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The Roots of Opting Out: Family, School, and Neighborhood Characteristics Associated with Non-Local School Choices

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A Thesis Presented to the Faculty
of the Graduate School of Education of Harvard University
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for the Degree of Doctor of Education

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Abstract

Intra-district open enrollment policies are increasingly implemented as a means of expanding children's educational opportunities and promoting greater racial integration in urban schools. However, racial segregation continues to endure in many choice-oriented urban school districts, to the extent that schools are often more segregated than their surrounding communities. I investigate the interplay between family, school, and neighborhood racial characteristics as they relate to pre-k and kindergarten school choice patterns in Boston, Massachusetts. Findings suggest school choice is a function of a variety of factors, with a school's racial composition remaining salient even after accounting for academic achievement, discipline records, and distance from home. Furthermore, racial background moderates school choices such that White and Asian families displayed similar behavior, as they tended to choose schools with higher proportions of White and Asian students and lower proportions of Black students and students receiving free and reduced-price lunch subsidies. Neighborhood racial composition was not found to be a significant factor in families' choices, but the average racial profile of the neighborhood schools did shape White and Asian families' decisions to stay local or not. Finally, I found that families from neighborhoods with higher levels of ethnic heterogeneity and lower levels of socioeconomic advantage were more willing to travel longer distances for schools. The results underscore the importance of acknowledging the persistent salience of race in school choice processes, even when also accounting for various aspects of schools' academic achievement, discipline, and location.

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1. Introduction

Since the advent of controlled choice policies in Boston and New York City in the early 1970s, intra-district open enrollment has proliferated in cities across the United States. Many of these policies initially developed out of court-ordered desegregation efforts that combined forced busing with voluntary transfer and choice to promote integrated schools and expand educational opportunities for families who were previously bound to locally-zoned schools. Expanded choice represents a strategy of promoting equity by allowing families to opt out of neighborhood schools that may be poorly resourced or present a poor match for their educational preferences and the academic needs of their children (Bell, 2009; Scott and Levin, 2005). Currently, 27 states require their districts to implement intra-district open enrollment policies, with approximately one in seven districts implementing such policies (Cullen, Jacob, and Levitt, 2005; Education Commission of the States, 2013). This trend likely contributed to a decline in students attending public schools to which they would have been assigned based on residency, down from 80% in 1993 to 69% in 2007 (NCES, 2009). In Boston, the proportion of students attending their locally zoned public schools is much lower than the national average, with more than 60% of public school students attending non-local public schools as of 2012.

In addition to increasing access to non-local school options, open enrollment policies are used as a strategy to promote integrated schools. Accomplishing this goal, however, has proved challenging, as districts are not permitted to use racial characteristics in school choice and assignment policies following the 2007 Supreme Court decision in *Parents Involved in Community Schools v. Seattle School District.* Nonetheless, voluntary transfer and choice programs are increasingly relied upon to promote and maintain diverse schools, as districts move away from court-ordered desegregation policies. Since the early 1990s forced integration regimes have dwindled, with more than half of all districts under court-ordered desegregation rulings having ended those policies between 1991 and 2011 (Reardon et al., 2012). Thus, many school districts in the United States remain segregated by race and class, in contexts with a variety of school choice and assignment policies, such as citywide specialty and magnet schools, inter-district transfer agreements, charter schools, and intra-district open enrollment lotteries (Clotfelter, 2004; Lankford and Wyckoff, 2005; Reardon et al., 2012).

While urban schools remain persistently segregated across the United States, urban communities are becoming increasingly diverse (ESRI, 2013). In Boston, for example, the demographic profile of the city's general population has evolved and diversified, yet racial sorting endures in the city's choice-oriented school district. Segregation between most racial and ethnic groups has changed little in the city's public schools since the mid-1990s. Following decades of White families fleeing the district, White enrollment went up overall between 2004 and 2011. However, only a third of the schools in the district saw any rise in White enrollments, suggesting continued segregation across Boston's public school district that has had an intra-district open enrollment policy in place since 1988 (Kimelberg and Billingham, 2012).

Given the prevalence of intra-district open enrollment regimes like Boston's, and the seemingly contradictory trends of persistent racial segregation in urban schools amidst racially diversifying cities, it is imperative to understand the possible race-based roots of school choice patterns. Integrating rational choice and racial contact theories, I investigated the salience of racial characteristics as associated with families' choices, controlling for measures of school distance, safety, and quality. This analysis focuses on families from Boston, Massachusetts—a city with a district-wide open enrollment program in which less than half of students attend their locally zoned school (Kimelberg and Billingham, 2012).

Specifically, among families of children entering pre-k and kindergarten programs in Boston Public Schools, I assessed the extent to which schools' racial composition remains a significant predictor of choice even after controlling for measures of distance, student attendance, school order and discipline, student academic achievement, and the proportion of students receiving free lunch subsidies. I also examined whether preferences vary among families of different racial backgrounds. Next, I investigated whether Boston families opt for non-local schools that are less diverse than their residential communities, and whether non-local preferences are related to school racial composition above and beyond indicators of school location, safety, and quality. Finally, I explored whether a preference for more distant schools was associated with the racial composition of families' residential neighborhoods, possibly serving as a force that "pushes" them away from the local schools and in order to opt for more distant alternatives.

Section 2 provides a comprehensive review of the literature on racial considerations in school choice, focusing on the ways in which school demographics have differing levels of salience for families of different backgrounds. This discussion also includes a review of existing research on the ways in which families' residential neighborhoods may influence the selection of a local school or not. The design of the study is reviewed in Section 3, which includes information on the study site and sample of families, schools, and neighborhoods, concluding with a detailed discussion of all analytic procedures. Next, in Section 4, the results of these analyses are presented, followed by a discussion of their significance along with policy implications in Section 5.

2. Literature Review

In this section the study of school choice in Boston's open enrollment system is situated within an integrated theoretical framework that combines perspectives on rational choice, race proxy, and racial contact theories. These models are combined to form an argument that families' school choices are based on utility maximizing logic models, which are likely to incorporate considerations of the available schools' racial composition along with other dimensions such as proximity, safety, and academic quality. Furthermore, neighborhood contexts are likely to influence families' choice processes as well, serving as a moderator of individual preferences about schools through contact and socialization with neighbors.

Rational School Choice

An investigation of choice behavior relies on the assumption that individuals make selections non-randomly, based on a rubric that evaluates which available option may have the greatest level of payoff (Train, 2009). Choosers are assumed to measure the costs, benefits, and opportunities for success among available options and ultimately select the alternative with the maximum level of return based on their particular set of values (Bosetti, 2004; Fuller, Elmore, and Orfield, 1996). These decisions are based on beliefs derived from past experiences and observations of other people's behaviors and outcomes that translate into context-specific preferences regarding the attributes of the options available (Gintis, 2007; Hechter and Kanazawa, 1997). Although there is no assumption that individuals will actually behave in a manner that is welfare-improving, there is an assumption that individuals will act based on a consistent set of preferences. Furthermore, choice behavior is shaped by various forms of constraints that serve to limit one's ability to make informed, utility-maximizing choices among the maximum number of worthy alternatives (Gintis 2007, 2009).

These three components of the *beliefs—preferences—constraints* (BPC) model of rational choice can be mapped onto situations of school choice. First, parents are assumed to have a framework of beliefs regarding educational quality and success based on a variety of factors, including their own past experiences as well as the experiences of kin, neighbors, and other groups in society. These beliefs then form the foundation of preferences regarding which types of schools might represent the best options for their children, such as schools with particular programmatic offerings, schools that are close to home, schools with particular demographic profiles, or schools with high achieving and/or well-behaved students. Finally, school choices are shaped by various forms of constraints that complicate the decision-making process and give rise to equity concerns in contexts where some families face many more constraints than others.

Beliefs and Preferences. Choice-oriented educational systems assume that parents are able to understand their preferences regarding various aspects of schooling options among which they are selecting, such as a school's goals, the teaching approach, or the educational philosophy, or demographic characteristics of the teachers or student body. It is then assumed that parents choose schools that are performing well on whatever attributes they value most. If parents are able to make multiple, ranked choices of their school preferences, then their first choice would be the top performing school on those attributes, the second choice school would be the second best, and so on (Berends and Zottola, 2009; Buckley and Schneider, 2003; Wells and Crain, 1992).

Families may be acting in utility-maximizing ways, but utility itself is ambiguous, as families are likely to have differing sets of values and preferences regarding what makes a good school (Gintis, 2009).

There is abundant empirical evidence showing how multiple factors matter to choosing families, with the specific rank ordering varying across studies, samples, and subgroups. Schneider et al. (2000) found that stated preferences indicate a multitude of factors that families value, with measures of academic quality such as teacher experience and test scores being valued the most, followed by indicators of safety and discipline. Other work finds that families are attracted to schools that are academically superior, have a match with their educational values, and contain fewer poor children and children of color (Bell, 2009; Bosetti, 2004; Hastings and Weinstein, 2008). Convenience often matters as well, as families will cite life factors such as locational proximity, transportation ease and timing, and relative location to after-school programming or childcare for children not in school yet (Rhodes and DeLuca, 2014). In Boston, the commonly promoted logic model among policymakers and education reformers is that families generally prefer close-by school with high levels of academic achievement.

Race Preferences. Despite parents' tendency to cite academic aspects such as high standards, strong curriculum, and good teaching as the most important factors driving their choices, schools' racial composition and other non-academic factors such as location and safety are strongly associated with the probability of families choosing a particular school over others (Goyette, 2008; Hastings, Kane, and Staiger, 2005; Roda and Wells, 2013). The proportion of same race students is a strong predictor of choice in a variety of contexts and policies: suburban vs. urban schools, private vs. public schools, magnet schools, and charter schools (Bifulco and Ladd, 2006; Bifulco et al., 2009; Buckley and Schneider, 2007; Weiher and Tedin, 2002). In addition, families of all races show preferences for schools with higher percentages of White students and lower percentages of Black and Hispanic students (Goyette, 2008; Henig, 1995; Saporito and Lareau, 1999; Sikkink and Emerson, 2008).

Race Proxy. School demographics factor into choice patterns both explicitly and implicitly, as for some choosers race may serve as a functional proxy for aspects of educational quality. Gintis (2009) argues that individuals will rely on several heuristics, or decision-making strategies, to help simplify complex or ambiguous choice situations. One heuristic that people use is to consider an easily observable trait as a representative proxy or "signal" of a more latent or complex set of attributes. For example, a school's racial composition could function as a signal of academic quality, safety, or cultural fit. Families who face a complex choice between several schools, about which they may have only limited knowledge, may rely on the more visible attributes of student demographics to guide their decision.

The race proxy theory has been promoted in the neighborhood choice literature, with race being associated with the perception of neighborhood crime, poverty, and social problems (Harris, 2001; Krysan, 2002). Neighborhood choice may be more a function of individuals' assumptions about school quality, socioeconomic status, and safety than it is about current racial composition, and these projections are often influenced by the perceived link between minority presence and structural decline (Ellen, 2000). There is some empirical support for this premise, as Whites have been found to overstate problems with public services and safety in neighborhoods that are racially integrated (Chiricos, McEntire and Gerts, 2001; Krysan 2002; Quillian and Pager, 2001). Additional empirical work reveals that race remains a significant predictor of the probability of a family choosing a particular neighborhood, even after controlling for structural characteristics such as the quantity and quality of neighborhood institutions (Chiricos, McEntire, and Gertz, 2001; Crowder 2000; Emerson, Yancey and Chai 2001).

Ellen's (2000) race project hypothesis can be applied to school choice as well, as families may use schools' racial profiles as a signal of quality. For example, White parents' perceptions of school quality may decline when Black representation in schools increases (Goyette, Farrie, and Freely, 2012). Using race as a functional signal of school success may stem from the fact that many measures of school "quality" often covary with racial composition. For example, school diversity is positively correlated with higher teacher-student ratios, lower quality teachers, decreased safety, and lower student achievement (Goyette, 2014). Multivariate analyses of school choice that include measures of racial composition and school quality indicate mixed support for this race proxy hypothesis. On one hand, studies show that even after controlling for indicators of racial composition, school quality indicators such as results from the SAT and state standardized test along with school violence rates also significantly influence the probability that a family chooses a particular school (Renzulli and Evans, 2005; Saporito, 2003). On the other hand, these same studies show that schools' racial characteristics are also significant predictors of families' choices, suggesting an independent effect of racial composition aside from considerations of quality.

Not only are the racial characteristics of schools important in choice processes, but the racial background of the families themselves serves as another source of variation in preferences and behavior (Henig, 1996; Schneider et al., 1998). For example, White families tend to avoid schools with higher proportion of non-White students, even when accounting for other school characteristics such as safety, appearance, and educational quality (Saporito, 2003). Schneider et al. (1998) found that differentiation along race and class emerge from "sorting," as lower SES parents stress a different set of values and choose schools that reflect different dimensions of education that are deemed most important. They found that Black parents and parents who have graduated from high school but have no college education are more likely to rank high levels of academic achievement as important. Parents who have attended college are 8 percentage points less likely to say high scores are important. This finding does not reflect common belief that individuals from lower SES do not value academic performance. Regarding discipline, parents with highest education levels evaluate discipline as important much less frequently. Finally, it should be noted that there is a dearth of empirical work focusing on the school choice processes and preferences for Asian American and Hispanic families, which is somewhat surprising given the increasing presence of these groups in urban school systems, particularly in the Northeast and West Coast.

Constraints. Race-based differences also may emerge from various constraints that choosing families face. Serving as a key component to many rational choice models, constraints shape options available and paths taken by agents who face choice situations (Gintis, 2007). The composition of families' choice sets of available schools are based on a variety of factors including their residential location in a city or suburban district or in a neighborhood with limited access to high quality school options.[1] Families' subsequent choices are often based on residential proximity to schools, and therefore race differences in educational preferences are often tied to patterns of residential segregation in cities (e.g., Jargowsky, 2014). Bell (2009) hypothesized that one reason why there may be differences in how parents rank schools might be contextual, as the supply side of the choice market is driven by local educational markets. The options available to families are likely to be shaped by the policy environment combined with their residential location as well as the larger policy environment in their respective cities or states. For example, some families in disadvantaged communities from one city may have access to only a limited subset of schools based on zoning rules or spatial buffers (e.g., schools within two miles), whereas some families from similar neighborhoods in different cities have access to all of the schools in the district. However, the inclusion of an entire district's schools in each family's choice set does not guarantee they have knowledge about all of these schools. Furthermore, race and location interact to create "blind spots" in choice markets, as families tend to know much more about neighborhoods where the same-race group has greater representation (Bader, 2009).

Another constraint faced by families is variation in information gathering processes, resulting in differing access to useful information on schools. Choosers' decisions may be based on a variety of choice algorithms, some of which are forward-thinking, some are backward-thinking, and some sideways-thinking (Hechter and

[1] Families may not all participate in the choice process to the same degree, or at all, even if they are afforded the opportunity to do so. Participation levels differ, which has been found to be a major driver of inequities among choosers of charter, private, and magnet schools (Bergends and Zottola, 2009). The present study examines choice behavior in a city-wide open enrollment

Kanazawa, 1997). Forward-thinking beliefs are based on estimates of what the future holds; actors assign subjective probabilities to various potential distal outcomes such as achievement in school, acceptance into selective high schools and colleges, and labor market success. Backward-thinking beliefs are based on past outcomes associated with their decisions. Finally, sideways thinking choice algorithms are based on actors imitating decisions made by neighbors or peers who are doing well. The decision algorithm adopted by families depends on the extent of information available about the future. If the past is the best predictor of the future, then actors will be backward-looking. If the future is best known by observing others who are doing well in the present, then actors will be sideways looking (Hecht and Kanazawa, 1997).

Parents of different race and class backgrounds may have similar motivation and processes for gathering information, yet the resulting school choices may differ based on the different types of information that may flow through their social networks (Kimelberg and Billingham, 2012). Families are most likely to know about the schools in their immediate neighborhoods, but even then the information might be limited to word-of-mouth via kin, friends, and neighbors (Lareau, 2014). The reliance on network ties may moderate the relative salience of particular school factors, as families who relied on their social circle more for school information were found to place less weight on performance data (Weininger, 2014). Middle class families rely on social networks more than official channels of information from school districts, as these networks are more likely to contain people with more comprehensive knowledge of schools (Horvat, Weininger, and Lareau, 2003; Schneider, 2001). However, disadvantaged families also use social networks, but the knowledge shared is often about a smaller subset of schools, resulting in less information gained from these networks (Rhodes and DeLuca, 2014). Thus some disadvantaged families may be more prone to rely on performance data as a functional substitute for social network information (Weininger, 2014). In sum, school choice is not just a product of individual beliefs and preferences, but also constraints shaped by individuals' social positions and interactions with extra-familial networks and institutions (Bosetti, 2004).

Neighborhood Context and School Choice

Despite the large body of work examining the relationship between schools' racial composition and families' school choices, much less is known about whether neighborhood-level racial characteristics play a role as well (for exceptions see Lauen, 2007, and Bell, 2009). Ignoring contextual factors suggests that school choice is strictly a family matter and that locational factors such as proximity to quality school options, neighborhood socioeconomic conditions, and racial segregation are of no consequence. With regard to racial composition, there are a number of potential ways in which neighborhood context may be associated with families' choice behavior.

Many families choose neighborhoods partially with the schools in mind, and in turn they may choose schools with the surrounding community in mind. There is a large literature on neighborhood choice, much of it converging on the conclusion that access to high quality schools is an important factor in shaping families' decisions (see Lareau and Goyette, 2014, for a discussion). However, families' residential choices may be constrained because of economic factors or social considerations such as proximity to jobs and extended family members, so even if families prefer to live close to good schools, many may not be able to act on the preference due to financial limitations (Ellen, 2000; Lauen, 2007). School choice may be less constrained, especially in a city with a range of choice options that include not only private and charter schools but also a wide array of public schools thanks to an intra-district open enrollment policy.

Goyette et al. (2012) identified two competing theories for how the demographic characteristics of neighborhood contexts may function in shaping school choice behavior. On one hand, racial contact theory suggests that families living in racially diverse neighborhoods may be more comfortable having their children attend similarly diverse schools because of the trust and comfort they have developed through their exposure to people of different races (Allport, 1954; Goyette et al., 2012; Pettigrew and Tropp, 2006). On the other hand, increased exposure to people of different races could increase out-group hostility that might lead to families being less open to having their children attend diverse schools. Animus could emerge across race or class lines, fomented by negative social interactions, competition for resources in situations of scarcity (i.e., spots in highly desirable schools), or a general sense of out-group hostility (Oliver and Mendelberg, 2000). This "racial threat" hypothesis mainly has been applied in analyses of White residents' reactions to increasing levels of non-White neighbors (e.g. Bobo, 1999), but it provides a useful framework for one possible reason why families of all races living in diverse communities may prefer to send their children to less diverse schools farther away from home.

The racial contact hypothesis argues that increased exposure to individuals of different races results in improved attitudes and cross-racial relations (Allport, 1954). For example, interracial contact, especially early in life and in school contexts, leads to greater likelihood of interracial friendships as adults (Ellison and Powers, 1994; Sigelman et al., 1996). Following this reasoning, one could argue that diverse neighborhoods might make families more comfortable having their children attend similarly diverse schools. There is an assumed link between attitudes and behaviors--if attitudes changed, behavioral change would follow, and possibly vice-versa (Goyette et al., 2012). Functioning through the social interactions that occur through neighborhood proximity, increased contact might assuage racial hostilities and increase shared goals for children's educational opportunities. Schools, in particular, might represent a common cause in which families of all backgrounds have a stake. Emerson, Kimbro, and Yancey (2002) identify four conditions under which social contact should result in positive change: common goals, intergroup cooperation, equal status, and authority support. If these four conditions are met then families residing in ethnically heterogeneous neighborhoods would be more prone to choosing diverse schools, compared with families from less diverse communities.

In contrast, the racial threat hypothesis suggests that increased inter-racial contact could exacerbate divisions between groups. There is abundant empirical evidence suggesting that increases in minority populations are associated with greater levels of White hostility toward different racial groups, (see discussion in Goyette et al., 2012). In contexts where families are competing over finite resources, such as a limited number of seats in desirable schools, competition between racial groups may ensue and hostility grows (Oliver and Mendelberg, 2000). Thus, increased levels of neighborhood diversity might serve as a "push" factor that encourages families to opt out of local school options because of their neighborhood-based aversion to other racial and ethnic groups.

A third possibility is that neighborhood racial composition would not moderate the school choice decisions at all. Individuals who value diversity in schools will act on that preference no matter where they live, and those who prefer high proportions of same race will act on that as well. Furthermore, families who live in diverse neighborhoods may have just as much racial animus or hostility as those residing in more segregated communities, but they happen to live in an integrated neighborhood due to economic constraints, not by choice. The school choice process, thus, represents a less constrained forum to act on true preferences, possibly resulting in schools that are more segregated than neighborhoods (Jargowsky, 2014). As racy proxy suggests, individuals might think that the schools in the neighborhood are bad due to the overall racial profile of the community, and so they might try to get their children out of the community context via school choice.

Rationale for Present Study

In sum, research on school choice that incorporates rational choice, race proxy, and racial contact theories reflects some of the complex ways that racial concerns permeate the choice process for families. Multiple aspects of schools are simultaneously considered when families are making school choices, with some of these factors being related to school quality and some being related to the racial profile of the students there. The relative salience of these different attributes may vary as a function of individual preferences, but social position also matters, particularly related to race and class. Choice behavior may be associated with the characteristics of families' residential locations, as both the supply and demand side of the educational market can be shaped by the demographic characteristics of families' communities.

This study focuses on a set of analyses to investigate the salience of family, school, and neighborhood racial characteristics as they pertain to Boston families' school choice behavior. There are four research questions:

RQ1: Are the racial characteristics of families and schools associated with Boston families' school choices for their pre-K and kindergarten-aged children, accounting for school quality, safety, and distance from home?

RQ2a: Is the ethnic heterogeneity of a child's neighborhood associated with the probability that the child's family will choose a non-local school as its first choice in the BPS open enrollment process, and does this association differ for children of different races?

RQ2b: For families choosing non-local schools as their first choice, what is the difference between the racial diversity of the chosen school and their residential neighborhood, and does this difference vary across racial groups?

RQ3: For families choosing non-local schools, does the racial composition of the neighborhood serve as a "push" factor associated with families opting out of local schools, or is it that the characteristics of the chosen school (racial or otherwise) serve as "pull" factors that lure families from other parts of the city?

Based on the theoretical and empirical literature outlined above, I aim to test several hypotheses. Regarding the characteristics of schools (RQ1), I anticipate families in Boston will make school choices based on several different school attributes, some of them quality-related and some of them race-related. I also anticipate preference variation to exist across race groups, with the relative salience of particular factors mattering more for some race subgroups compared with others. Based on the work of Schneider et al., (1998) and Weininger (2014), I anticipate White families' choices to be more closely tied to school racial demographics than Black or Hispanic families, who are likely to place greater emphasis on measures of academic achievement, discipline and safety. Regarding the characteristics of families' residential neighborhoods (RQ2a and RQ2b), I hypothesize that White families (compared with Black and Hispanic families) will have greater probabilities of opting for non-local schools if their neighborhoods are more diverse or have lower proportions of the same race. Furthermore, I expect those who opt out of local schools do so in order to attend more racially similar schools, thus confirming the existence of the racial threat hypothesis that individuals who reside in diverse communities are more likely to opt for non-local schools with more same-race representation. Finally, this study informs our general understanding of the school choice preferences of Asian and Hispanic families.

This work complements prior investigations into the racialized nature of school choice processes in multiple ways. First, I rely solely on an analysis of the revealed, rather than stated, preferences of families in Boston, thus presenting a more objective picture of variation in school preferences. Second, I utilize multivariate models that will test for the relative salience of racial considerations along with attributes of school quality and safety, thus providing insight into the functioning of the race proxy hypothesis. Third, I incorporate neighborhood-level characteristics as a potential factor that drives choice patterns. And fourth, I focus on a citywide open enrollment process, which should be considered apart from vouchers and charter programs due to the higher rate of student involvement and the breadth of the options available to students.

3. Research Design

Study Site and Data. This study uses school choice and assignment data from Boston Public Schools (BPS) that include the school choices, residential locations, and demographic characteristics for all families entering the BPS lottery for the 2010-2011, 2011-2012, and 2012-2013 school years (N=43,840). These data represent the universe of students whose families have registered with BPS for assignment to a school via the District's zone-based choice and assignment system. This assignment system has been in place since 1988 when the city regained control of its school attendance process following years of federally mandated desegregation. With the mandate of not allowing the schools to resegregate, the Boston School Committee divided the city into three geographic zones, each encompassing both majority White and majority Black neighborhoods. Following lawsuits from representatives of White students claiming the policy kept them from being able to attend schools in their own neighborhoods, race was eliminated as a factor in student assignment decisions in 1999 (Boston Public Schools, 2010). Another notable change came in 2006, when the assignment algorithm was re-designed to eliminate possible "gaming" strategies whereby families would strategically downgrade their true preferences. The revised algorithm ensures that families' choices reflected their true preferences by prioritizing top choices over those ranked lower (see Abdulkadiroglu et al., 2006 for a detailed description of the assignment algorithm).

With these changes in the assignment algorithm, the choice process for families remained relatively unchanged over the past two decades. Families with students enrolling in pre-k or kindergarten are allowed to choose from all of the schools within their attendance zone as well as those schools that lie within their "walk zone," the area within a one-mile radius of their residential location. There are also several city-wide schools that all families are allowed to select. These schools are often k-8 schools or schools with specialized curricula. For the pre-k families (n =7,004), their set of options included an average of 24.3 schools, with as few as 21 and as many as 36. Kindergarten families (n=11,059) have slightly larger choice sets, with the mean size being 28.4 schools, the minimum being 24, and the largest containing 40 schools. For each school in a family's choice set, BPS provides an information sheet that includes information on achievement levels, special programs or curricula offered at the school, and information on the overall size and student-teacher ratio. Demographic data pertaining to school-wide race and class composition are not provided to families directly by BPS.

These data on choices also contain the spatial locations of each family's residence (coarsened across 837 regions that serve as proxies for residential address) as well as the geospatial location of each school, allowing for location-specific analysis of each family's local educational context as well as the driving distance between each residential location and each available school. The spatial locations are linked with neighborhood measures from the 2011 5-year estimates from the U.S. Census Bureau's American Community Survey.

Sample. This study focuses on the choice patterns for families of students entering pre-kindergarten (pre-k) or kindergarten in Boston Public Schools over the course of three academic years. Due to the high percentage of middle- and high-school students that are in feeder and continuation programs that dictate school choice and assignment options, this analysis will focus only on children entering BPS' pre-k programs as well as regular full-day kindergarten programs. BPS offers full-day pre-k and kindergarten classes, although the number of available pre-k seats is smaller than the demand. BPS guarantees assignment for kindergarten and up. In order to avoid potential "double counting" of students who were in the pre-K group in one year and then the kindergarten group the following year, all analyses are conducted separately for the two subsamples. Thus, the two analytic samples are limited to the children whose families participated in the open enrollment process for pre-k seats (n=6,555) as well as kindergarten seats that are not pre-determined by pre-k enrollment from the year before (n=5,930).

The sample of available schools includes all public elementary and K-8 schools in BPS system, which includes several "pilot" schools in Boston that are independently run laboratory schools run by BPS administrators. Charter schools and private schools are not included. Of the 129 schools in the BPS system, this study focuses on the 76 schools that have kindergarten programs and the 65 schools that have pre-k programs. All schools offering pre-k also offer kindergarten, but the opposite is not true, as 11 schools offer kindergarten but not pre-k. See below for a detailed description of the sample of families, schools, and neighborhoods.

Measures

Outcome Measures

RQ1: Choice of School. Each research question was addressed with a separate statistical model and unique outcome measure. For research question 1, the outcome was a dichotomous indicator expressing whether a family chose a particular school as its first choice (0 = school was not chosen; 1 = school was chosen).

RQ2a: Walk Zone Choice. For research question 2a, the outcome was a dichotomous variable indicating whether families select a school in their walk zone as their first choice (0 = chosen school is not in the walk zone; 1 = chosen school is in the walk zone).

RQ2b: Neighborhood-School Heterogeneity Gap. For research question 2b, the outcome measure was the difference between the ethnic heterogeneity the family's neighborhood and that of the first choice school (referred to as the heterogeneity gap). A negative value of this gap score indicates that the chosen school was more diverse than their residential neighborhood, whereas a positive value suggests the neighborhood was more diverse than the school. Ethnic heterogeneity was represented by a diversity index that is commonly used by the U.S. Census Bureau among others **(**ESRI, 2013**).** The index represents the percentage of times two randomly selected people in a given geographic area (e.g., Census tracts) would differ by race/ethnicity, and it is calculated by squaring the percentage present of each racial group, summing the squares, and subtracting that sum from 1 (Brewer and Suchan, 2001). The calculation is represented in the following equation:

$$Ethnic\ Heterogeneity = 1 - \sum_{i=1}^{n} \left[\frac{x_i}{y}\right]^2 ,$$

where x_i represents the population of race/ethnicity group i of the area, y represents the total population of the area, and n represents the number of race/ethnicity groups considered in the area.[2]

RQ3: Spatially-Adjusted Probability of Choice. For research question 3, the outcome was the calculated 'probabilities' for an individual child from a particular neighborhood to choose a particular school based on the distance between home and school in addition to the proximity of other schools in the local educational market (Huff, 1963). The probabilities for all students selecting each school was averaged, representing the level of "pull" of that school (a low average probability represents a high level of pull). Similarly, the probabilities for all students selecting out of each neighborhood will be averaged, representing the level "push" of that neighborhood (a low average probability represents a high level of push) (Taylor, 2002). The probabilities were calculated as follows:

$$P_{ij} = \frac{D_j}{\sum_{j=1}^{n} D_j} \ ,$$

where P_{ij} represents the probability that student i will choose school j, D_j represents the distance to school j for child i, and the denominator of the fraction represents the sum of the distances to all other schools (n) not chosen by child i. Thus, the probability of choosing a particular school is based on the distance from the child's home relative to the distances to all possible alternatives.

Covariates.

[2] This metric is often referred to as the diversity index, and the terms diversity and ethnic heterogeneity are used interchangeably in this study.

Individual Measures. Models included indicators of the family's race, operationalized using four dummy indicators: White, Black, Hispanic, and Asian, with the White subsample serving as the omitted reference group.

School Measures. For the school chosen first by each family, I included a measure of driving distance, in miles, that was calculated using ESRI's Network Analyst tool in ArcMap. This measured the driving distance using an updated network of city streets and traffic patterns, as measured from the centroid of the family's geocode of residence to the exact location of the school. Although this measure of driving distance captures some level of real-world driving time in Boston, it fails to account for public transportation travel using Boston's extensity transit network. School demographic measures are calculated from publicly available enrollment rates provided by Boston Public Schools for the 2011-2012 school year. In addition to the aforementioned measure of ethnic heterogeneity (M=0.561, SD = 0.140), indicators of proportion White (M = 0.145, SD = 0.145), proportion Black (0.303, SD = 0.188), proportion Hispanic (M = 0.469, SD = 0.195), and proportion Asian (M = 0.057, SD = 0.088) are calculated.[3] These measures are then used to create a family-specific measure of the proportion of students at the school that are the same race. The proportion of students receiving a free or reduced-price lunch subsidy is also included (M=0.645, SD = 0.147). All proportion variables were standardized to have a mean of zero and a standard deviation of one prior to being used in statistical models.

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[3] As Figure 1 shows, schools that are less diverse tended to be predominantly Hispanic, whereas schools with higher values of ethnic heterogeneity tended to have higher proportions White, Black, and Asian. Thus, families who appear to prefer schools with higher levels of diversity may actually be acting on preference for schools with lower proportions Hispanic and/or higher proportions White, Black, or Asian. This underscores the importance of estimating models with the ethnic heterogeneity measure as well as separate models with specific race proportions.

Numerous indicators of school quality were included in this study, encompassing not only academic dimensions but also aspects of school safety and order. I included the attendance rate of the school (ranging from 90.2 to 98.7) for the 2010-2011 academic year, as well as a measure called "Good Order" that is based on a BPS-released report of the number of incidents against "good order" that occurred at each school over the 2010-2011 and 2011-2012 school years. This measure is a count of the violations including threats, disorderly conduct, disturbing school assemblies, and indecent exposure over this two-year period. Academic achievement was operationalized using English language arts and math results from the Massachusetts Comprehensive Assessment System (MCAS) for the 2010-2011 school year[4]. Specifically, I used the school's average Composite Performance Index (CPI), which is a measure of the school's aggregate level of proficiency for math (M = 69.181, SD = 10.002) and English language arts (M = 71.688, SD = 9.456). A CPI of 100 means that all students are proficient or advanced on this portion of the MCAS assessment. These CPI scores were standardized to have a mean of zero and a standard deviation of one prior to estimating all statistical models.

Neighborhood Measures. Using data from the 2011 5-year estimates of the American Community Survey, I included measures of neighborhood race and class composition at the census tract level. Proportion White, proportion Black, proportion Hispanic, and proportion Asian were used to generate measures of ethnic heterogeneity as well as proportion same race. In addition I captured neighborhood socioeconomic status using the neighborhood poverty rate as well as a measure of concentrated advantage that has been utilized in several prior studies on neighborhood socioeconomic

[4] Third grade is the first grade that students take these tests, with the exam repeating every year after that. Thus, the results represent the pooled results for all grades beyond third grade.

conditions as related to educational outcomes (Boyle et al., 2007; Duncan and Aber, 1997; Dupéré et al., 2010; Halpern-Felsher et al., 1997). This measure is a regression-weighted, standardized composite that includes the percentage of families with incomes higher than $75,000, the percentage of adults with a four-year college degree, and the percentage of the civilian labor force who were employed in professional or managerial occupations.

Analytic Strategy

Data were analyzed using a combination of traditional multilevel modeling methods, discrete choice modeling, and geo-spatial analytic techniques. These methods accounted for the fact that families were clustered in neighborhood contexts, which means their choice processes needed to be modeled in a way that accounts for variation due to their shared spatial location. Each research question had a distinct modeling strategy, discussed below, in turn.

RQ1: Are the racial characteristics of families, schools, and neighborhoods associated with Boston families' school choices for their pre-K and kindergarten-aged children, accounting for school quality, safety, and distance from home?

For RQ1, I used a conditional logit model to estimate the association between school attributes and choice. Originating in studies of transportation mode choice patterns (McFadden, 1973), this approach was used in studies estimating the factors predicting choice of college (Long, 2004) and neighborhood (Bruch and Mare, 2006). However, this analytic approach has yet to be applied to the study of school choice in a K-12 context. In a conditional logit (also known as a fixed effect logit model), the estimation is based on the measured attributes of the alternatives available to the choosers, with the choosers essentially serving as their own controls. The benefit of this approach is that it isolates the associations among the dependent variable (choice) and the measured information about the schools that are available to families. All information about the choosers, both observed and unobserved, are accounted for. A conditional choice model is similar to a multinomial logic model except the covariates are alternative-specific, rather than individual-specific.

The conditional logit model rests on two key assumptions. First, the dependent variable of choice must be recorded for each of the potential choices that an individual can make, which is the case in the present study in the sense there are as many instances of the dependent variable as there are options in each family's choice set. For example, a family that has twenty schools in its choice set appears in the data twenty times with the dependent variable of choice being a "1" for the school that was chosen first, and a "0" for the other nineteen schools. The conditional choice model, thus, controls for all of the attributes of the chooser (both observed and unobserved), as these variables do not vary across the schools in the choice set. Second, the information on the alternative schools is assumed to vary, as is the case here with the rich set of measured school attributes.

A conditional logit model estimates the differences in probability of selection as a function of differences in the attributes of the alternatives. In an example with one attribute x that varies across the choice set [S] of available schools the conditional model can be expressed as follows:

$$\Pr\left(y_i = s \middle| x_i^{[1]}, \ldots, x_i^{[S]}\right) = \frac{\exp\,(\beta x_i^{[s]})}{\sum_{c=1}^{S} \exp\,(\beta x_i^{[c]})},$$

with the coefficient βx_i representing the difference in log odds of a school being selected corresponding to a one-unit difference in x for all schools. Exponentiating this coefficient converts it to log odds format, which can be interpreted as the ratio of odds of choosing a school versus any alternative per one unit difference in x, holding all other attributes constant (Rabe-Hesketh and Skrondal, 2012).

Preference Variation. Although characteristics of the chooser cannot be included independently in the estimation, inter-individual differences were incorporated in the model. First, I integrated measures such as driving distance and proportion same race that varied for each combinations of school and family. Furthermore, interaction terms were generated between the school-level attributes and family-level variables that explicitly test for differences in the salience of particular school characteristics across race and class. This strategy for ascertaining "preference variation" based on family characteristics such as race and aspects of the families' neighborhoods was of particular interest in this study.

I estimated a series of conditional choice models. In Model 1A, I only included the ethnic heterogeneity of the school. Model 1B incorporated the proportion same race and in Model 1C I included measures of school quality (attendance rate, incidents of crime against good order, and the MCAS CPI for math and English language arts as well as the proportion of students receiving free or reduced-price lunch subsidies). In Model 1D, I tested for preference variation by including interactions between each of the school variables from Model 1C with dummy race indicators (Black, Hispanic, and Asian, treating Whites as the omitted referent).

Finally, a series of alternative models were estimated to consider race-specific patterns in preferences for school demographics. First, I estimated Model 1C described above separately for each race group (White, Black, Hispanic, and Asian). Second, I replaced the measures of school ethnic heterogeneity with specific race proportions—proportion White, Black, Hispanic, and Asian. Third, I replicate the preference variation models but replace ethnic heterogeneity and proportion same race with specific race proportions and then allow the coefficients for these proportions to vary across specific race groups. The results of these three sets of alternative models are presented in Appendix A.

RQ2a: Is the ethnic heterogeneity of a child's neighborhood associated with the probability that the child's family will choose a walk-zone school as its first choice in the BPS open enrollment process, and does this association differ for children of different races?

Whereas RQ1 focuses on school and individual characteristics as predictors and moderators of choice behavior, RQ2a examines the extent to which the demographics of the local neighborhood are associated with the probability of choosing a local school option or not. To address this issue I used a multi-level logistic regression that accounts for shared variance among families from the same neighborhood. A model of this type allows for the estimation of parameter estimates for individual-level as well as neighborhood-level covariates that may be associated with the probability of selecting a local school. The hypothesized population model for the outcome of opting into a walk zone school for student *i* in neighborhood *j* is as follows:

$$logit\{\Pr(IN_{ij} = 1|\boldsymbol{X}_{ij}, \zeta_j)\} = \beta_1 + \beta_2 x_{2j} + \beta_3 x_{3ij} + \beta_4 x_{2j} x_{3ij} + \zeta_j$$

where β_2 represents a coefficient for a neighborhood-level predictor such as ethnic heterogeneity, β_3 represents a coefficient for an individual-level predictor such as race, β_4 represents the coefficient for the cross-level interaction between neighborhood ethnic heterogeneity and individual race. The neighborhood random intercept, ζ_j, represents the combined effect of omitted neighborhood variables that may cause some families to not choose local schools (Rabe-Hesketh and Skrondal, 2012). The coefficient corresponding to the interaction between the ethnic heterogeneity of the child's neighborhood and the dummy indicators of the child's race (β_4) will be the primary coefficient of interest.

I estimated a series of models for RQ2a. In Model 2A, I included just the ethnic heterogeneity of neighborhood. In Model 2B, I added proportion of students of the same race in the neighborhood, and in Model 2C, I added neighborhood concentrated advantage. Model 2D then included interactions with dummy race indicators for Black, Hispanic, and Asian, treating Whites as the omitted reference group.

RQ2b: How does the ethnic heterogeneity of families' first-choice schools compare to their residential neighborhoods, and does this difference vary across racial groups and between those who choose walk zone vs. non-walk zone schools?

For RQ2b I used a two-step analytic process to look at race-based differences in neighborhood ethnic heterogeneity and that of the chosen schools. First, I conducted a two-way factorial ANOVA to test the null hypothesis that the mean difference between the ethnic heterogeneity of the school and that of the neighborhood (hereafter called the heterogeneity gap) is the same across all race groups and also between those who choose walk-zone schools or not. Second, I used the Tukey honestly significant difference (HSD) test to conduct multiple pairwise t-comparison tests to establish which groups' mean differences are statistically significantly different from the others. This test is a more conservative method for conducting multiple pairwise comparisons and does not require a Bonferonni standard error correction to prevent potential "false positives" (Hsu, 1996).

RQ3: For families choosing non-local schools, does the ethnic composition of the neighborhood serve as a "push" factor associated with families opting out of local schools, or is it that the characteristics of the chosen school (racial or otherwise) serve as "pull" factors that lure in families from other parts of the city?

For RQ3 I used a spatial statistical technique commonly referred as a gravity model (Huff, 1963; Taylor, 2007). This model involved the calculation of the probability that an individual child will choose a particular school based on the distance between home and school in addition to the proximity of other competitor schools in the local educational market. The probability represents the inverse of the "spatial effort" that parents have exert by selecting a schools that further away, relative to other alternatives available to the family (Taylor, 2002). Schools that had students choosing them despite low probability estimates suggests that the schools were very attractive, as the families are exerting more effort to get into these schools rather than the others. In other words, these schools had high "pull" factors. Looking at it from a different perspective, neighborhoods with children who were exerting similarly high levels of effort to travel to non-walk zone schools may be seen as having high "push" factors. Once these probabilities were calculated, standard regression techniques were implemented to test whether ethnic heterogeneity is associated with a neighborhood's "push" as well as a school's "pull" while controlling for other characteristics.

Neighborhood Push. For estimates of a neighborhood's "push" one regression model was estimated that used various neighborhood-level covariates, including the ethnic heterogeneity of the neighborhood as well as proportion White, proportion Black, proportion Hispanic, proportion Asian, concentrated advantage and poverty rate.

School Pull. For estimates of a school's "pull" I estimated two regression models. Model 3A included measures of school quality (attendance rate, incidents of crime against good order, and the MCAS CPI for math and English language arts) and Model 3B included measures of the school's race and class composition (ethnic heterogeneity, proportion White, proportion Black, proportion Hispanic, proportion Asian, and the proportion of students receiving free or reduced-price lunch).

4. Results

I conducted numerous distinct sets of analyses to answer my research questions. Prior to estimating models, I performed univariate analysis on the sample of families who participated in the school choice process, the schools that were available to them, and the neighborhoods where they resided. Bivariate analyses also were conducted to ascertain associations across school characteristics.

I then conducted several conditional logit models to examine the relative salience of school characteristics in relation to the probability of families choosing a school as their first choice for pre-k or kindergarten. This analysis included the estimating of interaction models based on the racial background of the choosing families to see if there were statistically significant variations in preferences across race groups.

The school-based analysis was followed by two sets of analyses that focused on the salience of neighborhood characteristics in shaping families' choices. The first was a taxonomy of random intercept logistic regression models estimating the associations among the selection of a local school as a first choice and the demographic characteristics of the local community. I then estimated analyses of variance (ANOVA) models with post-hoc Tukey HSD tests to see whether families of different races are more or less likely to select schools that are less ethnically heterogeneous than their neighborhoods.

Finally, I estimated a spatial gravity model to calculate a neighborhood-by-school matrix of probabilities for selecting each available school over all other more proximal alternatives. These probabilities were then outcomes in separate OLS regression models that estimated the factors associated with schools' attractiveness (or "pull") as well as the factors that drive families to opt out of neighborhood schools (referred hereafter as the neighborhood's "push" factor).

In the sections below I summarize the results of the univariate and bivariate descriptive analyses, which is then followed by the presentation of the analytic results, organized by research question.

Descriptive Analyses

Family Sample.[5] The mean values for the demographic characteristics of the sample of choosers, disaggregated by grade level and choice participation is presented in Table 1. Like the rest of the Boston Public Schools enrollment, the sample of incoming pre-k and kindergarten families was majority-minority, with Hispanics representing the largest proportion for pre-k (0.449) and kindergarten (0.375). The pre-k sample was slightly more White and less Hispanic than the kindergarten sample. In addition, the kindergarten sample had a higher proportion of students receiving free and reduced-price lunch subsidies (0.782 compared to 0.731) and more students whose first language is something other than English, compared with the pre-k sample (0.587 compared to 0.523). However, there were more pre-k students who were designated as having limited English proficiency (0.404 for pre-k compared to 0.41 for kindergarten).

The kindergarten sample was much larger than the pre-k sample (11,059 compared 7,004), but the rate of participation was much lower for the kindergarten

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[5] The data provided by Boston Public Schools is at the student level, with each observation representing a child in the school choice and assignment system. Nonetheless, I refer to the choosing agents as the "family" of the students based on the assumption that a primary caregiver or family unit is making the choice for the child, who is likely between 4 and 6 years old. The data do not allow for the identification of multiple children who belong to the same family.

families. Almost half of the kindergarten families made no choices. Although the amount of non-choosing was high among both samples, almost 100% of non-choosers ended up being assigned to a school based on the District's "Final Pass" priority rule. This designation means that they were assigned to the school because they were already enrolled there and did not need to make a choice in order to guarantee a spot. Furthermore, t-tests revealed that there were no statistically significant differences between the choosers and non-choosers on any of these characteristics for either sample. Because nearly all non-choosers refrained from participating because they already had seats in schools, these individuals were omitted from all subsequent analysis.

School Sample. The sample of schools available to the families is summarized in Table 2. The families had 76 schools available for kindergarten, with 65 of these institutions also having capacity for pre-k students. The average enrollment for these schools was 391 students, with fewer seats generally available for pre-k students (approximately 34 seats at each pre-k accepting school) than for kindergarteners (approximately 55.5 kindergarten seats per school).

The mean ethnic heterogeneity index across the schools was 0.561 (*SD* = 0.140), which can be interpreted as there being a 56% chance of randomly selecting two students from a school and having them be of different racial or ethnic backgrounds. The demographic composition of the schools followed a similar pattern to that of the sample of choosers, with Hispanic students representing the highest proportion of the enrolled students (0.469), followed by Black students (0.303), White students (0.145), and finally students of Asian descent (0.057). More than two-thirds of the students received free lunch subsidies on average in these schools (*M*=0.645, *SD* = 0.147).

The average attendance rate across the schools was just above 94% for the 2011-2012 school year. On average, schools reported fewer than 8 incidents against "good order" over the course of the 2010-2011 and 2012-2013 school years (*M* = 7.89, *SD*= 10.532). Finally, the composite performance index (CPI) on the MCAS math exam was 69.181 (*SD* = 10.532), meaning approximately 69% of all students in 3rd grade or beyond were proficient or advanced on this portion of the MCAS assessment. The rate was slightly higher for the ELA portion of the exam, with an average CPI of 71.688 (*SD* = 9.456).

Bivariate associations were estimated for these school characteristics in order to detect potential multicollinearity across measures (see Table 3). Unsurprisingly, most of the respective racial proportion measures were negatively correlated with each other, suggesting that as one racial group was more represented in a school, each of the other racial groups was less represented. Ethnic heterogeneity had a strong negative correlation with proportion Hispanic (r = -0.742), suggesting that schools that were less diverse tended to be predominantly Hispanic, whereas more diverse schools had higher proportions White (r = 0.410), Black (r = 0.214), and Asian (r = 0.398). This pattern is supported by a visual inspection of Figure 2. Racial proportions, proportion free and reduced-price lunch, and achievement indicators were also correlated, highlighting the importance of multivariate analyses that incorporates both demographic and "quality"-based attributes of schools. For example, an important theoretical and empirical consideration in the present study was disentangling whether school choices that are correlated with race are actually racially motivated or were due to 'race-proxy' process whereby choices were based on school characteristics such as achievement scores that also correlate with racial composition.

Neighborhood Sample.[6] In Table 4, the results of descriptive analysis of the Census tracts where the families reside are presented. The level of ethnic heterogeneity in Boston census tracts is comparable to that which is found in elementary schools, at 0.571 (*SD* = 0.226). However, the demographic similarities between neighborhoods and schools were minimal when looking at race-specific proportions. On average, census tracts in Boston were almost half White (*M* = 0.488, *SD* = 0.310), with Black residents being the second most populous group (*M* = 0.222, *SD* = 0.251) followed by Hispanic (*M* = 0.169, *SD* = 0.150) and then Asian residents (*M* = 0.084, *SD* = 0.097). The concentrated advantage composite measure was standardized, with a mean of zero and standard deviation of 1. Finally, census tracts had an average poverty rate of 0.159 (*SD* = 0.142).

RQ1: *Are the racial characteristics of families and schools associated with Boston families' school choices for their pre-K and kindergarten-aged children, accounting for school quality, safety, and distance from home?*

[6] Because of the notable differences between the demographic composition of Boston schools and their surrounding neighborhoods, an alternative set of analyses were considered in which neighborhood context was operationalized as the local educational market for each residential geocode (specifically, the schools within the one mile walk zone from each residential location). However, due to concerns over spatial collinearity (individuals from adjacent geocodes will have nearly identical measures, as their walk zones are very similar), these analyses were discarded in favor of the more traditional approach of using census derived, tract-level neighborhood measures.

School Attributes and Choice Behavior. See Table 5 for the results of conditional logit models for the pre-k and kindergarten samples.[7] The model estimated how the attributes of a school are associated with the probability that a family might choose that school conditional on the attributes of the alternative schools in their choice set. Results are presented in odds ratio format, which should be interpreted as the proportional change in the odds of a family selecting a school for a unit increase in the variable, holding all other variables constant.

In Model 1A, the ethnic heterogeneity of a school had a positive but non-significant association with the probability of choice for the pre-k sample. However, there was a negative and statistically significant association for the kindergarten sample (OR = 0.948, $p < 0.001$). This finding can be interpreted as a reduction in the odds of choosing a school by a power of 0.948 based on a difference of one standard deviation in ethnic heterogeneity. The limited practical significance of this result should be noted, as the estimated odds ratio is very close to 1, which would be equivalent to zero association in non-ratio terms. These equivocal results, considered alongside the extremely low Pseudo-R^2 value for both the pre-k and kindergarten samples (0.000) suggest that a school's level of ethnic heterogeneity, on its own, explained very little of the variation in families' school choice patterns.

In Model 1B, the standardized version of the schools' proportion same race was added. Results suggest that greater levels of diversity in a school were preferable to

[7] The pseudo-R^2 that is reported with the conditional logit results in Table 6 and Table 7 refers to McFadden's rho-squared statistic, which is a measure of model fit based on comparisons between the estimated model and a baseline model with no predictors. This statistic is interpreted in a similar fashion to traditional OLS-generated R^2 measures in the sense that higher is better, however, the values of McFadden's rho-squared are typically much smaller. Values between 0.2 and 0.4 are generally considered "good fit" (McFadden, 1975).

families, as long as the relative proportion of their own race remained constant. For both the pre-k and kindergarten samples, ethnic heterogeneity had a positive and statistically significant association, with odds ratios of 1.237 ($p < 0.001$) for pre-k and 1.220 ($p < 0.001$) for kindergarten. Furthermore, as expected, the proportion same race at a school had a positive association with the likelihood of choice, controlling for ethnic heterogeneity (OR = 1.814, $p < 0.001$ for pre-k, and OR = 1.969, $p < 0.001$ for kindergarten). This result can be interpreted as the likelihood of a family choosing a school first almost doubling per a standard deviation increase in proportion same race.

In Model 1C, I incorporated the remaining school level measures: driving distance, attendance rate, incidents against good order, standardized math and ELA composite performance indices, and the standardized proportion of students receiving free and reduced-price lunch. Among the pre-k and kindergarten samples, ethnic heterogeneity and proportion same race were positively associated with the probability of families choosing particular schools, controlling for distance and quality. For pre-k, a difference of one standard deviation of ethnic heterogeneity was associated with 1.529 times the likelihood of a family choosing a particular school, when holding proportion same race, proportion free and reduced-price lunch, and indicators of quality and distance. The magnitude of this association remained positive but was smaller for kindergarten families (OR = 1.293, $p < 0.001$). Proportion same race had a similarly positive association across the two samples, while controlling for other demographic covariates and attributes of distance and quality (OR = 1.727, $p < 0.001$ for pre-k and OR = 1.719, $p < 0.001$ for kindergarten).

As expected, driving distance had a negative association with the probability of choice, such that every additional mile decreased the odds of a family choosing a school by less than half. This association was consistently positive and statistically significant among both the pre-k and kindergarten samples (OR = 0.432, $p<0.001$ for pre-k, and OR = 0.479, $p<0.001$ for kindergarten). Attendance and incidents against "good order" both had positive and statistically significant associations with the likelihood of a family choosing a school across both samples with odds ratios of 1.205 ($p<0.001$) for pre-k and 1.095 ($p<0.001$) for kindergarten. Somewhat surprising, however, was the positive coefficient for incidents that was found for both samples (OR=1.032, $p<0.001$, and OR=1.026, $p<0.001$). Also surprising was the slight negative association between math CPI and probability of choosing a school in pre-k, as a one standard deviation unit difference in math CPI was associated with a slightly lower probability of choice, by the power of 0.946 ($p<0.05$). The association was positive for kindergarten, however, but neither coefficient was statistically significant at the 0.05 level. Achievement on the ELA MCAS had a positive association with choice probabilities for both samples, with an odds ratio of 1.214 ($p<0.001$) for pre-k and 1.122 ($p<0.001$) for kindergarten. Finally, as expected, the standardized proportion of students receiving free lunch subsidies had a negative association with the likelihood of choosing a school, with an estimated odds ratio of 0.887 ($p<0.001$) for pre-k and 0.760 ($p<0.001$) for kindergarten.

In sum, the results of Models 1A, 1B, and 1C were consistent across the pre-k and kindergarten samples, and showed that greater levels of ethnic heterogeneity and proportion same race were associated with higher likelihood of choice. Greater driving distances and higher proportions of students with free lunch subsidies were associated with lower likelihood of family choice, whereas higher attendance rates and more incidents against good order were associated with greater likelihood of choice. MCAS achievement in math had a slightly negative association for pre-k and a positive association for kindergarten, whereas ELA achievement was consistently positive among both samples.

Variation in Preferences by Race. Tables 7 and 8 show the results of Model 1D that tested for variation in preferences by race for each of the eight school-level covariates. To isolate the race-based variation for each variable, interactions were estimated separately for each school covariate, while controlling for all other school attributes. Each column in Table 7 and Table 8 represents a different version of the model, showing results for interactions between race dummy indicators and the particular school variable in question. These interaction estimates are presented in bold.

White families served as the reference group, so the coefficient of the odds ratio of the particular covariate in question was the estimated association for just this subgroup. The interaction terms should then be interpreted along with the main effects in a multiplicative manner, showing the proportional difference between the reference group and the Black, Hispanic, and Asian families (Buis, 2009). For example, the coefficient for *Distance* in the third column of Table 7 (OR = 0.314) is interpreted as the negative association between driving distance and the probability of choosing a school for White families only. Comparing this coefficient to the interaction term *Distance * Black* shows us that the coefficient for Black families was 1.701, which means that this subgroup's odds ratio was 1.708 times as large as the White families' odds ratio. These terms are then multiplied together to show the odds ratio for the Black families (0.314 x 1.701 =

0.534). Thus, the odds ratio for the Black subsample was actually 0.534, indicating a negative association for the Black subgroup, but not as strongly negative as that found among the White families. These results along with the estimated interaction models for the other seven school variables are described below, in turn.

Ethnic Heterogeneity. Among both pre-k and kindergarten families, the level of ethnic heterogeneity in a school was found to be an attractive attribute for families. There was a positive association between the probability of choosing a school and the school's ethnic heterogeneity for White families, with the relationship being stronger among pre-k, compared to kindergarten, families (OR = 1.498, p <0.001 for pre-k and 1.138, p <0.001 for kindergarten). In pre-k there were no statistically significant differences between the White subsample and the Black and Hispanic groups, suggesting a similarly positive association among these subsamples. However, for the Asian pre-k families, ethnic heterogeneity was an even more attractive school attribute than it was for Whites, based on the positive and statistically significant interaction term (OR = 1.507, p <0.001). Among the kindergarten sample, Black families had a stronger positive association between ethnic heterogeneity and choice probability compared to White families (OR = 1.401, p <0.001), and the Asian subsample had a very large interaction term, suggesting a stronger positive association for this group compared to the White reference group (OR = 1.951, p <0.001). In sum, all racial groups were found to have a positive association between ethnic heterogeneity and probability of choice, controlling for proportion same race and multiple indicators of school quality. This association was strongest for Asian families in both kindergarten and pre-k, but Black families in kindergarten were also found to have stronger associations compared to Whites. Hispanic families had associations that were no different than the White reference group.

Proportion Same Race. The proportion same race had the largest coefficient among all school measures for the White families (OR = 2.031, p <0.001 for pre-k and OR = 2.364, p <0.001 for kindergarten), suggesting higher levels of White students was a very attractive attribute of schools for White families. The interaction term for Asian families was non-significant in both models, suggesting these families and White families have similar associations between proportion same race and probability of school choice. However, the interaction term for Black families was negative (less than 1) and significant in both grades, suggesting a weaker positive association for these families in pre-k (calculated by multiplying the main effect of prop. same race, 2.031, equaling 1.021). However, for Black kindergarten families the association was slightly negative (calculated as 2.364 x 0.386, equaling 0.912). A negative interaction was found for the Hispanic families of kindergartners, but in this case the product of the main effect and interaction term resulted in a slightly positive association for these families (calculated as 2.364 x 0.756, equaling 1.287). In sum, proportion same race had a strong positive association for the White and Asian families in the sample, but for Black and Hispanic families the association was substantially less positive, and even negative in the case of Black families of kindergartners. Figure 2 provides a visual representation of this relationship, with the predicted probabilities for White and Asian families have a much stronger positive association compared to Black and Hispanic families.

Distance. As expected, there was a negative association between the driving distance to a school and the probability of choice, across all race groups in both the pre-k and kindergarten samples. White families of pre-k children had a negative association with driving distance (OR = 0.314, $p<0.001$), as did the Black, Hispanic, and Asian subsamples. However, distance had the strongest negative association for White families, as the interaction coefficients for Black (OR = 1.701, $p<0.001$), Hispanic (OR = 1.420, $p<0.001$), and Asian families (OR = 1.240, $p<0.05$) confirm. The first column of Table 8 shows that this pattern of associations was the same for kindergarten families, with all groups having a negative association with distance, but with the strongest relationship occurring for the White subsample. Thus, whereas all groups prefer schools to be closer to home, minority families were placing less of a penalty on this factor, when controlling for other attributes of school quality and demographic composition.

Attendance. Among the pre-k sample (see Table 7), White families had a positive association between a school's attendance rate and the probability of choice, suggesting higher attendance was an attractive attribute for these families (OR = 1.245, $p<0.001$). There were no statistically significant interactions for the Black and Asian families, indicating similar associations among these subgroups, but the Hispanic families had a negative interaction term, which suggests less positive association among this subgroup (calculated as 1.245 x 0.928 equaling 1.116). Thus, attendance was an attractive attribute for all pre-k families. This positive association was not present among kindergarten families, as there was a negative association between attendance and choice probability for White families (OR = 0.935, $p<0.01$). However, the other three race groups all had statistically significant interaction terms that suggest positive associations for these respective subgroups. For example, the interaction coefficient for Black * Attendance was 2.113 ($p<0.001$), which translates to an odds ratio of 1.975 when multiplied by the coefficient for the White families. A similar pattern is found for the Hispanic and Asian families compared to White families. Thus, in kindergarten, racial minorities preferred schools with higher attendance rates more so than White families, on average.

Disciplinary Incidents. Among both samples, the number of incidents against good order and the probability of choosing a school, when controlling for other aspects of school composition and quality. For both the pre-k and kindergarten samples, White families had a slightly positive association between choice probability and the number incidents against good order (OR = 1.034, $p<0.001$ for pre-k and OR = 1.053, $p<0.001$ for kindergarten). This positive association was also present among Asian families, who had no significant differences from the White families, as well as the Hispanic subsample, who had a positive association as well, but of a lesser magnitude than White families. For Black families, there was a similarly positive association in pre-k (no differences from the White reference group), but among the kindergarten sample Black families had a negative interaction term, suggesting a weaker positive association for this subgroup as compared to White families.

MCAS Achievement, Math. In the pre-k sample, White and Black families had a negative association between the probability of choosing a school and the average MCAS math achievement level (OR = 0.829, $p<0.001$, for White families, with a non-significant interaction term for the Black subsample). In contrast, for Hispanic and Asian families, the association was slightly positive, as the product of interaction terms indicate (calculated as 0.829 x 1.223, equaling 1.014 for Hispanic families, and 0.829 x 1.405, equaling 1.165 for Asian families). In the kindergarten sample, however, the White families had a slightly positive association with math achievement, but it failed to reach statistical significance. Thus, among the kindergarten subsample, families of all race groups appear to be choosing schools for reasons other than math achievement.

MCAS Achievement, ELA. In contrast to the equivocal results for math achievement, ELA achievement had a consistently positive association among all race groups in both grade levels. For both the pre-k and kindergarten samples, White families had a positive association between choice probability and schools' average ELA achievement on the MCAS (OR = 1.368, p <0.001 for pre-k and (OR = 1.300, p <0.001 for kindergarten). Furthermore, in both grades there were statistically significant differences between the reference group and the Black and Hispanic subsamples, such that subgroups both had positive associations as well, but of a lesser magnitude than White families. No statistically significant differences were found between the Asian and White families.

Proportion Free and Reduced-Price Lunch. All families across both pre-k and kindergarten subsamples had negative associations with the standardized proportion of students receiving free or reduced-price lunch, although among some pre-k families the relation lacked statistical significance. Asian families were the only pre-k subgroup that had a negative and statistically significant negative interaction term (OR = 0.768, p<0.001), indicating these families, more than the other racial groups, were dissuaded by schools with elevated levels of students on free or reduced price lunch subsidies. Among the kindergarten sample, families of all races had a negative association with the standardized proportion of students receiving free or reduced-price lunch. Furthermore, Black families and Asian families had negative and significant interaction terms, suggesting these families were more dissuaded than White families when considering the proportion of students receiving free or reduced-price lunch.

In conclusion, the results of the preference variation models in Table 6 and Table 7 reveal several ways in which families' choices were associated with a variety of school factors. Some school attributes were consistently attractive to families, such as ethnic heterogeneity, the number of incidents against good order, and the average level of ELA achievement. There were also consistently negative associations for driving distance and the proportion of students receiving free and reduced lunch subsidies among all four race groups. There were inconsistent associations for attendance and match achievement, such that White kindergarten families actually placed a minor penalty on these seemingly positive school attributes, whereas the other race groups had positive associations.

As the present study is primarily concerned with the salience of demographic attributes, it is important to note that schools' racial characteristics continue to matter for all groups even after accounting for a variety of other school characteristics. Although families of all races preferred diverse schools, controlling for other factors, this attribute had a stronger positive relationship among Black and Asian families, compared to White and Hispanic families. Furthermore, proportion same race was also a mostly positive attribute for all families, particularly among the White and Asian subgroups. The one exception to this was among Black kindergarten families, who had a negative association between proportion same race and the probability of choosing a school, controlling for various factors of overall diversity, distance, and quality.[8]

RQ2a: *Is the ethnic heterogeneity of a child's neighborhood associated with the probability that the child's family will choose a walk-zone school as its first choice in the BPS open enrollment process, and does this association differ for children of different races?*

See Table 8 for the results of a series of multilevel logistic models for the pre-k and kindergarten samples, showing the probability of families choosing a school from their walk zone as their first choice. All results are presented as odds ratios, which should be interpreted as the proportional change in the odds of a family selecting a walk zone school for one unit increase in the variable, holding all other variables constant.

In Model 2A, the ethnic heterogeneity of a family's residential neighborhood, in standard deviation units, was negatively associated with the probability of choosing a walk zone school, which was the case for both pre-k (OR = 0.759, p<0.001) and kindergarten (OR = 0.729, p<0.001) families. The negative association between neighborhood ethnic heterogeneity remained even after controlling for the proportion same race in the neighborhood in Model 2B. In this model the standardized measure of

[8] Results of alternative models that include race proportions rather than the measure of ethnic heterogeneity were also estimated and are presented in Appendix A. These results support the general finding that proportion same race was a strong predictor of school choice. The results also revealed that White and Asian families preferred schools with lower proportions Black, suggesting that the positive associations found for ethnic heterogeneity may actually be driven by families demonstrating preferences for school with higher proportions of White and Asian students and lower proportions of Black and Hispanic.

neighborhood's proportion same race was positively associated with the probability of selecting a walk zone school, both for the pre-k sample (OR = 1.274, $p<0.001$) and the kindergarten sample (OR = 1.278, $p<0.001$).

In Model 2C, after controlling the neighborhood's level concentrated advantage, neighborhood ethnic heterogeneity had no association with the choice of a walk zone school among both pre-k and kindergarten families. However, the proportion same race had a positive association among both pre-k and kindergarten samples (OR = 1.282, $p<0.001$ for pre-k and OR = 1.301, $p<0.001$ for kindergarten). Concentrated advantage was only associated with choosing a local school for the kindergarten sample, with a positive odds ratio of 1.365 ($p<0.001$). Thus, on average, families were more likely to select a school within their walk zone when their residential neighborhoods had higher levels of same-race residents and higher levels of concentrated advantage. Ethnic heterogeneity no longer had an association, positive or negative, when controlling for these demographic characteristics.

Model 2D included race dummy indicators (Black, Hispanic, and Asian, with White as the omitted referent) and race-based interaction terms for each of these three neighborhood demographic measures. Among the pre-k and kindergarten samples, neighborhood ethnic heterogeneity was not associated with choosing a local school, both among the White reference group and the three other race subgroups. The proportion same race also had a non-significant association with the probability of choosing a walk zone school, across all of the race groups for both grade levels. Whereas both measures of racial composition had no association with the probability of opting for a local school, neighborhood concentrated advantage had a consistently positive association among the

White families in both grade levels (OR = 1.30, $p<0.05$ for pre-k and OR = 1.964, $p<0.001$ for kindergarten). This positive association was also found for Hispanic and Asian families of pre-k children, as there were no statistically significant interactions between these groups and the White pre-k subsample. Hispanic families of kindergartners had a significant negative interaction (OR = 0.544, $p<0.001$), indicating a weaker positive relationship than that of the White reference group. The interaction term for the Black subsample was significant and negative for both age groups, suggesting a negative association for the Black pre-k families (calculated as 1.466 x 0.537, equaling 0.787) and a weak but positive association for the Black kindergarten parents (calculated as 2.726 x 0.392, equaling 1.069). Finally, the statistically significant main effects of the race dummy variables suggests that non-White families were less likely to choose a walk zone school when they lived in neighborhoods that had the mean level of ethnic heterogeneity, proportion same race, and concentrated advantage (OR = 0.472, $p<0.001$ for Blacks; OR = 0.472, $p<0.001$ for Hispanics; and OR = 0.679, $p<0.001$ for Asians).

To summarize, the results of Models 2A-2D suggest that neighborhood racial characteristics had some bearing on whether families chose a walk zone school as their first choice, such that higher proportions same race and lower levels of ethnic heterogeneity encouraged families to opt for a local school. However, once accounting for neighborhood SES, as measured by the level of concentrated advantage, these race-based effects largely disappeared. Model 1D suggests that a neighborhood's class composition was more salient than race, particularly for White, Hispanic, and Asian families. Finally, the inconsistent results for Black families suggest that residing in a neighborhood with higher levels of socioeconomic advantage may not translate into a desire to stay local, and may even lead some families to choose more distant schools for their children, as was found for the pre-k subgroup.

RQ2b: How does the ethnic heterogeneity of families' first-choice schools compare to their residential neighborhoods, and does this difference vary across racial groups and between those who choose walk zone vs. non-walk zone schools?

In Table 9, I present the results of two-way factorial ANOVA models, testing the null hypothesis that the mean heterogeneity gap[9] was the same across the four main race groups and also across those who chose walk zone schools or not. The heterogeneity gap was calculated for each family, with values ranging from -0.690 to 0.719 (M=0.087, SD = 0.263) for pre-k families and between -0.657 and 0.737 (M = 0.128, SD = 0.276) for kindergarten families. Among the pre-k sample, there was a statistically significant difference in the heterogeneity gap across the race groups (F = 436.65, p<0.001) and also between those who chose a walk zone school and those who did not (F = 4.79, p<0.05). The interaction term was only marginally significant, suggesting minimal evidence that race-based differences may be functioning differently between walk zone and non-walk zone choosers. For the kindergarten sample, there was a statistically significant difference across race groups (F = 273.64, p<0.001), and there were also statistically significant differences in the heterogeneity gap for walk zone compared to non-walk zone choosers (F = 11.300, p<0.01). The interaction terms were also statistically significant (F

[9] This gap score was calculated as the difference between the ethnic heterogeneity of the families' residential neighborhood and that of their first choice school. Negative values indicate the school was more heterogeneous, whereas positive values indicate the neighborhood was more heterogeneous.

= 13.03, $p<0.001$). These results suggest there are systematic differences between the demographics of families' residential neighborhoods and their chosen schools, and that this heterogeneity gap may vary as a function of the families' racial background. However, more analysis was needed to discern which racial groups had larger or smaller heterogeneity gaps relative to each other.

The ANOVA estimation was followed by the Tukey honestly significant difference (HSD) test to establish which groups' mean differences were statistically significantly different from the others. In Tables 10 and 11, I show that all race groups had statistically significant differences in the heterogeneity gap measure when compared to each other in a pairwise fashion, and this pattern was consistent among those who chose a school in the walk zone and those who chose a school outside of their walk zone. Across both grade levels, White families had the largest negative heterogeneity gap, suggesting that the schools they chose were substantially more diverse than their residential neighborhoods. Asian families had the next lowest heterogeneity gap, with both pre-K and kindergarten subgroups choosing schools that were nearly equal in the level of diversity, relative to their residential neighborhoods. Black and Hispanic families had positive mean of the heterogeneity gap, with Hispanic families having the highest gap score of the four subgroups, meaning the schools they chose were substantially less diverse than the neighborhoods where they lived, on average. All of these gaps were statistically significant based on the Tukey HSD test, confirming the findings from the ANOVA models that there were systematic racial differences in the distribution of the heterogeneity gap scores.

The pattern of differences in gap scores was consistent across grade level and among those who chose walk zone schools and those who did not. However, it is important to note that among all race groups, the heterogeneity gaps were generally much smaller in absolute value that the average scores for walk-zone choosers. This pattern suggests that those who opt for non-local schools may be selecting options that more closely reflect the demographic profile of their residential neighborhoods.

RQ3: Does the ethnic composition of the neighborhood serve as a "push" factor associated with families opting out of local schools, or is it that the characteristics of the chosen school (racial or otherwise) serve as "pull" factors that lure in families from other parts of the city?

Prior to estimating multivariate models of the factors predicting a school's pull as well as a neighborhood's push, spatially weighted probabilities were estimated using the gravity model tool in ArcMap. This probability represents the likelihood that a family would choose a particular school based on the distance between home and school, relative to the proximity of other competitor schools. The probability represents the inverse of the "spatial effort" that parents exert in order to bypass alternative schools that are closer than their chosen option (Taylor, 2007).[10] These probabilities ranged from 0.017 to 0.890, with a mean of 0.215 (*SD* = 0.153). Neighborhoods with low probability are those in which people exert spatial effort to leave. These were neighborhoods where

[10] For example, a family who selected a school that is three miles away, even though there are three other schools that are closer, demonstrated more willingness to travel to a distant school, compared to a family that choose a school that is three miles away when there are no closer alternatives.

families were choosing schools despite lower probabilities, which means they were exerting similarly high levels of effort to travel to more distant schools, and thus they would be seen as having high "push" factors. Negative coefficient means the variable encourages push. For the neighborhoods, the probabilities ranged from 0.023 to 0.586 with a mean of 0.203 (*SD* = 0.122).

In Table 12, the results of OLS regressions that estimated the association between a neighborhood's push and the demographic characteristics of the community are presented. For the pre-k and kindergarten samples, a neighborhood's ethnic heterogeneity was negatively associated with the average probability score for its residents (est. = -0.333, $p<0.01$ for pre-k and est. = -0.237, $p<0.05$ for kindergarten). This finding should be interpreted as neighborhoods with greater levels of ethnic heterogeneity had residents who were more prone to bypass closer school options in favor of more distant alternatives.[11] On the contrary, concentrated advantage had a positive association with the probability measure (est. = 0.040, $p<0.05$), suggesting elevated neighborhood socioeconomic status discouraged "push" away from the local schools.

In Table 13, the results of OLS regressions that estimated the relationship between a school's pull and indicators of its safety, achievement and demographic composition are presented. Model 3A included the quality-oriented measures (attendance, incidents against good order, math achievement, and ELA achievement), and results show that when modeling based on the choices of pre-k families, none of these

[11]Neighborhoods with children who are exerting high levels of effort to travel to more distant schools may be seen as having high "push" factors. Neighborhoods with low probability are those in which people exert spatial effort to leave. Negative coefficient means the variable encourages push.

attributes were associated with the school's average level of probability. However, when modeling based on the spatial probabilities of kindergarten families' choices, attendance had a negative association with the average probability (est. = -0.026, $p<0.01$) and ELA achievement had a positive association with the probability measure (est. = 0.090, $p<0.001$). That is, schools with higher attendance rates and *lower* levels of ELA achievement were more likely to have families choose them over closer alternatives.[12] In Model 3B I incorporated demographic measures for the schools. For pre-k families, there were no statistically significant relationships, suggesting that none of these school measures were associated with the level of spatial effort that pre-k families were exerting when they chose a school. For kindergarten, however, the results reflected those found in Model 3A, such that the coefficient for attendance was negative and significant (est. = -0.037, $p<0.01$) and ELA CPI was positive and significant (est. = 0.073, $p<0.01$). None of the demographic characteristics had statistically significant associations, suggesting a school's demographic characteristics were not associated with families' willingness to bypass local schools in favor of options further away.

To summarize, families who were choosing schools that were further away than the closest options were doing so for a variety of reasons. Models estimating the association between spatially-weighted probabilities and neighborhood characteristics indicated neighborhood ethnic heterogeneity to be a "push" factor that encouraged families to look at more distant alternatives, whereas neighborhood concentrated advantage had the opposite relationship with opting for distant schools. School

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[12] Schools that have students choosing them despite low probability estimates suggests that the schools are very attractive, as the families are exerting more effort to get into these schools rather than closer alternatives. In other words, these schools have high "pull" factors. Thus, a negative coefficient means the variable encourages pull, and a positive coefficient discourages pull.

characteristics may have played a role as well, as schools' attendance rates were a statistically significant "pull" factor that was associated with families being more willing to travel further for their first choice. The counter-intuitive result for ELA achievement among kindergarten families is puzzling, as it appeared higher levels of achievement in this domain were associated with families being less likely to opt for a school if there were closer options. Finally, the demographic characteristics of the schools had no association with the spatially-weighted probabilities of choice, suggesting families might opt for more distant schooling options based on other factors besides the racial composition of a school's student body.

5. Discussion

In light of research showing how school, family, and neighborhood racial characteristics interact to shape families' school decisions, I examined the relative salience of school- and neighborhood-level demographics as they relate to the choice behavior of pre-k and kindergarten families in Boston's intra-district open-enrollment system. Regarding school-level demographics, I found limited support for the commonly promoted logic model that families value schools with high levels of academic achievement that are close to home. Although increased driving distance had a consistently negative association with choice probabilities, math achievement had a negative association for White kindergarten parents and non-significant associations for all other race groups. ELA achievement, on the other hand, had a consistently positive relationship with the probability of choice. The magnitude of the association for ELA achievement was smaller than that found for most demographic indicators, suggesting that race might have an independent influence on families' choices.

Families of all races preferred schools that were ethnically heterogeneous yet also had higher levels of same-race representation, with the exception of Black kindergarten families who preferred schools with lower proportions of students of their own race. These race-based associations endured even after controlling for driving distance, attendance rate, discipline, and academic achievement. Although one might conclude from the positive results related to ethnic heterogeneity that families value diversity and have not hesitation having their children attend school with students of different racial backgrounds, alternative analyses that explicitly separated out the race groups revealed otherwise. In particular, families that appeared to be favoring schools with higher levels of ethnic heterogeneity actually may have been acting upon preferences for schools with higher proportions White and Asian and lower proportions Black and Hispanic.

Race also was a consistent moderator of school choices, with White and Asian displaying similar preferences that were distinct from Black and Hispanic families. Tests of preference variation across race groups suggest White and Asian families have similar choice models that place high value in proportion same race and lower proportions of students receiving free lunch subsidies. Black and Hispanic families had similar preferences regarding most indicators of school quality and racial composition, except in the case of ethnic heterogeneity, about which Black families placed a much stronger preference. When modeled separately, White and Asian families did not display a preference for schools with higher levels of ethnic heterogeneity. Furthermore, White families had a consistently negative association between proportion Black and the probability of choosing a school, whereas Black and Hispanic families had positive associations with elevated proportions of all race groups.

Regarding neighborhood-level demographics, I found minimal support for the racial threat hypothesis, which posits that families who reside in diverse communities would be less likely to opt for similarly diverse schools. Specifically, I found that the probability of selecting a walk zone school had no association with the ethnic heterogeneity and proportion same race of a family's residential neighborhood, once controlling for the socioeconomic stats of the neighborhood (as operationalized by the composite measure of concentrated advantage). However, I also found that White and Asian families tended to choose schools that were more diverse than their residential neighborhoods, whereas Black and Hispanic families chose schools that were less heterogeneous, on average. These patterns were likely a function of White and Asian families living in more segregated neighborhoods than Black and Hispanic families.

Finally, I found that neighborhood ethnic heterogeneity was associated with families being more willing to select distant school options, even when there were other available schools that were closer. Thus, neighborhood-level diversity may represent a "push" factor that encourages families to opt out of local schools. Although this result might be interpreted as a confirmation of the racial threat hypothesis that families are more likely to avoid diverse schools if their neighborhoods are diverse (Goyette et al., 2012), it is important to note that the families were not necessarily avoiding diversity when they were opting out of local schools, as the non-local schools they were choosing were also diverse. In sum, the role of neighborhood diversity was somewhat murky, with no consistent pattern of results across analytic techniques and samples. This inconsistency is possibly due to neighborhood socioeconomic advantage driving the association, with families residing advantaged communities preferring local schools more than families from less advantaged neighborhoods.

Preferences Regarding School Attributes. Conditional choice models were estimated using a variety of school-level attributes—distance, attendance rates, incidents against the good order of the school, math and ELA achievement, and indicators for ethnic heterogeneity, proportion same race, and proportion of students receiving free lunch subsidies. All of these factors were significant predictors of choice, both among pre-k and kindergarten parents, and their associations were mostly in the expected association: negative for distance and proportion free lunch, and positive for attendance rate, achievement, proportion same race, and ethnic heterogeneity. The results were largely consistent with prior empirical work that finds school choice to be a function of a combination of academic, demographic, and logistic factors, with a school's racial composition remaining salient even after accounting for factors such as test scores, discipline rates, attendance, and distance from home (Saporito and Lareau, 1999; Schneider et al., 1998).

There were, however, a few unexpected results. For example, the amount of incidents against good order had a positive association with choice probabilities, which runs counter to the findings from several studies of parents' stated preferences about schools, in which they cite safety and discipline as concerns (e.g., Schneider et al., 2000). One possible explanation is that higher levels of reported incidents may represent a school having a higher degree of disciplinary enforcement, rather than a higher degree of disorder. Furthermore, it should be noted that this particular metric of school discipline is not regularly available to parents. The typical information sheet that BPS provides families mainly focuses on test scores, academic programs, staff profiles, and information about the school's facility. Therefore the finding may be spurious, rather than planful.

Another unexpected result was the universally positive association between ethnic heterogeneity and choice probability, as prior research suggests that some parents may be averse to diverse settings in favor of schools that only have high proportions of students who are the same race (e.g. Bifulco et al., 2009). However, there is some evidence supporting the notion that diversity is an attribute that parents want for their children, especially if there remains some level of representation of same-race students (Kimelberg and Billingham, 2012). In addition, Boston parents may have an affinity for schools that are diverse in the true sense of the word, rather than homogenously composed of one particular racial group, as is the case in many segregated urban schools. Thus, in Boston, opting for a more diverse may mean avoiding schools that are homogenously Black or Hispanic.[13] This distinction is important, as an apparent embracing of diversity may actually be preferences for racial sorting among Boston families, particularly White and Asians.

A third unexpected result was the generally small coefficients for math and ELA achievement, relative to the other school attributes in the model. This finding runs counter to prior research suggesting parents are more likely to select high achievement schools, especially when they are provided with detailed information about the schools' achievement levels (Hastings and Weinstein, 2008). One explanation could be that parents of pre-k and kindergarten students were paying minimal attention to these particular measures of academic quality, especially. Instead, parents may have focused on the demographic aspects of the schools, perhaps seeking the educational benefits of exposure to diversity while also having their child attend a school with some same-race representation or lower rates of Black and Hispanic students. These findings support recent work that found parents of elementary school students placed less emphasis on academic factors compared to parents of middle and high school-aged children (Kimelberg & Billingham, 2012). Nonetheless, the consistent results across samples and analytic models suggests that these parents were privileging demographic factors over

[13] Schools in Boston that are non-diverse tend to be predominantly Black or Hispanic. Among the schools that serve pre-k and kindergarten students, the maximum level of proportion Black in schools is 0.757 and the maximum level of proportion Hispanic is 0.904, whereas the maximum level of proportion White is 0.668 and the maximum level of proportion Asian is 0.567.

academics, which runs counter the assumed logic model that families value a nearby school of a high quality, defined by traditional measures of academic achievement.

Preference Variation by Race. Models estimating preference variation across race groups indicated that almost all attributes of schools that were included in the model had significant interactions. A number of the measures, such as distance, attendance, incidents, achievement, and proportion receiving free lunch subsidies, had interactions that suggested the differences were more a matter of magnitude and not direction. For example, distance had a negative association for all race groups, but the White subsample had the strongest aversion to schools that were further away. This particular finding supports prior work showing that families tend to know the most about the schools that are close to them (Bader, 2009).

The most notable example of preference variation in these models was the stark difference in the association between proportion same race and probability of choosing a school. Providing some affirmation of the hypothesis that White families would be more prone to value racial factors over achievement metrics, White and Asian families revealed a much stronger preference for schools with more students like themselves, compared with Hispanic families who had a much weaker preference for this attribute. Furthermore, Black parents of kindergarten students preferred schools with lower proportions of students of the same race, instead placing a greater emphasis on the level of ethnic heterogeneity.

These divergent preferences are consistent with prior research finding proportion same race to be a major driver of families' school choices. Specifically, this work shows that Whites are much less likely to attend schools that have higher proportions non-

White, although this prior work has mainly focused on choice processes related to private, magnet, and charter schools (Reznulli and Evans, 2005; Saporito and Sohoni, 2006). Furthermore, these results confirm earlier studies showing families of all races prefer schools with lower proportions of Black students, even among Black families, while also preferring schools with higher proportion White and Asian students (Fairlie, 2002; Saporito and Lareau, 1999; Schneider et al., 1998).

The fact that racial composition endures as a significant predictor even when controlling for aspects of location, safety, and quality suggests that race has an independent association with choices, above and beyond any race-based proxy associations that may shape families' decisions. The enduring salience of race supports multivariate analyses that the race proxy theory to only partially explain families' apparently racialized school choice patterns (Saporito, 2003; Saportio and Sohoni, 2006). Thus, providing families with the freedom to select schools in an intradistrict open enrollment system without any mechanism for promoting race or class integration would likely result in greater levels of segregation, particularly among White and Asian families.

Neighborhood Context and Choice. Regarding the hypothesis that families from more diverse neighborhoods would be more likely to choose non-local schools, I found consistent evidence to the contrary. Neighborhood ethnic heterogeneity was not associated with choice of walk zone school, when controlling for proportion same race and concentrated advantage. Furthermore, the proportion same race was not a significant predictor once individual race was included. This finding runs counter to prior work that finds parents associated the racial profile of the community with the quality of its institutions, and were therefore less likely to choose local schools if their neighborhoods had higher levels of diversity or lower levels of proportion same race (e.g., Krysan, 2002).

These results suggest that neither racial contact nor racial threat theories were functioning among this sample, as families were neither prone to stay local nor prone to choose non-walk zone schools based on the overall composition of their communities. School preferences were not influenced by the social contexts of their communities, suggesting families' heuristics were based more heavily on school-level factors rather the surrounding community, and these priorities were unlikely to change based on the social experiences and institutional resources available in their neighborhoods. Thus, one may conclude that neighborhood demographics were a secondary concern for families' school choice logic models, trumped by a focus on the demographic characteristics of the schools being chosen.

Another possible explanation for the lack of consistent race-based neighborhood associations is that choice behavior may be more strongly associated with neighborhood-level SES. Specifically, neighborhood socioeconomic advantage was consistently associated with families' preferences for local vs. non-local schools. Families in more advantaged neighborhoods were generally more likely to opt for local schools, perhaps because they initially selected into these neighborhoods with the schools in mind. White families in advantaged communities were the most likely to prefer local schools, whereas Black families were more likely to prefer non-local schools if they resided in more advantaged communities. This supports prior work showing non-White, economically disadvantaged families were less likely to use residential choice as a means of school choice, compared to more advantaged White families (Rhodes and DeLuca, 2014).

Regarding the hypothesis that those who opt out of local schools did so in order to attend schools that are less diverse, I found mixed evidence. Black and Hispanic families, on average, selected schools that were less diverse than their residential neighborhoods, whereas White and Asian families chose schools that were more diverse than the census tract where they lived. This race difference was largely attributable to the differing levels of segregation in these families' residential neighborhoods, and likely not based on any sort of systematic flight from diversity among the Black and Hispanic families. Furthermore, families who chose schools outside of their walk zones had smaller heterogeneity gaps than those choosing schools in their walk zones, signifying families may be opting out of local schools in order to send their children to alternatives that are more like their residential neighborhood. As the findings of the final set of analyses suggest, non-local choosers may do so for reasons besides race.

The Push and Pull of Non-Local Choices. Integrating both school and neighborhood racial characteristics, I tested the hypothesis that there may exist push and pull between neighborhood and school racial composition that encourages families to opt for schools that are further away from their local options. I found that higher levels of neighborhood ethnic heterogeneity were associated with families being more willing to avoid local schools. In contrast, neighborhood concentrated advantage had the opposite association, suggesting families in more advantaged communities are less willing to travel to more distal school options and instead tend to select closer school options.

These results confirm prior work showing that students from high-SES communities are less likely to opt out of locally zoned school in favor of a city-wide specialty school that may be further away (Lauen, 2007). As explained above, the families residing in less diverse, high-SES communities may have selected these locations with the local schools in mind, and they may have had the economic means to select high-demand communities near their most preferred schools.

The racial characteristics of schools did not constitute pulls that lured families from other neighborhoods. Instead, attendance rate was the only factor that promoted a school's attractiveness to non-local families. Surprisingly, ELA achievement had an adverse association with a school's pull. These counter-intuitive findings, coupled with the relatively small coefficient size for math achievement, suggest test scores may have a minimal impact on schools' attractiveness for families when also accounting for aspects of safety, order, and race. One possible explanation might be that families, in general, preferred to stay local when choosing schools for their children, and when they do opt for more distant schools it may have been for a variety of reasons that are not captured by these models. For example, families may opt for more distant schools because of sibling attendance or the location of after school care or jobs, not because of anything about their home neighborhood or the allure of the distant school (Rhodes and DeLuca, 2014). In addition, it should be noted that these models were particularly underpowered in terms of sample size (n=172 in the neighborhood models and n=76 in the school models), which opens the possibility that smaller associations might not be noticeable due to high standard errors. Thus, the results of this final set of models should be met with some level of skepticism.

Putting the Findings in Context

In addition to the problems of statistical power discussed in the preceding section, there are a number of other limitations that should be noted. Although the reliance on implied preferences is a notable asset to the present study, the lack of stated-preference information via survey data or parental interviews results in a limited understanding of families' choice processes and preferences. School choice is a multi-step process that involves behavioral variation at multiple points—the engagement in the choice system, the research and information gathering about the school options, the choices themselves, and finally the decision to enroll or not enroll in the school to which their child was assigned. This study is exclusively focused on the choices, and therefore minimal insight is gained regarding families' school shopping processes and ultimate enrollment decisions.

The lack of information about families' information gathering processes hinders our ability to make definitive statements about families' true preferences regarding schools' racial composition. Boston Public Schools do not provide families with demographic characteristics of the schools in their choice sets, so any race-based decision making must be based on families doing extra research via unofficial channels such as school information websites like www.greatschools.org or their personal social networks. Etensive research suggests that families rely on social networks for information and may even act in concert with their circle of friends when choosing schools (Lareau, 2014; Lauen, 2007). Thus, future work should seek to link data from multiple sources that capture a more complete picture of families' choice processes, including survey data on stated preferences and priorities, strategies employed to research schools, and the school choice behavior of friends, neighbors, and kin. The data are also lacking information on sibling enrollment locations, which has been cited as driving mechanism behind families' choice processes (Rhodes and DeLuca, 2014). In Boston this consideration is particularly important, as younger siblings are often guaranteed seats in their older siblings' schools. Furthermore, incorporating data on actual enrollment decisions would allow for the investigation of how choice processes influence a variety of distal outcomes, both for the schools and for the students.

With these limitations in mind, I contend that this study makes a valid and rigorous attempt to refine our understanding of the interaction between family-, school-, and neighborhood-level demographics as they pertain to school choice. This study expands the literature on school choice in a number of ways. First, the focus on implied preferences via families' actual school choices presents a more accurate picture of variation in choice logic models than studies that rely solely on stated preferences. Second, the integration of multiple aspects of school quality with racial characteristics helps refine our understanding of how race may function as a signal, or *proxy*, for other school attributes such as safety, order, and achievement that often covary with race. Third, the inclusion of neighborhood-level characteristics offers new insight into the potential role that contextual factors may play in shaping families school choice patterns, a topic which has gone largely unstudied (see Bell, 2009, and Lauen, 2007, for notable exceptions). Finally, the examination of the choices of families participating in a city-wide, intra-district open enrollment regime represents an alternative to the bulk of prior research on school choice that has focused on charter, magnets, and voucher systems.

Implications for School Choice Policy

Segregation in schools is seen as a de-facto consequence of residential segregation in American cities, and expanding school choice has been seen as a way to decouple these two forms of division. However, policymakers need to be careful that choice systems do not allow for the educational marketplace to exacerbate segregation in schools due to families' race preferences. Although many studies of choice argue that school segregation inevitably worsens as opportunities for choice expand (e.g., Epple and Romano, 2003; Liebowitz and Page, 2014), much of this work focuses on choice contexts involving charter schools, private school vouchers, and inter-district transfer systems. This study contributes to our understanding of racial preferences in an intradistrict school choice regime by testing hypotheses regarding the salience of racial factors above and beyond school quality, safety, and proximity.

The results show that the demographic characteristics of schools matter for families' school choices for pre-k and kindergarten, at times more so than a schools' academic record as measured by standardized test results. Researchers and policymakers may note that the results are not particularly surprising: families want schools that are close to home and somewhat diverse as long as there is a decent representation of students with the same race. However, this prevailing logic differs from the assumed set of priorities that policymakers often ascribe to families: that they want geographically close schools that perform well on indicators of academic achievement. Thus, the results of this study underscore the importance of acknowledging the persistent salience of race in school choice processes, even when accounting for various aspects of academic quality, discipline, and location.

Intradistrict open enrollment policies, such as Boston's, have dual goals of promoting educational equity and promoting school integration across race and class lines. However, the findings of this study suggest that these two policy goals may be in conflict with each other. If Boston's choice system were to be equitable in the sense that every family received its first choice of school, the composition of schools would be closely tied to residential patterns, and therefore the schools would likely end up more segregated. When residential location is privileged in a city's school choice and assignment process, as is the case in Boston, neighborhood selection takes on greater significance and families would be more prone to act on their economic advantages to select into high-demand neighborhoods. Just as families were more likely to use residential moves to sort themselves after cities ended race-based forced busing systems, thus resulting in a slip back toward residential and school segregation, families in districts using open enrollment might be more prone to sort themselves by moving closer to preferred schools (Liebowitz and Page, 2014; Reardon et al., 2011). Thus, policies that were seemingly agnostic in terms of race and class, actually resulted in greater levels of sorting along these lines. Privileging residential location by giving walk zone families a priority in the assignment algorithm may strengthen the link between residential segregation and school segregation.

Boston's assignment algorithm functioned such that families were not entitled to their first choice of school, as the District utilizes a lottery system for over-subscribed schools as well as a series of priorities for sibling attendance and proximity that privileges some families over others. Due to federal regulation, however, the city is not permitted to incorporate any sort of race correction or balancing component to the school assignment process, so explicit race-based controlling of families choices is not possible. With this in mind, the city should consider incorporating some sort of SES-based weighting scheme to increase the probability that diverse families would all have equal access to schools in more economically advantaged communities. Furthermore, the district may want to consider ending the privileging of residential proximity in assignment algorithms, which would likely be a very politically unpopular reform that would go against popular notion that communities would be strengthened by having more students attend local schools.

School district officials are left with limited leverage when it comes to controlling the choices of families in a large choice system that is designed to promote racial integration and equity of access to high quality schools. The most effective way to mitigate worsening racial sorting is to continue ensuring that all families have access to numerous schools that are equitably distributed around the city. The district must be proactive about advertising these schools to families, perhaps highlighting the academic characteristics and de-emphasizing the demographic aspects of the student body. Although it might be inevitable that parents will select neighborhoods based on the local schools and then rely on social networks for information about schools, it behooves school district officials, along with administrators and teachers, to reach out to parents of all races and social backgrounds to ensure a maximum amount of exposure to various schooling options, both within and outside of their local communities.

Appendix

Appendix A: Results from Alternative Models for Race Subsamples and School

Table A1. Conditional Logit Results, by Grade and Race (Ethnic Heterogeneity Models)

	Pre-K				*Kindergarten*			
	White	Black	Hispanic	Asian	White	Black	Hispanic	Asian
Ethnic Het.	1.159	1.257***	1.658***	1.674**	0.821	1.119*	1.367***	1.937**
Prop Same Race	2.253***	0.855**	2.195***	2.132***	3.429***	0.790***	2.045***	2.335***
Driving Distance	0.307***	0.504***	0.453***	0.380***	0.288***	0.561***	0.476***	0.359***
Attendance	1.477***	1.327***	1.140***	1.141	1.138**	1.281***	1.157***	0.945
Incidents	1.035***	1.031***	1.026***	1.034***	1.065***	1.025***	1.018***	1.046***
Math CPI	0.609***	0.94	1.143**	0.973	1.054	1.082	1.024	0.979
ELA CPI	1.773***	1.07	1.186***	1.228	1.212	1.006	1.139**	0.99
Prop FR Lunch	1.116	1.290***	0.969	0.636**	1.317**	1.228***	0.816***	0.472***
Pseudo R^2	*0.499*	*0.148*	*0.223*	*0.456*	*0.577*	*0.115*	*0.218*	*0.488*

*** p< 0.001, ** p<0.01, *p<0.05, ~p<0.10

Table A2. Conditional Logit Results, by Grade and Race (Race Proportion Models)

	Pre-K Sample				*Kindergarten Sample*			
	White	Black	Hispanic	Asian	White	Black	Hispanic	Asian
Prop White	3.395	1.255	5.206***	44.492**	1.933	7.063***	4.215***	9.653
Prop Black	0.741	1.045	3.578**	24.281	0.218*	7.311***	3.107**	4.245
Prop Hispanic	1.834	1.316	8.072***	62.981*	0.634	9.441***	7.327***	7.251
Prop Asian	2.214*	1.109	2.632***	15.404**	1.09	2.697***	2.562***	7.213*
Driving Distance	0.323***	0.507***	0.442***	0.373***	0.312***	0.552***	0.465***	0.365***
Attendance	1.629***	1.370***	1.201***	1.332***	1.100*	1.295***	1.168***	0.979
Incidents	1.015**	1.034***	1.024***	1.030**	1.052***	1.027***	1.017***	1.046***
Math CPI	0.515***	0.973	1.085	1.431*	1.023	1.236**	0.983	1.365
ELA CPI	1.768***	1.077	1.054	0.759	1.177	0.916	1.064	0.623
Prop FR Lunch	1.397***	1.285**	1.275***	1.482*	1.358***	1.372***	0.997	0.896
Pseudo R^2	0.528	0.145	0.239	0.483	0.595	0.119	0.234	0.502

*** p< 0.001, ** p<0.01, *p<0.05, ~p<0.10

Table A3. Results of Preference Variation Models, by School-Level Attribute (Pre-K)

	Prop. White	Prop. Black	Prop. Hispanic	Prop. Asian
Prop White	**7.738*****	3.638***	6.493***	6.598***
Prop Black	2.751**	**1.176**	4.544***	4.568***
Prop Hispanic	5.248***	4.038***	**4.635*****	8.305***
Prop Asian	2.450***	2.188***	2.966***	**3.269*****
Distance	0.422***	0.417***	0.412***	0.411***
Attendance	1.349***	1.336***	1.315***	1.319***
Incidents	1.028***	1.026***	1.027***	1.026***
Math CPI	0.905**	0.888***	0.923*	0.922*
ELA CPI	1.189***	1.171***	1.170***	1.147***
FR Lunch	1.316***	1.297***	1.328***	1.273***
Prop White * Black	**0.393*****			
Prop White * Hispanic	**0.485*****			
Prop White * Asian	**0.645*****			
Prop Black * Black		**2.979*****		
Prop Black * Hispanic		**1.699*****		
Prop Black * Asian		**1.118**		
Prop Hispanic * Black			**1.753*****	
Prop Hispanic * Hispanic			**2.362*****	
Prop Hispanic * Asian			**0.926**	
Prop Asian * Black				**0.764*****
Prop Asian * Hispanic				**0.828****
Prop Asian * Asian				**1.783*****
Pseudo R^2	*0.282*	*0.277*	*0.278*	*0.275*

*** p< 0.001, ** p<0.01, *p<0.05, ~p<0.10

Note -- coefficients in **bold** are race-specific estimates of taste variation.

Table A4. Results of Preference Variation Models, by School-Level Attribute (Kindergarten)

	Prop. White	Prop. Black	Prop. Hispanic	Prop. Asian
Prop White	**12.768*** **	5.502***	7.328***	8.094***
Prop Black	4.295***	**1.608**	5.844***	6.504***
Prop Hispanic	8.329***	7.148***	**4.782*** **	11.842***
Prop Asian	2.948***	2.755***	3.224***	**3.101*** **
Distance	0.458***	0.446***	0.451***	0.444***
Attendance	1.171***	1.146***	1.142***	1.135***
Incidents	1.024***	1.023***	1.023***	1.023***
Math CPI	1.045	1.055	1.05	1.064
ELA CPI	1.087*	1.074*	1.078*	1.078*
FR Lunch	1.074*	1.090**	1.086**	1.058
Prop White * Black	**0.369*** **			
Prop White * Hispanic	**0.385*** **			
Prop White * Asian	**0.493*** **			
Prop Black * Black		**3.638*** **		
Prop Black * Hispanic		**2.125*** **		
Prop Black * Asian		**1.781*** **		
Prop Hispanic * Black			**1.974*** **	
Prop Hispanic * Hispanic			**2.971*** **	
Prop Hispanic * Asian			**0.992**	
Prop Asian * Black				**0.985**
Prop Asian * Hispanic				**1.035**
Prop Asian * Asian				**2.359*** **
Pseudo R^2	*0.256*	*0.246*	*0.252*	*0.244*

*** p< 0.001, ** p<0.01, *p<0.05, ~p<0.10

Note -- coefficients in **bold** are race-specific estimates of taste variation.

Table A5. Conditional Logit Results, by Grade and Race (Race Proportion Models, with Omitted Refernce)

	Pre-K Sample				*Kindergarten Sample*			
	White	Black	Hispanic	Asian	White	Black	Hispanic	Asian
Prop Black	0.151***	0.784*	0.443***	0.158***	0.086***	0.610***	0.495***	0.206***
Prop Hispanic	0.403***	0.986	1.017	0.465***	0.271***	0.778**	1.189***	0.369***
Prop Asian	1.070	0.970	1.006	1.604***	0.736***	0.849**	1.103*	1.859***
Driving Distance	0.322***	0.507***	0.441***	0.379***	0.313***	0.554***	0.464***	0.365***
Attendance	1.605***	1.370***	1.185***	1.320***	1.099*	1.315***	1.166***	0.995
Incidents	1.015**	1.034***	1.025***	1.031**	1.052***	1.029***	1.018***	1.046***
Math CPI	0.496***	0.964	1.034	1.128	0.989	1.138	0.948	1.151
ELA CPI	1.914***	1.081	1.088	0.838	1.187	0.930	1.071	0.639
Prop FR Lunch	1.411***	1.285**	1.248***	1.448*	1.384***	1.393***	1.005	0.876
Pseudo R^2	*0.527*	*0.145*	*0.237*	*0.478*	*0.595*	*0.115*	*0.232*	*0.500*

*** p< 0.001, ** p<0.01, *p<0.05, ~p<0.10

Table A6. Results of Preference Variation Models with Ommitted Reference Group, by School-Level Attribute (Pre-K)

	Prop. Black	Prop. Hispanic	Prop. Asian
Prop Black	**0.214*** **	0.417***	0.413***
Prop Hispanic	0.790***	**0.444*** **	0.768***
Prop Asian	1.028	0.984	**1.068**
Distance	0.416***	0.410***	0.409***
Attendance	1.324***	1.297***	1.299***
Incidents	1.026***	1.027***	1.026***
Math CPI	0.844***	0.858***	0.857***
ELA CPI	1.213***	1.231***	1.212***
FR Lunch	1.286***	1.312***	1.255***
Prop Black * Black	**3.229*** **		
Prop Black * Hispanic	**1.803*** **		
Prop Black * Asian	**1.147**		
Prop Hispanic * Black		**1.676*** **	
Prop Hispanic * Hispanic		**2.319*** **	
Prop Hispanic * Asian		**0.879**	
Prop Asian * Black			**0.778*** **
Prop Asian * Hispanic			**0.839** **
Prop Asian * Asian			***1.788*** ***
Pseudo R^2	*0.276*	*0.275*	*0.273*

*** p< 0.001, ** p<0.01, *p<0.05, ~p<0.10

Note -- coefficients in **bold** are race-specific estimates of taste variation.

Table A7. Results of Preference Variation Models with Ommitted Reference Group, by School-Level Attribute (Kindergarten)

	Prop. Black	Prop. Hispanic	Prop. Asian
Prop Black	**0.159*****	0.452***	0.445***
Prop Hispanic	0.811***	**0.378*****	0.827***
Prop Asian	1.010	0.993	**0.899**
Distance	0.443***	0.449***	0.441***
Attendance	1.145***	1.141***	1.133***
Incidents	1.025***	1.024***	1.024***
Math CPI	0.994	0.979	0.987
ELA CPI	1.085*	1.094**	1.098**
FR Lunch	1.098**	1.098**	1.064*
Prop Black * Black	**4.243*****		
Prop Black * Hispanic	**2.391*****		
Prop Black * Asian	**1.909*****		
Prop Hispanic * Black		**1.928*****	
Prop Hispanic * Hispanic		**2.988*****	
Prop Hispanic * Asian		**0.945**	
Prop Asian * Black			**0.996**
Prop Asian * Hispanic			**1.043**
Prop Asian * Asian			**2.348*****
Pseudo R^2	*0.243*	*0.248*	*0.240*

*** p< 0.001, ** p<0.01, *p<0.05, ~p<0.10

Note -- coefficients in **bold** are race-specific estimates of taste variation.

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Tables

Table 1. Sample Descriptive Statistics, by Grade and Level of Choice Participation

	Pre-K			*Kindergarten*		
	Full Sample	Choosers	Non-Choosers	Full Sample	Choosers	Non-Choosers
n=	*7,004*	*6,567*	*437*	*11,059*	*6,039*	*5,020*
Prop White	0.223	0.223	0.219	0.169	0.149	0.193
Prop Black	0.219	0.215	0.275	0.251	0.223	0.285
Prop Hispanic	0.449	0.454	0.375	0.472	0.512	0.423
Prop Asian	0.074	0.073	0.092	0.078	0.086	0.069
Prop Other	0.053	0.035	0.040	0.030	0.029	0.031
Prop FR Lunch	0.731	0.734	0.699	0.782	0.873	0.724
Prop Current LEP[1]	0.404	0.399	0.471	0.341	0.333	0.350
Prop English First Language	0.523	0.516	0.629	0.587	0.585	0.588
Mean ELD Score[2]	1.868	2.167	1.825	2.219	2.120	2.237

[1]LEP = Limited English Proficiency. Students are designated as either non LEP, former LEP, or current LEP

[2]English Language Development Assessment, on a scale of 1 to 5 with 1 being the lowest command of English and 5 having the highest among ELL students

Table 2. School Descriptive Statistics (n=76)

	Mean	*sd*
Enrollment	391.592	*203.277*
Pre-K Capacity[1]	33.954	*16.509*
Kindergarten Capacity	55.526	*26.344*
Ethnic Heterogeneity	0.561	*0.14*
Proportion White	0.145	*0.147*
Proportion Black	0.303	*0.188*
Proportion Hispanic	0.469	*0.195*
Proportion Asian	0.057	*0.088*
Proportion Free Lunch	0.645	*0.147*
Attendance Rate	94.157	*1.583*
Incidents against Good Order	7.898	*10.532*
MCAS CPI, Math	69.181	*10.002*
MCAS CPI, English Language Arts	71.688	*9.456*

[1]Of the 76 schools that have capacity for Kindergarten students, only 65 also have capacity for pre-K.

Table 3.Correlation Matrix of School Attributes (n=76)

		1	2	3	4	5	6	7	8	9	10
1	Attendance Rate	1									
2	Incidents	-0.338	1								
3	MCAS CPI, Math	0.548	-0.446	1							
4	MCAS CPI, ELA	0.468	-0.162	0.766	1						
5	Ethnic Heterogeneity	-0.028	0.048	0.120	0.217	1					
6	Proportion White	0.262	-0.171	0.483	0.606	0.410	1				
7	Proportion Black	-0.141	0.162	-0.402	-0.304	0.214	-0.486	1			
8	Proportion Hispanic	-0.143	-0.045	-0.125	-0.25	-0.742	-0.324	-0.562	1		
9	Proportion Asian	0.161	0.028	0.253	0.104	0.398	0.016	-0.095	-0.380	1	
10	Proportion Free Lunch	-0.447	0.182	-0.442	-0.539	-0.150	-0.7593	0.490	0.121	0.007	1

Table 4. Census Tract-Level Descriptive Statistics (n=172)

	Mean	*sd*
Ethnic Heterogeneity	0.571	*0.226*
Proportion White	0.488	*0.310*
Proportion Black	0.222	*0.251*
Proportion Hispanic	0.169	*0.150*
Proportion Asian	0.084	*0.097*
Concentrated Advantage	0.000	*1.000*
Poverty Rate	0.159	*0.142*

Table 5. Conditional Logit Results Predicting Probability of Choice of School

	Pre-K Sample			*Kindergarten Sample*		
	Model 1A	Model 1B	Model 1C	Model 1A	Model 1B	Model 1C
Ethnic Het.	1.015	1.237***	1.529***	0.948***	1.220***	1.293***
Prop. Same		1.814***	1.727***		1.969***	1.719***
Distance			0.432***			0.479***
Attendance			1.205***			1.095***
Incidents			1.028***			1.023***
Math CPI			0.946			1.053
ELA CPI			1.214***			1.122***
Prop. F.R. Lunch			0.887***			0.760***
Pseudo R^2	*0.000*	*0.060*	*0.269*	*0.000*	*0.077*	*0.238*

*** p< 0.001, ** p<0.01, *p<0.05, ~p<0.10

Table 6. Results of Preference Variation Moodels, by School-Level Attribute (Pre-K)

	Ethnic Het.	Prop. Same	Distance	Attendance	Incidents	Math CPI	ELA CPI	FR Lunch
Ethnic Het.	**1.498*****	1.462***	1.533***	1.521***	1.524***	1.535***	1.504***	1.529***
Prop. Same	1.689***	**2.031*****	1.756***	1.697***	1.724***	1.768***	1.667***	1.762***
Distance	0.432***	0.429***	**0.314*****	0.431***	0.432***	0.433***	0.432***	0.432***
Attendance	1.208***	1.242***	1.222***	**1.245*****	1.206***	1.205***	1.208***	1.211***
Incidents	1.028***	1.028***	1.029***	1.028***	**1.034*****	1.028***	1.028***	1.028***
Math CPI	0.942	0.924*	0.959	0.949	0.948	**0.829*****	0.947	0.944
ELA CPI	1.218***	1.253***	1.190***	1.221***	1.208***	1.203***	**1.368*****	1.207***
FR Lunch	0.901***	1.011	0.888***	0.885***	0.886***	0.887***	0.899***	**0.902**
Ethnic Het. * Black	**1.176**							
Ethnic Het. * Hispanic	**0.928**							
Ethnic Het * Asian	**1.507****							
Prop. Same * Black		**0.503*****						
Prop. Same* Hispanic		**0.971**						
Prop. Same * Asian		**0.976**						
Distance * Black			**1.701*****					
Distance * Hispanic			**1.420*****					
Distance * Asian			**1.240***					
Attendance * Black				**0.967**				
Attendance * Hispanic				**0.928****				
Attendance * Asian				**1.044**				
Incidents * Black					**0.998**			
Incidents * Hispanic					**0.989***			
Incidents * Asian					**1.01**			
Math CPI * Black						**1.112**		
Math CPI * Hispanic						**1.223*****		
Math CPI * Asian						**1.405*****		
ELA CPI * Black							**0.817****	
ELA CPI * Hispanic							**0.860***	
ELA CPI * Asian							**1.134**	
Prop FR Lunch* Black								**0.904**
Prop FR Lunch *Hispanic								**1.055**
Prorp FR Lunch* Asian								**0.768****
Pseudo R^2	*0.270*	*0.276*	*0.274*	*0.270*	*0.270*	*0.270*	*0.270*	*0.270*

*** p< 0.001, ** p<0.01, *p<0.05, ~p<0.10

Note -- coefficients in **bold** are race-specific estimates of taste variation.

Table 7. Results of Preference Variation Moodels, by School-Level Attribute (Kindergarten)

	Ethnic Het	Prop. Same	Distance	Attendance	Incidents	Math CPI	ELA CPI	FR Lunch
Ethnic Het.	**1.138***	1.175***	1.321***	1.323***	1.299***	1.303***	1.263***	1.300***
Prop. Same	1.715***	**2.364*****	1.753***	1.750***	1.728***	1.729***	1.652***	1.772***
Distance	0.478***	0.471***	**0.287*****	0.479***	0.477***	0.479***	0.479***	0.479***
Attendance	1.097***	1.134***	1.114***	**0.935***	1.092***	1.093***	1.098***	1.097***
Incidents	1.022***	1.024***	1.023***	1.024***	**1.053*****	1.023***	1.022***	1.023***
Math CPI	1.054	1.045	1.047	1.027	1.045	**1.005**	1.049	1.05
ELA CPI	1.127***	1.131***	1.115***	1.113***	1.120***	1.119***	**1.300*****	1.123***
FR Lunch	0.782***	0.884***	0.770***	0.763***	0.751***	0.759***	0.768***	**0.839****
Ethnic Het. * Black	**1.401*****							
Ethnic Het. * Hispanic	**1.068**							
Ethnic Het * Asian	**1.951*****							
Prop. Same * Black		**0.386*****						
Prop. Same* Hispanic		**0.756*****						
Prop. Same * Asian		**0.95**						
Distance * Black			**2.113*****					
Distance * Hispanic			**1.660*****					
Distance * Asian			**1.331***					
Attendance * Black				**1.288*****				
Attendance * Hispanic				**1.212*****				
Attendance * Asian				**1.204****				
Incidents * Black					**0.965*****			
Incidents * Hispanic					**0.966*****			
Incidents * Asian					**1.003**			
Math CPI * Black						**1.096**		
Math CPI * Hispanic						**1.032**		
Math CPI * Asian						**1.129**		
ELA CPI * Black							**0.847***	
ELA CPI * Hispanic							**0.835****	
ELA CPI * Asian							**1.033**	
Prop FR Lunch* Black								**0.827***
Prop FR Lunch *Hispanic								**0.931**
Prop FR Lunch* Asian								**0.773***
Pseudo R^2	*0.24*	*0.248*	*0.245*	*0.24*	*0.24*	*0.238*	*0.238*	*0.238*

*** p< 0.001, ** p<0.01, *p<0.05, ~p<0.10

Note -- coefficients in **bold** are race-specific estimates of taste variation.

Table 8. Results from Random Intercept Logistic Models Predicting Probability of Selecting a Walk Zone

	Pre-K				*Kindergarten*			
	Model 2A	Model 2B	Model 2C	Model 2D	Model 2A	Model 2B	Model 2C	Model 2D
Ethnic Het.	0.759***	0.754***	0.863	0.969	0.729***	0.678***	0.920	1.188
Prop. Same		1.274***	1.282***	0.936		1.278***	1.301***	1.084
Concentrated Advantage			1.227	1.466*			1.641***	2.726***
Ethnic Het. * Black				0.918				0.736
Ethnic Het. * Hispanic				0.745				0.759
Ethnic Het. * Asian				0.928				0.720
Prop. Same * Black				1.387				0.927
Prop. Same * Hispanic				1.551				1.276
Prop. Same * Asian				1.519				1.580
Advantage * Black				0.537**				0.392***
Advantage * Hispanic				0.853				0.544**
Advnatage * Asian				0.92				0.681
Black				0.427***				0.603**
Hispanic				0.645***				0.617***
Asian				0.679*				0.432***
Intercept	2.038***	1.743***	1.737***	2.564***	1.933***	1.703***	1.714***	2.506***
rho[1]	0.177***	0.165***	0.159***	0.157***	0.187***	0.172***	0.141***	0.128***
(se)	(0.023)	(0.022)	(0.022)	(0.022)	(0.023)	-0.023	(0.021)	(0.021)

[1]The estimated residual intraclass correlation; asterisks indicate rejection of the null hypothesis of rho=0, thus confirming the use of a multilevel model.

*** p< 0.001, ** p<0.01, *p<0.05, ~p<0.10

Table 9. Estimated Results from ANOVA Models of Differences in School and Neighborhood Ethnic Heterogeneity, by Grade Level

	Pre-K		*Kindergarten*	
	SS	F-statistic	SS	F-statistic
Race	71.771	436.65***	51.224	273.64***
Walk Zone	0.262	4.79*	0.705	11.30**
Race * Walk Zone	0.427	2.60~	2.438	13.03***
Residual	338.27		355.55	
Total	427.34		433.67	
R^2	*0.208*		*0.18*	

*** p< 0.001, ** p<0.01, *p<0.05, ~p<0.10

Table 10. Group Comparisons of the Neighborhood-School Hetergeneity Gap (Pre-K)

Group	vs	Group	Group Means		Mean Diff.	HSD-test
			Walk-Zone Choosers			
White	*vs*	Black	-0.1163	0.1048	0.2211	24.732*
White	*vs*	Hispanic	-0.1163	0.1798	0.2961	33.120*
White	*vs*	Asian	-0.1163	-0.0007	0.1155	12.925*
Black	*vs*	Hispanic	0.1048	0.1798	0.075	8.388*
Black	*vs*	Asian	0.1048	-0.0007	0.1055	11.807*
Hispanic	*vs*	Asian	0.1798	-0.0007	0.1805	20.195*
			Non-Walk Zone Choosers			
Group	*vs*	Group	Group Means		Mean Diff.	HSD-test
White	*vs*	Black	-0.074	0.099	0.173	13.472*
White	*vs*	Hispanic	-0.074	0.208	0.282	21.928*
White	*vs*	Asian	-0.074	0.004	0.078	6.049*
Black	*vs*	Hispanic	0.099	0.208	0.109	8.455*
Black	*vs*	Asian	0.099	0.004	0.095	7.423*
Hispanic	*vs*	Asian	0.208	0.004	0.204	15.879*

* $p < 0.05$ on the Tukey HSD Test

Table 11. Group Comparisons of the Neighborhood-School Hetergeneity Gap (Kindergarten)

Group	vs	Group	Group Means		Mean Diff.	HSD-test
			Walk-Zone Choosers			
White	*vs*	Black	-0.109	0.113	0.222	22.335*
White	*vs*	Hispanic	-0.109	0.229	0.338	34.044*
White	*vs*	Asian	-0.109	-0.030	0.079	7.952*
Black	*vs*	Hispanic	0.113	0.229	0.116	11.709*
Black	*vs*	Asian	0.113	-0.030	0.143	14.383*
Hispanic	*vs*	Asian	0.229	-0.030	0.259	26.092*
			Non-Walk Zone Choosers			
Group	*vs*	Group	Group Means		Mean Diff.	HSD-test
White	*vs*	Black	-0.013	0.108	0.120	8.3152*
White	*vs*	Hispanic	-0.013	0.200	0.213	14.7043*
White	*vs*	Asian	-0.013	0.027	0.040	2.7648
Black	*vs*	Hispanic	0.108	0.200	0.092	6.3891*
Black	*vs*	Asian	0.108	-0.027	0.080	5.5504*
Hispanic	*vs*	Asian	0.200	-0.027	0.173	11.9395*

* $p < 0.05$ on the Tukey HSD Test

Table 12. Results of OLS Regression Models Predicting Neighbohroods' Spatial Probabilities, by Grade Level

	Pre-K	Kindergarten
Ethnic Het.	-0.090***	-0.073***
Prop. White	-0.146	-0.153
Prop. Black	-0.132	-0.112
Prop. Hispanic	0.008	-0.006
Prop. Asian	-0.005	0.016
Concentrated Advantage	0.019	0.042*
Poverty Rate	0.000	0.001
Intercept	0.160***	0.134***
R^2	0.222	0.218

* p<0.05, ** p<0.01, *** p<0.001

Table 13. Results of OLS Regression Models Predicting School's Spatial Probabilities, by Grade

	Pre-K		*Kindergarten*	
	Model 3A	Model 3B	Model 3A	Model 3B
Attendance	-0.011	-0.016	-0.026**	-0.037**
Incidents	0.000	0.000	0.000	-0.001
Math CPI	-0.022	-0.002	-0.045*	-0.027
ELA CPI	0.046	0.017	0.090***	0.073**
Ethnic Het.		-0.052		-0.037
Prop. White		-0.022		0.026
Prop. Black		0.004		0.026
Prop. Hispanic		0.040		0.060
Prop. Asian		0.004		0.027
Prop. FR Lunch		-0.032		-0.020
Intercept	1.198	1.663	2.631**	3.622***
R^2	0.093	0.474	0.285	0.403

* p<0.05, ** p<0.01, *** p<0.001

Figures

Figure 1. Association between School Race Proportions and Ethnic Heterogeneity Index

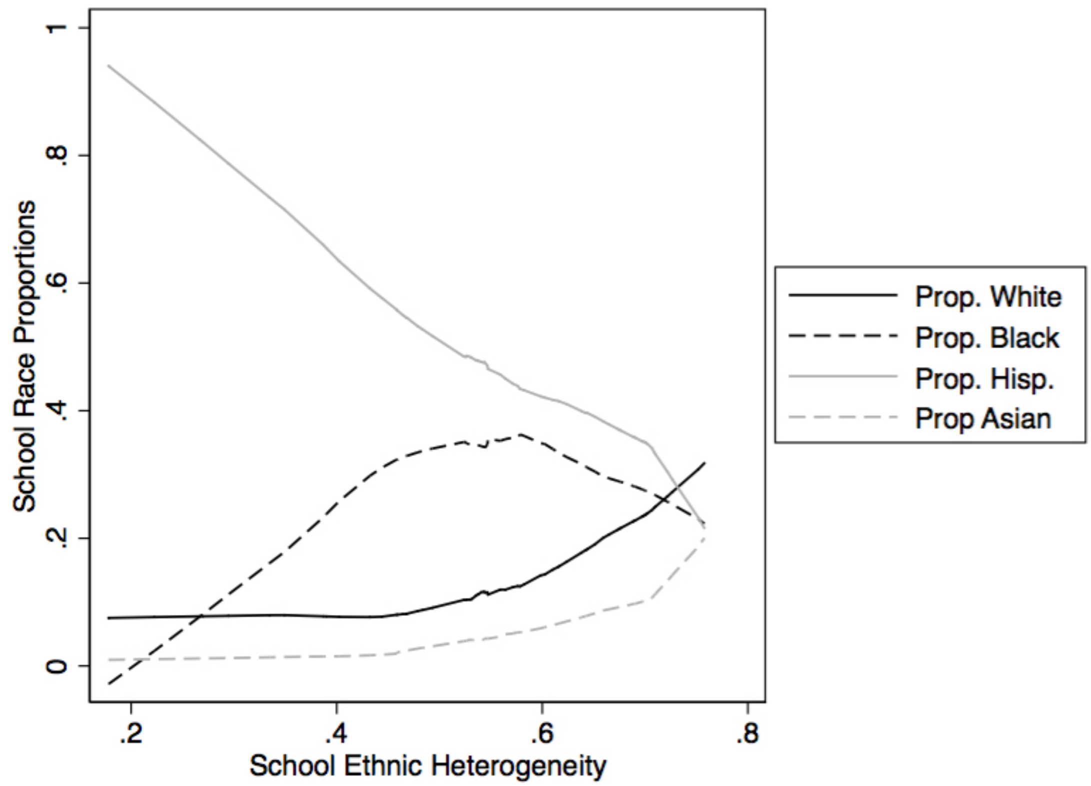
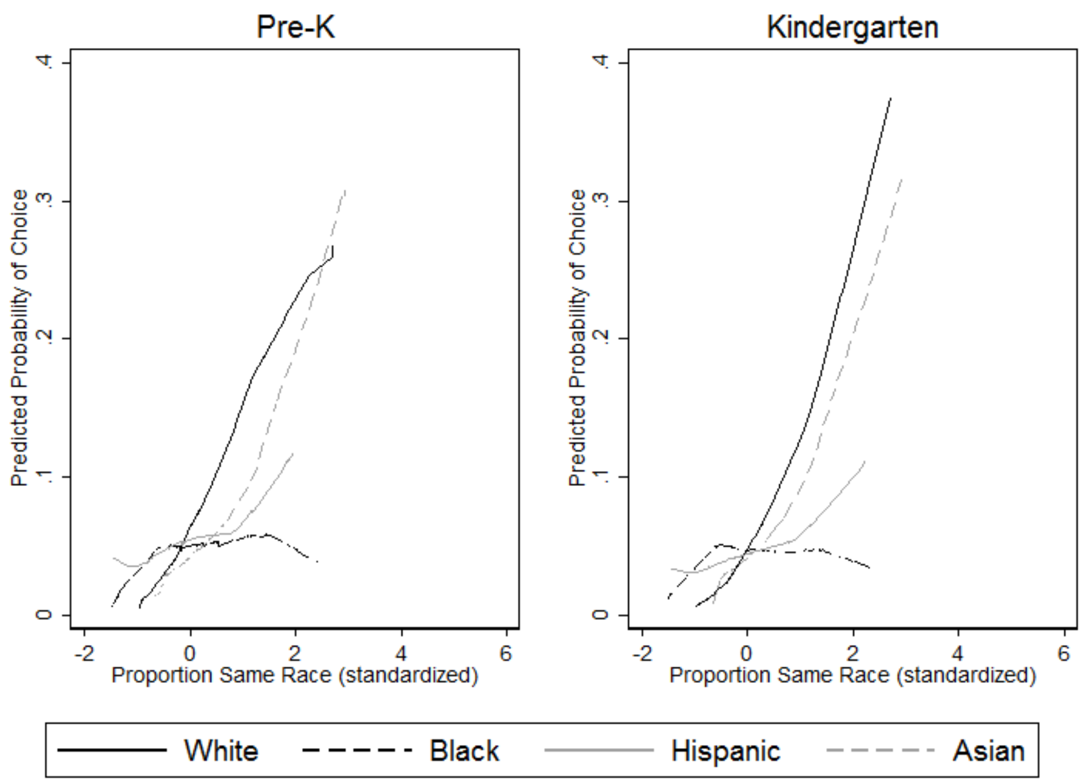


Figure 2. Predicted Probability of Choosing a School as a Funciton of Proportion Same Race, Controlling for Distance, Order, Academic Achivement, Ethnic Heterogeneity, and Proportion Free and Reduced-Price Lunch



Vita

1996-2000	The Ohio State University Columbus, OH	B.A. June 2000
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