middle schools less (more) proximate to home are more likely to rank as their top high school choice schools that are less (more) proximate to home. For every additional mile of distance to assigned middle school, families rank as their top choice a high school that is on average .5 miles farther away. Similarly, families who are quasi-randomly assigned Title 1 schools following UES in fifth grade are 14 percentage points more likely to rank a Title 1 school first in their applications in eighth grade.

THREATS TO INTERNAL VALIDITY

In my investigation of families' preferences for schools in LUSD, I focus on the school characteristics that predict application behaviors to schools, the stability of these tastes for schools over time, and the impact of assigned school characteristics on later UES applications. Though the first two of these explorations are descriptive exercises, the third focal area of my study attempts to identify causal effects. There are several potential threats to the internal validity in my estimates of the impact of attributes of families' middle schools assigned through unified enrollment on their high school application behaviors (Table 5).

I am first concerned by the potential that differential attrition from my sample biases results. To investigate longitudinal UES data from families, I necessarily focus on those who use unified enrollment in LUSD in both fifth and eighth grade. Not all students who submitted applications for middle schools, however, also submitted applications for high schools. Many of these students did not yet have eighth grade application data at the time of this study. In Figure 6, I document the dispositions for those who, based on the time span of my panel of data, at least had the opportunity to use UES in both fifth and eighth grade.

[Insert Figure 6 about here.]

Most students who use unified enrollment for middle school choice are still in LUSD in sixth grade. Approximately 80 percent are also attending the school that they were assigned to by the UES process. But the figure shows that applicants' mobility rates away from the district and their assigned schools increase over time.

Some amount of "attrition" as students progress through middle school and into high school is not unsurprising nor uncommon. Families might move for reasons unrelated to the schools that they are assigned to in LUSD, and even in fifth grade I show that not all students in the district who could did submit applications to UES. However, this attrition means that I do not have outcome measures for families who do not use UES in eighth grade and/or leave LUSD. If families leave the district because of the specific attributes of the schools that they are assigned to, the internal validity of my estimates for the impact of assigned middle school attributes (Table 5) may be biased.

The patterns shown in Figure 6 generally assuage some concern about differential attrition of families from my sample. If families were responding specifically to the UES results in fifth grade by leaving LUSD, I would have expected a substantial increase in exit from LUSD

immediately in sixth grade. Instead, I observe a gradual increase in exit, which converges with typical patterns of families leaving a school district. The high rate of placement of families to one of their top two school choices (Table 1) may lead to this stability of district enrollment following UES student assignment for middle school.

[Insert Table 6 about here.]

To further explore potential attrition bias, in Table 6, I present coefficients from estimation of the regression model represented by equation (3), but I predict students' dispositions using students' UES assigned middle school characteristics, controlling for students' risk sets to ensure that variation in school attributes is due to quasi-random chance. Ideally, I would find that none of the attributes of applicants' assigned middle school predict measures that capture attrition from the sample. For the 17,500 students who used UES in fifth grade that I could potentially have eighth grade unified enrollment application data for, none of the attributes of students' assigned middle school consistently predict attrition over time. The evidence in totality leads me to conclude that attrition is not a major concern for the internal validity of my estimates.

[Insert Table 7 about here.]

In traditional experiments, it is also common for researchers to test for baseline differences between those in the treatment and control groups. In Table 7, I present results from analogous tests, which helps to address concerns that any observed effects of assigned middle school characteristics on high school UES applications might be attributable to differences between which families are exposed to these different characteristics. The table specifically provides regression coefficients from estimations of the regression model represented by equation (3), but with applicants' baseline characteristics as the dependent variable. Ideally, I

would find that none of the assigned school attributes significantly predict these baseline characteristics after accounting for variation across risk sets. Overall, I uncover little evidence that quasi-randomly assigned middle school attributes predict students' achievement or other background characteristics (e.g., gender, race/ethnicity).

DISCUSSION AND CONCLUSION

In this paper I investigate families' preferences for school attributes using families' school application data from a large urban school district (LUSD), one of the largest districts in the U.S. with substantial school choice. My results replicate past studies that show families to generally care about school proximity, quality, and the demographic composition of schools. I provide the first evidence on whether families' tastes for schools are similar over time. I find that applicants' top middle school choices largely look similar to their top high school choices in terms of the racial/ethnic makeup of the student population and distance from home; quality is more weakly predictive over time.

Policymakers in education have incentive to increase enrollment at high performing schools and/or addressing the segregation of student subgroups between schools. Yet little prior research has demonstrated how families' tastes for school attributes may be shaped so that these goals—especially the latter—can be achieved more easily. My study is the first to investigate the causal effect of families' prior schools on their preferences when selecting schools in the future. I find that the characteristics of families' middle schools quasi-randomly assigned through the district's UES unified enrollment program largely do not impact their application behaviors to high schools. Though families assigned to schools of higher quality or those that serve a larger population of students from a specific race/ethnic subgroup (e.g., Black, White, or Hispanic)

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appear to value these attributes when choosing schools later on, after accounting for different preferences for schools across families, these impacts disappear. Thus, though school choice policies in districts like LUSD afford families the chance to express their preferences for enrollment into higher quality and/or more diverse schools, the unbiased effect of being assigned a higher quality and/or more diverse school does not appear to moderate families' tastes.

There are some limitations to my causal estimates for the impact of attributes of families' quasi-randomly assigned schools. First, the standard errors on many regression coefficients (Table 5, panel B) include zero but also a wide range of potential magnitudes. For example, the 95-percent confidence interval for the impact of assigned school SPF score, my measure of school quality, spans from approximately -.08 to .12. This indicates that a 10 percentage point increment in assigned school SPF scores between families in LUSD with the same exact preferences for schools and priorities at these schools leads anywhere from a .8 percentage point decrement to a 1.2 percentage point increment in preferred high school SPF score on average. However, even when I consider the extent of plausible magnitudes for coefficients, it is noteworthy that the impact of assigned school characteristics is substantially lower than the unadjusted effects that do not account for families' prior school preferences (Table 6, panel A).

Second, as I allude to earlier, my empirical strategy does not allow me to make conclusions on the causal impact of the characteristics of assigned school attributes on tastes for schools per se, but instead the causal impact on tastes from being assigned schools that possess certain characteristics. My models may be excluding other key school-based factors that explain relationships between included measures and families' application behaviors. Though I cannot fully account for omitted variable bias in my estimates, I have been able to investigate most of the characteristics used in prior research on school preferences—and in particular those that

educational policymakers have some control over affecting. Given the impracticality of random or quasi-random assignment of families to school attributes, my study provides the next best approximation to answer the question of how assigned school attributes predict families' tastes for schools.

School choice can help address persistent educational and adulthood inequalities in our society. The evidence thus far, however, highlights that the potential for school district policies like unified enrollment to lead to systemwide improvements depends on attending to the intersection between the policies themselves and how families engage with them. The decision by families to use school choice in a manner that would support educational policymakers' goals undoubtedly predicts the effectiveness of school choice policies. Future research should thus build on the work described in this paper and continue to seek causal moderators of families' preferences for schools—so that programs might be designed that encourage families towards schools of higher quality and diversity.

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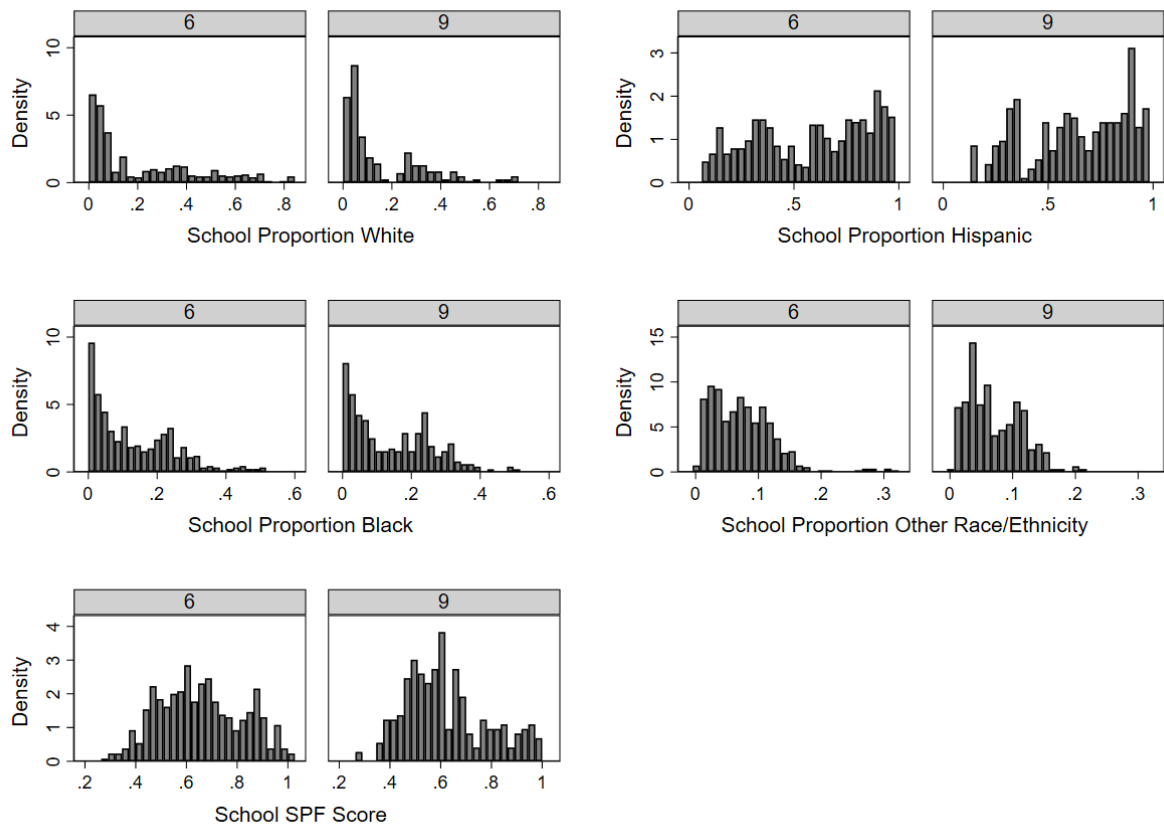
Figure 1. Distribution of Characteristics for School-School Year Observations by Grade

Note: Grade subplots include the schools that LUSD students apply to using UES during fifth grade (6) and eighth grade (9).
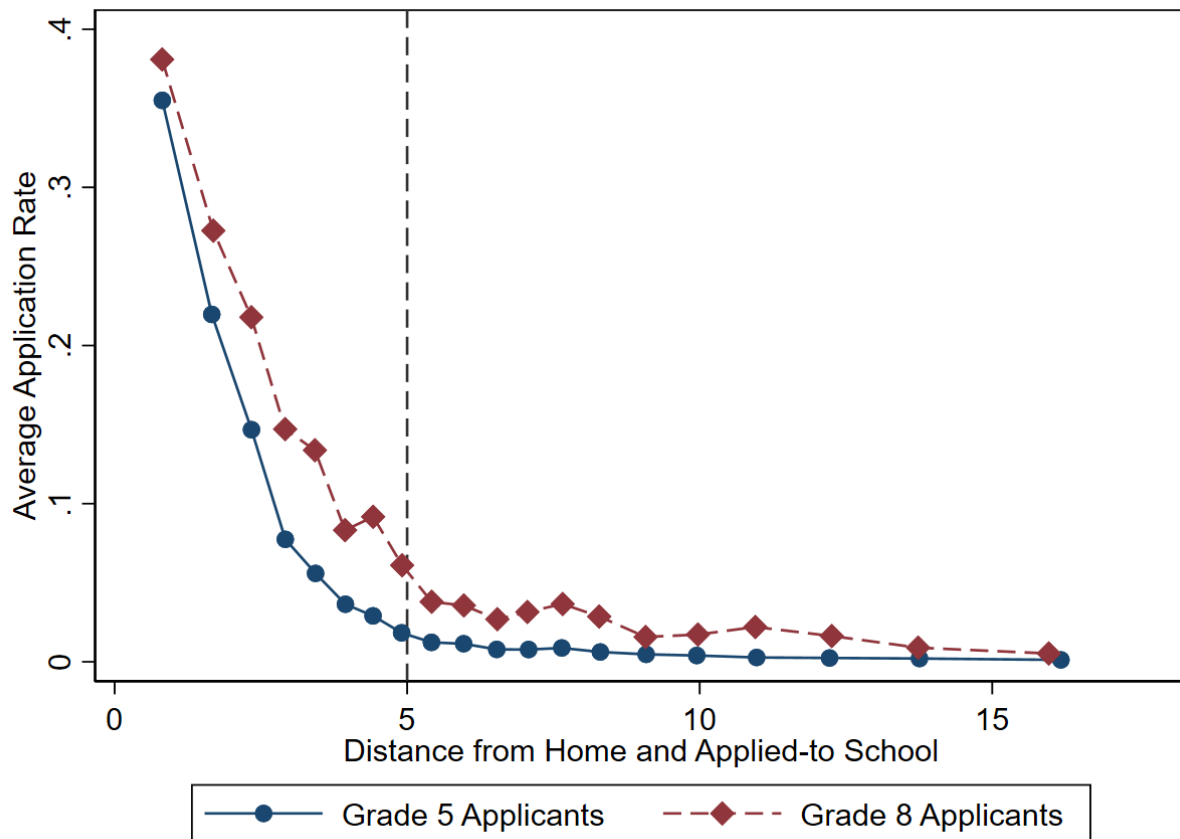
Figure 2. Scatter Plot (20 Bins) of Average Application Rates to Schools Against School Proximity to Students' Homes by Grade

Note: Average application rates represent the average proportion of schools applied to of all possible schools across students in a grade level.
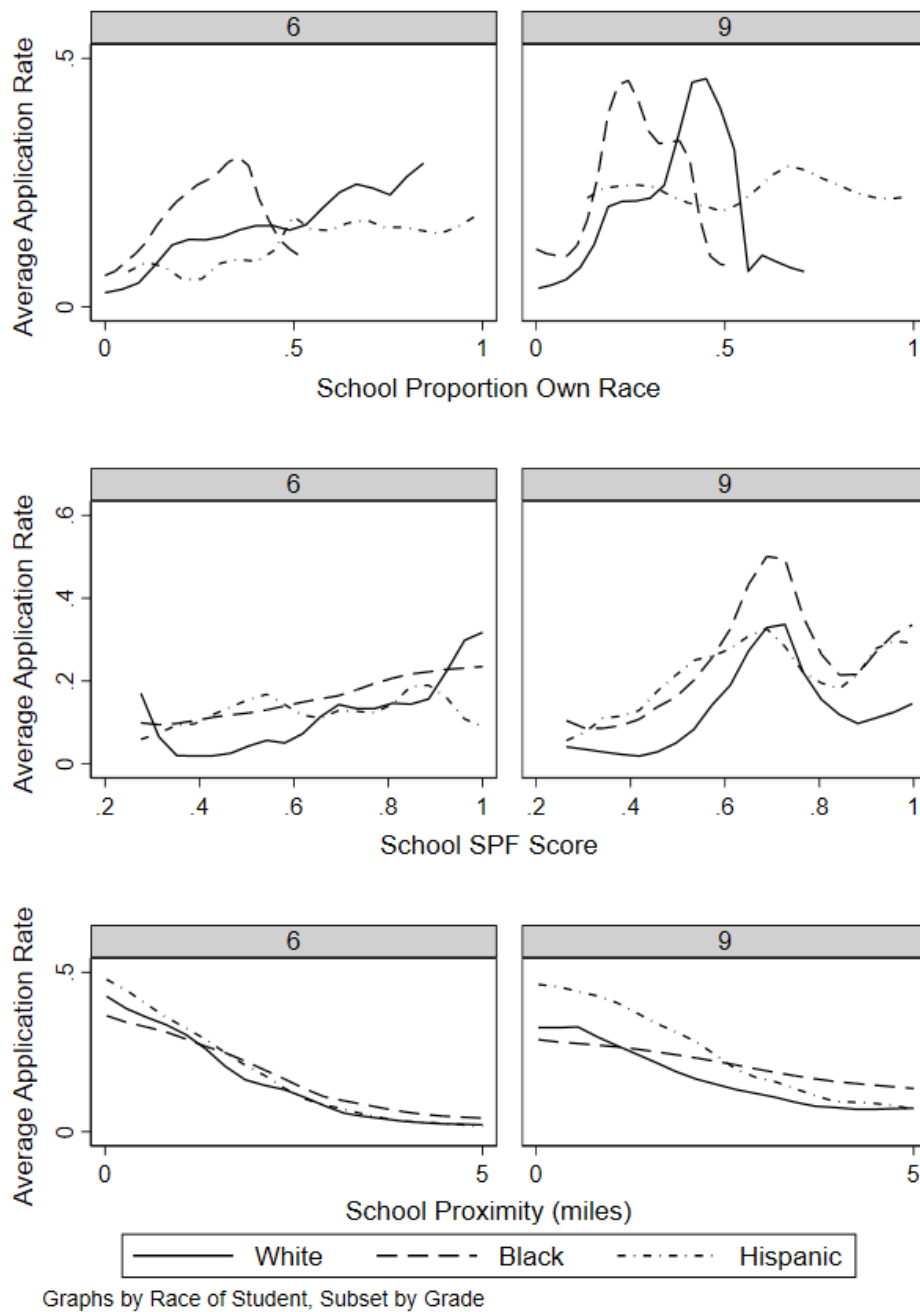
Figure 3. Kernel-weighted Local Polynomial Smooth Plot of Application Rates to Schools Against School Characteristics by Grade and Applicant Race/Ethnicity

Note: Average application rates represent the average proportion of schools applied to of all schools in students' choice sets across students in a grade level and of a race/ethnicity. Local polynomial smooth obtained via Stata's *lpoly* function with default settings.
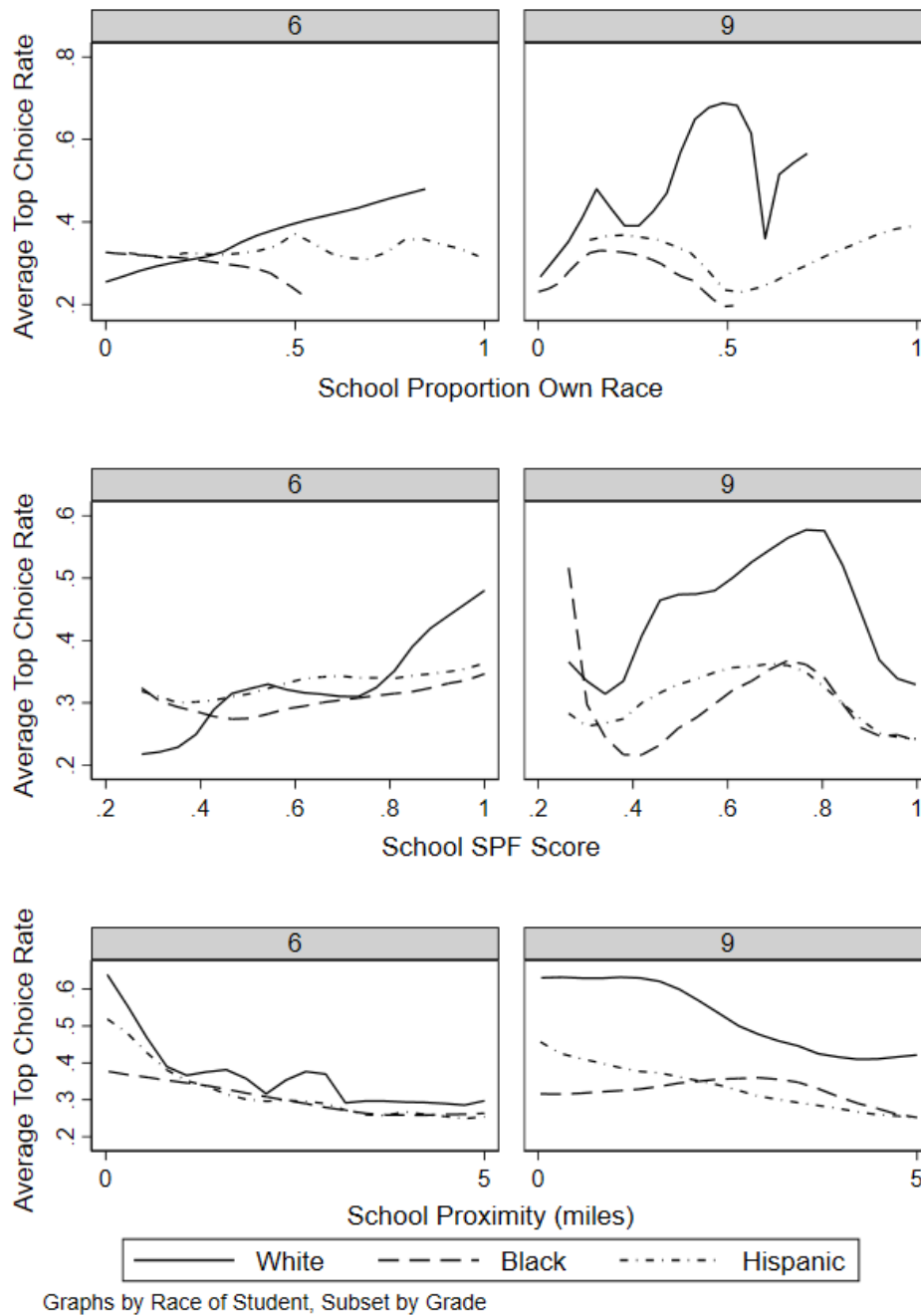
Figure 4. Kernel-weighted Local Polynomial Smooth Plot of Top Choice Rates to Schools Against School Characteristics by Grade and Applicant Race/Ethnicity

Note: Average top choice rates represent the average proportion of schools ranked as applicants' top choice of all schools applied to in UES applications across students in a grade level and of a race/ethnicity. Local polynomial smooth obtained via Stata's *lpoly* function with default settings.
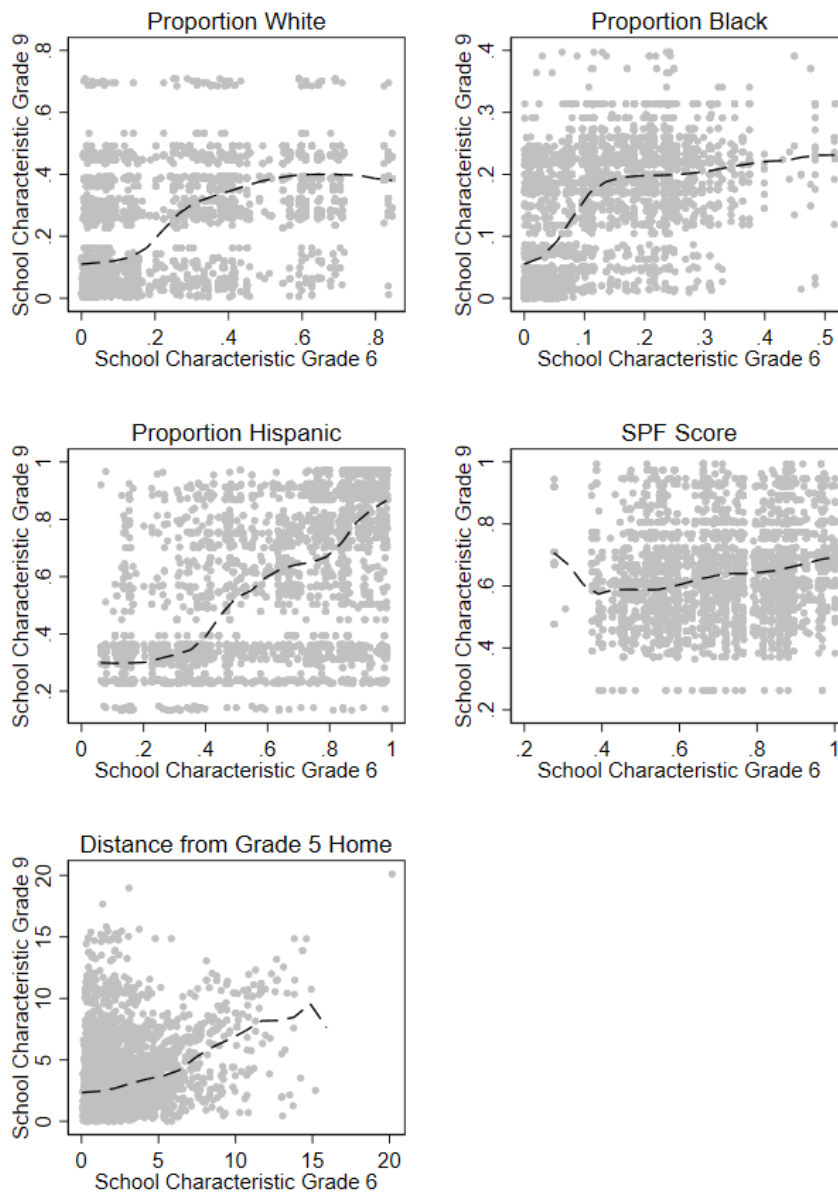
Figure 5. Kernel-weighted Local Polynomial Smooth and Scatter Plot of Grade 9 Top Ranked Schools' Characteristics Against Grade 6 Top Ranked Schools' Characteristics

Note: School characteristics come from students' top ranked schools in UES applications for grades 6 and 9. Local polynomial smooth obtained via Stata's *lpoly* function with default settings.
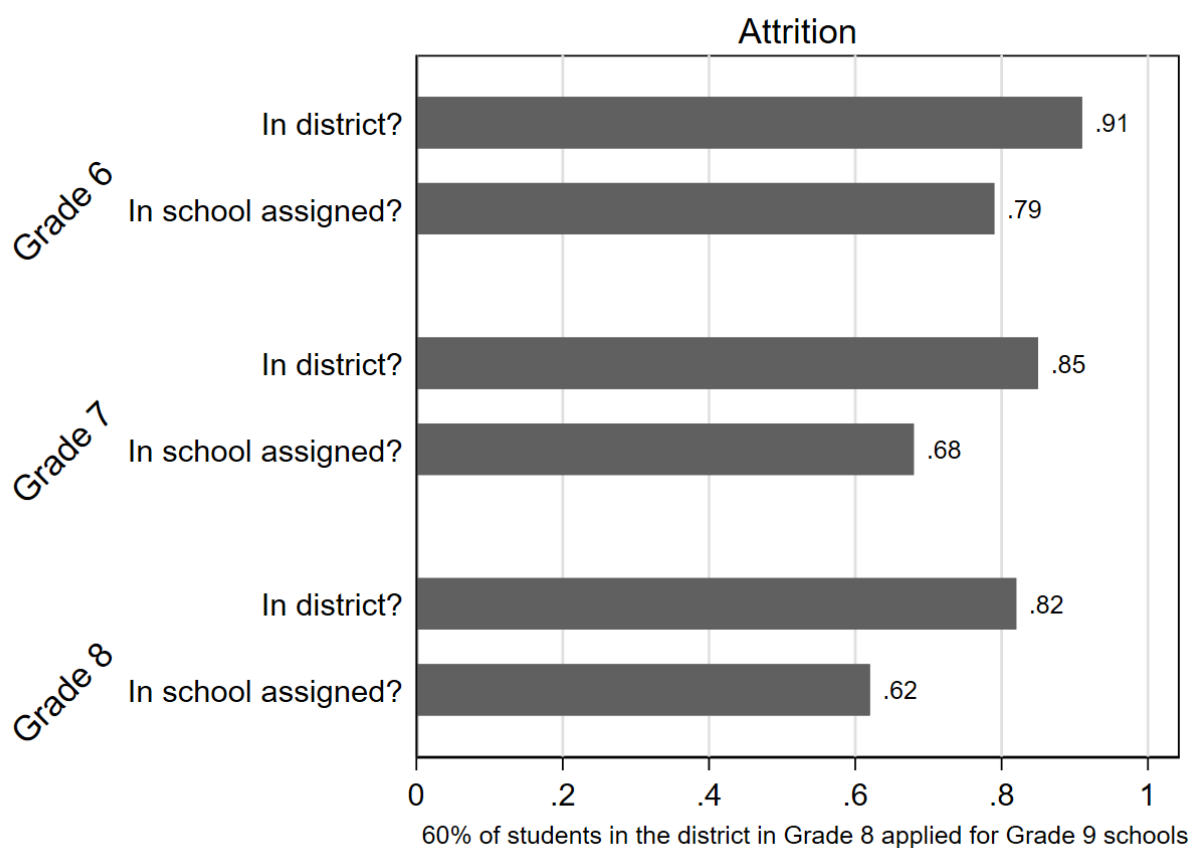
Figure 6. Proportion of Students Remaining in the District and/or School Assigned Over Time for Those Using UES in Grade 5

Table 1. Descriptive statistics of students.

	Not In Sample		In Sample			
	Mean	SD	Mean	SD	Difference	
Panel A. Applying to Grade 6 Schools						
N	14279.00		34324.00		20045.00	
Age (Years)	11.52	(.397)	11.50	(.373)	-0.02	***
Median household income (CBG)	47553.16	(2357)	55254.19	(3091)	7701.03	***
English language learner	0.35		0.34		-0.01	
Gifted	0.09		0.18		0.09	***
Male	0.52		0.51		-0.01	*
Race/ethnicity: Black	0.17		0.13		-0.05	***
Race/ethnicity: Hispanic	0.64		0.61		-0.03	***
Race/ethnicity: White	0.19		0.26		0.08	***
Student with disability	0.15		0.11		-0.04	***
Mathematics test *z*-score	-0.26	(.918)	0.07	(1.00)	0.33	***
Number of schools applied to			3.02	(1.51)		
Assigned top choice school			0.82			
Assigned second choice school			0.11			
Assigned third choice school			0.03			
Assigned fourth choice school			0.01			
Assigned fifth choice school (or higher)			0.00			
Panel B. Applying to Grade 9 Schools						
N	18816.00		23625.00		4809.00	
Age (Years)	14.55	(.429)	14.51	(.398)	-0.04	***
Median household income (CBG)	49455.80	(2562)	53724.34	(2921)	4268.54	***
English language learner	0.29		0.28		0.00	
Gifted	0.18		0.25		0.07	***
Male	0.52		0.49		-0.03	***
Race/ethnicity: Black	0.15		0.15		-0.01	~
Race/ethnicity: Hispanic	0.65		0.63		-0.03	***
Race/ethnicity: White	0.19		0.23		0.03	***
Student with disability	0.13		0.11		-0.03	***
Mathematics test *z*-score	-0.14	(.991)	0.11	(1.00)	0.25	***
Number of schools applied to			2.86	(1.55)		
Assigned top choice school			0.83			
Assigned second choice school			0.11			
Assigned third choice school			0.03			
Assigned fourth choice school			0.01			
Assigned fifth choice school (or higher)			0.00			

Note: Not-in-sample (in-sample) students include those enrolled in either fifth or eighth grade who do not (do) use UES. The statistical significance of the difference between means is determined using a paired *t-test*. ~*p<.1*; **p<.05*; ***p<.01*; ****p<.001*.

Table 2. Relationships between school characteristics and inclusion of schools in students' UES applications.

	(1)	(2)	(3)	(4)	(5)	(6)
Charter school	-0.0336**	-0.0713***	0.0479***	-0.0125	0.0358***	-0.0635**
	(0.0136)	(0.0233)	(0.0100)	(0.0235)	(0.0127)	(0.0278)
Proportion own race	0.306***	1.484***	0.361***	0.0898	1.509***	2.300***
	(0.0942)	(0.210)	(0.109)	(0.272)	(0.121)	(0.224)
Title 1 school	-0.0280	0.0145	0.0457***	0.105**	0.0197	-0.0189
	(0.0208)	(0.0411)	(0.0153)	(0.0413)	(0.0167)	(0.0312)
SPF score	-0.827**	1.940***	0.215	1.642***	-0.0793	1.953***
	(0.370)	(0.394)	(0.192)	(0.481)	(0.279)	(0.440)
Distance from home (miles)	-0.0438***	-0.00995***	-0.0551***	-0.00487	-0.00941***	0.0571***
	(0.00431)	(0.00347)	(0.00274)	(0.00413)	(0.00291)	(0.00243)
Proportion own race squared	-0.340**	-1.799***	-0.264***	-0.113	-2.456***	-3.718***
	(0.142)	(0.242)	(0.0903)	(0.211)	(0.269)	(0.537)
SPF score squared	0.798***	-1.419***	-0.00717	-1.011***	0.255	-1.239***
	(0.289)	(0.305)	(0.153)	(0.370)	(0.211)	(0.342)
Student race/ethnicity	White	White	Hispanic	Hispanic	Black	Black
Observations	184626	59336	418608	173885	76416	36825
N School-Year Observations	416	232	416	232	416	232
Grade	6	9	6	9	6	9

Note: Regressions include fixed effects for school year of UES application and an indicator variable capturing if the applied to school is a new school the following school year, and standard errors are clustered at the school-school year level, as specified by equation (1). ~$p<.1$; *$p<.05$; **$p<.01$; ***$p<.001$.

Table 3. Relationships between school characteristics and ranking of school as students' top choice in UES applications.

	(1)	(2)	(3)	(4)	(5)	(6)
Charter school	-0.143***	-0.143***	-0.107***	-0.107***	-0.0697***	-0.124***
	(0.0284)	(0.0512)	(0.0165)	(0.0248)	(0.0158)	(0.0305)
Proportion own race	0.667***	1.083***	0.565***	-1.507***	0.149	0.668*
	(0.178)	(0.236)	(0.169)	(0.242)	(0.203)	(0.356)
Title 1 school	0.0725***	0.131***	-0.0182	0.0501*	-0.0252	-0.0554**
	(0.0280)	(0.0345)	(0.0249)	(0.0277)	(0.0225)	(0.0276)
SPF score	-1.692***	0.676	0.000623	1.950***	-0.165	1.293**
	(0.549)	(0.729)	(0.302)	(0.446)	(0.377)	(0.504)
Distance from home (miles)	-0.0231***	-0.0516***	-0.0291***	-0.0286***	-0.0166***	-0.0146***
	(0.00482)	(0.00436)	(0.00198)	(0.00186)	(0.00220)	(0.00196)
Proportion own race squared	-0.644**	-0.0677	-0.370***	1.270***	-0.630	-1.533
	(0.257)	(0.399)	(0.132)	(0.193)	(0.504)	(0.976)
SPF score squared	1.471***	-0.543	0.295	-1.244***	0.240	-0.796**
	(0.424)	(0.529)	(0.233)	(0.326)	(0.277)	(0.342)
Student race/ethnicity	White	White	Hispanic	Hispanic	Black	Black
Observations	24387	10514	63179	44988	14065	11393
N School-Year Observations	465	260	477	268	455	261
Grade	6	9	6	9	6	9

Note: Regressions include fixed effects for school year of UES application and an indicator variable capturing if the applied to school is a new school the following school year, and standard errors are clustered at the school-school year level, as specified by equation (1). ~$p<.1$; *$p<.05$; **$p<.01$; ***$p<.001$.

Table 4. Relationships between school characteristics of students' top sixth grade choice in UES applications and school characteristics of students' top ninth grade choice in UES applications.

	Charter school	Proportion Black	Proportion White	Proportion Hispanic	Title 1 school	SPF score	Distance from home (miles)
Charter school	0.266***	-0.0573***	-0.0159	0.00623	0.0266	0.00465	-0.311*
	(0.0389)	(0.00675)	(0.0120)	(0.0172)	(0.0372)	(0.0123)	(0.161)
Proportion Black	0.344**	0.557***			-0.864***	0.360***	4.708***
	(0.140)	(0.0279)			(0.157)	(0.0584)	(0.799)
Proportion White			0.420***				
			(0.0462)				
Proportion Hispanic	0.430***			0.760***	0.757***	-0.0724**	0.730
	(0.0762)			(0.0287)	(0.141)	(0.0351)	(0.453)
Title 1 school	-0.00418	-0.0127	-0.0642***	-0.0194	0.239***	-0.0127	-0.0277
	(0.0297)	(0.00787)	(0.0188)	(0.0174)	(0.0502)	(0.0148)	(0.170)
SPF score	0.263**	0.125***	-0.102**	0.180***	-0.0703	0.112**	0.472
	(0.121)	(0.0243)	(0.0480)	(0.0553)	(0.139)	(0.0506)	(0.474)
Distance from home (miles)	-0.00213	0.000950	0.00345	-0.00251	0.00227	0.000333	0.398***
	(0.00278)	(0.00112)	(0.00220)	(0.00311)	(0.00742)	(0.00173)	(0.0313)
Proportion other race/ethnicity	0.277				1.746***	0.0503	0.553
	(0.246)				(0.430)	(0.136)	(1.629)
Observations	8573	8573	8573	8573	8573	8573	8573
N School-Year Observations	263	263	263	263	263	263	263

Note: Regressions include fixed effects for school year of UES application and an indicator variable capturing if the applied to school is a new school the following school year, and standard errors are clustered at the school-school year level, as specified by equation (2). ~$p<.1$; *$p<.05$; **$p<.01$; ***$p<.001$.

Table 5. Impact of school characteristics of students' assigned top sixth grade choice in UES applications on school characteristics of students' top ninth grade choice in UES applications.

	SPF score	Proportion Black	Proportion White	Proportion Hispanic	Distance from home (miles)	Charter school	Title 1 school
			Panel A. No Risk set Fixed Effects				
SPF score	0.114**	0.137***	-0.0773	0.152**	0.485	0.235*	-0.107
	(0.0493)	(0.0258)	(0.0535)	(0.0605)	(0.499)	(0.120)	(0.153)
Proportion Black	0.355***	0.562***			4.482***	0.362**	-0.845***
	(0.0639)	(0.0282)			(0.823)	(0.144)	(0.179)
Proportion White			0.441***				
			(0.0533)				
Proportion Hispanic	-0.0916**			0.787***	0.583	0.470***	0.802***
	(0.0380)			(0.0335)	(0.514)	(0.0789)	(0.162)
Distance from home (miles)	0.00125	0.000940	0.00510**	-0.00434	0.392***	-0.000617	-0.000685
	(0.00191)	(0.00137)	(0.00238)	(0.00362)	(0.0319)	(0.00330)	(0.00844)
Charter school	0.00436	-0.0555***	-0.0215*	0.00857	-0.286*	0.249***	0.0161
	(0.0127)	(0.00659)	(0.0126)	(0.0181)	(0.165)	(0.0363)	(0.0363)
Title 1 school	-0.000184	-0.00966	-0.0561***	-0.0280	0.115	-0.0240	0.221***
	(0.0151)	(0.00749)	(0.0203)	(0.0180)	(0.176)	(0.0317)	(0.0530)
Proportion other race/ethnicity	-0.0269				2.019	0.0139	1.760***
	(0.140)				(1.942)	(0.252)	(0.520)
Observations	8581	8581	8581	8581	8581	8581	8581
N Clusters	251	251	251	251	251	251	251
			Panel B. Risk set Fixed Effects				
SPF score	0.0170	0.0156	-0.0234	0.0237	-0.939	0.405*	-0.0657
	(0.0521)	(0.0241)	(0.0529)	(0.0742)	(0.794)	(0.224)	(0.160)
Proportion Black	-0.0525	0.0309			4.196	0.226	0.285
	(0.134)	(0.0577)			(2.598)	(0.443)	(0.442)
Proportion White			0.0424				
			(0.0819)				
Proportion Hispanic	-0.0835			0.147	1.442	-0.0508	-0.0725
	(0.0788)			(0.104)	(1.626)	(0.286)	(0.264)

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Distance from home (miles)	-0.00152	0.000777	-0.00408**	0.00336	0.526***	0.00497	0.00625
	(0.00191)	(0.00102)	(0.00194)	(0.00267)	(0.0511)	(0.00559)	(0.00616)
Charter school	0.00284	-0.0101	-0.00926	0.0173	0.371	0.0541	-0.0261
	(0.0183)	(0.00690)	(0.0179)	(0.0260)	(0.276)	(0.0700)	(0.0534)
Title 1 school	0.0139	-0.00984	-0.0275	0.0145	-0.340	0.0414	0.143*
	(0.0249)	(0.0102)	(0.0231)	(0.0330)	(0.457)	(0.0836)	(0.0779)
Proportion other race/ethnicity	0.135				3.996	-1.512	-1.450*
	(0.248)				(5.092)	(0.949)	(0.754)
Observations	8581	8581	8581	8581	8581	8581	8581
N Clusters	3879	3879	3879	3879	3879	3879	3879
Risk set	Top 2	Top 2	Top 2	Top 2	Top 2	Top 2	Top 2

Note: Regressions in panel A include fixed effects for school year of UES application; standard errors are clustered at the school-school year level. Regressions in panel B include fixed effects grouping students who apply to the same top two schools in their UES applications for sixth grade and have the same priorities at these schools; standard errors are clustered at the risk set level, as specified by equation (3). ~$p<.1$; *$p<.05$; **$p<.01$; ***$p<.001$.

Table 6. Impact of school characteristics of students' assigned top sixth grade choice in UES applications on student-level enrollment and UES application Status over time.

	In LUSD in Grade 6	In LUSD in Grade 7	In LUSD in Grade 8	Used UES in Grade 9
Charter school	-0.00255	-0.0213	-0.0224	-0.137**
	(0.0307)	(0.0359)	(0.0399)	(0.0545)
Title 1 school	-0.0558*	-0.0498	-0.0152	0.0144
	(0.0315)	(0.0354)	(0.0423)	(0.0548)
Distance from home (miles)	-0.00186	-0.000868	-0.00718*	0.00212
	(0.00305)	(0.00378)	(0.00417)	(0.00453)
SPF score	0.0641	0.0448	0.110	0.363**
	(0.0996)	(0.112)	(0.127)	(0.172)
Proportion Black	-0.208	-0.279	-0.219	0.189
	(0.221)	(0.244)	(0.275)	(0.337)
Proportion Hispanic	-0.0691	-0.0962	-0.0478	0.301
	(0.121)	(0.132)	(0.150)	(0.216)
Proportion other race/ethnicity	-0.392	-0.333	-0.141	-2.558***
	(0.364)	(0.390)	(0.464)	(0.702)
Observations	17465	17465	17465	17465
N Risk sets	6680	6680	6680	6680
Risk set	Top 2	Top 2	Top 2	Top 2

Note: Regressions include fixed effects grouping students who apply to the same top two schools in their UES applications for sixth grade and have the same priorities at these schools; standard errors are clustered at the risk set level, as specified by equation (3). ~$p<.1$; *$p<.05$; **$p<.01$; ***$p<.001$.

Table 7. Impact of school characteristics of students' assigned top sixth grade choice in UES applications on student-level baseline characteristics.

	Male	Mathematics test z-score	English language learner	Gifted	Student with disability	Median household income (CBG)	Age (Years)	Black	Hispanic	White
Charter school	-0.0652	0.244*	-0.121*	-0.0753	-0.0279	4654	0.0155	0.00993	-0.0170	0.00708
	(0.0686)	(0.148)	(0.0632)	(0.0643)	(0.0497)	(3473)	(0.0544)	(0.0447)	(0.0552)	(0.0472)
Title 1 school	0.0608	0.105	-0.0497	-0.0557	-0.0681	1586	0.0279	-0.0186	-0.0306	0.0492
	(0.0873)	(0.164)	(0.0675)	(0.0783)	(0.0596)	(4797)	(0.0613)	(0.0593)	(0.0735)	(0.0601)
Distance from home (miles)	0.00821	-0.0107	0.00450	-0.000818	-0.00324	-361.3	-0.00178	0.00702	0.00965	-0.0167***
	(0.00827)	(0.0136)	(0.00631)	(0.00669)	(0.00442)	(568.3)	(0.00582)	(0.00615)	(0.00661)	(0.00562)
SPF score	-0.00419	-0.504	0.262	0.0723	-0.104	-10607	0.143	0.0404	0.0281	-0.0685
	(0.206)	(0.456)	(0.170)	(0.202)	(0.138)	(9777)	(0.165)	(0.124)	(0.150)	(0.138)
Proportion Black	-0.0687	-0.0435	-0.00867	0.0611	-0.313	8498	-0.232	0.328	-0.186	-0.142
	(0.519)	(0.908)	(0.390)	(0.451)	(0.283)	(31510)	(0.355)	(0.392)	(0.432)	(0.383)
Proportion Hispanic	-0.127	-0.550	0.260	0.0299	0.0828	-10184	0.0320	0.242	0.0480	-0.290
	(0.305)	(0.492)	(0.227)	(0.277)	(0.156)	(21264)	(0.216)	(0.176)	(0.256)	(0.259)
Proportion other race/ethnicity	0.661	-1.562	0.439	-1.686**	0.401	10824	0.540	0.966	-0.596	-0.370
	(1.078)	(1.665)	(0.772)	(0.773)	(0.652)	(61750)	(0.674)	(0.685)	(0.751)	(0.578)
Observations	8581	8581	8581	8581	8581	8581	8581	8581	8581	8581
N Risk sets	3879	3879	3879	3879	3879	3879	3879	3879	3879	3879
Risk set	Top 2	Top 2	Top 2	Top 2	Top 2	Top 2	Top 2	Top 2	Top 2	Top 2

Note: Regressions include fixed effects grouping students who apply to the same top two schools in their UES applications for sixth grade and have the same priorities at these schools; standard errors are clustered at the risk set level, as specified by equation (3). ~p<.1; *p<.05; **p<.01; ***p<.001.

Appendix Tables

Table A1. Impact of school characteristics of students' assigned top sixth grade choice in UES applications on school characteristics of students' top ninth grade choice in UES applications.

	SPF score	Proportion Black	Proportion White	Proportion Hispanic	Distance from home (miles)	Charter school	Title 1 school
			Panel A. No Risk set Fixed Effects				
SPF score	0.114**	0.137***	-0.0773	0.152**	0.485	0.235*	-0.107
	(0.0493)	(0.0258)	(0.0535)	(0.0605)	(0.499)	(0.120)	(0.153)
Proportion Black	0.355***	0.562***			4.482***	0.362**	-0.845***
	(0.0639)	(0.0282)			(0.823)	(0.144)	(0.179)
Proportion White			0.441***				
			(0.0533)				
Proportion Hispanic	-0.0916**			0.787***	0.583	0.470***	0.802***
	(0.0380)			(0.0335)	(0.514)	(0.0789)	(0.162)
Distance from home (miles)	0.00125	0.000940	0.00510**	-0.00434	0.392***	-0.000617	-0.000685
	(0.00191)	(0.00137)	(0.00238)	(0.00362)	(0.0319)	(0.00330)	(0.00844)
Charter school	0.00436	-0.0555***	-0.0215*	0.00857	-0.286*	0.249***	0.0161
	(0.0127)	(0.00659)	(0.0126)	(0.0181)	(0.165)	(0.0363)	(0.0363)
Title 1 school	-0.000184	-0.00966	-0.0561***	-0.0280	0.115	-0.0240	0.221***
	(0.0151)	(0.00749)	(0.0203)	(0.0180)	(0.176)	(0.0317)	(0.0530)
Proportion other race/ethnicity	-0.0269				2.019	0.0139	1.760***
	(0.140)				(1.942)	(0.252)	(0.520)
Observations	8581	8581	8581	8581	8581	8581	8581
N Clusters	251	251	251	251	251	251	251
			Panel B. Risk set Fixed Effects				
SPF score	0.0297	0.0159	-0.00259	-0.0236	-0.962	0.451	-0.102
	(0.112)	(0.0500)	(0.0918)	(0.141)	(1.600)	(0.496)	(0.270)
Proportion Black	-0.0994	0.0848			2.751	0.411	0.115
	(0.280)	(0.126)			(5.619)	(1.007)	(1.034)
Proportion White			0.172				
			(0.172)				

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Proportion Hispanic	-0.130			0.295	0.378	0.0854	0.107
	(0.146)			(0.198)	(2.702)	(0.560)	(0.577)
Distance from home (miles)	-0.00332	0.00218	-0.00465	0.00250	0.544***	0.00235	0.00632
	(0.00292)	(0.00166)	(0.00307)	(0.00445)	(0.0757)	(0.00792)	(0.00977)
Charter school	-0.00150	-0.00512	-0.0130	0.0104	0.162	0.0193	0.000375
	(0.0367)	(0.0151)	(0.0317)	(0.0515)	(0.592)	(0.166)	(0.105)
Title 1 school	0.0130	-0.00924	-0.0271	0.00438	-0.756	0.0338	0.192
	(0.0442)	(0.0171)	(0.0326)	(0.0471)	(0.850)	(0.146)	(0.133)
Proportion other race/ethnicity	0.145				1.652	-1.581	-0.829
	(0.420)				(7.385)	(1.719)	(1.460)
Observations	8581	8581	8581	8581	8581	8581	8581
N Clusters	5586	5586	5586	5586	5586	5586	5586
Risk set	Top 3	Top 3	Top 3	Top 3	Top 3	Top 3	Top 3

Note: Regressions in panel A include fixed effects for school year of UES application; standard errors are clustered at the school-school year level. Regressions in panel B include fixed effects grouping students who apply to the same top three schools in their UES applications for sixth grade and have the same priorities at these schools; standard errors are clustered at the risk set level, as specified by equation (3). $\sim p<.1$; $*p<.05$; $**p<.01$; $***p<.001$.

Table A2. Impact of school characteristics of students' assigned top sixth grade choice in UES applications on student-level enrollment and UES application status over time.

	Grade 6	Grade 7	Grade 8	Applied to Grade 9
Charter school	-0.0453	-0.0447	-0.0364	-0.134
	(0.0595)	(0.0722)	(0.0823)	(0.106)
Title 1 school	-0.0664	-0.0541	0.00766	0.00600
	(0.0578)	(0.0670)	(0.0715)	(0.0972)
Distance from home (miles)	-0.000101	-0.00141	-0.00916	0.00139
	(0.00462)	(0.00639)	(0.00694)	(0.00785)
SPF score	0.106	0.0720	0.145	0.378
	(0.180)	(0.223)	(0.259)	(0.336)
Proportion Black	-0.521	-0.413	-0.310	-0.0394
	(0.401)	(0.479)	(0.531)	(0.693)
Proportion Hispanic	-0.133	-0.101	-0.146	0.304
	(0.243)	(0.270)	(0.283)	(0.423)
Proportion other race/ethnicity	-0.210	-0.139	-0.397	-2.508**
	(0.625)	(0.718)	(0.787)	(1.142)
Observations	17465	17465	17465	17465
N Risk sets	10699	10699	10699	10699
Risk set	Top 3	Top 3	Top 3	Top 3

Note: Regressions include fixed effects grouping students who apply to the same top three schools in their UES applications for sixth grade and have the same priorities at these schools; standard errors are clustered at the risk set level, as specified by equation (3). ~$p<.1$; *$p<.05$; **$p<.01$; ***$p<.001$.

Table A3. Impact of school characteristics of students' assigned top sixth grade choice in UES applications on student-level baseline characteristics.

	Male	Mathematics test z-score	English language learner	Gifted	Student with disability	Median household income (CBG)	Age (Years)	Black	Hispanic	White
Charter school	-0.0577	0.244	-0.286*	0.0324	-0.0318	5942	0.0794	0.0672	-0.0477	-0.0195
	(0.169)	(0.305)	(0.156)	(0.150)	(0.0715)	(6266)	(0.121)	(0.0838)	(0.0960)	(0.0913)
Title 1 school	0.0899	0.277	-0.177	0.150	-0.00221	1027	-0.0125	-0.0491	-0.0768	0.126
	(0.191)	(0.345)	(0.134)	(0.153)	(0.0850)	(8441)	(0.113)	(0.105)	(0.127)	(0.119)
Distance from home (miles)	0.00734	-0.00457	-0.00283	-0.00228	-0.00452	-268.4	0.000321	0.00978	0.00638	-0.0162
	(0.0141)	(0.0251)	(0.0101)	(0.0116)	(0.00733)	(977.5)	(0.0100)	(0.00973)	(0.0111)	(0.00989)
SPF score	-0.0357	-0.401	0.484	-0.100	-0.169	-10287	0.114	-0.0171	-0.0325	0.0496
	(0.533)	(0.934)	(0.394)	(0.448)	(0.239)	(16393)	(0.347)	(0.182)	(0.247)	(0.228)
Proportion Black	0.224	2.120	-0.117	0.411	-0.611	40163	-0.533	0.614	-0.903	0.289
	(1.250)	(1.726)	(0.863)	(1.024)	(0.512)	(81826)	(0.678)	(0.798)	(0.677)	(0.635)
Proportion Hispanic	-0.212	-0.323	0.410	-0.170	-0.179	-27724	-0.0271	0.0889	0.409	-0.498
	(0.650)	(0.855)	(0.462)	(0.549)	(0.225)	(34186)	(0.417)	(0.320)	(0.368)	(0.450)
Proportion other race/ethnicity	-0.411	-2.033	-0.0496	-1.819	0.239	-42435	0.775	0.848	0.341	-1.189
	(2.235)	(2.837)	(1.378)	(1.686)	(0.977)	(117770)	(1.113)	(0.959)	(0.876)	(0.919)
Observations	8581	8581	8581	8581	8581	8581	8581	8581	8581	8581
N Risk sets	5586	5586	5586	5586	5586	5586	5586	5586	5586	5586
Risk set	Top 3	Top 3	Top 3	Top 3	Top 3	Top 3	Top 3	Top 3	Top 3	Top 3

Note: Regressions include fixed effects grouping students who apply to the same top three schools in their UES applications for sixth grade and have the same priorities at these schools; standard errors are clustered at the risk set level, as specified by equation (3).
*~p<.1; *p<.05; **p<.01; ***p<.001*.