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The Role of Selective High Schools in Equalizing Educational Outcomes: Heterogeneous Effects by Neighborhood Socioeconomic Status

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We investigate whether elite Chicago public high schools can help close the achievement gap between high-achieving students from more and less affluent neighborhoods. Seats are allocated based on prior achievement with 70 percent reserved for high-achieving applicants from four neighborhood socioeconomic status (SES) categories. Using regression discontinuity design, we find no effect on test scores or college attendance for students from high- or low-SES neighborhoods and positive effects on student reports of their experiences. For students from low-SES neighborhoods, we estimate significant negative effects on rank in high school, grades, and the probability of attending a selective college.

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I. Introduction

The achievement gap between low-income students and their more affluent counterparts has widened in the last 50 years (Reardon, 2011). While much attention has been paid to racial achievement gaps, the gaps between students from low-income and high-income families are actually much larger. There is also growing concern about increasing income disparities in this country (Autor, Katz, & Kearney, 2006; Kopczuk, Saez, & Song, 2010). These disparities, coupled with the fact that intergenerational income mobility is quite low in the United States compared with other developed countries (Solon, 2002; Corak, 2013) and that low-income students attend lower quality public schools on average (Rouse & Barrow, 2006; Barrow & Schanzenbach, 2012), mean that without any interventions low-income students are likely to struggle with poverty their entire lives. In this paper, we investigate whether elite public high schools can help close the achievement gap between students from more and less affluent neighborhoods.

High-quality public schools may be a lever for closing the gap by providing equitable educational opportunities for students who have fewer economic resources at home. We know that low-income students can succeed in school, but many who are high performing in elementary school fail to make it to college (Fox, Connolly, & Snyder, 2005), suggesting that high-achieving, low-income students may lack good high school options or that there are barriers to entry into high-performing high schools for students who have fewer resources. If selective public schools improve student outcomes for low income students by a greater amount than they improve outcomes for high income students, then selective public schools may help close achievement gaps by family income.

While we cannot directly test for differential effects of selective public schools by family income, Chicago offers a unique opportunity to explore the

heterogeneity in estimated effects by student socioeconomic status (SES) as defined by residential neighborhood. In addition, student survey data allow us to estimate the effects of selective schools on students' experiences in high school in addition to more traditional academic outcomes. In other cities, selective schools serve the highest-achieving students, regardless of race/ethnicity or SES. But Chicago is different. The admissions policy in Chicago Public Schools (CPS) is determined by neighborhood economic context in addition to student performance with the hope of maintaining equitable access to selective public schools for eligible students living in low-income neighborhoods.

In this paper, we estimate the effect of being admitted to a selective enrollment high school on a variety of academic outcomes as well as on students' perceptions of their high school experience. Overall, we find little effect on test scores or educational attainment, but students admitted to selective schools have lower grade point averages (GPAs). At the same time, admitted students are more positive about their peers, teachers, and high schools. Looking at estimates by neighborhood SES, we find no evidence that admission to elite public schools in Chicago helps close the achievement gap between students from high- and low-poverty neighborhoods. Selective high school admission has no effect on test scores, regardless of neighborhood SES, and we find no evidence that students from low-SES neighborhoods experience greater improvements in their reported high school experience than students from high-SES neighborhoods. When it comes to grades, the negative effect of selective high school admission on GPAs is larger for students from low-SES neighborhoods than for students from high-SES neighborhoods. While this does not translate into differences in high school graduation or college attendance, we find that students from low-SES neighborhoods who are admitted to a selective high school are 13 percentage points less likely to attend a selective college than students from low-SES neighborhoods who just miss the admission cutoff. For students from high-SES

neighborhoods we estimate that admission to a SEHS increases the probability of attending a selective college by 11 percentage points but the estimate is noisy and not statistically different from zero. These estimated impacts are statistically different from one another and combined suggest that selective high schools may be widening some gaps between high- and low-poverty students. We cannot say if this result is driven by differences in where students apply to college, where they are admitted, or scholarship eligibility, although we believe this result is most likely related to the negative effect of SEHS admission on grades. We do not interpret this as evidence that SEHSs have negative effects on student learning but rather that there is a somewhat mechanical relationship between relative achievement rank and grades that disproportionately affects students from low-SES neighborhoods.

II. Background and Prior Research

A. The Goal of Selective Public Schools

Selective public schools (known as "exam" schools in Boston and New York and "selective enrollment" schools in Chicago) provide an option for academically high-performing students who might benefit from a challenging curriculum beyond what is offered in their neighborhood high schools. The CPS policy proclaims the purpose of selective schools is "to develop students' critical and analytic thinking skills and promote diverse academic inquiry by bringing students together from a wide range of backgrounds." Nationally, some of these selective public high schools have been around for more than 100 years while others were established quite recently. In some districts these high schools started by a push from policymakers, parents, or philanthropic foundations to offer high-achieving students a college preparatory education that was hard to obtain in

regular high schools. In other cases, these schools were the product of court-ordered desegregation efforts.

Selective schools are characterized by having admissions requirements, but the exact selection process varies across schools and districts. In some districts, each school sets its own admissions requirements; some districts base admissions on a single entrance exam, making this exam extremely high stakes for students; and yet other districts rely on a combination of grades and test scores to determine which students are admitted. The selectivity of these schools results in media attention and even controversy. Because of the correlation between achievement and demographic characteristics, the student body of these schools often looks very different from the composition of students in the district overall. As a result, some people are concerned with the lack of diversity in terms of race, gender, and/or socio-economic status among students attending these schools. Others are concerned that students from high-income families have an unfair advantage in admission because low-income students are more likely to attend lower-performing elementary and middle schools and may therefore be less well-prepared for the entrance exams or cannot afford to pay for test preparation courses. Still others are opposed to any public schools that are accessible only to a subset of high-performing students because these schools draw students and resources away from neighborhood high schools but serve only a small share of the total students in a district.

In the presence of these objections, questions remain about whether these schools offer a distinct advantage over other public high school options. Because of the selection criteria used for determining admission to these schools, it is not surprising that students who attend them do well academically. What is less clear is if these students would have done well regardless of the high school attended or if selective schools are doing something special—providing exceptional peers, higher quality instruction, and/or higher expectations—to improve the outcomes

of the students who attend them. The evidence from existing research is mixed, and we review them in more detail in the following section.

B. Existing Research on Selective Schools

Studies on the effectiveness of schools with achievement-based selection criteria provide mixed evidence. Research using data from outside the U.S. from countries in which secondary school assignment system-wide is based on prior achievement test scores find positive impacts on later test score outcomes. Pop-Eleches & Urquiola (2013) use a regression discontinuity design (RDD) with data from Romania to show that attending a higher-performing high school raises student test scores on a high-stakes test by 0.05 standard deviations. Jackson (2010) uses an instrumental variables strategy based on school assignment rules and student preferences to study the effects of attending high schools with higher achieving peers in Trinidad and Tobago. He finds that attending schools with higher achieving peers based on incoming test scores raises the number of high stakes secondary school exams passed. He also finds that it raises the probability of passing at least five such exams which is a typical prerequisite for continuing post-secondary education. These papers look at the effect of attending high-achieving high schools and point to the potential for selective schools to improve test score outcomes.

Unlike the Romanian and Trinidad and Tobago systems, other education systems allocate seats to only a subset of secondary schools based on prior achievement. This practice is most similar to what we study in Chicago, and the evidence from these studies is less positive. Research in the United Kingdom using a RDD finds no impact of attending a selective high school on student test scores but finds suggestive evidence that attending a selective high school for four years may increase the probability of enrolling in a university (Clark, 2010). RDD

studies using data from Boston and New York find no effect of attending elite exam schools on either student test scores or college going (Abdulkadiroğlu, Angrist, & Pathak, 2014; Dobbie & Fryer, 2014). In earlier work on the subsample of students enrolling in NYC public high schools, Dobbie & Fryer (2011) find that students take more rigorous coursework and have a higher probability of graduating with a more advanced high school diploma. These benefits, however, do not translate into effects on college outcomes.

These findings suggest that any apparent advantages gained by attending a selective high school are actually due to selection and not to value that the schools themselves add for their students—namely, students who attended these high schools would have done well anyway. Notably, however, policies in these settings simply admit the top-scoring applicants without taking student demographics into consideration. In that regard, Chicago is very different in their admissions process, using students' neighborhood characteristics as a proxy for student SES in addition to application scores to determine admission to selective high schools. These selection criteria allow us to look at the effects of being admitted to a selective school for high-performing youth who are also likely to come from a disadvantaged background. We can compare these estimated impacts to those for students from more affluent neighborhoods thereby testing whether selective schools have larger impacts on students from more disadvantaged backgrounds. Further, we add to the literature by looking at impacts on non-academic outcomes in addition to impacts on test scores and college going—do students attending selective high schools report having better high school experiences in terms of, for example, safer learning environments or better relationships with teachers and peers?

C. The Case for Admission Quotas

The admissions policy in Chicago uses neighborhood SES quotas (described in greater detail later in the paper). This aspect of the policy allows us to test if students from low-SES neighborhoods benefit more from selective high schools than students from high-SES neighborhoods. But why might we expect selective schools to differentially affect high-achieving disadvantaged youth?

One argument for moving high-performing, low-SES students to better schools comes from concerns that students from high-poverty neighborhoods are stuck in extremely low-performing schools with very low graduation rates. Approximately 2,000 high schools in the country have been identified as "dropout factories," producing 51 percent of the nation's dropouts (Balfanz & Legters, 2004). These schools generally serve large numbers of low-income students; they face substantial educational challenges; and staff members often are overwhelmed by trying to serve so many high-needs students (Neild, 2004). Empirically, we show that it is the case in Chicago that high-achieving students living in low-SES neighborhoods generally attend lower-performing schools than students from high-SES neighborhoods.

Figure 1 contrasts the distribution of high school average ACT scores for schools attended by high-achieving students from low-SES neighborhoods (left panel) with the distribution of high school average ACT scores for schools attended by high-achieving students from high-SES neighborhoods (right panel).[1] High-achieving students living in low-SES neighborhoods are much more likely to attend high schools with lower average ACT scores. This discrepancy perhaps points to inequitable access to high-quality high schools even for students who do

[1] High-achieving students score one standard deviation above average on their combined reading and math score in 8th grade. Low neighborhood SES refers to the bottom quartile of student-weighted census block groups on the UChicago Consortium measure of social status based on Census measures of education and employment in managerial and professional positions. High neighborhood SES refers to the top quartile of student-weighted census block groups using this measure of social status. We use data on students enrolled in 9th grade in fall 2007, 2008, and 2009 before the district adopted neighborhood SES as part of the admissions policy.

well academically prior to high school. Thus, students from low-SES neighborhoods may benefit more from attending a selective high school than students from high-SES neighborhoods.

On the other hand, students coming from more disadvantaged backgrounds could be made worse off if selective high schools offer a more rigorous educational experience, but low-SES students arrive grossly underprepared, and the schools cannot provide enough supports to bridge the gap. Under Chicago's accountability system, all schools are given a performance level based on student test scores, attendance, and value-added in reading and mathematics. In Figure 2, we graph the shares of high-achieving students from low- and high-SES neighborhoods who attend each level of elementary school using data from the cohorts of students in our study. High-achieving students from low-SES neighborhoods are roughly equally likely to attend elementary schools of each level. In contrast, high-achieving students from high-SES neighborhoods are much more likely to attend an elementary school with the highest rating (66 percent) compared with a low-rated elementary school (7 percent).

Second, relative to students from high-SES neighborhoods, students from low-SES neighborhoods may benefit more from attending school with many high-achieving peers. The literature on tracking and peer effects generally shows that students benefit from interacting with high-achieving peers in terms of improvements to test scores (Betts and Shkolnik, 2000; Duflo, Dupas, and Kramer, 2011; Hoxby, 2000; Nomi and Allensworth, 2013 Sacerdote, 2001). Selective schools attract high-achieving students creating a student body of academically-oriented peers. Access to such a peer group may be more beneficial to high-performing students from low-SES neighborhoods who might otherwise attend schools with comparatively disadvantaged and lower-performing peers. At the elementary and middle school levels, the evidence is mixed on whether access to higher-performing peers is differentially beneficial by student race or income.

Card and Giuliano (2016) find that tracking of elementary school students into gifted programming had large effects on student achievement particularly for black and Hispanic students. In contrast, Bui, Craig, and Imberman (2014) find no positive effect of gifted programming on student achievement overall or for race or income subgroups.

However, research that looks at outcomes other than test scores provides evidence that students' grades and pass rates tend to be lower in classrooms with higher-achieving peers, compared to students with similar test scores in classrooms with lower-achieving peers (Farkas, Sheehan, & Grobe, 1990; Kelly, 2008; Nomi & Allensworth, 2009). If grades largely reflect relative performance, students in academic settings with higher-achieving peers will appear weaker academically which then translates into lower grades. This is potentially a critically important distinction since some research has shown grades to be better predictors of students' later college and workforce success than test scores (Bowen, Chingos, & McPherson, 2009; Geiser & Santelices, 2007; Miller, 1998; Roderick, Nagaoka, & Allensworth, 2006). One might also be concerned that lower grades in high school could have direct effects on students' future access to more selective colleges and universities. Because on average, students from low-SES neighborhoods will be lower in the achievement distribution, grades for students from low-SES neighborhoods may be more likely to suffer from attending a selective school that grades for students from high-SES neighborhoods.

Finally, the benefits of attending a selective high school may be larger for students from lower-SES neighborhoods if higher-SES parents offset any differences in school quality with private investments in ways that lower-SES parents cannot (Rouse & Barrow, 2006; Barrow & Schanzenbach, 2012). It may also be the case that high-achieving students from low-SES neighborhoods benefit from the social capital generated by parents and communities that have more

economic and social resources to support schools (Bryk, Sebring, Allensworth, Luppescu, & Easton, 2010; Coleman & Hoffer, 1987).

III. Selective High Schools in Chicago

Chicago has a longstanding history of offering many school choices to families, including most recently an expansion of charter schools and selective enrollment schools.[2] The first selective enrollment high school (SEHS) in Chicago was created in 1997. As of the 2013-14 school year, there were 10 selective enrollment high schools. Admission to these schools is based on student achievement, although to uphold a 1980 court-ordered desegregation consent decree, race was also a formal component of the application until 2009. In order to achieve the consent decree goal of desegregation, selective enrollment (and magnet) schools used race-based admissions policies. In 2009, a United States federal court lifted the consent decree, which resulted in CPS removing race as an admissions factor. Concerns were raised that if seats were awarded based solely on student achievement, disadvantaged youth would be displaced, and the selective schools would primarily serve students from affluent families and neighborhoods. In response, CPS immediately established a new admissions policy to ensure that students from high-poverty neighborhoods would still be admitted to selective schools. Beginning with applications for enrollment in fall 2010, SES variables were used in the application process for the first time.

CPS assigns each Chicago census tract to one of four SES 'tiers" based on six factors. Five come from Census data—median family income, adult educational

[2] For example, Cullen, Jacob, & Levitt (2006) look at the effects of winning a lottery at an oversubscribed Chicago public high school in the early 2000s. They disaggregate effects by the performance level of the high school and find no effects of attending high-performing high schools on traditional academic outcomes like test scores, course performance, or high school graduation, although they do find that students who win lotteries are lower ranked in their high schools than those who do not. Students who win lotteries to attend high-performing schools also report being less likely to get in trouble at school or be arrested. However, in this paper, we examine the effects of selective schools on student outcomes. These schools serve the highest-performing students in the district and are much higher-performing than those studied previously in Chicago.

attainment, percent of homes that are owner occupied, percent of single-parent households, and percent of the population speaking a language other than English. The sixth factor reflects neighborhood school performance. Tier 1 neighborhoods, the lowest SES neighborhoods, are clustered on the west and south sides of the city, while the north side neighborhoods are primarily tier 4, the highest SES neighborhoods. The SEHSs are located throughout the city. See Appendix Figure 1 for a map of census tract tiers and the SEHS locations.

Each applicant receives an application score of up to 900 points based on test scores and grades. Final grades in seventh-grade core courses (math, English, science, and social studies), seventh-grade standardized test scores, and the test score from a selective enrollment entrance exam each account for a maximum of 300 points. In order to be eligible for admission, students must have an application score of 650 or above. Figure 3 shows the distribution of application scores for all SEHS applicants entering 9th grade in fall 2010 through fall 2013, with a vertical line denoting the 650-point eligibility requirement.[3] The majority of applicants (59 percent) do not meet that threshold. It is also worth noting that there is some bunching at the top of the distribution with 0.7 percent of all applicants receiving the maximum score.

Students are able to rank up to six selective schools through a centralized application process. The first 30 percent of available seats in each school are assigned based on academic performance (open seats), and the remaining 70 percent of seats in each selective high school are divided equally among students in the four SES tiers (tier seats). The assignment mechanism is a serial dictatorship with students ranked according to their application score and assigned seats in the order they are ranked. Each applicant is awarded an offer from the highest-ranked school on their application for which an open or tier seat is still available. Open seats at each school are filled before tier seats. If all tier seats are

[3] There is a separate admissions process for students with identified disabilities, so we do not include these students.

filled for a student's neighborhood tier at all of the schools to which she applied, no offer is given. The district then moves on to the next highest ranked student on the list. This process continues until all available seats have been filled or no qualifying applicants remain.

Each year, CPS makes offers of admissions to each SEHS using the rules described above and publicly posts a table of cutoff scores by school for open seats and for seats for each neighborhood SES tier. We define a student as having received an offer to attend a SEHS if she scores above the published admissions cutoff score for her neighborhood tier for a school to which she applied in the year of her application.

IV. Analytic Sample and Data Description

A. Overall and Analytic Sample Characteristics

For the 2010-11 through 2013-14 school years there were 99,966 first-time grade 9 students who were also enrolled in CPS in grade 8 during the prior school year. Of these 43,461 students completed SEHS applications. We restrict the sample to students enrolled in CPS in grades 8 and 9 in order to have pre-treatment data, as well as outcome data, for these students.[4] Restricting the sample in this way means that we are excluding three types of students from the estimation sample: 1) grade 8 CPS students who applied to a SEHS but left the district for grade 9 (8.8 percent of applicants), 2) non-CPS grade 8 students who applied to a SEHS and enrolled in CPS for grade 9 (5.25 percent of applicants), and 3) non-CPS grade 8 students who applied to a SEHS but did not enroll in CPS in grade 9 (3.68 percent of applicants).[5]

[4] Results are unchanged if we also include students who enter CPS in grade 9.

[5] Attrition can be a threat to valid estimation in our RD approach. Overall, we find that within the estimation application score bandwidth 8 percent of admitted students leave CPS before grade 9 compared to 12 percent of non-admitted students. The likelihood of leaving the district increases monotonically with neighborhood tier (10 percent leave in tier 1 compared with 19 percent in tier 4). Using a regression framework, we predict whether or not an applicant leaves CPS with a variety

Table 1 shows pre-treatment characteristics for all CPS students enrolled for the first time in grade 9 who were also enrolled in CPS in grade 8 (column 1), the subset of those students who completed applications for a SEHS (column 2), and our analysis sample which further limits the sample to students whose application score is within 0.5 standard deviations of the admissions cutoff for at least one of the SEHSs to which they applied (column 3). As one might expect, applicant students are positively selected on academic achievement when compared with non-applicant students; namely, applicant students have eighth grade test scores that are 0.64 standard deviations above the overall mean. Applicants are also more likely to have engaged in school choice prior to high school with 56 percent attending their assigned neighborhood elementary school compared with 62 percent of students overall. Applicant students are more likely to be white or Asian, although about equally likely to be Hispanic, less likely to qualify for free/reduced-price lunch, less likely to be male, and much less likely to have an identified disability than non-application students. It is worth noting that only 41 percent of applicants met the eligibility threshold of 650 application points while 27 percent scored above the cutoff for admission, and 23 percent enrolled in a SEHS. In other words, for many students the hurdle is attaining an application score of 650.

In Table 1, we also compare the characteristics of applicant students (column 2) to our analysis sample (column 3) which further drops applicant students with special education status and limits students to those scoring relatively close to the admissions cutoff score as described in more detail below. This limitation drops many students whose application scores lie well below the cutoff for admission and a few with scores well above the cutoff. Not surprisingly, the analytic sample

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of observable characteristics, as well as interactions between being admitted to a SEHS and those same characteristics. Most of the predictors are not statistically significant – exceptions include free/reduced-price lunch status and race is white. Controlling for these characteristics in the RD models does not affect the results. Given our investigations, we believe that attrition is unlikely to bias our results.

is positively selected relative to the application sample. Average grade 8 test scores are nearly 1.3 standard deviations above the mean, seventh-grade math and reading percentiles are 10 percentage points higher, and application scores average 150 points higher. Again, this sample is less likely to be African American, more likely to be white or Asian, less likely to qualify for free or reduced-price school lunch, and less likely to be male. Throughout this paper, we focus on comparisons of impacts for tier 1 applicants with impacts for tier 4 applicants. Average pre-treatment characteristics for students from each tier are shown in columns 4 through 7. Tier 1 applicants live in the lowest SES neighborhoods in Chicago, and tier 4 applicants live in the highest SES neighborhoods. While race is not used to determine neighborhood tier, the percent black or Hispanic declines monotonically with neighborhood tier while the percent white correspondingly rises with neighborhood tier reflecting the racial and economic segregation of Chicago. Nearly all of tier 1 students are African American or Hispanic and 4 percent are white or Asian, while 46 percent of tier 4 students are African American or Hispanic and 51 percent are white or Asian. Students from tier 4 neighborhoods tend to be higher performing – they outperformed their tier 1 peers by about one-half of a standard deviation on the grade 8 standardized tests, and their average application scores are 90 points higher. Tier 4 students are also more likely to have attended their neighborhood elementary school than tier 1 students (55 percent compared with 46 percent), suggesting that CPS elementary schools in high SES neighborhoods are perceived as being more desirable. Ninety-two percent of tier 4 students met the eligibility threshold of 650 application points and 65 percent met the admission cutoff at a SEHS to which they applied, compared with 74 percent being eligible and 58 percent scoring above the admission cutoff for tier 1 applicants.

B. Characterizing the Counterfactual High School Experience

Like selective high schools in Boston and New York City, SEHSs in Chicago differ from the other public high schools on many observable characteristics. In Table 2 we present information on how the characteristics of high schools attended differ between applicants in the analytic sample who score above the admission cutoff and those who score below. We compute these differences using the same regression framework employed for estimating the effects of admission to a SEHS on student outcomes (described in more detail below). As a result, the school characteristics are weighted by the number of students who attend each high school, so high schools that are more popular among applicants receive more weight in the average differences presented. Each cell entry can be interpreted as the change in the characteristic of the average high school attended for students at the cutoff for admission to a SEHS. We present the overall differences in column (1). The remaining columns present the changes in the high school characteristics at the cutoff for students in each neighborhood SES tier.

Looking overall, analysis sample applicants who are offered a SEHS seat attend schools in which grade 9 students are 4 percentage points more likely to be on-track for graduation, all students are 8 percentage points more likely to be enrolled in AP courses, and grade 11 students score 2.0 points higher on the ACT. Students receiving offers also attend schools that are slightly more racially mixed (as reflected by the race Herfindahl-Hirschman Index), more economically advantaged (as measured by free/reduced-price lunch eligibility), and have larger total enrollment. Students scoring above the admission cutoff also attend schools in which students report higher levels of parental support by 0.4 standard deviations and higher levels of community support by 0.2 standard deviations; while the teachers in their schools report much lower levels of crime, violence,

and disruption. (See Appendix Table 1 for descriptions of the survey items included in these measures.)

These differences hold across neighborhood SES tier as well, but for most characteristics, the change in average high school characteristics at the cutoff for students living in tier 1 neighborhoods is not statistically different from the change at the cutoff for students from tier 4 neighborhoods. The primary exceptions are measures of college going and persistence. Students in tier 1 neighborhoods who are admitted to a SEHS attend high schools where more graduates enroll in college than tier 1 students who are not admitted to a SEHS (a 7.1 percentage point difference). For tier 4 students the difference is only 4.5 percentage points. Tier 1 students who are admitted to a SEHS also attend high schools where graduates are more likely to persist in college than tier 1 students who are not admitted (a difference of 8.3 percentage points). The difference in college persistence rates for tier 4 students who do and do not get admitted to a SEHS is only 2.4 percentage points.

Other characteristics point to larger differences for tier 4 students. In particular, differences in teachers' reports of program continuity and teacher satisfaction with CPS as an employer are larger for tier 4 students (0.5 and 0.6 standard deviations, respectively) than for tier 1 students (0.1 and 0.2 standard deviations). Although these differences are large in magnitude, they are not statistically significant at conventional levels. The overall pattern suggests that being admitted to a SEHS may generate some differences in high school experiences, although these differences across tiers are smaller than we expected *a priori*.

C. Data Description

We use CPS SEHS application data which include a record for each student, his/her ranking of up to 6 selective high schools, overall application score, the

scores for the three component parts, neighborhood tier, and ultimate admissions status. We also use publicly available tier cutoff scores for each SEHS in each year in order to identify which students are offered a SEHS seat. (See Appendix Table 2 for the cutoff scores for tier seats by tier, school, and application cohort.) We link the application data to longitudinal CPS administrative data, as well as UChicago Consortium annual survey data on student experiences. The administrative data contain complete enrollment and demographic records for each student, high school course transcripts, and achievement test scores. For CPS graduates, the administrative data also include National Student Clearinghouse data on college enrollment. Using these linked data we are able to study the impact of attending a SEHS on students' test scores, course grades, college enrollment, and experiences in high school.

Specifically, to measure the impact of admissions to an SEHS on traditional academic student outcomes, we use the following data sources.

Test Score Data.—CPS students take standardized tests in the spring of grades 3 – 8. From these data we make use of a UChicago Consortium predicted grade 8 test score in order to calculate an incoming class percentile rank for each student in the high school they attend.[6] High school students take the ACT Educational Planning and Assessment System (EPAS) series of tests: EXPLORE, PLAN, and ACT. Grade 11 ACT test scores are missing for the most recent cohort of students. We standardize all scores to have a mean zero and standard deviation of one within cohort and test.

Grades and Transcript Data.—These data provide detailed course-taking information for each student, providing a list of courses in which the student enrolls, the grades they receive, and an indicator for whether by the end of grade 9

[6] The predicted test score comes from a three-level hierarchical linear model, with a measurement model at level 1 taking into account the standard error associated with any single test score, and test scores nested within year (level 2) and students (level 3). The model additionally controls for the student's age (and square term) at the time of the test, cumulative number of times the student was retained, cumulative number of times the student skipped a grade, the school, and the student's cohort.

a student is on track to graduate from high school.[7] From these data we construct grade point averages (GPA) for grade 9 and an indicator for whether a student takes any honors classes.

National Student Clearinghouse Data.—For CPS graduates, CPS obtains matched data reflecting where a graduate is enrolled in college in the fall following high school graduation. We use these data for the oldest cohort of students to identify whether and where a student enrolls in college, and we use Barron's college selectivity rating categories to define whether the college attended is among the most competitive to get into.

Studying SEHSs in Chicago also allows us to explore the impact of SEHSs on students' experiences in high school in ways that have not been previously explored. To do this, we use a variety of survey data outcomes.

Survey Data.—UChicago Consortium conducts district-wide surveys of all high school students and teachers every spring. We link these data to administrative data about the student, so we can compare the responses of students admitted to selective enrollment high schools to the counterfactual students. Survey items are used to construct measures of school climate, including personal safety, course quality, and relationships with teachers and peers. Appendix Tables 1 and 3 list the survey measures and their component items for those measures that we use in this paper. Eighty-one percent of our analytical sample has data for at least one survey measure with most measures having response rates between 75 and 80 percent. We find no differences in response rates by admissions to an SEHS overall or by neighborhood tier.

[7] A student is on-track to graduate from high school if she earns at least five full-year course credits (10 semester credits) and has no more than one semester F in a core course (English, math, science, or social science) in her first year of high school. The on-track indicator is highly predictive of high school graduation (Allensworth & Easton, 2005).

V. Regression Discontinuity Approach

We are interested in estimating the effect of being admitted to a selective enrollment high school allowing for heterogeneity in the effects by neighborhood SES. Because admissions are conducted separately for each tier and each school, there are multiple cutoff points that determine admissions based on student preferences, the number of seats at a particular school, and the student application scores for a given year. We implement a regression discontinuity design, using the various cutoffs based on neighborhood tiers as the exogenous source of variation for identification. The running variable in this case is the application score, and the main identifying assumption is that students with application scores just below the cutoff provide a good comparison group for those with application scores just above the cutoff. Further, because students cannot precisely manipulate their application score around the threshold, acceptance to a SEHS for students near the cutoff is as good as random.

Because of the allocation of seats by neighborhood tier, we have four cutoff points at each of Chicago's ten selective high schools. Using the RDD approach, we can estimate an overall treatment effect of being admitted to a selective high school or estimate separate treatment effects for students from each neighborhood tier. Parametrically, we estimate the "intent-to-treat" effect of receiving an offer from any SEHS. We also implement a nonparametric approach described in the online appendix. The results are shown in Appendix Tables 5 and 6.

Define the centered application score (X_{icjt}) for student i, in cohort c, applying to school j, and living in a tier t neighborhood as the individual student's application score minus the relevant cutoff score (based on school, cohort, and neighborhood tier). The estimating equation for the overall effect of admission to a selective high school can be expressed as follows:

$$(1) \qquad Y_{icjt} = \beta_0 + \delta SE_{icjt} + \beta_1 f(X_{icjt}) + \beta_2 f(X_{icjt}) * SE_{icjt} + \phi_{cjt} + \varepsilon_{icjt},$$

where Y_{icjt} is the outcome of interest, $f(X_{icjt})$ is a quadratic function in the centered application score; SE_{icjt} is an indicator for whether student *i* was offered a seat at school *j*; ϕ_{cjt} is a cohort-school-neighborhood tier fixed effect; and ε_{icjt} is the individual error term. We control for interactions of the centered score quadratic terms with the SE_{icjt} indicator to allow for differences in functional form on either side of the cutoff. δ is our parameter of interest to be estimated and represents the impact of being offered a seat at a SEHS on the outcome of interest.

In order to investigate heterogeneity by neighborhood tier, we interact everything with neighborhood tier, and our estimation equation is the following:

$$(2) \qquad Y_{icjt} = \sum_{t=1}^{4}\left[\beta_{0t} tier_t + \delta_t tier_t SE_{icjt} + \beta_{1t} tier_t f(X_{icjt}) + \beta_{2t} tier_t f(X_{icjt}) * SE_{icjt}\right] + \phi_{cjt} + \varepsilon_{icjt},$$

where $tier_t$ are neighborhood tier fixed effects which have been fully interacted with the quadratic terms in the running variable, the indicators for being offered a selective enrollment seat, and the interactions of the quadratic terms with the SE_{icjt} indicator. Our parameters of interest are the δ_t, and we test whether the effects differ for students from tier 1 and tier 4 neighborhoods.

These models pool all applicant students together. For the estimates of the effect of admissions to any SEHS, students can be observed multiple times. If a student is offered admissions to any SEHS, that student is observed as treated for the school where she was made an offer. Students who did not receive an offer to any SEHS can be included in the counterfactual at each school they ranked on their

application. If a counterfactual student is close to the cutoff score at multiple ranked schools, she contributes to the estimation multiple times.[8]

In order to produce unbiased estimates of the effect of being offered a seat at a selective high school, RDD relies on the assumption that assignment of students to selective high schools at the cutoff score is as good as random (Lee & Lemieux, 2010). The extent to which students are able to manipulate their application score, thus changing their admissions status, poses a threat to this key assumption. It may be the case that individual components of the admissions score—particularly grades—are vulnerable to manipulation. For example, a teacher may assign a higher grade to a student than the student earned if the teacher knows the student is likely to apply to a selective school. Ultimately, however, the admissions score consists of pieces that are less subject to manipulation, namely standardized test scores. We demonstrate the smoothness of select pre-treatment covariates through the application score cutoff in Appendix Figure 2. We generally do not see discrete discontinuities in these variables at the application score cutoff. Other pre-treatment variables look similar, and figures are available upon request. We also find that our estimates are unaffected by controlling for student demographics directly.

Figure 4 presents the probability of enrolling in a SEHS in grade 9 as a function of the centered application score. Roughly 20 percent of students with application scores just below zero are enrolled at a SEHS in grade 9 based on the administrative records. At zero, roughly 75 percent of students are enrolled in a SEHS in grade 9. Students below the cutoff may enroll in SEHSs as part of the No Child Left Behind (NCLB) choice program or under "principal discretion."

[8] In practice, 20.4 percent of tier 1, 14.4 percent of tier 2, 11.8 percent of tier 3, and 9.7 percent of tier 4 students are observed in the counterfactual multiple times. For robustness, we have also estimated the alternative specification in which counterfactual students are only included for the school to which they are closest to the cutoff score; we find similar results.

VI. Results

A. Academic Performance

Table 3 presents reduced-form estimates of the effect of gaining admissions to a SEHS on outcomes reflecting measures of academic performance.[9] (See Appendix Figure 3 for graphical evidence of the effects for select outcomes.) Each column represents a different outcome measure, and for each outcome, the first row (counterfactual mean) contains the outcome variable mean and standard deviation for the analysis sample students who score below the admission cutoff for all schools to which they applied.[10] Subsequent rows present overall estimates based on equation (1) of the impact of being admitted to a SEHS (the all tiers row), as well as estimates based on equation (2) allowing for the impact of being admitted to a SEHS to vary by neighborhood SES (rows tier 1 through tier 4) followed by the p-value for the test that the impact estimate for tier 1 (lowest neighborhood SES) equals the impact estimate for tier 4 (highest neighborhood SES). Finally, we include the number of student-school observations in the last row of each column.

We find a small but not statistically significant negative effect on grade 9 test scores overall and by neighborhood tier; the same is true for grade 11 ACT scores. Ultimately, when it comes to outcomes like test scores, these students do well regardless of admission to a SEHS.

[9] In addition to our preferred specification, we have estimated numerous alternative specifications for robustness. Specifically, we 1) include observable pre-treatment student characteristics in the model, 2) include third- and fourth-order polynomial terms of the running variable in the model, 3) allow entrants into CPS in grade 9 to contribute to the estimation, 4) allow counterfactual students to appear only once in the analytic sample, using the school to which their application score is closest to the cutoff, 5) include fixed effects for the applicant's ranking of the school, and 6) allow the relevant cutoff be the least-preferred school according to the applicant's ranking of schools. Our estimates are robust to these different specifications with the exception of using the least-preferred school as the relevant cutoff. In that case, we estimate statistically significant effects on ACT scores (-0.136), and larger negative effects on GPA (-0.244). Results from robustness checks are available upon request.

[10] Outcome means by SES tier are in Appendix Table 4.

We estimate negative impacts on grades. Overall, students who are admitted to SEHSs have 9th-grade GPAs that are on average 0.122 grade points lower than their counterparts' who were not admitted to a SEHS. The magnitude of the negative GPA effect is larger for students from the lowest SES neighborhoods (tier 1) than for students from the most affluent neighborhoods (tier 4). Students from tier 1 neighborhoods who are just admitted to a SEHS have a GPA that is 0.323 grade points lower than their counterparts who are not admitted to a SEHS while students from tier 4 neighborhoods who are admitted to a SEHS have a GPA that is only 0.044 grade points lower (p-value of the difference = 0.018). This is perhaps not surprising to the extent that students just admitted to a SEHS may be at the bottom of the SEHS achievement distribution (as two-thirds of the application score is based on test score percentiles) while those falling just below the cutoff may end up at the top of the distribution of the non-SEHS in which they enroll. The negative effect on GPA persists through grade 11 although the effect is somewhat smaller. Overall, being admitted to a SEHS has a marginally significant -0.096 effect on grade 11 cumulative GPA. For tier 1 students the estimate is -0.216, and the estimate for tier 4 students is -0.054.

The negative impacts on GPA do not appear to translate into negative impacts on high school graduation or college enrollment on average (see columns (5) and (6) of Table 3). Students from SEHSs are no more likely to graduate from high school or enroll in college than their counterparts in other high schools. However, we estimate a negative effect on the probability of enrolling in a selective college for students from low-SES neighborhoods.[11] Tier 1 students admitted to a SEHS are 13 percentage points less likely to enroll in a selective college (p-value = 0.046), conditional on graduating from a CPS high school, than tier 1 applicants

[11] We use Barron's college selectivity list accompanying Leonhardt (2013) and define "selective" as any college defined by Barron's as "Very Competitive Plus" (selectivity rank of 1, 2, 3, or 4). Our findings hold with narrower definitions of selective college as well, e.g. Barron's selectivity rank of 1 which would exclude University of Illinois – Urbana Champaign (rank equals 2).

who are not admitted to a SEHS. In contrast, we estimate a positive 11 percentage point increase in the probability of enrolling in a selective college for students from high-SES neighborhoods (p-value = 0.109), and we can reject that the estimated effects for tier 1 and tier 4 students are equal (p-value = 0.027).[12] While the estimates of college going and college selectivity are based on only one cohort of students (those entering 9th grade in fall 2010), estimated impacts for other outcomes are quite similar to those shown when we limit the estimation sample to this one cohort.[13] As a result, we suspect that the college enrollment and selectivity results will hold up when data are available for the more recent cohorts.

B. High School Experience

If there are no positive academic effects of being admitted to a SEHS, and possibly negative effects especially for students from lower-SES neighborhoods, why are these schools so highly sought after? One possibility is that parents want to enroll their children in these schools for the different high school environment and experience they offer in terms of peers, teachers, and course quality. We turn to estimates of the effect of SEHS admission on these outcomes in Table 4, which is structured in the same way as Table 3.[14] We characterize differences in academic experience as measured by a student's place in the incoming distribution of achievement compared to his or her high school peers, whether or not a student takes honors courses, the amount of time spent on homework, and

[12] Using the narrower definition of selectivity (Barron's selectivity ranking of 1), SEHS admission reduces the probability that a tier 1 student enrolls in a selective college by 9 percentage points (p-value = 0.086) and increases the probability that a tier 4 student enrolls in a selective college by 7 percentage points (p-value = 0.109). Again, we can reject that the effects on tier 1 and tier 4 students are equal (p-value = 0.039).

[13] These results are available from the authors on request.

[14] Survey responses were collected during grade 9. We also replicated these findings using survey responses to the same items in grade 11. The estimates are very similar regardless of the grade at which the survey is administered. We prefer the results from grade 9 because response rates are higher in the earlier high school grades.

the quality of science courses (columns 1-4 of Table 4).[15] We then present results for survey measures of personal safety, peer support, teacher-student trust, and sense of belonging in the school (columns 5-8 of Table 4). In contrast with the traditional academic outcomes presented previously, being admitted to a selective high school has effects on many experiential outcomes.

First, there is a large negative effect on incoming class rank. On average at the beginning of ninth grade, students admitted to SEHSs were ranked 16 percentile points lower than the counterfactual students not admitted to an SEHS. This is, perhaps, of little surprise. Students admitted at the margin will have relatively higher performing peers than the students who just miss the cutoff. When we allow the effect of SEHS admission to differ by neighborhood tier, we estimate that the negative effect on incoming rank is larger in absolute value for tier 1 students than for tier 4 students. Tier 1 students admitted to a SEHS rank 25 percentile points lower in their high school than tier 1 students who are not admitted to a SEHS. For students from tier 4 neighborhoods, being admitted to a SEHS lowers their incoming rank by 10 percentile points.

How a student ranks in the distribution of her peers may be important for several reasons. First, if schools track students into different courses based on prior achievement, lower ranked students may not have access to the same curriculum, peers, or teachers as higher ranked students. Additionally, lower rank may also translate into lower grades to the extent that grades are a relative performance measure rather than an absolute measure. Finally, rank may affect how students perceive their own academic skills or ability, how teachers perceive students, or both.

We next look at enrollment in honors courses, reports of time spent on homework, and student reports on the quality of their science courses. Admission

[15] Although we also have measures for English and math courses, the science measure was the most statistically reliable of the three. The results for English and math are similar to science and available on request.

to a SEHS has no overall effect on the probability of taking an honors class or spending 10 or more hours per week on homework. However, students admitted to a SEHS report higher quality science classes. When we look at the effects by neighborhood tier, we find a statistically significant difference between tier 1 and tier 4 for the likelihood of spending 10 more hours on homework per week. Tier 1 students admitted to a SEHS are 3.5 percentage points more likely to report spending 10 or more hours on homework although the estimate is not statistically significant at conventional levels. In contrast, tier 4 students admitted to a SEHS are 11.4 percentage points less likely to report spending 10 or more hours per week on homework than their peers who were not admitted to a SEHS. This point estimate is statistically different from zero at the 5 percent level and we can reject that the tier 1 and tier 4 estimates are equal (p-value = 0.026).

Being admitted to a SEHS appears to make the most difference in the day-to-day relationships that students experience in the school building. The most consistent evidence we find is that students admitted to a SEHS report better relationships with peers and teachers. On average, students report a greater sense of personal safety in their school (a 0.30 standard deviation difference), more supportive peers (a 0.25 standard deviation difference), and better, more trusting relationships with their teachers (a 0.13 standard deviation difference). However, students admitted to a SEHS are no more likely to report a better sense of belonging at their school. Looking at results by neighborhood tier, the estimates are not statistically different between tier 1 and tier 4 although the point estimates for tier 4 students are larger than the point estimates for tier 1 students.

VII. Discussion and Conclusion

Selective enrollment high schools command a lot of attention – they generally serve the most academically successful students, the seats are highly coveted as

there are many more applicants than available slots, and they are often hailed as the best schools in the system. These schools also receive criticism for serving student bodies that are much less racially diverse than the district in which they are situated. The affirmative action admission policy in Chicago, reserving seats for students from low-SES neighborhoods, makes selective schools the most racially diverse public high schools in the city. This feature also allows us to look at separate effects for students from different SES backgrounds. We find that when it comes to test scores attending a SEHS has no statistically significant impact. Simply put, on average, these students would have performed well on tests with or without selective schools. This finding is consistent with previous studies of selective schools in the U.S. This paper extends the scope of prior work by allowing the effect of selective school admission to differ by students' neighborhood SES status. Nevertheless, even for students from the most disadvantaged neighborhoods, we find no positive impact on test scores. Given these findings, SEHSs are likely not helping to close the achievement gap between high- and low-SES students.

But test scores are only one outcome. SEHSs have a positive effect on students' perceptions of the high school experience. When it comes to relationships with students and teachers, SEHS students are more positive than their counterparts in non-SEHSs. SEHS students are more likely to say that students get along well and treat each other with respect, and they are similarly more likely to report that their teachers care about them and listen to their ideas. Students in SEHSs also report a greater sense of safety – they are less likely to worry about crime, violence, and bullying at the school. Perhaps it is factors like these that make SEHSs highly desirable to students and families – more so than the potential to improve test scores and college outcomes.

High school GPA is another important academic outcome that affects both college admissions and college scholarship eligibility. We find negative effects of

being admitted to a SEHS on GPA, and this effect is primarily driven by the large negative impact on GPA for students from more disadvantaged neighborhoods. The negative impacts on GPA in combination with unaffected test scores do not translate into a decreased likelihood that SEHS students enroll in college, although they might explain differences in the probability of attending a selective college. Our results suggest that admission to a SEHS reduces the probability that a student from a low-SES neighborhood attends a selective college, while potentially increasing the probability that a student from a high-SES neighborhood attends a selective college. This finding is particularly troubling. On the one hand, the finding that students from high-SES neighborhoods have more access to selective colleges is likely one of the reasons families seek out SEHSs. On the other, students from less-resourced parts of the city are not similarly benefitting.

Our data on college selectivity is based on where students enroll in college. We do not have information about where students apply or where they get in. As a result, we cannot determine whether the difference in the effect of SEHSs on the probability of enrolling in a selective college is driven by differences in where students are admitted, where they apply, or where they ultimately decide to enroll. For students admitted to SEHSs from the lowest-SES neighborhoods, their average grade 11 GPA – the GPA used on college applications – is around 2.50, which may be a cutoff for admissions or scholarship eligibility. If that is the case, these students may not be admitted to selective colleges or they may become ineligible for merit-based scholarships, which are likely especially important for these students. Further, there is a push for colleges to rely less on test scores and weigh other measures, such as grades, more heavily. This "test-optional" movement may have the unintended consequence of penalizing students like those admitted to SEHSs from low-SES neighborhoods: otherwise qualified students with relatively lower grades. In addition, we do not know how counseling

resources at high schools are allocated, or if counselors are encouraging relatively lower-performing students to apply to a different set of colleges than relatively higher-performing students. At the same time, students from lower-SES neighborhoods may rely more heavily on college counselors at high schools for advising.

One could conclude from these results that CPS should do away with SEHSs because they have no impacts on student achievement outcomes and yet they increase uncertainty and stress for parents and children and require the district to administer entrance exams and an admissions system. At the same time, these schools serve the additional goal of creating more diverse student bodies than generally arise in a neighborhood school system. Another potential benefit of offering selective schools as part of a portfolio of district school options is that SEHSs may attract or retain families who would otherwise leave the district for private schools or suburban districts. Retaining families could ultimately benefit districts in terms of financial and nonfinancial resources by increasing the tax base and the social capital of families with children in the public schools. How families respond to the various schooling options they face is an important area for further study and one that should certainly be investigated as it relates to selective schools.

Finally, whether or not historically disadvantaged students can benefit from high-performing school environments has received national attention. In the U.S. Supreme Court case *Fisher v. University of Texas* challenging the University's top 10 percent admission policy, Justice Scalia speculated that affirmative action admission policies might result in less-qualified minority students gaining access to colleges that are too rigorous for their level of preparation or previous academic successes. The tier system in Chicago Public Schools puts into place admissions quotas based on students' neighborhood SES, which result in affirmative action in high school admissions by neighborhood context. We do not

believe that it is the case that students from low-SES neighborhoods cannot do well in elite public school programs. In fact, there is no evidence of learning declines, as test scores for less affluent students are unaffected. On a less objective measure of academic performance – grades – students from low-SES neighborhoods do not perform as well, and access to selective colleges suffers. Understanding the mechanism driving this result is important for determining policy implications.

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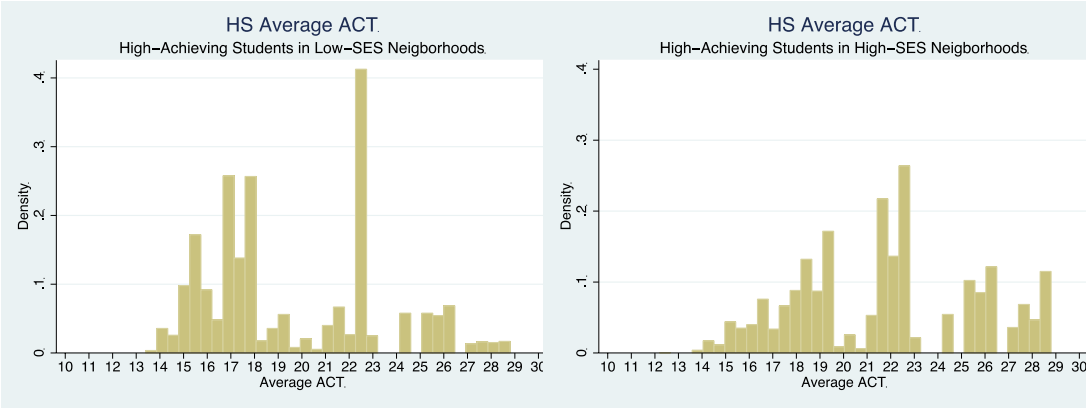

FIGURE 1. DISTRIBUTION OF AVERAGE ACT SCORE AT HIGH SCHOOLS ATTENDED BY HIGH-ACHIEVING STUDENTS FROM LOW-SES NEIGHBORHOODS (LEFT) AND HIGH-SES NEIGHBORHOODS (RIGHT).

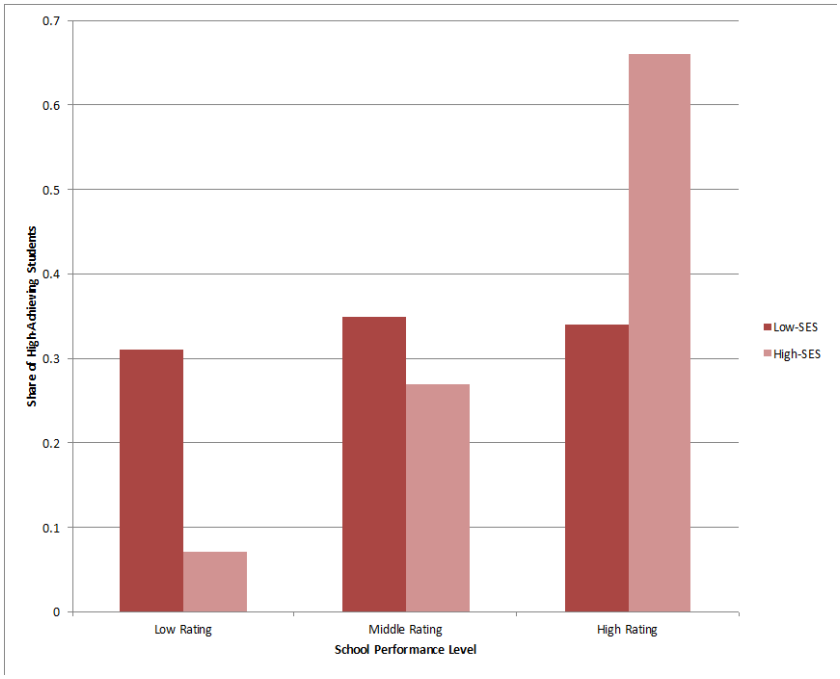

FIGURE 2. SHARE OF HIGH-ACHIEVING STUDENTS ATTENDING EACH PERFORMANCE LEVEL OF ELEMENTARY SCHOOL BY NEIGHBORHOOD SES

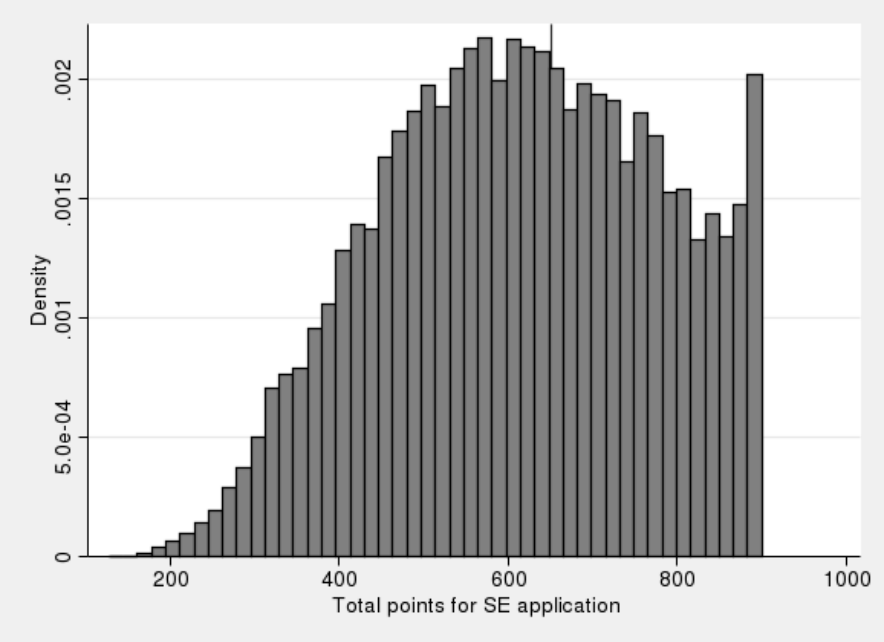

FIGURE 3. DISTRIBUTION OF SEHS APPLICATION SCORES

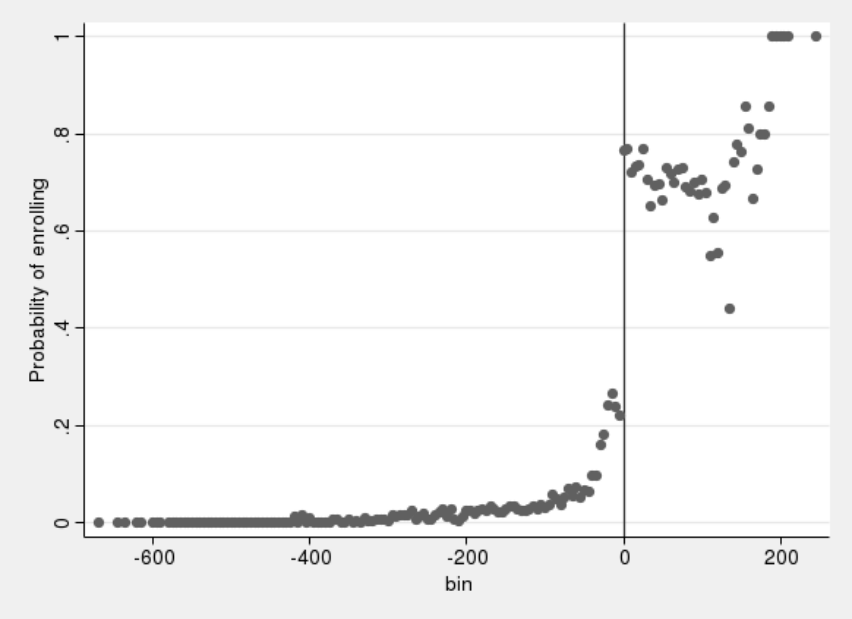

FIGURE 4. PROBABILITY OF ENROLLING IN A SEHS GIVEN CENTERED APPLICATION SCORE

TABLE 1. STUDENT CHARACTERISTICS BY APPLICATION STATUS AND TIER

Student Characteristics	All Students	All Applicants	Analytic Sample	Tier 1 (Lowest SES) Analytic Sample	Tier 2 Analytic Sample	Tier 3 Analytic Sample	Tier 4 (Highest SES) Analytic Sample
Standardized grade 8 test score	0	0.64	1.27	0.99	1.15	1.30	1.53
Grade 7 ISAT math percentile	n/a	78.49 (15.40)	88.62 (9.55)	85.65 (10.05)	87.55 (9.65)	89.12 (9.28)	91.22 (8.56)
Grade 7 ISAT reading percentile	n/a	78.03 (15.89)	87.96 (10.02)	85.17 (10.61)	86.50 (10.41)	88.49 (9.49)	90.72 (8.91)
Attends assigned elementary school	0.62	0.56	0.50	0.46	0.48	0.51	0.55
African American	0.43	0.39	0.30	0.43	0.33	0.30	0.19
Hispanic	0.45	0.44	0.43	0.52	0.54	0.42	0.27
White	0.07	0.10	0.16	0.02	0.04	0.13	0.39
Asian	0.04	0.06	0.09	0.02	0.08	0.13	0.12
Male	0.50	0.44	0.39	0.38	0.38	0.41	0.41
Free/Reduced-Price Lunch	0.88	0.82	0.73	0.90	0.86	0.77	0.45
Special Education	0.15	0.05	0	0	0	0	0
Application score (maximum of 900)	n/a	606.0 (164.2)	751.8 (86.45)	705.3 (72.3)	734.5 (78.4)	758.5 (80.8)	794.1 (86.6)
Eligible for admission to a SEHS based on total points	n/a	0.41	0.86	0.74	0.85	0.90	0.92
Cutoff based admission	n/a	0.27	0.61	0.58	0.60	0.60	0.65
Enrolled in a SEHS in grade 9	0.11	0.23	0.49	0.47	0.46	0.48	0.55
Number of Students	99,966	43,461	16,028	3,291	3,840	4,408	4,489

Notes: "All Students" includes all CPS students enrolled for the first time in grade 9 who were also enrolled in CPS for grade8. "All Applicants" includes only the subset who also completed a Selective Enrollment High School application. Our analytic sample limits the students to students within a one-half standard deviation of the cut-score for each SEHS. "Cutoff based admission" is an indicator for the student being offered a seat at a SEHS based on the published cutoff scores. Students are defined as "enrolled in a SEHS in grade 9" if they are enrolled in one of the SEHSs, regardless of whether they are specifically in the SEHS program.

TABLE 2. MEAN DIFFERENCE OF AVERAGE SCHOOL CHARACTERISTICS BY SELECTION RULE (S.E. IN PARENTHESES)

School level characteristic	Overall	Tier 1 (Lowest SES)	Tier 2	Tier 3	Tier 4 (Highest SES)
Percent of grade 9 students on track for graduation	3.8 (1.8)	13.8 (3.9)	-0.7 (4.7)	-1.9 (5.1)	5.1 (3.9)
Percent of students enrolled in AP classes	8.1 (1.3)	8.3 (1.6)	7.3 (2.2)	7.2 (1.5)	9.3 (1.7)
Average ACT composite score	2.03 (0.29)	2.05 (0.38)	1.99 (0.46)	1.87 (0.38)	2.22 (0.35)
5-year Cohort Graduation Rates	4.8 (1.0)	4.3 (1.3)	4.5 (2.1)	5.4 (1.8)	5.2 (0.7)
Percent of grads enrolling in college	6.0 (0.7)	7.1 (1.3)	7.8 (1.0)	6.3 (0.9)	4.5 (0.6)
Percent of college enrollees enrolled for a second year	4.7 (0.5)	8.3 (0.6)	6.4 (0.8)	4.2 (0.6)	2.4 (0.5)
Year-end attendance rate	1.9 (0.3)	1.8 (0.5)	2.2 (0.7)	2.1 (0.6)	1.6 (0.4)
Percent of students receiving an out-of-school suspension	-6.2 (1.0)	-7.1 (1.8)	-7.9 (3.4)	-7.1 (1.3)	-4.6 (0.8)
Herfindahl-Hirschman index of racial concentration	-0.03 (0.01)	-0.06 (0.03)	-0.06 (0.02)	-0.02 (0.03)	-0.01 (0.02)
Percent male	-2.3 (0.5)	-2.8 (0.9)	-2.9 (0.6)	-1.7 (0.5)	-2.0 (0.5)
Percent of students with an IEP	-1.7 (0.3)	-2.0 (0.4)	-2.2 (0.4)	-1.6 (0.5)	-1.4 (0.3)
Percent of students eligible for free/reduced-price lunch	-6.2 (1.4)	-7.0 (2.4)	-7.1 (1.9)	-5.4 (1.5)	-6.2 (2.3)
Total enrollment	150.7 (232.6)	310.4 (295.9)	299.3 (234.8)	160.9 (219.2)	-29.4 (300.9)
Average student report of parental support	0.39 (0.10)	0.35 (0.13)	0.40 (0.18)	0.35 (0.16)	0.42 (0.19)
Average student report of community support	0.21 (0.22)	0.22 (0.31)	0.26 (0.37)	0.15 (0.27)	0.25 (0.17)
Average student report of classmates' views on importance of school	0.57 (0.11)	0.97 (0.34)	0.91 (0.30)	0.50 (0.27)	0.41 (0.12)
Teacher report on crime/disruption/violence	-0.61 (0.10)	-0.58 (0.12)	-0.52 (0.17)	-0.57 (0.17)	-0.72 (0.08)
Teacher report on program continuity	0.20 (0.18)	0.09 (0.15)	0.05 (0.29)	0.02 (0.14)	0.48 (0.25)
Teacher satisfaction with CPS	0.31 (0.20)	0.19 (0.25)	0.01 (0.25)	0.20 (0.20)	0.63 (0.22)

Notes: Mean differences are weighted by student such that schools enrolling more applicants from the analytic sample receive more weight. The mobility rate equals the number of students entering and exiting the school as a percent of average daily enrollment. A student is considered "on-track" to graduate if she earns at least five full-year course credits (10 semester credits) and has no more than one semester F in a core course (English, math, science, or social science) in her first year of high school. 5-year cohort graduation and dropout rates reflect the percent of first-time 9th grade students graduating or dropping out of school as of 5-years after first-time 9th grade enrollment. Verified transfers out of the district are excluded from this calculation. See Appendix Table 1 for descriptions of the survey measures. School-level discipline data are unavailable in 2010 and 2011. College persistence data are unavailable for the 2013-14 school year. 5-year cohort dropout and graduation rates as well as average ACT test scores are missing for recently opened schools. Additionally, charter schools do not report school-level transcript and discipline measures.

TABLE 3. REDUCED-FORM ESTIMATES OF THE EFFECTS OF ADMISSION TO AN SEHS ON ACADEMIC PERFORMANCE

	Standardized test score (PLAN) (grade 10)	Standardized test score (ACT) (grade 11)	GPA (grade 9)	GPA (grade 11)	High school graduation (4-year rate)	Enroll in any college the fall after graduation	Enroll in a selective college
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Counterfactual mean (std. dev.)	0.778 (0.654)	0.765 (0.682)	2.948 (0.779)	2.935 (0.658)	0.951 (0.217)	0.822 (0.383)	0.181 (0.385)
All tiers	-0.024 (0.022)	-0.020 (0.027)	-0.122 (0.044)	-0.096 (0.050)	-0.025 (0.027)	0.030 (0.039)	0.011 (0.040)
Tier 1 (Lowest SES)	-0.042 (0.050)	-0.096 (0.071)	-0.323 (0.055)	-0.216 (0.068)	-0.047 (0.040)	0.011 (0.097)	-0.130 (0.055)
Tier 2	-0.011 (0.051)	-0.018 (0.099)	-0.170 (0.047)	-0.221 (0.056)	-0.012 (0.020)	0.019 (0.105)	0.001 (0.108)
Tier 3	-0.049 (0.054)	-0.107 (0.066)	-0.073 (0.087)	0.002 (0.102)	-0.017 (0.040)	0.024 (0.051)	0.007 (0.087)
Tier 4 (Highest SES)	-0.022 (0.056)	0.090 (0.067)	-0.044 (0.059)	-0.054 (0.055)	-0.029 (0.022)	0.084 (0.060)	0.115 (0.078)
P-value: Tier 1 = Tier 4	0.768	0.125	0.018	0.117	0.628	0.527	0.027
Observations	17,768	12,657	16,733	11,511	8,161	3,349	3,349

Notes: Bandwidth is limited to centered application scores within 0.5 standard deviations of the cutoff. Estimating equations include an indicator for admission to any SEHS, a quadratic in the centered application score, interactions between the admission indicator and the centered application quadratic terms, as well as application school-by-cohort-by-tier fixed effects. Estimates by tier come from a single regression with control variables fully interacted with tier indicators. The analytic sample includes only applicants with complete applications and who were enrolled in CPS in grade 8 and grade 9, consecutively. Students are first-time ninth graders in 2010-11, 2011-12, 2012-13, and 2013-14. Standard errors are clustered at the application school level.

TABLE 4. REDUCED-FORM ESTIMATES OF THE EFFECTS OF ADMISSION TO AN SEHS ON HIGH SCHOOL EXPERIENCE

	Incoming class rank	Takes any honors class	Spends >10 hours on homework per week	Quality of science courses	Personal safety	Peer relationships	Teacher-student trust	Sense of belonging at school
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Counterfactual mean (std. dev.)	75.407 (22.505)	0.820 (0.384)	0.213 (0.410)	0.058 (0.843)	0.047 (0.949)	0.076 (0.924)	0.082 (0.964)	0.108 (0.982)
All tiers	-15.859 (1.327)	0.004 (0.010)	-0.029 (0.023)	0.145 (0.046)	0.296 (0.055)	0.251 (0.050)	0.131 (0.052)	0.096 (0.100)
Tier 1 (Lowest SES)	-25.390 (3.985)	0.025 (0.016)	0.035 (0.025)	0.161 (0.075)	0.244 (0.114)	0.202 (0.080)	0.073 (0.081)	0.010 (0.075)
Tier 2	-14.287 (4.270)	0.010 (0.030)	0.085 (0.032)	0.169 (0.058)	0.314 (0.101)	0.137 (0.126)	-0.007 (0.116)	-0.047 (0.163)
Tier 3	-18.669 (3.029)	-0.010 (0.036)	-0.075 (0.050)	-0.017 (0.063)	0.245 (0.052)	0.301 (0.054)	0.225 (0.108)	0.114 (0.035)
Tier 4 (Highest SES)	-10.405 (1.878)	-0.014 (0.021)	-0.114 (0.039)	0.272 (0.137)	0.351 (0.097)	0.334 (0.091)	0.192 (0.090)	0.203 (0.219)
P-value: Tier 1 = Tier 4	0.006	0.062	0.026	0.495	0.470	0.152	0.347	0.398
Observations	19,022	16,733	15,326	14,596	15,305	15,264	15,167	15,245

Notes: Bandwidth is limited to centered application scores within 0.5 standard deviations of the cutoff. Regressions are limited to students with complete applications. Estimating equations include an indicator for admission to any SEHS, a quadratic in the centered application score, interactions between the admission indicator and the centered application quadratic terms, as well as application school-by-cohort-by-tier fixed effects. Estimates by tier come from a single regression with control variables fully interacted with tier indicators. The analytic sample includes only applicants who were enrolled in CPS in grade 8 and grade 9 consecutively. Students are first-time ninth graders in 2010-11, 2011-12, 2012-13, and 2013-14. Standard errors are clustered at the application school level.

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Appendix Text, Figures, and Tables

As stated by Lee and Lemieux (2010), the parametric and nonparametric RD estimates should be viewed as a complement to each other and as a way of confirming the specification of the model and the results. Section V in the paper described the estimated model and tables 3 and 4 presented the estimates limiting the sample to observations where the centered application score was within 0.5 standard deviations of the cutoff (approximately 82 points on each side of the cut point).[16] This appendix presents the results from our nonparametric estimation strategy.

We first calculate the optimal data-driven IK bandwidth for each of the cohort-school-neighborhood tier group as suggested in Imbens and Kalyanaraman (2012). We use a uniform kernel and assume a quadratic functional form as described in Section V of the main text. We limit the sample of observations in each cohort-school-neighborhood tier group using the IK bandwidth and estimate the parameters using this sample.

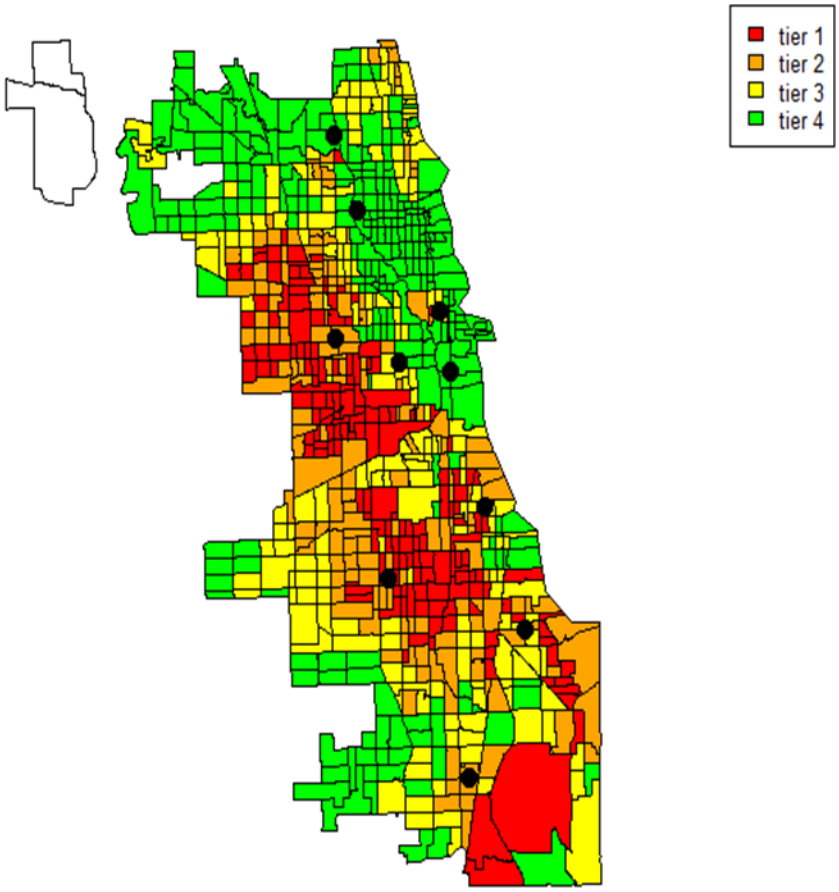
Appendix tables A5 and A6 present the results of the estimation for academic performance and high school experiences respectively. For each outcome we show the distribution of the bandwidths applied and how many of the cohort-school-neighborhood tiers are represented. In some instances it was not possible to find an optimal bandwidth given the functional form and the data. The first thing to notice is that on average the IK bandwidth is wider than the 0.5 standard deviation from the cutoff that we allowed in the main results presented in the paper. This leads to having more observations in the nonparametric estimation on

[16] In some sense, this is already a nonparametric approach because not all the observations are used to estimate the model.

both sides of the cutoff and therefore the tables show lower mean values of the outcome for the control group.

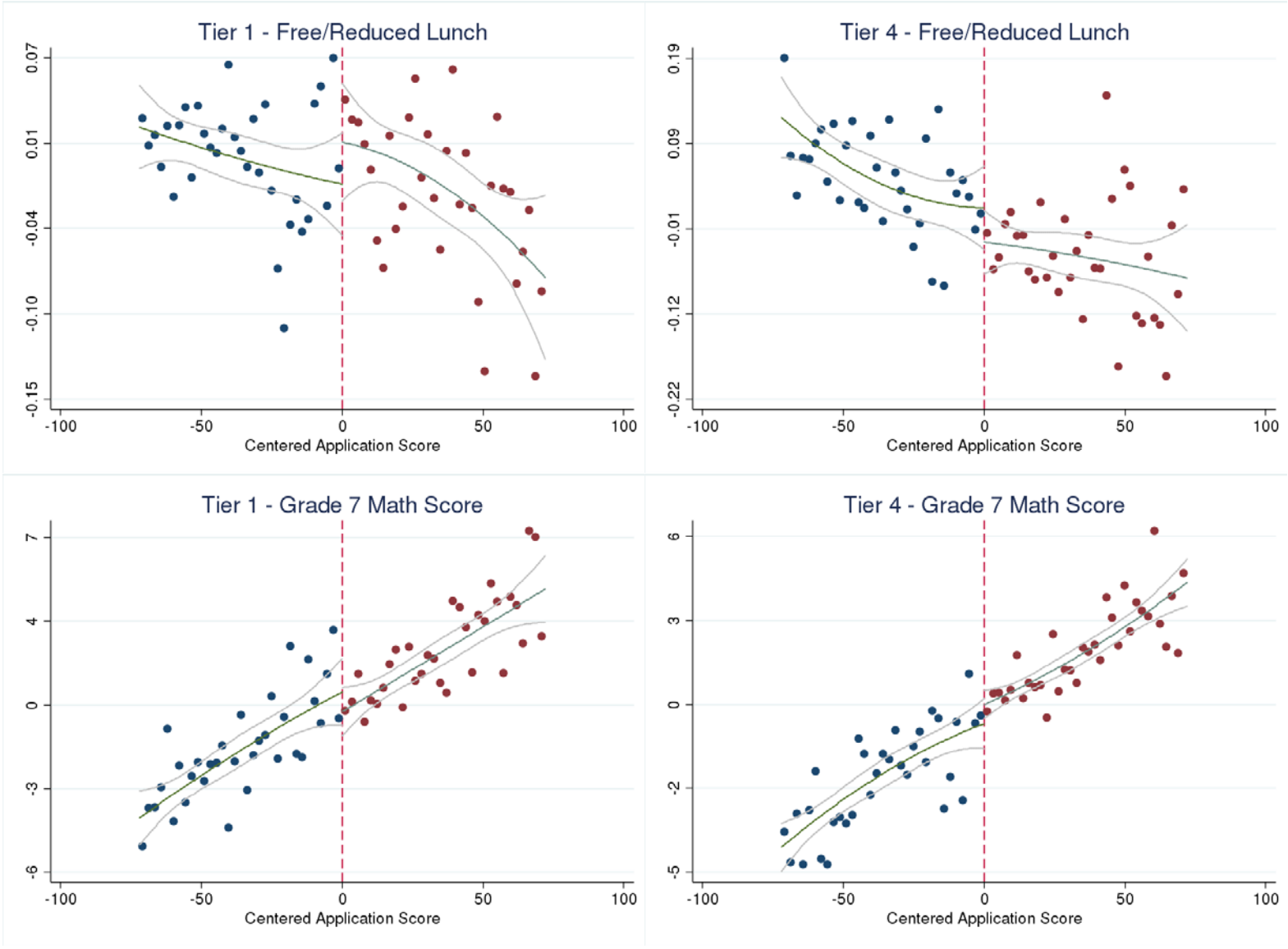
The overall academic performance effects are very similar to the ones in Table 3 with the exception of ACT scores. Using our nonparametric estimation strategy, we estimate a statistically significant, negative effect of SEHS admission on ACT scores (-0.062) that is larger in absolute value than estimated in the parametric specifications. While the negative effect of SEHS admissions on ACT scores for students from low-SES neighborhoods is somewhat larger in absolute value than the estimated negative effect on ACT scores for students from high-SES neighborhoods, the difference is not statistically significant. However, we do find statistically different impacts of SEHSs on PLAN test scores for students from low- and high-SES neighborhoods (p-value = 0.005), even though the overall estimate is not different from the main results. The nonparametric estimate of the effect of SEHSs on PLAN test scores is positive for students from low SES-neighborhoods (0.047) and negative for students from high-SES neighborhoods (−0.044).

In terms of high school experiences the overall effects lose statistical significance for self-reports of science course quality and teacher-student trust. Differences among students from low-SES neighborhoods and high-SES neighborhoods emerge in the self-reports of sense of belonging at school. The effect for students from low-SES neighborhoods becomes negative in the nonparametric estimates driving the difference with students from high-SES neighborhoods to be larger and statistically significant (p-value = 0.037). In general, we find the nonparametric estimates are very similar to the main results reported in the report.

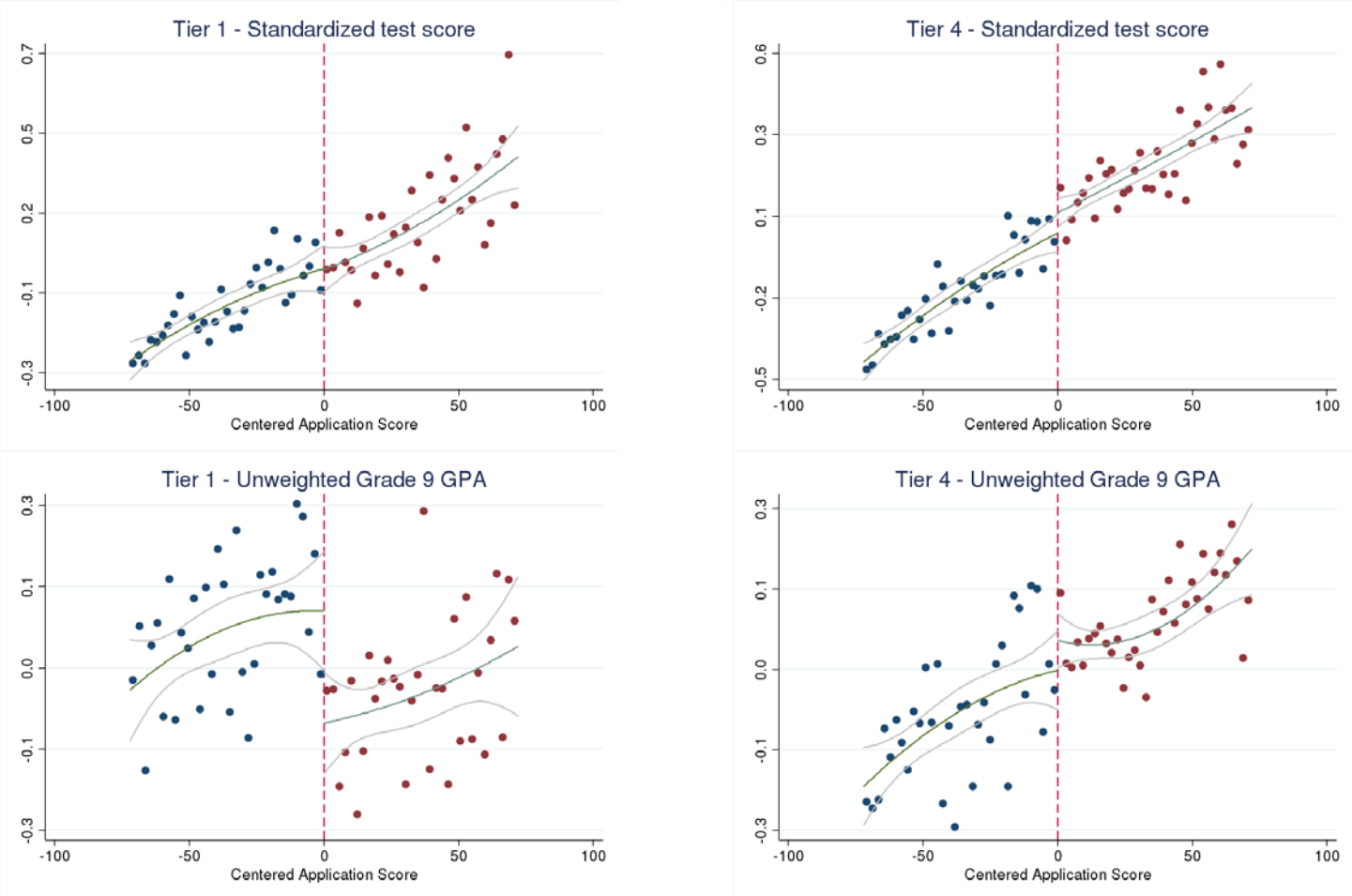


APPENDIX FIGURE 1. MAP OF CHICAGO CENSUS TRACT TIERS AND THE LOCATIONS OF SELECTIVE ENROLLMENT HIGH SCHOOLS

Notes: Each dot represents the location of a Chicago selective high school that was open during the study period,



APPENDIX FIGURE 2. RELATIONSHIP BETWEEN THE CENTERED APPLICATION SCORE AND PRE-TREATMENT CHARACTERISTICS



APPENDIX FIGURE 3. RELATIONSHIP BETWEEN THE CENTERED APPLICATION SCORE AND OUTCOMES

APPENDIX TABLE 1. SCHOOL-LEVEL SURVEY MEASURES

Student report of parental support	*How often do your parents do the following?* • Encourage you to work hard at school • Are supportive of the things you like to do outside of school • Listen to you when you need to talk • Show they are proud of you • Take time to help you make decisions
Student report of community support	*How much do you agree with the following statements about the community in which you live?* • Adults in this neighborhood know who the local children are. • During the day it is safe for children to play in the local park or playground. • People in this neighborhood can be trusted. • There are adults in this neighborhood that children can look up to. • The equipment and buildings in the neighborhood, park, or playground are well kept.
Student report of classmates' views on the importance of school	*How many of the students in your target class?* • Feel it is important to come to school every day • Feel it is important to pay attention in class • Think doing homework is important • Try hard to get good grades
Teacher report on	*To what extent is each of the following a problem at your school?* • Physical conflicts among students • Robbery or theft • Gang activity • Disorder in classrooms • Disorder in hallways • Student disrespect of teachers • Threats of violence toward teachers
Teacher report on program continuity	*To what extent do you disagree or agree with the following?* • Once we start a new program we follow up to make sure that it's working. • We have so many different programs in this school that I can't keep track of them all. • Many special programs come and go at this school. • Curriculum, instruction, and learning materials are well coordinated across the different grade levels at this school. • There is consistency in curriculum, instruction, and learning materials among teachers in the same grade level at this school.
Teacher satisfaction with CPS	*To what extent do you agree or disagree with the following statements?* • I would recommend CPS as a great place to work for my friends. • If I were offered a comparable teaching position with similar pay and benefits at another district, I would stay with CPS. • My school leader encourages me to come up with new and better ways of doing things. • I am satisfied with the recognition I receive for doing my job. • The people I work with at my school cooperate to get the job done. • I have access to the resources (materials, equipment, technology, etc.) I need in order to effectively teach my students.

APPENDIX TABLE 2. ADMISSIONS CUTOFFS BY SCHOOL, TIER, AND YEAR

Tier	2010-11 Cohort	2011-12 Cohort	2012-13 Cohort	2013-14 Cohort
		Brooks		
1	688	650	681	675
2	699	697	720	701
3	746	741	758	745
4	758	727	756	715
		Jones		
1	797	780	775	757
2	826	810	816	811
3	847	847	854	840
4	852	865	875	867
		King		
1	672	650	657	650
2	676	671	663	650
3	678	690	691	650
4	665	652	651	650
		Lane Tech		
1	736	688	737	713
2	761	734	768	770
3	771	770	813	804
4	789	782	839	831
		Lindblom		
1	660	651	685	665
2	660	696	706	716
3	660	708	732	708
4	662	686	716	675
		Northside		
1	850	792	792	782
2	850	828	835	837
3	863	872	882	878
4	882	891	895	897
		Payton		
1	855	806	822	801
2	862	833	861	845
3	877	869	885	871
4	889	889	896	898
		Southshore		
1				653
2				653
3				650
4				651

		Westinghouse		
1	701	676	704	691
2	727	717	728	723
3	705	728	738	717
4	702	705	718	689
		Young		
1	818	784	800	803
2	832	802	822	840
3	852	837	864	859
4	864	865	879	876

Notes: Table compiled using publically released admissions cutoff scores in each year by tier available from CPS.

APPENDIX TABLE 3. DESCRIPTION OF STUDENT-LEVEL SURVEY MEASURES ON HIGH SCHOOL EXPERIENCE

Time spent on homework	*How much time do you spend studying or doing homework for ALL your classes?* • Less than 2 hours • 3-5 hours • 6-9 hours • 10-14 hours 15 or more hours
Quality of science course	*How often do you do the following?* • Use laboratory equipment or specimens • Write lab reports • Generate your own hypotheses • Use evidence/data to support an argument or hypothesis • Find information from graphs and tables
Personal safety (reverse coded)	*How much do you agree with the following statements about your school?* • I worry about crime and violence at this school • Students at this school are often teased or picked on • Students at this school are often threatened or bullied
Peer relationships	*How much do you agree with the following statements about students in your school? Most students in my school:* Strongly Disagree, Disagree, Agree, Strongly Agree • Like to put others down • Help each other learn • Don't get along together very well • Treat each other with respect
Teacher-student trust	*How much do you agree with:* Strongly Disagree, Disagree, Agree, Strongly Agree • My teachers really care about me • My teachers always keep his/her promises • My teachers always try to be fair • I feel safe and comfortable with my teachers at this school • When my teachers tell me not to do something, I know he/she has a good reason • My teachers will always listen to students' ideas • My teachers treat me with respect
Sense of belonging	*How much do you agree with the following statements about your school?* • I feel like a real part of my school • People here notice when I'm good at something • Other students in my school take my opinion seriously • People at this school are friendly to me • I'm included in lots of activities at school • I'm excited to go to school every day

APPENDIX TABLE 4. OUTCOME MEANS

Outcome variable	All Applicants	Analytic Sample	Tier 1 Analytic Sample admit = 0	Tier 2 Analytic Sample admit = 0	Tier 3 Analytic Sample admit = 0	Tier 4 Analytic Sample admit = 0
Standardized test score (PLAN)	0.548	1.153	0.536	0.676	0.809	1.043
Standardized test score (ACT)	0.541	1.160	0.501	0.642	0.796	1.063
GPA (grade 9)	2.751	3.069	2.821	2.901	2.969	3.061
GPA (grade 11)	2.763	3.044	2.813	2.899	2.954	3.032
High school graduation (4-year rate)	0.909	0.953	0.939	0.943	0.955	0.963
Enroll in any college the fall after graduation	0.766	0.85	0.757	0.787	0.838	0.885
Enroll in a selective college	0.156	0.272	0.162	0.163	0.179	0.212
Incoming class rank	62.281	66.506	75.578	75.831	76.981	73.076
Takes any honors class	0.665	0.886	0.768	0.769	0.860	0.861
Spends >10 hours on homework per week	0.189	0.284	0.178	0.170	0.217	0.278
Self-reports of science course quality	0.062	0.123	0.095	0.067	0.072	0.005
Self reports of personal safety	0.145	0.355	0.096	0.020	0.021	0.060
Self reports of peer relationships	0.124	0.345	0.017	0.068	0.093	0.116
Self reports of teacher-student trust	0.083	0.207	0.089	0.085	0.099	0.055
Self reports of sense of belonging at school	0.109	0.256	0.121	0.072	0.121	0.117

Notes: "All Students" includes all CPS students enrolled for the first time in grade 9 who were also enrolled in CPS for grade8. "All Applicants" includes all CPS students enrolled for the first time in grade 9 who were also enrolled in CPS for grade8 and who completed a Selective Enrollment High School application. Our analytic sample limits the students to students within a one-half standard deviation of the cut-score for each SEHS. "admit = 0" is indicates that the student was not offered a seat at a SEHS based on the published cutoff scores.

APPENDIX TABLE 5. NONPARAMETRIC REDUCED-FORM ESTIMATES OF THE EFFECTS OF ADMISSION TO AN SEHS ON ACADEMIC PERFORMANCE

	Standardized test score (PLAN) (grade 10)	Standardized test score (ACT) (grade 11)	GPA (grade 9)	GPA (grade 11)	High school graduation (4-year rate)	Enroll in any college the fall after graduation	Enroll in a selective college
	(1)	(2)	(3)	(5)	(6)	(7)	(8)
Control mean	0.589	0.617	2.846	2.848	0.941	0.812	0.167
(std. dev.)	(0.618)	(0.653)	(0.807)	(0.682)	(0.235)	(0.390)	(0.373)
All tiers	-0.022	-0.062	-0.123	-0.126	-0.028	-0.006	-0.045
	(0.024)	(0.025)	(0.025)	(0.016)	(0.017)	(0.018)	(0.040)
Tier 1	0.047	-0.072	-0.237	-0.235	-0.069	0.003	-0.146
	(0.022)	(0.039)	(0.050)	(0.034)	(0.040)	(0.091)	(0.052)
Tier 2	-0.006	-0.082	-0.150	-0.203	-0.022	0.006	-0.072
	(0.050)	(0.065)	(0.088)	(0.072)	(0.015)	(0.075)	(0.100)
Tier 3	-0.052	-0.049	-0.035	-0.019	-0.023	-0.028	-0.000
	(0.037)	(0.026)	(0.061)	(0.064)	(0.029)	(0.064)	(0.060)
Tier 4	-0.077	-0.044	-0.075	-0.131	-0.016	0.012	0.002
	(0.034)	(0.045)	(0.041)	(0.044)	(0.015)	(0.027)	(0.059)
P-value: Tier 1 = Tier 4	0.005	0.715	0.090	0.201	0.140	0.938	0.022
IK bandwidth							
Average	106.4	99.9	111.2	107.8	117.5	97.3	98.5
	(38.3)	(31.6)	(40.4)	(38.3)	(39.4)	(30.7)	(26.8)
Minimum	27.4	20.2	22.5	21.5	38.1	33.4	35.4
Maximum	210.1	174.4	245.6	289.2	215.7	141.8	142.3
# cohort-school-neighborhood tiers	115	84	109	80	45	27	28
Observations	24,515	16,278	22,548	14,890	11,099	4,155	4,280

Notes: Bandwidth is selected using a quadratic uniform kernel for each of the 148 comparisons in the analyses, cohort-school-neighborhood tiers groups. Regressions are limited to students with complete applications. Estimating equations include an indicator for admission to any SEHS, a quadratic in the centered application score, interactions between the admission indicator and the centered application quadratic terms, as well as application school-by-cohort-by-tier fixed effects. Estimates by tier come from a single regression with control variables fully interacted with tier indicators. The analytic sample includes only applicants who were enrolled in CPS in grade 8 and grade 9 consecutively. Students are first-time ninth graders in 2010-11, 2011-12, 2012-13, and 2013-14.

APPENDIX TABLE 6. NONPARAMETRIC REDUCED-FORM ESTIMATES OF THE EFFECTS OF ADMISSION TO AN SEHS ON HIGH SCHOOL EXPERIENCE

	Incoming class rank	Takes any honors class	Spends >10 hours on homework per week	Quality of science course	Personal safety	Peer relationships	Teacher-student trust	Sense of belonging at school
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Control mean	74.7	0.754	0.177	0.075	0.033	0.030	0.053	0.085
(std. dev.)	(21.6)	(0.431)	(0.382)	(0.874)	(0.960)	(0.950)	(0.977)	(0.984)
All tiers	-18.020	-0.012	-0.014	0.089	0.263	0.224	0.064	0.042
	(2.915)	(0.028)	(0.015)	(0.048)	(0.061)	(0.041)	(0.047)	(0.066)
Tier 1	-26.456	-0.020	0.032	0.174	0.279	0.248	0.058	-0.094
	(5.766)	(0.038)	(0.022)	(0.066)	(0.101)	(0.053)	(0.050)	(0.066)
Tier 2	-17.302	0.014	0.055	0.054	0.283	0.157	0.012	0.018
	(5.620)	(0.038)	(0.026)	(0.056)	(0.123)	(0.092)	(0.067)	(0.097)
Tier 3	-16.585	-0.037	-0.056	-0.024	0.244	0.214	0.059	0.043
	(3.865)	(0.035)	(0.032)	(0.030)	(0.065)	(0.090)	(0.093)	(0.072)
Tier 4	-11.566	0.010	-0.099	0.171	0.268	0.272	0.143	0.207
	(1.967)	(0.077)	(0.033)	(0.094)	(0.042)	(0.040)	(0.072)	(0.135)
P-value: Tier 1 = Tier 4	0.045	0.640	0.003	0.977	0.921	0.700	0.460	0.037
IK bandwidth								
Average	102.4	108.0	102.3	101.4	102.1	105.4	101.9	99.8
	(33.2)	(19.1)	(33.6)	(30.7)	(31.2)	(33.6)	(34.6)	(29.8)
Minimum	23.1	68.6	23.4	23.2	26.0	22.6	19.4	23.1
Maximum	194.1	169.3	188.3	165.9	164.8	245.2	201.3	186.9
# cohort-school-neighborhood tiers	114	78	110	110	110	109	108	108
Observations	25,661	16,389	20,128	19,106	20,175	20,684	20,100	19,704

Notes: Bandwidth is selected using a quadratic uniform kernel for each of the 148 comparisons in the analyses, cohort-school-neighborhood tier groups. Regressions are limited to students with complete applications. Estimating equations include an indicator for admission to any SEHS, a quadratic in the centered application score, interactions between the admission indicator and the centered application quadratic terms, as well as application school-by-cohort-by-tier fixed effects. Estimates by tier come from a single regression with control variables fully interacted with tier indicators. The analytic sample includes only applicants who were enrolled in CPS in grade 8 and grade 9 consecutively. Students are first-time ninth graders in 2010-11, 2011-12, 2012-13, and 2013-14.