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What Do Parents Want? An Exploration of School Preferences Expressed by Boston Parents

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An Exploration of School Preferences Expressed by Boston Parents

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HARVARD Kennedy School
RAPPAPORT INSTITUTE
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About the Rappaport Institute for Greater Boston

The Rappaport Institute for Greater Boston at Harvard's Kennedy School of Government strives to improve the region's governance by attracting young people to serve the region, working with scholars to produce new ideas about important issues, and stimulating informed discussions that bring together scholars, policymakers, and civic leaders. The Rappaport Institute was founded and funded by the Phyllis and Jerome Lyle Rappaport Foundation, which promotes emerging leaders in Greater Boston.

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I: Introduction

What do parents value in their children's schools? Under the current assignment process, Boston's families rank schools, and these rankings provide us with a means of assessing the schools that parents like best.

As part of the 2012-13 process of reforming the Boston Public Schools' ("BPS") student assignment process, BPS has released a vast amount of data around the choices made in this process and school characteristics. Previously, the demand data was limited and information about the relationship of demand and school characteristics was largely anecdotal. Using this data, we examine the correlations between school characteristics and parental preferences. We ask what school attributes are particularly associated with parents ranking the schools highly in their choice sets.

We focus on parental preferences at kindergarten, grade six and grade nine, which are the gateway years for elementary school, middle school and high school respectively. These years contain the lion's share of the available data. We have grouped 4 year old kindergarten ("K1") and 5 year old kindergarten ("K2") choice together in our analysis, but the patterns are generally quite similar if we look at the years separately. Grade 6 results were generally an outlier relative to the other two grades, perhaps reflecting the transitional nature of the grade in the Boston public schools. Across all three grades, we focus on application to general education programs, although again, we do present results for the broader range of more specialized education that Boston makes available

We use a composite ranking ("choice points") to determine the most highly demanded schools by giving 1 point for every time a school was chosen first by a family, 2/3 of a point if it was a second choice, and 1/3 of a point if it was a third choice. We sum the points for each school to provide a single numerical value to account for demand level.

Our goal is to measure school popularity holding the level of nearby families constant. We correct for the tendency of people to select close schools. The city's current assignment system favors children in walk-zones[1] for primary school assignment. Parents as well, presumably, prefer proximity, all else being equal. We control for several measures of demand using 2010 American Community Survey Census data for tracts within one mile of the school: the number of families with children under 19, the share of families with children of relevant ages, and the share of the population that is a college graduate.

We find that the number of nearby families is only weakly associated with school quality, but the share of families with children of relevant ages is strongly associated with kindergarten and high school popularity. We also find that kindergartens that are surrounded by more educated adults are more popular. We include the last variable as a control for local demand, because better educated adults may be more involved with the assignment system and more focused on applying. However, this variable may also be correlated with the school's academic quality.

When we move past neighborhood characteristics, we find that test scores play a dominant role in determining parental preference for kindergarten and ninth grade. As the share of a schools' students scoring proficient or advanced on either the math or the English MCAS (Massachusetts Comprehensive Assessment System) increases by 14 percent (approximately one standard deviation), there are typically sixteen more families ranking the school's kindergarten program among their top three choices, which is 34 percent of the mean number of parents ranking the program so highly. At the kindergarten level, the close correlation of these two tests scores makes it impossible to separately identify the effect of math versus English scores. The Math score is somewhat more strongly associated with parental choice in kindergarten, and we include that score as a control in the rest of our work.

In grade 9, both test score measures have a strong positive effect on their own. A nineteen percent increase in the shares scoring proficient or advanced in either test is associated with about eighty-five more families ranking the school in their top three, which is about 47 percent of the mean number of top choices received by a high school general education program. When both variables are included, the math score is the stronger variable and so we include it as a control variable in subsequent analyses.

In grade 6, the correlations between test scores and parental choice are weak. Neither test score is correlated with parental choice. When both variables are included, English appears to have a slight positive effect and math appears to have an equal offsetting negative effect. So we include the share of students scoring proficient or advanced on the English language MCAS as a control in subsequent analyses

Given the correlation between test scores and popularity, we examined another dimension of test scores the growth percentage of both math and English scores, a measure that gauges progress in test score improvement over time relative to schools across Massachusetts. In Kindergarten, English student growth was associated with higher ranking. In High School, stronger performance in student growth percentages was also associated with higher ranking. In Grade 6 no association was observed and no grade showed any effect of performance on student growth percentage.

We then examine the connection between popularity and school facilities, including the presence of a gym, square footage per pupil and whether all classrooms have a computer. Few of these variables have much of a relationship, outside of the general condition of the building and the cleanliness of the school. Those schools that have below average cleanliness attract fewer parents at all grade levels. Schools with better conditions attract more sixth grade parents.

Taken literally, these results suggest that if the school system wants to take parents preferences more seriously, it needs to devote more resources towards cleanliness, and perhaps to invest less in overall school size or other facilities such as gyms and widespread computers. However, there are at least two reasons to be cautious. The negative effect of lack of school cleanliness might reflect social problems at the school rather than dirt per se. Moreover, the presence of computers and gyms might have positive effects on student skills and health that have significant social value, even if parents aren't giving such considerations much weight in their decisions. Further research is needed before leaping to any definitive policy recommendations.

We then turn to school programming, such as the presence of art and music programs, science labs and vocational facilities. The presence of art and music is positive, but the effects are modest and statistically insignificant. The absence of a science lab has no effect on demand for the older and younger children, but it does weakly depress demand for sixth grade schools. The presence of universal wireless connectivity has no effect on demand at any grade level.

We also find a strong positive relationship between vocational facilities and demand for high school students, but this is due to a single large school: Madison Park High. Demand for Madison Park High is significant, with over 250 parents choosing it among their top three high schools, but that is not enough to fill the school's ample classrooms. As such, this high level of demand does not imply that Boston should be building allocating more resources to vocational training.

There is also a connection between the racial makeup of the neighborhood and the popularity of nearby schools. Schools close to Asian and white populations are typically more popular. Again, this suggests that moving towards a more neighborhood based school model would effectively redistribute towards these populations.

These correlations are somewhat interesting, as they do suggest the popularity of schools inhabited by students of different ethnic groups, but they do not necessarily imply that parents are valuing the ethnicity of the student population. In most cases, it seems as likely to reflect the assignment or preference of different ethnicities to schools of varying degrees of popularity.

At the kindergarten level, we find that a ten percent increase in the share of the student body that is Asian increases the number of families ranking the kindergarten among their top three choices by ten, holding Math language proficiency scores constant. This result is caused primarily by the high demand for the Murphy elementary school, which has a relatively high percentage of Asians. There is also a somewhat weaker relationship between the share of the student population that is white and parental choice, but that relationship becomes statistically insignificant once we control for the share of the student population that receives free or reduced lunches. The free lunch measure is a relatively standard measure of economic disadvantage and it somewhat depresses demand at the kindergarten level.

In grade six there is no correlation between ethnic variables and parental preference. In grade nine, the coefficient on Asian population in the school switches and becomes negative. A reasonable interpretation of this result is that Asians are disproportionately attending high schools that are less popular, such as Josiah Quincy Upper School. Since Josiah Quincy is selected by a tiny number of families, its high Asian percentage presumably reflects the assignment process, not parental choice.

With the potential for increased numbers of assignment zones, the distribution of popular schools by neighborhood is an important question. West Roxbury is particularly well endowed with popular schools. By contrast, the schools in East Boston and Roxbury are considerably less popular than the average. These facts attempt to control for the existing density of local demand, so this suggests that moving towards more neighborhood schools will mean effectively redistribute popular schools towards the parents in West Roxbury and away from parents in Roxbury and East Boston. In higher grades, there is far less correlation between neighborhood and popularity.

Parents do strongly value higher test scores in their school choices, which does suggest that they are really valuing academic outcomes for their children. Of course, test scores are far from perfect determinants of demand, which means that many parents are valuing other attributes beyond the academic quality of the school. We also find that kindergarten parents seem to want avoid schools with poorer students, holding test scores constant. Race seems to have far less influence on parental preference.

The importance of academics for popularity suggests that parents are displaying reasonable preferences. The facilities and programming data suggests that parents value some school attributes, such as cleanliness and art, but not others, such as square footage per pupil and music. We do not think that these results lead directly towards any policy implications, but rather set the stage for further research.

There is a wide disparity in the popularity of kindergartens and high schools. Popular kindergartens are far more common in West Roxbury and less common in Roxbury, Allston-Brighton and East Boston, even holding the nearby population density and education level constant. Schools near Asian and white populations are also typically more popular. These results suggest that moving towards an approach that give more preference to nearby students will typically make more popular options more available to parents in West Roxbury, and to white and Asian parents. There will be an offsetting reduction in the availability of popular choices to the parents living in Roxbury, Allston-Brighton and East Boston.

As the Boston Public Schools takes on the challenging task of simultaneously implementing a new school assignment system, improving school quality, and adding additional capacity in lower grades, this analysis provides a useful framework for implementing and analyzing each of these processes. The new school assignment system should be carefully monitored to insure that it meets the goal of improving access to quality. The efforts to improve quality and add capacity should also carefully consider what items are important (and unimportant) to parents.

II: Background

Boston's school assignment process has been the focus of intense debate from its inception. The process grew out of the 1974 ruling by Judge W. Arthur Garrity that found the Boston public schools to be racially segregated and unequal in its distribution of resources. He ordered the Boston School Committee to remedy the problem and, after it failed to act, Garrity appointed a group to oversee corrective action.

This oversight continued for over a decade until the BPS began development of a student assignment plan that was enacted in 1988, creating the three zone plan that is currently in place (albeit with significant revisions) today.

The BPS assignment process begins either at age four for K1 or age five for K2. Although the city has a stated goal of full coverage of K1, it is still in the process of expanding this program due to personnel costs and facility demands. Therefore, many schools still do not offer K1 and begin with K2 (as is standard in all surrounding communities). Because of 'guaranteed priority' (where all students being promoted a grade are guaranteed a seat in the higher grade), a school beginning with K1 will realistically only have a large number of available seats in that year and not for K2 (in the following year).

At this stage, students submit a list of their preferred schools from their zone. The city is broken up into three zones – North, East, and West. Every student is assigned a random number (that is not known to the student).

Next, two major forms of preference come into play – sibling and walk zone. Sibling preference applies to anyone who already has a sibling at the school and is designed to insure that all members of the same family are at the same school. Walk zone refers to an advantage given to all students who live within 1 mile of the school[2]. Fifty percent of the seats at each school are set aside in the first round of the assignment process for these students.

With these preferences in place, the assignment process begins. First priority is given to those applicants with both sibling and walk zone preference. Second priority is

Exceptions

The BPS assignment process as described above is how the vast majority of parents and students experience the process. However, there are exceptions to these rules. These exceptions include:

- BPS operates a 3 year old kindergarten program focused on children with certain special education needs who are transitioning from Early Intervention services. A small number of general education students are accepted into the program to create inclusion classrooms.
- The Hernandez School provides 'two-way' instruction in both English and Spanish. It provides a 'dual language preference' to certain applicants in order to insure a balance of native speakers in both languages.
- The Orchard Gardens School has a 75 percent walk zone preference which was granted in response to neighborhood demand after a new school building was built.
- There are several city-wide elementary schools that may be selected by any parent, regardless of their zone.
- The walk zone for elementary schools is 1 mile. Students whose walk zones stretch beyond their assignment zone may select any school within their walk zone, even if it is outside their assignment zone.
- Students living in East Boston are guaranteed seats in East Boston schools (if they so choose) to avoid travel through tunnels to the rest of the city.
- Most significantly, many families do not participate in the lottery process and those children are placed in schools based on "administrative assignment"

given to those applicants with sibling preference only. Sibling preference guarantees a spot at a school only up to the number of available seats. The level of seats filled by siblings is not provided by BPS, except in 2005[3].

Remaining seats up to a threshold of 50% of available seats are then granted to those with walk zone preference, in order of their random number. Following that, any remaining seats are allocated on the basis of random numbers.

For many applicants, they will not receive their first choice (or several choices). If their numbers are high enough, they may be placed on a waiting list for some of the schools they had ranked higher but failed to receive a seat.

In 2004, a Task Force was convened to examine reforms to the school assignment process. It recommended a six zone option which was not implemented by the School Committee. The only major change in the process at this point was the substitution of the Gale-Shapley deferred acceptance mechanism for the "Boston Mechanism". The details and ramifications of this change are discussed below in the literature review.

In 2009, Superintendent Johnson presented a five zone plan to change the student assignment process but it was withdrawn several months after its launch.

In the Mayor's State of the City address in January 2012, Mayor Menino pledged reforms to the school assignment process. BPS presented five reform options publicly and collected public comment on the proposed plans. The Mayor appointed a 24 member External Advisory Committee on School Choice ("EAC"). The EAC held a number of public hearings and had BPS make significant alterations to their initial plans.

The EAC settled on three potential plans, a 10 zone plan (later amended to 11) and two variations on an algorithm-based plan that limited choice options to schools in proximity to each prospective student across a variety of quality levels (known as

Home-Based A and Home-Based B). The two algorithm-based plans were developed by MIT graduate student Peng Shi, as iterations on his previous work. A majority of the EAC voted in support of Home-Based A, which was forwarded (with a variety of other recommendations regarding the assignment process) to the Boston School Committee ("BSC").

On March 13, 2012, the BSC approved the adoption of the Home-Based A plan, while also dropping the walk zone preference.

III: Development of Assignment Processes

The BPS assignment process is an issue that spans the realms of the personal, political, policy, and academic. It is a much-examined subset of a larger economics problem – how to allocate goods in an optimal manner in situations where pricing mechanisms are not appropriate. Notably, the importance of this problem earned two prominent theorists, Lloyd Shapley and Alvin Roth, the 2012 Nobel Prize in Economics.

Shapley, along with his co-author David Gale, wrote the foundational work in the field[4]. They put forth a 'deferred acceptance' algorithm that allowed for several steps of matching between two sets of entities (in their case, college students and college admissions as well as men and women) that resulted in a stable state, where no parties have an incentive to renegotiate outside the mechanism.

Alvin Roth built on these concepts by proposing their use with other real-world matching problems, including the medical residency program and kidney exchanges. Roth was involved in the 2004-2005 reform of the Boston Public School System that moved the system towards the Gale-Shapley mechanism in a way that reduced the incentive of parents to game the system. That reform makes stating true preferences a dominant strategy rather than a strategic choice that combines demand with the impact that choice may have on getting in.

Other economists have taken these concepts and examined the design of school choice mechanisms in Boston and New York. Prior to 2005 (and the participation of the various economists cited below), the Boston Public Schools used an lottery system based on a first preference first mechanism. This system emphasized the first choices of participants and economic literature continues to refer to "the Boston Mechanism" despite the BPS' switch to an alternative mechanism[5].

The discussion of these options, along with BPS' internal belief that the Boston Mechanism was prone to strategic behavior ('gaming the system'), provided an opening for economic theorists to become involved in public policy. A group of economists began consulting directly with the BPS, recommending a adoption of a deferred acceptance mechanism .

After the BPS adopted a deferred acceptance mechanism, the impact of strategic and non-strategic players under the previous mechanism was examined. Under a priority matching system, strategic players were incentivized to avoid choosing high demand schools, instead picking less popular but acceptable as their first choice. Meanwhile, naïve players who chose high demand schools as their top choices were frequently shut out. Substantial circumstantial evidence suggested the presence of strategic players in the prior mechanism who were not stating their true preference[6]. Substantial efficiency gains under the new process were also evident[7].

Reflecting the complexity and richness of school choice, ex ante analysis of Boston's (and other communities) change in mechanisms continues[8]. New York's school choice mechanism has more school-specific variables (as opposed to Boston's where priorities are set centrally and apply across all schools). Recent work has questioned the impact of these school specific priorities on efficiency[9]. A revisionist approach to the issue argues that the Boston Mechanism is being unfairly judged and may provide greater welfare in certain cases[10].

Theoretical refinements to the school choice matching process continue to be suggested[11]. As part of Boston's school assignment reform process, there has been an open call for additional proposals, at least one of which is derived from previous theoretical work[12].

Given Boston's potential move away from a 3 zone plan to a larger number of zones (with a greater emphasis on proximity to choices), the experience of other communities also informed our analysis. The Charlotte-Mecklenburg School District ("CMS") moved from a race-based busing system to a choice-base system with a guaranteed local placement option. Research on CMS found that many parents had a strong preference for academic quality (even at the expense of proximity). They also found two cohorts of parents – the first was highly responsive to quality measures and responded to quality improvements with higher demand for higher performing schools; the second was less responsive to academic quality and sought out proximity (resulting in greater placement at lower performing schools[13]. Other analysis of the impact of CMS' move finds that it increased racial inequality in achievement, attainment, and crime. However, attempts by CMS to mitigate some of these impacts through preferential resource allocation were partially effective for achievement and attainment, although not for crime[14].

In Boston, the proposed reform plans have already been analyzed by several institutions. A team from the Harvard Graduate School of Education found that the reform plans proposed by the BPS would decrease access to high quality schools for many students[15]. Another analysis which piggybacked on the Harvard GSE's formulation of school quality (MCAS scores, demand level and DESE designation) but, crucially, looked at access to both medium and high quality schools had slightly different findings. The Metropolitan Area Planning Council's report had more complex findings. It found that many students are already bused long distances for low quality schools and that certain reform configurations might improve access to medium and high quality schools for certain minority and low income students[16].

In response to this input and comments in multiple public forums, the EAC went through several iterations of proposed plans. One participant in the process, MIT graduate student Peng Shi, refined his submission, resulting in the development of two of the three assignment plans under final consideration including "Home-Based A" which was ultimately adopted. Shi and Parag Pathak, produced an analysis of the impact of the final three plans under consideration[17], modeling each plan's impact on access.

IV: Methodology and Data

Data was drawn from two primary sources. As part of the 2012 school assignment reform process, the Boston Public Schools placed data on its website[18], including parent demand choices and achievement level by school. This data on parent demand was drawn from Round 1 for School Year 2012-2013. Student characteristic data is for School Year 2011-2012. School performance and descriptive data, including MCAS results, are from School 2010-2011.

The other primary source of school data was a datafile provided by the Massachusetts School Building Authority. These file is an expanded version of the data provided in its 2010 Needs Survey[19]. We supplemented this information with tract level data from the 2010 Census. The Census data enabled us to look at the impact of proximity to families of different types on school preference.

We created a composite ranking to determine the most highly demanded schools by giving 1 point for every time a school was chosen first by a family, 2/3 of a point if it was a second choice, and 1/3 of a point if it was a third choice. The points for each school were summed to provide a single numerical value to account for demand level.

Our goal is to measure school popularity holding the level of nearby families constant, to correct for the tendency of people to select close schools. We therefore control for several measures of demand within one mile of the school (measured using 2010 American Community Survey Census data): the number of families with children under 19, the share of families with children of relevant ages, and the share of the population that is a college graduate. We include the last variable as a control for local demand, because better educated adults may be more involved with the assignment system and more focused on applying.

All regressions control for demand with a K1 indicator (for the kindergarten regression), a K-8 school indicator (for the kindergarten and sixth grade regression), school zone indicator, share of population with a college degree within one mile of the school, share of population in a certain age bracket within one mile of the school (ages 5-9 for the kindergarten regression, age 10-14 for the sixth grade regression, and age 15-19 for the ninth grade regression), and the log of number of families with children 189 and younger within a mile of the school. Dummy variable are also used to control for Special Education, English Language Learning, and Advanced Work Class when a regression includes all programs.

It should be noted that the conclusions of this paper are necessarily limited by the data available. Care should be taken to note the difference between “high demand” and “high quality”, only the former is being analyzed here. In addition, MCAS success is being used as an indicator of academic performance but its limitations in this role should also be considered.

This demand level was treated as the dependent variable and subjected to regression analysis against a series of independent variables.

Our basic approach is to look at the correlates of parental choice. Our core outcome variable is the number of families who rank the school as one of their three top choices in kindergarten, sixth grade and ninth grade. These are the three years where families typically choose schools. In the case of kindergarten, we combine K1 and K2, both of which have substantial numbers of applicants, and omit K0, which is far smaller. We have not found significantly different results for the two kindergarten years, but we do include a control variable for the K1 year.

Our decision to focus on the top three choices is, in a sense, fairly arbitrary, but we have replicated our work with different choice cutoffs and found essentially identical results.

In all of our work, we use multivariate regressions which measure the correlation between two variables, holding other variables constant. There is a natural tendency to interpret regressions causally, but that inclination should be checked. In many cases, the observed correlation may reflect omitted characteristics that are actually driving the relationship. For example, if we estimate the connection between parental choice in kindergarten and the share of children in the school from East Boston, we find that schools with more children from East Boston are less popular. In fact that relationship only reflects the lower demand for schools in East Boston, not anything about the students themselves.

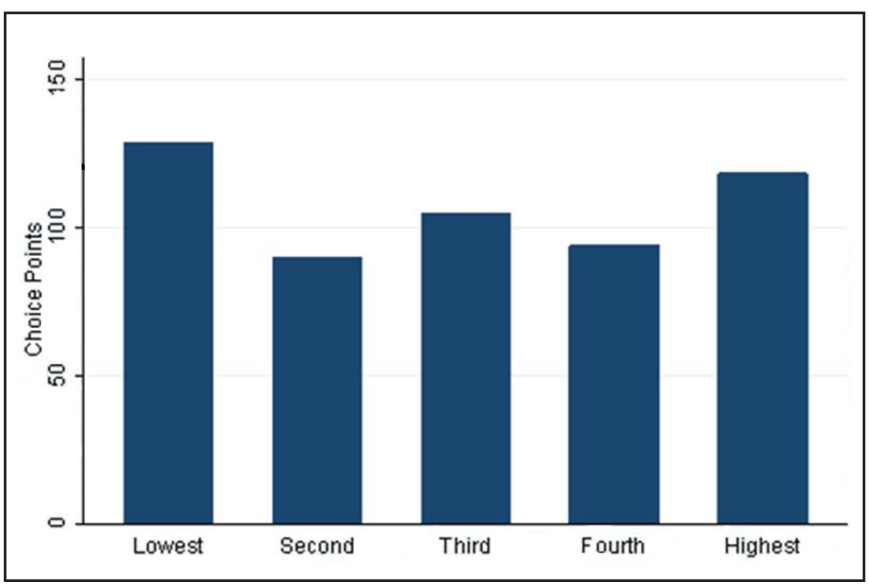
In multivariate regressions, we had an option of whether to include many variables or just a few. There are risks in either direction. When there are few observations, as in the case of high school choices, including too many variables can mean that none appear statistically significant because there just isn't enough data to really tease out the relevant relationship, especially when the explanatory variables are highly correlated. But if we exclude important variables, like location in East Boston as discussed above, spurious correlations may appear.

We have tried to proceed gradually, adding variables into the specification and then excluding those that don't seem to have much of an effect. Yet in some cases, we have included so many variables at once that it is almost reasonable to expect that none can be found to have an independent effect. In these cases, we have also estimated the independent effect of each variable independently and found similar results. We have chosen not to report those results to save space.

Another key decision is whether to include only general education programs, which are somewhat comparable at least in their aim, or to include the great variety of programs within the Boston Public School System. We have adopted a hybrid approach. We focus primarily on general education, but also include results for the entire system. In that case, we include control variables for whether the program is special education or English language or Advanced Work Class.

We had originally imagined that it would be necessary to control for program size, as it is conceivable that larger programs attract more applicants. However, as shown in Figure 1, for kindergarteners there is little relationship between program size and

Figure 1: Choice Points v. Enrollment
Kindergarten General Education



the number of applicants. Small programs, at least in general education, are typically as likely to attract applicants as larger programs. If parents were trying to game the system, they might well apply more assiduously to larger programs, but they are not. This does not imply that parents are reporting their true preferences, but it is a piece of evidence suggesting that these choices are not primarily strategic.

V: Findings

Copious anecdotal evidence exists to support a variety of preferences for parents selecting schools for their children. These include proximity to home, academic characteristics, school/building features, program variety ("specials") and grades offered. Here we attempt to add to the discussion by statistically examining these anecdotal preferences to determine their correlation with actual parental choice.

Our core outcome variable is the number of families who rank the school as one of their three top choices in kindergarten, sixth grade and ninth grade. In all of our work, we use multivariate regressions which measure the correlation between two variables, holding other variables constant.

Population Characteristics – Density/Education Level

Our goal was to assess popularity controlling for the level of local demand. Many parents want schools that are close as discussed previously. To correct for the level of local demand, we use three Census based variables based on tracts within one mile of the school. We control for the share of the population that is in the relevant age group. For kindergartens, that means the share of families with children aged between five and nine. For grade 6, we include the share of families with children aged between 10 and 14. For grade 9, we include families with children aged between 15 and 19. We could have zeroed in on children aged a single year, but that would tend to increase measurement error and when we tried that approach it yielded less statistically significant results.

We also control for the logarithm of the number of families with children under the age of 19 (children aged 18 and under). This is meant to capture the overall population density nearby. We take logarithms to smooth this variable and avoid the impact of extremes. We also control for the share of adults within a mile that have a college degree. College education may be a proxy for engagement with the education process and as such it can be seen as another measure of demand. Of course, it may also proxy for the quality of the school because of the preference given to walk-zone children. For that reason, we compare the coefficient on this variable with and without controlling for test scores.

Our regressions include a number of other basic controls. For kindergarten and sixth grade, we also control for the school's zone and whether the school is citywide. We combine data for K1 and K2 programs, but control for whether the program is K1. In a few cases, there are multiple general education programs at a single school. In that case, we have included all of the observations but corrected the standard errors to reflect the fact that two programs at the same school are not independent observations. While we have 147 programs in our sample, we only have 68 separate schools. We address this by clustering our data by school, a well-established statistical procedure that will typically tend to make results less statistically significant. For kindergarten and sixth grade, we control for whether the school is a K-8 school.

The first regression in Table 1 shows our first set of results for general education kindergarten programs. There is more demand in K1 than in K2, which is

Table 1

Variables	(1) Choice Points K1 and K2 (Gen Ed only)	(2) Share Prof/ Adv in Math K1 and K2 (Gen Ed only)	(3) Choice Points K1 and K2 (Gen Ed only)	(4) Choice Points K1 and K2 (All Programs)	(5) Choice Points 6th Grade (Gen Ed only)	(6) Choice Points 6th Grade (All programs)
School in East Boston Indicator	-43.96* (24.26)	-0.195** (0.0849)	-35.73 (22.79)	-11.88 (19.40)	47.07 (73.89)	53.67* (28.64)
School in Roxbury Indicator	-33.19 (27.63)	00.237** (0.101)	-20.38 (24.01)	-16.42 (22.07)	17.44 (85.29)	35.34 (27.13)
School in South Dorchester Indicator	37.95 (36.35)	-0.111 (0.0999)	43.93 (29.61)	34.62 (29.55)	134.8* (71.58)	80.83*** (24.81)
School in West Roxbury Indicator	62.32** (25.18)	0.0745 (0.104)	55.64** (21.56)	46.47** (20.04)	23.73 (66.26)	21.56 (20.95)
School in North Dorchester Indicator	34.87 (35.89)	-0.0671 (0.109)	35.96 (29.97)	39.54 (29.12)	61.58 (80.12)	36.54 (36.68)
School in Mattapan Indicator	44.41 (37.96)	-0.139 (0.122)	52.10 (31.45)	41.62 (29.42)	82.85 (79.34)	64.24** (30.96)
School in Roslindale Indicator	-6.741 (26.85)	-0.123 (0.0888)	3.310 (23.16)	4.739 (21.42)	36.45 (67.39)	35.54 (24.470
School in Allston-Brighton Indicator	-42.80* (25.63)	0.162* (0.0948)	-43.09* (21.61)	-20.22 (19.58)	-68.54 (75.87)	-25.59 (31.32)
School in Jamaica Plain Indicator	-16.92 (25.23)	-0.144* (0.0844)	-12.63 (20.76)	-4.343 (20.32)	-8.441 (68.61)	-3.224 (22.84)
School in Hyde Park Indicator	18.83 (33.89)	-0.127 (0.104)	26.53 (28.68)	26.18 (26.95)	83.24 (60.21)	53.47** (21.73)
School in Central Boston Indicator	2.108 (27.64)	0.106* (0.0607)	-11.80 (25.97)	27.18 (23.85)	-19.77 (65.43)	-0.155 (24.93)
School in South Boston Indicator	32.62 (38.45)	-0.0523 (0.126)	29.64 (32.71)	47.27 (31.56)	3.194 (123.6)	27.17 (59.42)
School in South End Indicator	-30.25 (23.07)	-0.262* (0.136)	-13.97 (22.22)	-11.47 (18.25)	-60.66 (74.73)	-16.60 (29.81)
All Math-%Prof/Adv.			82.23*** (21.63)			
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Constant	18.81 (106.0)	0.267 (0487)	28.68 (106.2)	-46.00 (94.01)	181.0 (412.6)	-45.80 (201.7)
Observations	158	148	147	227	38	119
R-Squared	0.517	0.498	0.615	0.423	0.578	0.583

Robust standard errors in parenthesis.
*** p,0.01, ** p<0.05, * p<0.01
Controls: Standard errors are clustered at the school level and Charlestown Neighborhood Indicator dropped. No Kindergarten or Grade 6 in Back Controls: All regressions control for demand with a K1 indicator (for the kindergarten regression), a K-8 school indicator (for the kindergarten and sixth grade regression), school zone indicator, share of population with a college degree within one mile of the school, share of population in a certain age bracket within one mile of the school (age 5-9 for the kindergarten regression, age 10-14 for the sixth grade regression, and age 15-19 for the ninth grade regression), and the log of number of the families with children 18 and younger within a mile of the school. Dummy variables are also used to control for Special Education, English Language Learning, and Advanced Work Class in regresisons where all programs are included.

unsurprising given the desirability of getting children in early. There is also more demand for K-8 programs, which may reflect the desire to ensure that a child can stay at the same school through high school. We see no effect of different zones, which is not surprising if we believe that the zones are drawn in part to ensure an even match between the number of students and the number of school slots. Citywide schools are more popular, receiving an extra 46 choice points on average in kindergarten.

The neighborhood characteristics all have the expected sign. As the share of families with a child between 5 and 9 within the walk zone increase by 5 percent (about one standard deviation), the number of choice points for the school increases by 64. This is an extremely large effect that suggests the important of controlling for this variable.

Actual Versus Predicted Popularity

Using this regression, we can produce a list of kindergarten programs by popularity controlling for all local neighborhood characteristics.This list take the number of points received by a program and subtracts the amount predicted by its local neighborhood characteristics. Table 2 shows the top and bottom ten programs, by popularity, in Boston. Murphy K-8 is the most popular school in this ranking followed by Quincy Elementary. Murphy is the most popular program overall as well, but Quincy has been lifted up by our procedure. Several of the schools in the bottom ten look worse because we have controlled for local demand.

Table 2

Bottom 10 programs					Top 10 programs				
School Name	Grade	Program	Choice Points	Actual Choice Points-Pre-dicted Choice Points	School Name	Grade	Program	Choice Points	Actual Choice Points-Predicted Choice Points
1. Edison K-8	K1	ked	7.00	-65.52	1. Murphy K-8	K1	ked	250.67	164.16
2. Jackson/ Mann K-8	K1	iee	7.33	-55.15	2. Quincy Elementary	K1	ked	130.33	94.13
3. Edison K-8	K2	ked	10.33	-51.35	3. Lyndon K-8	K1	ked	179.33	88.94
4. Jackson/ Mann K-8	K2	iee	6.67	-44.98	4. Murphy K-8	K2	ked	162.33	86.66
5. Curley K-8	K1	iee	41.00	-44.78	5. Beethoven Elementary	K1	ked	152.67	86.56
6. Greenwood, Sarah K-8	K1	ked	37.00	-44.72	6. Young Achievers K-8	K1	ked	147.00	71.90
7. Holmes Elementary	K1	ked	19.33	-43.58	7. Quincy Elementary	K2	ked	94.67	69.30
8. King K-8	K1	ked	21.00	-41.31	8. BTU School K-8	K1	ked	139.67	64.29
9. Jackson/ Mann K-8	K2	ked	12.33	-39.32	9. Young Achievers K-8	K2	ked	126.67	62.40
10. King K-8	K2	ked	12.33	-39.15	10. Ellison/ Parks EE School	K1	ked	91.00	51.55

The impact of nearby college graduates is similarly significant statistically, but the coefficient is much smaller. As the share of adults with a college degree increases by four percentage points (about one standard deviation), nearby schools typically receive an extra 6.8 choice points. The impact of the number of families is not statistically significant, but it is positive. On average, as the number of families increases by .33 (about one-third), the school receives an extra five choice points. We will continue to control for these variables in all of our specifications.

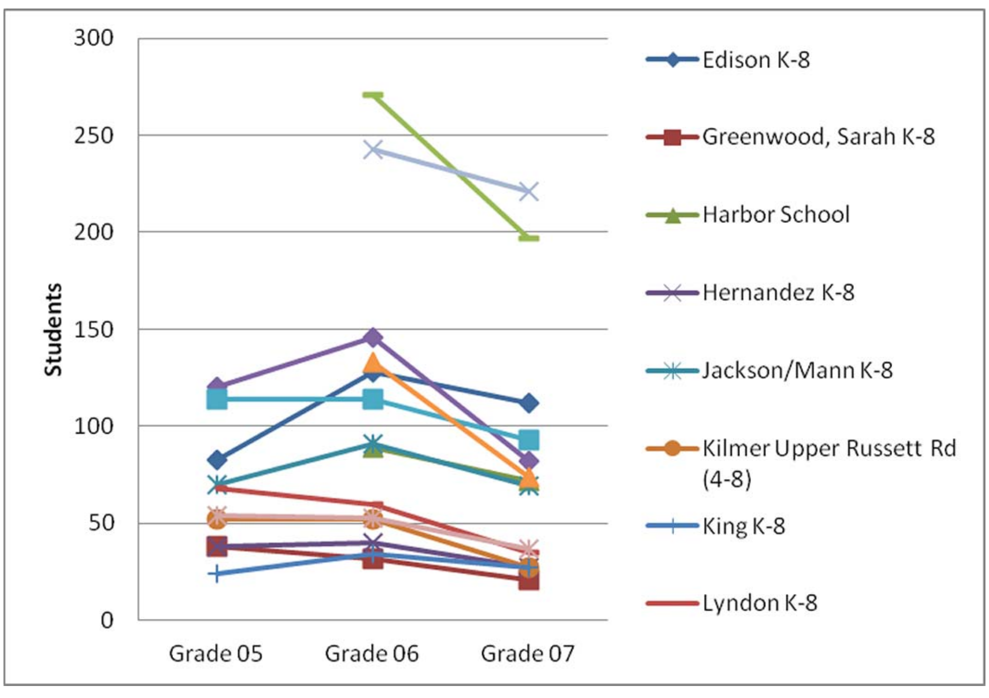
The second regression repeats this procedure including all of the kindergarten programs, including special education and English language learning. We control for the type of program (general education versus English language versus special education) and continue to cluster our standard errors at the school level to avoid over-counting. Special education programs are typically far less popular, with 41 fewer choice points on average. English language programs are slightly less popular.

Across all programs, the effect of college education and children age five to nine remains statistically significant and similar in magnitude to regression one. The impact of the number of families becomes slightly smaller and remains statistically insignificant. The K-8 school indicator becomes statistically insignificant, but the estimated coefficient is statistically indistinguishable from the coefficient in the first regression.

Regressions three and four turn to grade six. We have included these results for completeness, but almost none of the coefficients for Grade six are statistically significant. We interpret this as meaning that grade six is a somewhat anomalous year that doesn't seem to tell us much about parental preferences.

The Grade 6 Puzzle

Across our analysis, Grade 6 stands as an outlier. Many of the relationships found in our examinations of Kindergarten and Grade 9 are not found consistently in Grade 6. One possible reason for this may be the complex structure of Boston's grade configurations by school (ranging from K0/K1-1, K1/K2-5, K1/K2-8, 6-8, 7-12, 9-12). The large number of K-5 schools and the potential to test into a 7-12 exam school creates a situation where, for certain families, Grade 6 becomes a transition year. Evidence from selected schools shows instances of a Grade 6 enrollment bump or a decline from Grade 6 to Grade 7.



This suggests that the selection of Grade 6 schools in the lottery may have different drivers of demand than Kingergarten or Grade 9 selections.

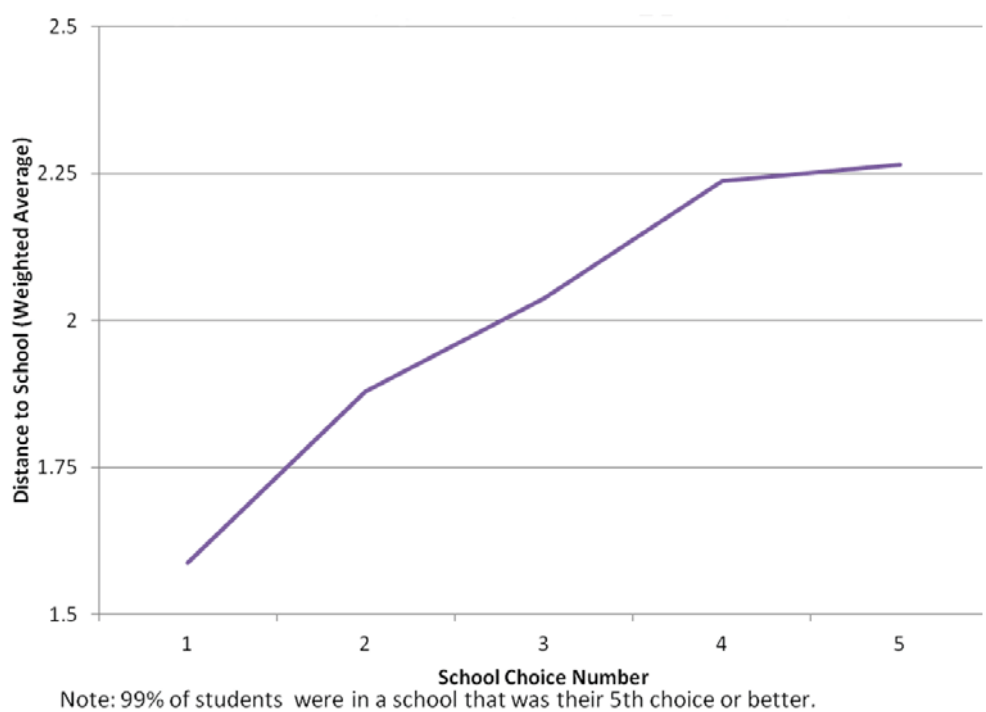
Regressions five and six look at high school programs. In this case, the share of adults with college degrees nearby no longer has any impact and neither does the number of families. The share of families with 15 to 19 year olds does continue to strongly predict school preference. Although this effect is far stronger when we look only at general education programs than when we include the other programs as well. It is worth stressing that there are only 24 options for general education high schools, which somewhat limits our ability to draw inferences from the data.

Proximity

One of the most frequently stated preferences[20] by parents, particularly those from certain neighborhoods, was access to nearby schools, commonly termed 'neighborhood schools'. The potential for the lottery process to produce results contrary to this preference was demonstrated, in anecdotal fashion, by coverage of a modestly-sized single street in Boston where the nineteen school-age residents attended 15 different schools[21].

As the BPS lottery system contains a preference[22] for walk zone students (described above), it is not surprising a strong linear relationship exists between demand, assignment, and proximity. However, emerging research suggests that walk zone preference may have a minimal effect, contrary to public perception suggesting that proximity is a stronger preference on the part of parents that initially expected[23]. Figure 2 show that those students receiving their first choice had an average distance to school of 1.58 miles. Those receiving their second choice were 1.88 miles away on average. Third choice assignees were 2.04 miles away and fourth choice assignees were 2.24 miles away.

Figure 2: Average Distance to School by Choice



Note: 99% of students were in a school that was their 5th choice or better.

Test Scores

Table 3 begins our analysis of the school level correlates of parental demand for schools. In the first two regressions, we look at the correlation between the share of parents who rank the kindergarten in their top three choices and the share of students in the school that score either advanced or proficient on the MCAS tests for Math and English respectively. We cannot tell if these test score differences reflect the educational impact of the school, or just the selection of more academically prepared students into different programs. In the first four regressions, we look only at general education programs.

Table 3

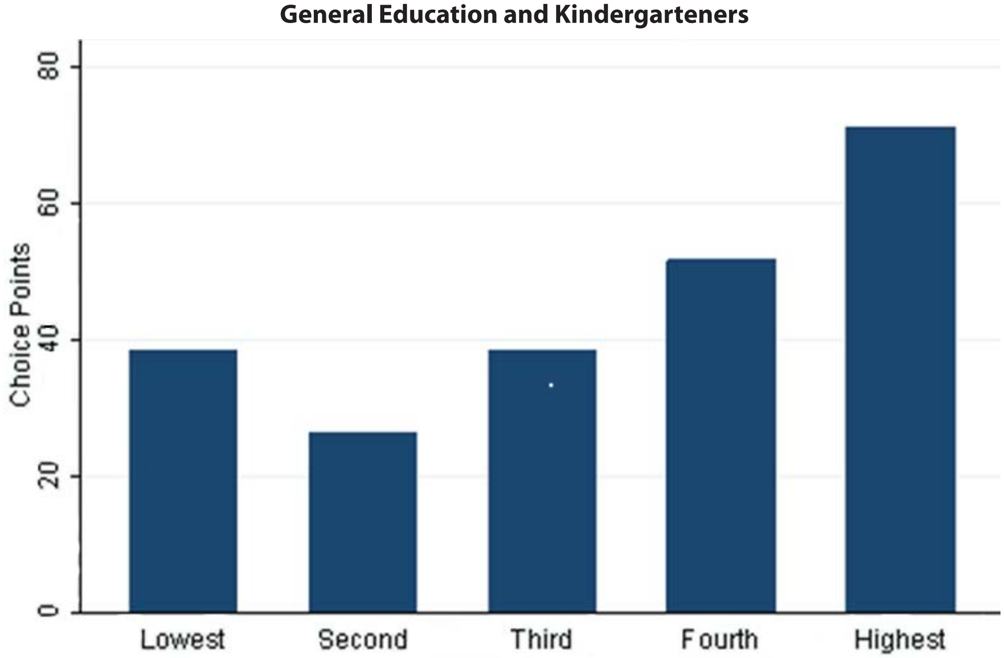
Variables	(1) Choice Points K1 and K2 (Gen Ed)	(2) Choice Points K1 and K2 (Gen Ed)	(3) Choice Points K1 and K2 (Gen Ed)	(4) Choice Points Kindergarten (Gen Ed with subprograms combined	(5) Choice Points Grade 6 (Gen Ed)	(6) Choice Points Grade 6 (Gen Ed)	(7) Choice Points Grade 9 (Gen Ed)	(8) Choice Points Grade 9 (Gen Ed)	(9) Choice Points Grade 9 (Gen Ed)	(10) Choice Points Grade 9 (All programs)
All Math-%Prof/Adv	130.4*** (28.42)		161.3*** (46.76)	286.0** (133.4)	-71.02 (79.28)		476.6*** (118.4)		570.1*** (178.0)	158.8*** (49.57)
All ELA-%Prof/Adv		93.29*** (25.54)	-35.81 (35.99)	-43.30 (127.5)		16.37 (62.58)		422.2** (201.6)	-139.2 (270.7)	-44.86 (52.88)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-149.8 (100.6)	-175.6 (108.0)	-146.9 (100.4)	-356.3 (245.5)	-322.9 (276.4)	-323.0 (277.1)	-566.4 (473.8)	-130.1 (588.4)	-641.3 (534.1)	2.825 (120.0)
Observations	147	147	147	68	37	37	23	23	23	115
R-squared	0.148	0.343	0.423	0.352	0.305	0.294	0.699	0.615	0.703	0.633

Robust standard errors in parenthesis.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$
Standard Errors are Clustered at the School Level
See Table 1 for Controls.

The first regression shows a strong connection between math test scores and school popularity. As the share of the school population that scores proficient or advanced increases by 14 percent (one standard deviation), the number of families ranking the school among their top three choices increases by 18. The mean number of top choices that any kindergarten program receives is 47, so this is a substantial increase. The second regression shows that the impact of English language test scores is quite similar in magnitude, although somewhat smaller.

The basic relationship between math test scores and parental preference for kindergartens is also shown in Figure 3, which shows the average number of top choices by test score. The schools with the highest scores, in the top fifth of the sample have on average seventy families ranking them highly while those schooling in the bottom fifth of the sample have on average forty family ranking them highly.

Figure 3: Choice Points v. % Math Proficient or Advanced (Quintiles) General Education and Kindergarteners



In the third regression, we include both test scores in the same regression. This regression finds that the coefficient on math scores becomes stronger, while the coefficient on English language scores becomes statistically insignificant. However, the correlation between these test scores is so strong that it is hard to really interpret this result as schools rarely excel on one test while faltering on the other. Math scores are somewhat more correlated with parental choice, but that is really all that can be taken away from this table.

One potential issue with our procedure is that some high scoring schools have multiple programs, causing them to appear less popular than they actually may be. To address this concern, in the fourth regression we combine all general education kindergarten (one and two) for each school. In this case, the relationship becomes considerably larger, and a 14 percentage point increase in the share of students scoring proficient or advanced on Math raises the number of families ranking the school highly by 38. Of course, the average number of choice points for each school in this sample has risen to 106, so the effect is of a 14 percentage point increase is now 36 percent of the mean number of top choices received by each school.

On one level, this shows that parents do seem to be quite attuned to the academic achievements of a particular school. Yet test scores are not the only determinant of popularity, and indeed they explain less than a fifth of the variation in popularity across schools. There are some schools, Lyon K-8 and Hale Elementary that are ranked highly by few parents despite having high test scores. More unusually, there are a few other schools, like the Young Achievers Academy, that are quite popular despite low average test scores.

The relative popularity of Young Achievers may well reflect a central problem of relying on test scores to measure academic quality. Young Achievers includes many lower income children, with more than seventy-five percent of its students receiving free or reduced price lunches, and that may explain its low test scores. It is possible that the school is performing well, given the nature of its student body, and that parents' choosing schools are responding to that fact.

The results for Grade 6 are inconclusive, shown in regressions five and six. Math scores are actually negatively correlated with parental choice, but the effect (while large) is statistically insignificant. Indeed, the imprecision of the coefficient means that we can't really rule out even a large positive effect. In regression six, we see essentially no relationship between English language test scores and the popularity of sixth grade programs. We have also run these scores together, and for the full set of sixth grade programs including special education and English language. In no case did we find any significant results.

In regression seven through ten, we look at high schools and see results that are reminiscent of those observed for kindergarteners. A one standard deviation increase in the share of students scoring proficient of advanced in the math MCAS, which is 19 percent for this group, is associated with over 90 more parents rating the school highly. This should be compared with the mean level of choice points of 179 in this sample, suggesting a comparable effect to kindergartens.

Regression eight and nine bring in scoring on English language tests. As in the case of kindergarten, English language test scores also have a strong effect on their own, which is only marginally smaller than math scores. When both scores are included in regression ten, we see that math is significant while English scores are not. Again, the high correlation between math and English test scores make these results very difficult to interpret.

The final regression in the table includes all programs and finds, on average, significantly smaller effects. However, the mean is also much smaller (43 as opposed to 179), so the effect remains quite larger relative to the mean. We again find that when we include both math and English test scores, math scores are significant while English scores are not.

The pattern is quite similar at the kindergarten and grade 9 level: test scores really effect parental choice. The interpretation of these results depends, partially, on one's intellectual starting point. If one thought that rational parents would singlemindedly seek the highest performing schools, then the relatively modest ability of test scores to explain preferences could be a point against parental choice. If one expected many other things to matter, as well as the vicissitudes of the tastes of individual families, then these strong effects should make you more confident about trusting parents to choose their schools.

Table 4

Variables	(1) Choice Points K1 and K2 (Gen Ed)	(2) Choice Points K1 and K2 (Gen Ed)	(3) Choice Points K1 and K2 (Gen Ed)	(4) Choice Points Kindergarten (Gen Ed with subprograms combined	(5) Choice Points Grade 6 (Gen Ed)	(6) Choice Points Grade 6 (Gen Ed)	(7) Choice Points Grade 9 (Gen Ed)	(8) Choice Points Grade 9 (Gen Ed)	(9) Choice Points Grade 9 (Gen Ed)	(10) Choice Points Grade 9 (All programs)
MATH Student Growth Percentage	-0.0725 (0.209)		-0.315 (0.207)	0.0474 (0.834)	0.00359 (0.594)		3.279* (1.614)		2.475 (1.943)	0.858* (0.483)
ELA Student Growth Percentage		0.398 (0.243)	0.602** (0.254)	1.157 (1.060)		0.569 (1.232)		3.632*** (1.257)	2.633 (1.871)	0.855* (0.452)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-219.1* (114.2)	-240.7** (116.1)	-242.2** (114.2)	-555.6** (259.8)	-334.2 (261.3)	-379.0 (278.0)	122.7 (501.6)	-60.56 (422.3)	72.51 (489.9)	55.41 (116.1)
Observations	141	141	141	66	38	38	23	23	23	114
R-squared	0.287	0.299	0.308	0.293	0.294	0.298	0.592	0.587	0.624	0.627

Robust standard errors in parenthesis.
*** p<0.01, ** p<0.05, * p<0.1
Standard Errors are Clustered at the School Level
See Table 1 for Controls.

Given the correlation between test scores and popularity, we examined another dimension of test scores, namely the growth percentage of both math and English scores, a measure that gauges progress in test score improvement over time relative to schools across Massachusetts, in Table 4. In Kindergarten, English student growth percentage was associated with higher rankings. In High School, stronger performance in student growth percentages was also associated with higher ranking. In Grade 6 no association was observed and no grade showed any effect of performance on student growth percentage. This may be due to the fact that absolute test score performance is relatively easy to observe, while student growth percentage improvements are more difficult to observe.

In regressions one through four, we examine the association between improvement in Math and English Student Growth Percentage and an increase in choice points. Only the third regression, which looks at both Math and English scores, shows a moderately significant but small relationship. Regressions five through ten examine the relationship between Student Growth Percentage and choice points in Grades 6 and 9. Again, no relationship is observed except for Grade 9, where strong performance on English Student Growth Percentage is associated with 3.6 additional choice points.

School Facility Characteristics

In our next two tables we turn towards other school characteristics that could potentially influence parental choice. Table 5 focuses on school characteristics; Table 6 examines program availability. In principle, evidence on the influence that these variables have on parental choice should provide significant information about the value parents place on these attributes, which in turn should help guide investment decision by the Boston Public Schools. Yet there are several reasons why we should be wary about drawing conclusions from any evidence of this kind.

Table 5

Variables	(1) Choice Points K1 and K2 (Gen Ed Only)	(2) Choice Points K1 and K2 (Gen Ed Only)	(3) Choice Points K1 and K2 (Gen Ed Only)	(4) Choice Points K1 and K2 (Gen Ed Only)	(5) Choice Points K1 and K2 (Gen Ed Only)	(6) Choice Points K1 and K2 (Gen Ed Only)	(7) Choice Points K1 and K2(All Programs)	(8) Choice Points Grade 6 (Gen Ed Only)	(9) Choice Points Grade 6 (All Programs)	(10) Choice Points Grade 9 (Gen Ed Only)	(11) Choice Points Grade 9 (All programs)
GSF/Student	0.0729 (0.0618)					0.0509 (0.0655)	0.0598 (0.0499)	0.0210 (0.0782)	0.0124 (0.0375)	-0.0479* (0.0269)	-0.0423** (0.0185)
Building Condition Rating		2.652 (5.507)				3.318 (5.523)	1.873 (4.100)	10.97 (17.14)	13.80* (7.984)	10.39 (28.13)	1.583 (4.685)
Has Gym			8.806 (7.448)			4.670 (7.812)	0.688 (5.787)	-45.77 (34.81)	-18.24 (14.29)	89.18 (53.80)	34.90** (15.72)
All Classrooms Have Computers Indicator				-3.503 (7.515)		-2.697 (7.570)	-1.623 (5.272)	69.25** (25.87)	27.62** (10.60)	-14.10 (61.85)	-10.75 (11.07)
General Clenliness Below Average					-14.25* (8.192)	-12.07 (8.961)	-16.74** (6.612)	-44.90** (19.58)	-14.92* (8.758)	-51.13 (65.65)	-27.57 (26.14)
All Math-%Prof/ Adv	142.0*** (26.18)	130.6*** (28.68)	140.5*** (26.15)	132.0*** (28.46)	124.1*** (28.46)	140.0*** (26.89)	108.6*** (20.76)	-188.5 (116.1)	-46.60 (46.81)	686.5*** (234.4)	226.0*** (46.61)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-162.6 (100.6)	-144.8 (93.62)	-149.3 (101.6)	-145.2 (104.8)	-142.7 (95.00)	-142.6 (95.04)	-124.5 (78.22)	-488.8** (200.0)	-197.9 (125.5)	-665.2 (556.8)	-168.2 (171.9)
Observations	147	147	147	147	147	147	212	37	114	23	115
R-squared	0.429	0.421	0.428	0.420	0.427	0.442	0.417	0.535	0.547	0.774	0.657

Robust standard errors in parenthesis.
*** p<0.01, ** p<0.05, * p<0.1
Standard Errors are Clustered at the School Level
See Table 1 for Controls.

First, school characteristics are not random and they are potentially correlated with other omitted school characteristics. School cleanliness for example may be related to other disciplinary problems in the school. Second, our measures of all these variables are imperfect. A school that has an art program may not have a very good art program. A school that doesn't have a formal art program may in fact have art woven into other courses. Third, parents may not have been all that aware of these school attributes at the time that they were making their choices.

With these caveats in mind, we now turn to the tables. All regressions include both our neighborhood level controls and the control for math scores in the school. The first regression shows that relationship between gross square footage per pupil and choice points. The coefficient is positive, but small and statistically insignificant. The point estimate suggest that an increase in gross square feet per student of 65, which represents one standard deviation in this sample, is associated with about three more choice points. Even if this underestimates the true impact of gross square footage, the coefficient certainly suggests that parents aren't valuing physical space a great deal.

The potential worry with this coefficient is that schools with more square footage may have other problems. It is, for example, typically true that kindergartens with more space have lower test scores on average, for whatever reason. Of course, we control for math test scores but if other omitted characteristics are correlated with gross square footage per student, then this could be explaining why parents don't seem to value larger schools.

The second regression shows the relationship between the building condition rating and school popularity. There is no significant relationship here either, although we suspect that this variable may not be that informative. The sign is actually counter-intuitive because lower ratings suggest better condition.

The third regression examines the presence of a gym in the school. Only about 38% of the kindergartens have a gym present. Typically, the presence of a gym is associated with about nine extra choice points. While this is statistically insignificant, it does suggest that gyms may be a slight positive, although it would be harder to conclude anything really relevant for cost-benefit analysis of building more gyms.

The fourth regression examines the impact of whether all classrooms in the school have a computer present. About 70 percent of the schools in this sample say that they have computers in every classroom. If anything, universal computer presence has a slight negative effect, but this is statistically insignificant. Moreover, schools without universal computers also seem to have very high levels of computer availability, which suggests that this coefficient may not be telling us all that much.

The fifth regression looks at the cleanliness of the school, and specifically whether the school is rated as having cleanliness below average. About 7 percent of schools in this sample rated as have below average cleanliness. The regression estimates that schools with below average cleanliness attract about 14 fewer choice points and this is marginally statistically significant. We cannot however be confident that this represents the impact of dirt per se or some other negative characteristic of the school, such as social disorder.

The sixth regression includes all of the variables simultaneously. This regression just serves to show that the results look broadly similar when we include everything. The one significant result on general cleanliness becomes statistically insignificant here, but the magnitude of the coefficient remains broadly similar. The seventh regression includes all the variables and all programs (with dummy variables controlling for each program), and once again the general cleanliness variable is negative and statistically significant.

Regression eight to eleven repeat these results for grade 6 and grade 9. We find very little for any of these building attributes, whether they are included en masse or independently. There is a slight positive effect of building condition for grade 6 families, but since higher ratings mean worse condition the result seems to be going in the wrong direction. The cleanliness variable is statistically significant for Grade 6, and there is a significant positive effect for the presence of computers in all classrooms.

The presence of a gym in high school has a more significant effect on popularity, especially when we include programs other than general education. It does seem that families of teenagers value on-site athletic facilities.

Table 6

Variables	(1) Choice Points K1 and K2 (Gen Ed Only)	(2) Choice Points K1 and K2 (Gen Ed Only)	(3) Choice Points K1 and K2 (Gen Ed Only)	(4) Choice Points K1 and K2 (Gen Ed Only)	(5) Choice Points K1 and K2 (Gen Ed Only)	(6) Choice Points K1 and K2(All Pro-grams)	(7) Choice Points Grade 6 (Gen Ed Only)	(8) Choice Points Grade 6 (All Pro-grams)	(9) Choice Points Grade 9 (Gen Ed Only)	(10) Choice Points Grade 9 (All programs)
No Art Indicator	-7.449 (7.349)				-5.778 (7.136)	-1.896 (5.384)	15.45 (29.10)	14.67 (15.05)	-74.52 (46.20)	-1.736 (15.49)
No Music Indicator		-6.156 (6.871)			-4.566 (6.741)	-8.679 (5.595)	-27.86 (23.05)	-18.98* (10.69)	193.2** (68.94)	91.83** (37.08)
No Vocational Facilities									-217.5*** (69.94)	-63.73** (24.58)
No Science Lab			5.788 (11.75)		9.562 (11.59)	12.30 (7.691)	-13.93 (24.48)	-5.956 (5.637)	93.33 (55.10)	-10.68 (15.70)
No Wireless Indicator				-5.186 (8.590)	-3.387 (8.590)	-0.149 (5.425)	8.178 (43.78)	9.210 (16.82)	-68.25 (48.95)	22.05 (18.24)
All Math-%Prof/ Adv	134.7*** (27.30)	131.5*** (27.15)	131.6*** (28.85)	126.7*** (30.82)	134.1*** (29.73)	112.5*** (20.78)	-18.32 (177.6)	32.43 (88.35)	168.3 (228.6)	-23.90 (88.94)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-154.4 (98.81)	-146.6 (103.8)	-148.8 (99.93)	-154.2 (96.64)	-152.2 (95.60)	120.5 (83.77)	-249.4 (270.9)	-134.6 (124.5)	-96.99 (482.4)	515.0* (265.9)
Observations	147	147	147	147	147	212	37	114	23	115
R-squared	0.426	0.424	0.420	0.422	0.433	0.412	0.349	0.503	0.818	0.666

Robust standard errors in parenthesis.
*** p<0.01, ** p<0.05, * p<0.1
Standard Errors are Clustered at the School Level
See Table 1 for Controls.

Curricular Additions

In Table 6, we turn to other school attributes including art, music, vocational facilities, wireless, and science lab. We first look at whether have art or music present in the school increases parent demand. We find that an absence of either art or music in kindergarten depresses demand by about six choice points. This effect is statistically insignificant. The magnitude seems small relative to math test scores, but relatively high when compared to school physical attributes. The results are similar whether or not we treat the variables independently or include them in the same regression.

The third regression looks at the presence of a science lab. Only eleven percent of the kindergartens in our sample are in a school with a science lab, so perhaps it is a little quixotic to even examine this variable at this young an age. The regression perhaps unsurprisingly finds no significant effect. If anything the coefficient appears to be positive, but the standard errors is so large that it is hard to read anything into this coefficient.

We finally look at whether the school has wireless access. About one-third of our kindergartens are in schools with wireless access. We do find that absence of wireless is associated with five fewer choice points. This coefficient is also statistically insignificant, and it is hard to take anything away from this result really. Combining all the effects in the fifth and sixth regressions show no significant results, but it the imprecision of results makes conclusions difficult.

In the seventh and eighth regressions, we turn to sixth grade results. In these regressions, there is little that is significant, but there are meaningfully large negative coefficients for the absence of science lab, suggesting that science labs may actually be important in this range. There is a comparable result for absence of music—a negative coefficient with a reasonably large magnitude that is only marginally significant.

Table 7

Variables	(1) Choice Points K1 and K2 (Gen Ed Only)	(2) Choice Points K1 and K2 (Gen Ed Only)	(3) Choice Points K1 and K2 (All Pro-grams)	(4) Choice Points Grade 6 (Gen Ed Only))	(5) Choice Points Grade 6 (All Pro-grams)	(6) Choice Points Grade 9 (Gen Ed Only)	(7) Choice Points Grade 9 (Gen Ed Only)	(8) Choice Points Grade 9 (All programs)
Percent of Population that is White w/in Mile of the School	236.3*** (70.57)	191.4** (73.08)	152.4** (58.48)	213.0 (254.9)	69.87 (205.2)	69.87 (205.2)	-187.9 (261.0)	-39.68 (62.99)
Percent of Population that is Black/African-American w/in Mile of School	197.9*** (62.13)	170.2*** (62.92)	110.1** (50.92)	77.18 (236.8)	59.31 (92.79)	-45.73 (223.1)	-247.4 (197.9)	-47.70 (45.70)
Percent of Population that is Asian w/in Mile of School	420.5*** (123.0)	337.5** (129.3)	276.3** (110.2)	344.1 (387.0)	210.6 (186.8)	-446.9 (495.1)	-465.8 (465.8)	-159.2 (152.4)
All Math-%Prof/Adv		92.26*** (26.52)					459.1*** (144.2)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes		Yes
Constant	-298.0*** (95.49)	-244.7** (99.25)	-210.8** (83.62)	-350.0 (260.7)	-226.7* (126.0)	283.0 (630.6)	-568.5 (564.1)	128.9 (153.6)
Observations	158	147	227	38	119	24	23	117
R-squared	0.388	0.490	0.328	0.328	0.511	0.494	0.720	0.615

Robust standard errors in parenthesis.
*** p<0.01, ** p<0.05, * p<0.1
Standard Errors are Clustered at the School Level
See Table 1 for Controls.

The results are somewhat more surprising for the grade 9 results. The absence of vocational facilities is strongly negatively associated with choice points. This correlation is strongly affected by the popularity of Boston's only high school with large scale Vocational-Technical facilities at Madison Park (aside from a classroom at the Horace Mann School for the Deaf and Hard of Hearing). Although Madison Park faces challenges in executing its mission[24], the school does receive a large number of placements in Grade 9, including all of those seeking vocational training and a large number of special education placements. However, before concluding that is makes sense to increase vocational training facilities, based on their popularity, it is worth noting that despite the high numbers of choice points received by Madison Park High, that large school operates below capacity by several hundred seats.

At the high school level, there is also a strange positive coefficient on the absence of music education, which we do not have an interpretation for. The absence of art and wireless both have negative effects that are large in magnitude but statistically indistinct from zero.

Population Characteristics – Ethnic/Racial

Our seventh table gives results looking at the racial characteristics of the neighborhood nearby. This attempts to quantify the extent to which moving towards more neighborhood-based schools will give more access to families from particular races. The first regression looks at the correlation between choice points and the share of families within one mile of the score that are white, Asian and African-American. Hispanic and other groups are the omitted category.

The first regression shows that schools near white and black families are both more popular. The effects of proximity to either group are strong and positive and similar in magnitude. Proximity to Asian parents is an even stronger predictor of the school's popularity. As the share of the population within a mile of the school that is Asian increases by ten percent, the number of choice points increases by 42. This effect may reflect the perceived popularity of the school or it may reflect the tendency of members of these groups to apply more to neighborhood schools.

The second regression shows that these effects remain, although their magnitudes are decreased, when we control for the math scores in the school. The Asian effect drops the most dramatically. Although the race effects do get somewhat smaller, they remain statistically significant and similar in magnitude. The third regression shows that these effects remain when we consider all kindergarten programs, not just general education.

Regression four and five look at grade six. In this case, all three racial coefficients remain positive, but the results are generally not significant. Regressions six, seven and eight look at results for high schools. In this case, the coefficients are typically negative, but they are not statistically distinct from zero.

Our results suggest that for kindergarteners, school popularity is significantly higher in areas that are close to white, black and Asian families. These results persist even when we control for test scores, so this is not just reflecting better academics in these areas. Still, they do suggest that restricting choice to near neighborhoods may particularly restrict the ability of Hispanics to get into more popular schools. We now turn to other correlates of school popularity.

Neighborhood Characteristics

In Table 8, we look at popularity across neighborhood. Our goal here is to see whether some neighborhoods are particularly likely to contain popular schools, even controlling for neighborhood characteristics. The concentration of larger numbers of popular schools in particular neighborhoods helps inform us about which areas will be winners and losers if there is a movement towards more neighborhood-based schooling.

The first regression in Table 8 includes our core controls and a series of neighborhood dummies. The omitted neighborhood is Charlestown so the neighborhood effects should be thought of as the added effect of being in that neighborhood relative to Charlestown. Three neighborhoods have large negative coefficients: Allston-Brighton, East Boston and Roxbury. The impact of East Boston may largely reflect that area's geographic isolation, which may not be fully captured by our local neighborhood controls. The impact of Roxbury is somewhat weaker than the other two neighborhoods but not statistically significant. Still, the -33 coefficient is almost equal to a full standard deviation of the choice variable, so it is a quite large effect even if it is statistically imprecise.

West Roxbury is the only neighborhood with a statistically distinct positive effect. This effect is almost two standard deviations and it reflects the extreme popularity of several West Roxbury schools. There are also large effects in North and South Dorchester, and Mattapan, although these effects are not statistically significant. It is hard not to conclude that neighborhood-based schools would mean that some neighborhoods would gain increased access to dramatically more popular schools, while other neighborhoods would be restricted to less popular kindergarten programs.

The second regression regresses math test score outcomes on the same set of variables. This regression essentially asks if particularly neighborhoods are likely to have schools with disproportionately high or low test scores. Our outcome is the share

Table 8

Variables	(1) Choice Points K1 and K2 (Gen Ed Only)	(2) Share Prof/Adv in Math K1 and K2 (Gen Ed Only)	(3) Choice Points K1 and K2 (Gen Ed Only)	(4) Choice Points K1 and K2 (All programs))	(5) Choice Points Grade 6 (Gen Ed Only)	(6) Choice Points Grade 6 (All programs)
School in East Boston Indicator	-43.96* (24.26)	-0.195** (0.0849)	-35.73 (22.79)	-11.88 (19.40)	47.07 (73.89)	53.67* (28.64)
School in Roxbury Indicator	-33.19 (27.63)	-0.237** (0.101)	-20.38 (24.01)	-16.42 (22.07)	17.44 (85.29)	35.34 (27.13)
School in South Dorchester Indicator	37.95 (36.35)	-0.111 (0.0999)	43.93 (29.61)	34.62 (29.55)	134.8* (71.58)	80.83*** (24.81)
School in West Roxbury Indicator	62.32** (25.18)	0.0745 (0.104)	55.64** (21.56)	46.47** (20.04)	23.73 (66.26)	21.56 (20.95)
School in North Dorchester Indicator	34.87 (35.89)	-0.0671 (0.109)	35.96 (29.97)	39.54 (29.12)	61.58 (80.12)	36.54 (36.68)
School in Mattapan Indicator	44.41 (37.96)	-0.139 (0.122)	52.10 (31.45)	41.62 (29.42)	82.85 (79.34)	64.24** (30.96)
School in Roslindale Indicator	-6.741 (26.85)	0.123 (0.0888)	3.310 (23.16)	4.739 (21.42)	36.45 (67.39)	35.54 (24.47)
School in Allston-Brighton Indicator	-42.80* (25.63)	-0.162* (0.0948)	-43.09* (21.61)	-20.22 (19.58)	-68.54 (75.87)	-25.59 (31.32)
School in Jamaica Plain Indicator	-16.92 (25.23)	-0.144* (0.0844)	-12.63 (20.76)	-4.343 (20.32)	-8.441 (68.61)	-3.224 (22.84)
School in Hyde Park Indicator	18.83 (33.89)	-0.127 (0.104)	26.53 (28.68)	26.18 (26.95)	83.24 (60.21)	53.47** (21.73)
School in Central Boston Indicator	2.108 (27.64)	0.106* (0.0607)	-11.80 (25.97)	27.18 (23.85)	-19.77 (65.43)	-0.155 (24.93)
School in South Boston Indicator	32.62 (38.45)	-0.0523 (0.126)	29.64 (32.71)	47.27 (31.56)	3.194 (123.6)	27.17 (59.42)
School in South End Indicator	-30.25 (23.07)	-0.262* (0.136)	-13.97 (22.22)	-11.47 (18.25)	-60.66 (74.73)	-16.60 (29.81)
All Math-%Prof/Adv			82.23*** (21.63)			
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Constant	18.81 (106.0)	0.267 (0.487)	28.68 (106.2)	-46.00 (94.01)	181.0 (412.6)	-45.80 (201.7)
Observations	158	148	147	227	38	119
R-squared	0.517	0.498	0.615	0.423	0.578	0.583

Robust standard errors in parenthesis.
*** p<0.01, ** p<0.05, * p<0.1
Standard Errors are Clustered at the School Level and Charlestown Neighborhood Indicator dropped. No Kindergarten or Grade 6 in Back.
See Table 1 for Controls.

of students who score proficient or advanced on the math MCAS. This regression suggests that schools in East Boston and Roxbury do have disproportionally lower test scores, as the coefficients on schools in these two neighborhoods are large, negative, and statistically significant. West Roxbury, Jamaica Plain, and the South End also have negative coefficients but they are only marginally significant. Central Boston has a marginally significant positive coefficient.

The third regression controls for test scores. This is essentially asking whether particular neighborhoods have schools that are more or less popular than their test scores would suggest. The neighborhood coefficients typically become slightly smaller, but remain similar in magnitude. The positive coefficient on location in West Roxbury remains significant. The negative coefficients on Roxbury and East Boston get somewhat smaller, and are insignificant. The coefficient on Allston-Brighton remains statistically significant and negative. This appears to show that some, but not all, of the popularity differences across neighborhood reflect differences in the academic outcomes of these schools, as measured by MCAS scores.

The fourth regression includes all kindergarten programs, not just general education. This causes the coefficients to fall closer to zero, and only the West Roxbury coefficient remains statistically significant. These results suggest that the neighborhood differences in special education and English language programs are less pronounced than in general education programs.

Regressions five and six look at results for sixth grade. In this case, the coefficients are typically quite poorly measured, which is not surprising given the smaller number of observations and the somewhat more anomalous nature of the sixth grade lottery. South Dorchester and Hyde Park now seem to have the most popular schools. Allston-Brighton continues to have less popular schools, but given the small number of observations, we are quite reticent about these results. Since Boston is not considering moving to a neighborhood model for its high schools, we do not present results for grade 9, but when we estimated those results, we only found a negative effect of location in Central Boston.

VI: Conclusion

Overall, this exercise yields several clear conclusions as well as revealing the limits of the data. When it comes to physical attributes, such as gross square footage, the coefficients at least at the kindergarten level were small and typically precisely enough estimated to infer that parents are not placing a large value on the characteristic. The one dramatic exception is school cleanliness, the lack of which does seem to decrease popularity.

This report has attempted to use school choice data to infer the popularity of different schools, controlling for neighborhood demand. Across neighborhoods in Boston, we estimate quite significant effects of the share of parents with the children of relevant age and of parents with college education within a mile of the school. There is also an insignificant but positive relationship between the overall number of families and the popularity of the school.

But when it comes to non-physical attributes, such as art and music, we often estimated coefficients that are reasonably large in magnitude and just imprecise. This means that we can't rule out that music and art have significant impacts on school choice for kindergarten parents, but the data just can't precisely estimate the coefficient.

We first looked at whether popular schools were particularly prone to be located in different neighborhoods of Boston controlling for these other neighborhood characteristic. We found that West Roxbury was well endowed with popular schools, while Allston-Brighton, Roxbury and East Boston were not. We found that areas with more white, black and Asian households (as a percentage of the total) generally had more popular schools. Hispanic areas had fewer popular schools. These results suggest that any move towards more neighborhood schools must guard against significant redistribution of opportunity across neighborhoods and demographic groups.

We then turned to the school-level correlates of popularity. Above all, math test scores correlate strongly with school popularity for kindergarten and high schools. The correlation is not perfect, implying either that parents care about more than test scores or that parents are not well-informed about this specific attribute, but it is still reasonably high.

Other school attributes valued by parents were the presence of K1 offerings, the K-8 structure and citywide eligibility.

By contrast, there are few other meaningful correlations with other school attributes. In general physical characteristics were not strongly correlated with school popularity, except for cleanliness, and these results were often precise enough to rule out any large positive effects. School curricular activities, conversely, did not have statistically dramatic effects, but we cannot rule out big impacts of art and music on school popularity.

Nonetheless, these school attribute effects should make us doubt whether there are any ready substitutes for academic quality, as measured by test scores. We should not think that we can make families whole by giving them larger classrooms or wireless availability, in exchange for lower test scores. Parents favor academic quality and that should give us somewhat more confidence in relying on parental choice in school assignment.

Endnotes

[1]Walk Zones are 1 mile for elementary schools, 1.5 miles for middle schools and 2 miles for high schools.

[2] The concept of the walk zone is bit less static than it appears. The 1 mile radius has been applied in the past to mean that any resident of a geocode (see map here: http://www.benchmarkemail.com/c/v?e=216FBB&c=17E75&l=279A3C4&email=PZgT7oll7Hk%2BFybDpF8VKwgx6WzItQTg&relid=4E2EFC5E) that has any part within the radius is considered to be in the walk zone. The result is that many students considered to be in the walk zone live more than 1 mile away.

[3] In response to an open records request, the BPS provided the data from 2005 to 2010. http://www.pioneerinstitute.org/blog/wp-content/uploads/2005-2010-West-Zone-Sibling-Preference-Data.xlsx

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