Transportation and Geographic Constraints to Educational Access and School Integration in a Context of School Choice

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TABLE OF CONTENTS

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

CHAPTER 1

INTRODUCTION

Over the last three decades, there has been an expansion of school choice in U.S. urban school districts in the form of charter schools, magnet schools, school voucher programs and other intra and inter district school choice. Moreover, it appears likely that school choice will continue to play an integral role in education policy under the current U.S. secretary of education. However, the expansion of school options has been marked by an uneven and mixed pattern of access (Frankenberg & Lee, 2003; Gross & Denice, 2016; Rhodes & DeLuca, 2014). Expanded school choice has triggered contentious debate among scholars regarding the impact these choice policies have on racial and socio-economic integration across urban schools (Holme & Wells, 2008; Viteritti, 1999, 2003; Wells & Crain, 2005). Most urban students reside in segregated neighborhoods where schools differ in terms of the level of integration and academic quality. Without the provision of transportation to schools of choice, many choice schools are not viable options for many students (Bell, 2007; Denice & Gross, 2016; Teske, Fitzpatrick, & O'Brien, 2009). If school choice is available only for some students the difference in access can lead to stratification across schools. This dissertation explores differences in access to and enrollment in schools of choice, integrated schools, and high-quality schools, based on the demographics of students' neighborhood of residence. It also explores the role access to transportation can play in shaping student enrollment patterns.

The impact of school choice and transportation access on integration is critical. There are important impacts of school integration tied to students' academic and later life outcomes, as well as their ability to communicate with and affinity for interacting with individuals or groups that are dissimilar from them. School and classroom integration has been tied to students' higher academic performance and a lower Black-White achievement gap (Billings, Deming, & Rockoff, 2014; Crain &

Mahard, 1981). Integration has also been found to lead to improved likelihoods of attending college, improved income levels, and different career prospects for Black students (Boozer, Krueger, & Wolkon, 1992; Braddock, 2009). Perhaps more importantly, integration (particularly when classrooms are integrated) is also associated with students' intergroup relations and a drop in anti-Black prejudice or stereotypes both while they are school age and as adults (Hallinan, 1998; Schofield & Sagar, 1983; Sonleitner & Wood, 1996; Wells, Holme, Revilla, & Atanda, 2005). The political polarization and racial division apparent in the U.S. through recent events, such as the clash in Charlottesville, suggest that this is an era when students should be learning the value of diversity in schools rather than be isolated within homogenous schools lacking opportunities for interracial exposure.

Residential segregation fundamentally shapes the characteristics of schools available to students of different racial backgrounds, as place of residence is closely tied to where students are zoned to attend school and eventually enroll. According to the most recent data from the National Center for Education Statistics (2015), 84.6 percent of students in public schools attended their assigned school in 2012. Much work conducted by sociologists and economists demonstrates that the distance to school and availability of transportation are significant factors for families, particularly those with a low income, when choosing a school (Bell, 2007; Rhodes & DeLuca, 2014; C. E. Smrekar & Goldring, 2009; Teske, Fitzpatrick, & O'Brien, 2009). School quality is also tied to the cost of housing, as families with greater means are able to live in neighborhoods with good schools, while low-income families are limited to a choice of the schools located in more affordable neighborhoods (Black, 1999; Brasington, 1999; Dhar & Ross, 2012; Haurin & Brasington, 1996; Lubienski & Dougherty, 2009; Sohoni & Saporito, 2009).

This dissertation examines the enrollment patterns of students based on neighborhood of residence; more specifically, it examines the impact of a policy that provides access to public transportation options within a major metropolitan school district. My aim is to examine the extent to

which robust school choice and transportation policies expand opportunities and access for students. The conceptual framework for this dissertation is anchored to the geography of opportunity, and to theories of inequality in school choice (rational choice theory, cultural capital, and social capital), and is centered specifically on enrollment trends in Nashville, Tennessee.

Part I of the analysis explores how school choice behaviors and racial segregation in the secondary schools of Metro Nashville Public Schools (MNPS) relate to geographic differences in demographics. First, I conduct a quantitative descriptive analysis of the enrollment patterns of Nashville's secondary school students and how these patterns differ in accordance with neighborhood demographics. Second, I explore the geographic feeder patterns for integrated schools in order to understand more fully where students who attend integrated schools are being drawn from. Third, in order to better understand what types of schools students attend if their default neighborhood school is considered relatively integrated, I explore the enrollment patterns of students who are zoned to attend an integrated school. To explore these enrollment patterns, I utilize descriptive statistics and geographic information systems (GIS) analysis with a unique student-level dataset.

Part II evaluates the influence of a new policy that provides students with a fare-free bus pass. This part specifically tests the degree to which this policy change is associated with alterations in student enrollment patterns in terms of their (1) attendance in a school of choice, (2) attendance in an integrated school, (3) attendance in a high performing school, and (4) the diversity of neighborhood representation in the school attended. Sub-group analyses test whether the policy is associated with differential influences for students according to race and level of affluence, residence along an efficient bus route, and the level of racial isolation within a student's neighborhood. Logistic and OLS regression are utilized, along with a differences-in-differences methodological approach that takes advantage of middle school students as a within-district, un-treated comparison group. I examine a relatively inexpensive policy change that has the potential to expand school choice sets for many students, and to

reduce the likelihood that a student will be restricted to all racially identifiable, racially isolated, or low-performing schools.

This work is designed to highlight disparities in student enrollment patterns and how they are shaped by geography within an urban environment. This is one of the first studies to examine the changes in enrollment patterns resulting from a policy that covers the financial costs of student transportation. The findings underscore the critical role transportation plays in shaping educational access and how cooperation between school districts and public transportation agencies can expand opportunity for some, but not all, students within a mid-size segregated city. This descriptive analysis of patterns and trends finds that use of school choice not evenly distributed geographically, there are pockets of students who reside in racially isolated neighborhoods and attend racially isolated zone schools, and some of these pockets of isolated students are located in neighborhoods with frequent public transit. This proximity to transit lines could allow more students to utilize school choice, if they are willing and able to ride the city bus. A policy providing secondary school students with bus passes is associated with increases in the use of school choice, increases in the likelihood of attending a school with a high value-added score, and for some students (particularly those near public transit) to increases in the likelihood of attending a school considered integrated by the department of Justice. These findings have critical implications for researchers and policymakers interested in school integration, school choice, and how districts can enable more students to expand their school choice set within an existing school choice system.

NASHVILLE CONTEXT

The Metro Nashville Public School (MNPS) district provides an ideal case for furthering understanding of the degree to which access to public transportation in a school choice network can alter how much students' educational opportunities are limited by geography. MNPS is located in a rapidly growing, mid-sized city. The district oversees a robust and growing school choice network of

magnet schools, charter schools, and intra-district choice for undersubscribed schools, which provides opportunities for students outside their neighborhood. (See Appendix A for individual school characteristics in 2011-2015.)

While not the most segregated city in the country, neighborhood segregation levels in the Metropolitan Nashville area are high. A zip code-based dissimilarity index that uses the 2013 American Community Survey (ACS) five-year estimates places Nashville among the nine most segregated metropolitan areas in the country (Kent & Frolich, 2015). The racial makeup has evolved over the last couple of decades, with a growing populations of Latinx (17 percent age 18 and under in Davidson County), Asians (3.1 percent, particularly due to Kurdish immigrants) and Whites under 18 (53.8%); meanwhile, the Black population age 18 and under has dropped to 31.7 percent (American Community Survey 2015 estimates for Davidson County).

Located in the heart of the South, Nashville has a complex history of residential and school segregation. As the metropolitan area expanded 1950 and 1980, suburban development occurred congruently with the development of mostly White suburban schools, with a shift away from urban schools. The *Schools for 1980* plan, which was used as a guide for both school and residential development in Nashville, discussed the importance of having schools located outside of dense urban areas and explicitly prioritized placing schools in suburban areas that were experiencing White population growth (Erickson, 2016, p. 127). This policy priority meant that even with a robust new highway system (which actually contributed to greater racial residential segregation in the metropolitan area), the new schools remained highly segregated. This was due in part to a failure to provide school bus transportation across neighborhoods or structures for substantial equal access and inclusion (Erickson, 2016, p.130).

A controversial busing desegregation plan was eventually adopted in Nashville as a result of *Kelley v. Metropolitan Nashville Board of Education* (1970). Judge William E. Miller held that the

Nashville schools had not acted affirmatively to ensure a unitary, desegregated system. The new plan placed substantial burdens on Black families in Nashville and was also quite unpopular with White families in the area, who often opted to use their school choice options to put their children in private schools or moved further into the developing suburbs. An immediate 18 percentage point decline in White student enrollment in MNPS followed in 1971, and decline continues over the following decades (R.A. Pride & Woodward, 1985).

Desegregation plans were revised throughout the 1970's and 1980's, as busing became less and less popular among the Black families who were forced to send their young children on long bus rides to school. In 1996 76 percent of White Nashvillians and 38 percent of Black Nashvillians wanted busing to end (Pride, 2000). Nashville was granted unitary status (ended the desegregation court order) in 1998, and the district subsequently ended the very unpopular busing system. The unitary status plan reorganized student school assignment into 11 cluster feeder patterns, which included attendance zones for elementary and middle schools that fed into a common high school. It also increased school choice by expanding the number of magnet schools and created of enhanced option schools that provided additional resources for high-poverty neighborhoods (Smrekar & Goldring, 2009).

The additional resources initially helped the enhanced option schools to maintain high academic standards with a high-minority and high-poverty student enrollment, while the magnet schools and traditional public schools did not maintain these same standards (Gamoran & An, 2016). As in many other school systems that relied on busing for school integration prior to being granted unitary status, the Nashville schools re-segregated following the discontinuation of this policy, due to the structural and historical factors that contributed to students' residential segregation and the ways attendance boundaries were drawn. Black students became much more likely to be racially isolated in highly concentrated Black schools. In 1995, Nashville had only one school with Black student enrollment over 90 percent; by 2005 there were 12, and by the end of the decade almost 20. Corresponding changes in

the poverty level of students and schools in MNPS have occurred: the 44 percent of students eligible for free and reduced-price lunch (FRPL) in the 1998-99 school year increased to over 72 percent by 2012-13, and 57 percent of the schools had more than 75 percent of their students eligible for FRPL (McQueen, Smrekar, & Kundson, 2013, pp. 14–15). This change in the poverty level is largely due to the changing composition of the school population; it is not necessarily due to rising poverty among Nashville's Black population.

Davidson County has become more diverse over the last few decades. There has been strong and steady growth in the Latinx population, coupled with lesser growth of the Vietnamese, Iraqi Kurdish, and Somali communities, due in part to refugee resettlement programs. In 1990, less than half of one percentage point of the county population was Latinx; this demographic grew to 9% by 2010 (McQueen, Smrekar, & Kundson, 2013, p.298). As of the 2014-15 school year, 154 Nashville schools were serving 84,070 students, 44.3 percent of whom were Black, 30.7 percent White, and 20.7 percent Latinx (TDOE, 2016). These demographic trends are coupled with a notable exit of White students from MNPS, particularly at the higher grade levels, while surrounding counties have seen corresponding growth at those grade levels (Johnson, Nattrass, & Phillips, 2013). The attrition seen in MNPS is particularly noticeable at middle and high school structural change years (enter middle school in 5th grade and high school in 9th grade), with a 10.8 percent average year to year attrition rate as students enter middle school (Johnson, Natrass & Phillips, 2013, p.22).

There has been an expansion of school choice in MNPS. In addition to the expanded magnet school program and the enhanced option schools that were established after MNPS was granted unitary status, there has been a significant increase in the number of charter schools in Nashville from 1 in 2003 to 30 in 2016. Moreover, using the optional schools application, the district allows students to apply to any school other than their assigned zone school that is not oversubscribed. Table 1 presents the demographic makeup of the secondary school students attend in the district over the five years

examined in this study. Demographics remain relatively stable over this time, with a slight increase in the Latinx population. Table 2 presents the characteristics of the type of school attended, showing a slight decrease in the proportion of students attending their assigned zone school (increased use of school choice) and a slight increase in the proportion of students attending a charter school. There is a significant take-up of school choice policies, with more than 30 percent of secondary school students attending a non-zone school and even more elementary school students doing so), but the transportation options for students over the last decade have been quite limited in terms of providing access to non-zone schools. Some charter schools have chosen to provide transportation for students, but many do not, and students wishing to attend other optional schools must find their own transportation.

Table 1: Secondary School Student Characteristics 2011-2015 (Proportions)

	2011	2012	2013	2014	2015	Total
White	0.322	0.318	0.316	0.303	0.298	0.311
	(0.467)	(0.466)	(0.465)	(0.460)	(0.457)	(0.463)
Black	0.480	0.474	0.461	0.461	0.452	0.465
	(0.500)	(0.499)	(0.498)	(0.498)	(0.498)	(0.499)
Latinx	0.155	0.163	0.178	0.190	0.204	0.178
	(0.362)	(0.370)	(0.382)	(0.393)	(0.403)	(0.383)
Asian	0.0406	0.0411	0.0427	0.0432	0.0433	0.0422
	(0.197)	(0.198)	(0.202)	(0.203)	(0.203)	(0.201)
Indian	0.000776	0.00121	0.00139	0.00141	0.00124	0.00121
	(0.0278)	(0.0348)	(0.0373)	(0.0375)	(0.0352)	(0.0348)
Pacific	0.000604	0.000573	0.000837	0.000982	0.00104	0.000812
	(0.0246)	(0.0239)	(0.0289)	(0.0313)	(0.0322)	(0.0285)
Two or More Races	0.0000431	0.0000212	0	0	0.0000801	0.0000293
	(0.00657)	(0.00461)	(0)	(0)	(0.00895)	(0.00541)
FRPL	0.702	0.766	0.778	0.744	0.719	0.742
	(0.457)	(0.423)	(0.416)	(0.437)	(0.449)	(0.438)

Table 2: Characteristics of Secondary Schools Attended 2011-2015 (Proportions)

	2011	2012	2013	2014	2015	Total
Attend Zone School	0.714	0.687	0.676	0.685	0.649	0.682
	(0.452)	(0.464)	(0.468)	(0.464)	(0.477)	(0.466)
Attend Charter	0.0536	0.0671	0.0731	0.0912	0.124	0.0824
	(0.225)	(0.250)	(0.260)	(0.288)	(0.329)	(0.275)
Attend Magnet	0.200	0.190	0.184	0.181	0.172	0.185
	(0.400)	(0.392)	(0.388)	(0.385)	(0.377)	(0.388)
Attend School Integrated w/in 20%	0.828	0.820	0.807	0.797	0.793	0.809
	(0.377)	(0.384)	(0.395)	(0.402)	(0.405)	(0.393)
Attend Racially Isolated School	0.0710	0.0700	0.0671	0.0765	0.0895	0.0750
	(0.257)	(0.255)	(0.250)	(0.266)	(0.286)	(0.263)

While Nashville is considering an array of plans for expanding public transportation options, the city has made a notable effort to more fully utilize the existing system. On August 4th, 2014, Mayor Karl Dean announced StrIDe, a program that links MNPS with the Metro Transit Authority (MTA) to increase student ridership and expand students' transportation options. The StrIDe program began midway through the 2014-15 school year, and in the first year was available only to ninth through twelfth graders. The program allowed all public high school students to use their student ID as a free bus pass on any MTA bus. The publicity for StrIDe highlighted the flexible transportation options it gave students, including allowing them to participate in extra-curricular activities before and after school—something the traditional yellow school bus did not do. While it was not necessarily the main emphasis of the program, StrIDe presents an opportunity to expand the options of choice schools available to students without cars or other means for transportation. This paper evaluates the degree to which this particular policy expanded opportunity and altered the enrollment patterns of students in Nashville. Links to information on the StrIDe program, as well as a short description, were provided on the optional schools application and the optional schools section of the MNPS website, highlighting this opportunity to overcome the transportation hurdles faced by students wishing to choose a non-zone school.

In December 2014, students were required to submit applications for optional schools or high school placement. By this time, the students considering their options for high school enrollment had received information about the StrIDe program and were able to take this transportation into consideration as they made their decisions. Given that the program began midway through the 2014-15 school year, students likely became aware of the program as their peers used the program. While the information was publicized and was likely understood by most students, it is possible that some students were not completely aware of the implications the policy change had for their enrollment options.

The program was expanded in the 2015-16 school year to give middle school students attending a non-zone school the option of using the StrIDe pass with parental permission (this was only made public after enrollment decisions were made for that year). During the first year of the program between 4,200 and 4,600 high school students used their school ID at least once per month to ride an MTA bus, and more than 18 percent of students used their school ID on an MTA bus (Street & Smith, 2015). Gains in ridership were made in the second year of the program, with between 4,700 and 5,700 distinct riders each month. Youth ridership made up 22 percent of the MTA total ridership, an increase of 2 percent from the previous year (Clelland & Smith, 2016). A seventh grader who used the program every day to get home stated, "It's good to be able to ride the bus home after school if your parents work – like mine – and can't come pick you up," (Clelland & Smith, 2016). No studies have been conducted to date to examine the impact of the program on school choice or school enrollment patterns.

CONCEPTUAL FRAMEWORK

A student's choice set is shaped by three types of barriers to enrollment and attendance, which constrain the choice sets available to parents as they consider their personal preferences: financial barriers, transportation barriers, and admissions barriers (Lankford & Wyckoff, 2005; Mickelson, Bottia, & Southworth, 2012; Stevens, Torre, & Johnson, 2011). If any of these barriers differentially limit the choice sets by race or income, one can expect segregation by race and income in the resulting choice sets. Each of these barriers is directly impacted by geographic location and inequality, due to segregation across neighborhoods. As families gather information on school quality and characteristics, financial, transportation, and admissions barriers filter and shape the pool of realistic school options; the family can then assert its personal preferences when selecting the school their child will attend. I do not suggest that parents necessarily approach school selection in this explicitly rational, linear and

orderly way, but I do argue that the school eventually chosen will reflect these constraints and limitations, as well as parents' personal preferences.

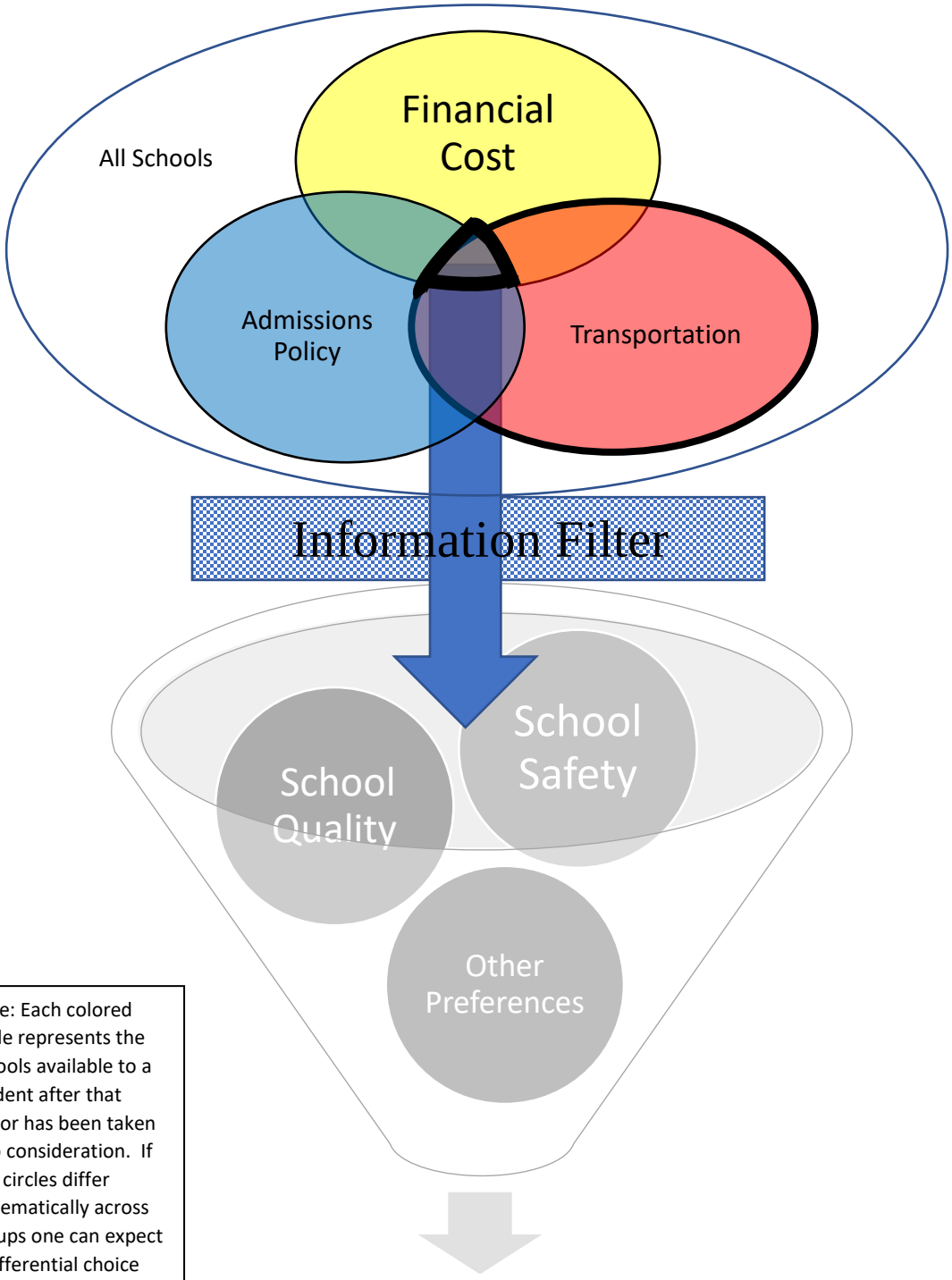
The financial cost of attending a school is a factor that limits the choice sets available to families (Bell, 2007; Lankford & Wyckoff, 2005). Although not a factor for some families, the cost of tuition and fees does prohibit many from enrolling their children in private schools. Thus, the choice set is tied to family income or wealth, and some degree of segregation across public and private schools can be expected. This should primarily impact racial segregation, in that racial demographics are often tied to income.

Admissions policies impact which students are eligible to enroll in or have a higher likelihood of being accepted by a given school (Mickelson et al., 2012; Stevens et al., 2011). Some schools require students to meet special academic or arts qualifications, such as magnet schools for academically gifted and talented students or those with arts auditions, while zone or priority zone schools give enrollment priority to students based on their neighborhood of residence or previous school attended. Given that students' place of residence in the Metro Nashville area, as with most urban districts, is both racially and economically segregated, the schools that give students priority enrollment based on residence will systematically differ by race and socioeconomic status (SES), and thus in their available choice sets.

The need for consistent access to transportation in order to attend a given school is another factor that limits some families choice sets (Bell, 2007; Mickelson, Bottia & Southworth, 2012; Rhodes &DeLuca 2014; Stevens, Torre, & Johnson 2011; Teske et al., 2009). Not every student or parent has a car to drive to a school across town, and many parents do not have a schedule that allows them to drop their child off and pick them up at school consistently; this often affects students differentially by SES. Consequently, some students must limit their choice set to schools to which they can walk, ride a bike, or take a reliable, affordable bus. All students are within walking distance of or have access to a yellow school bus that goes to at least one zoned school; however, the schools available to those walking or

riding a school bus differ according to where a student lives. Without access to reliable transportation, a student may not be able to consider enrolling in an alternative school. Some charter schools provide bus transportation, which enables students without reliable personal transportation to include them in their choice sets; however, most do not. Free public transportation could add many school possibilities to a student's set. Failing that, we can expect more significant race and income-based differences in students' school choice sets.

Figure 1: Structural Factors Shaping School Choice Sets and School Selection



Note: Each colored circle represents the schools available to a student after that factor has been taken into consideration. If any circles differ systematically across groups one can expect a differential choice set by group and resulting distribution of students across schools as a result.

The eventual choice of school is shaped by personal preferences and access to information (Bell, 2009; Hastings, Kane, & Staiger, 2005; Henig, 1990; Lankford & Wyckoff, 2005; Rhodes & DeLuca, 2014; Saporito, 2003; Schneider, Teske, & Marschall, 2000; Smrekar, 2009) Once the above factors have been considered, parents' school options can be further filtered in ways that could impact the distribution of students across schools and contribute to even greater school segregation. If personal preferences or access to information differ systematically by race or SES (as evidence suggests), we can expect to see an uneven distribution of students by race and income across schools. Personal preferences in school choice, which have been extensively researched, include prioritizing factors such as perceived school quality, religious affiliation, school theme or philosophy, safety, discipline, personal preference for sending a child to a school close to home or work, and to schools friends or siblings attend (Schneider et al., 2000; Smrekar, 2009; Stein, Goldring, & Cravens, 2011). Access to information about school quality, school characteristics, or the enrollment process can affect how these personal preferences enable parents to understand which schools have the characteristics they are most interested in. Little can be done in terms of policy making to change any racial or economic sorting that may occur due to personal preferences, unless the district is court ordered to maintain racial desegregation. However, policies can be implemented to ensure that all parents have access to accurate and unbiased information about the characteristics and quality of schools in their choice sets, and that transportation is not limited to those with the financial means to pay for private transportation.

While all of the above factors are critical, this project focuses on the transportation factor as an under-studied barrier to school access. My goal is to achieve a better understanding of how the provision of fare-free bus transportation impacts the differential sorting of students by race and SES within a segregated residential context, with the understanding that factors related to parental preferences, access to information, and school admission policies play a role in the uneven distribution of students across schools by race and SES.

RESEARCH QUESTIONS

Part I: How does geography and neighborhood segregation relate to school choice behaviors in MNPS?

1. *What are the baseline secondary school enrollment patterns of students from neighborhoods with different racial majorities or levels of affluence?*
    a. To what extent does the proportion of students who attend integrated schools differ based on the demographic makeup of their residential neighborhood?
    b. To what extent does the academic performance of the school attended differ by the demographics of a student's residential neighborhood?
    c. To what extent does the number of schools attended by students from a given neighborhood differ across neighborhoods with different racial and economic demographics?
2. *What are the characteristics of students and the residential neighborhoods of those who attend integrated schools?*
    a. What are the demographics of students who attend integrated schools and how long would it take them to attend if they commute via public transit?
    b. What proportion of these students are zoned to attend integrated schools?
    c. What is the racial and economic makeup of the neighborhoods of students who attend integrated schools?
3. *Where do students zoned to attend integrated secondary schools enroll and what are the demographic characteristics of the school they ultimately attend?*
    a. What proportion of students zoned to attend integrated schools actually go to an integrated school?
    b. If students are zoned to an integrated school but attend a different school, what are the demographic characteristics of the schools they attend?

c. What are the demographic characteristics of the school students attend if they are zoned to an integrated school, attend a different school, but end up in a different integrated school?

Part II: How does transportation policy influence the degree to which geography affects student opportunities?

1. *To what extent is the provision of free-fare busing within a school choice context associated with…*
    a. Whether a student leaves the school they attended previously?
    b. Students' participation in "active" school choice, that is, they attend a school other than the zone school they were assigned?
    c. The performance level of the school attended?
    d. The level of segregation and isolation students experience in school?
    e. The diversity of neighborhoods represented at the school attended?
2. To what extent does the policy influence students differently based on their race or SES?
    a. To what extent does this differ based on travel time on a public bus to the nearest integrated school without admissions restrictions?
    b. To what extent does the policy differently influence students from predominantly Black/Latinx/White neighborhoods?
    c. To what extent does the policy influence students differently based on their eligibility for FRPL?

CHAPTER 2

LITERATURE REVIEW

SCHOOL RESEGREGATION: HISTORY AND CONCEPTS

To understand current student enrollment patterns and segregation, it is important to review some key aspects of the history of segregation and resegregation in the United States. Many school districts that have gained unitary status over the past three decades, have discontinued the desegregation policies they previously had in place, such as cross-town busing, and replaced existing school zones and implemented policies that assign students to neighborhood schools and those generally "closer-to-home". This neighborhood schools approach has led to an increase in school segregation, largely due to historical and structural barriers to residential integration and lingering residential segregation (An & Gamoran, 2009; Clotfelter, Ladd, & Vigdor, 2006; Frankenberg, Lee, & Orfield, 2003; Goldring, Cohen-Vogel, Smrekar, & Taylor, 2006; Lutz, 2011; Reardon, Grewal, Kalogrides, & Greenberg, 2012).

The increase in grants of unitary status and patterns of residential segregation coalesced in 2007 with the consequential *Parents Involved in Community Schools v. Seattle School District No. 1 (PICS)* U.S. Supreme Court case (McDermott, Debray, & Frankenberg, 2012; Welner & Spindler, 2009). *PICS* limited the use of race in student assignment and school choice plans for districts not under court-ordered desegregation. This meant that magnet schools using race-based lotteries to maintain racially balanced student enrollments needed to find alternative ways to achieve integrated enrollment if integration in fact remained a priority. Justice Kennedy offered possible remedies for following "race-conscious" mechanisms that did not directly restrict admission based on race: strategic school siting, redrawing attendance zones based on neighborhood demographics, allocating resources for special programs, targeted recruiting of faculty and students, and tracking enrollment, performance and other statistics by

race. The efficacy of these measures has been questioned by legal scholars and policy analysts given evidence that all or most of these elements are unpopular, often unfeasible, or insufficient remedies to desegregate schools (McDermott et al., 2012; Welner & Spindler, 2009).

Resegregation accelerated throughout the 1990's and early 2000's (Glenn, 2012; Orfield & Lee, 2007). The progress made in reducing the percentage of Black students in predominantly minority schools was undone; having fallen from 77 percent in 1968 to 63 percent in 1988, the percentage rose to 73 percent by 2005 (Orfield & Lee, 2007). The resegregation of schools has led to greater isolation for Black students, but significant growth of the Latinx and Asian student populations has further complicated the segregation issue. Segregation can no longer be considered a Black-White issue, and must instead be considered in terms of a variety of minority groups. Latinx students have faced increased isolation and by some measures are the most segregated group, as they face triple segregation by ethnicity, poverty, and linguistic isolation (Orfield & Lee, 2007). There is evidence of a modest increase in racial integration in the 2000's, but even this is quite limited, with a smaller decrease in segregation in the South and large increases in large, racially diverse metropolitan areas, such as Nashville (Stroub & Richards, 2013).

Scholars also have tracked socio-economic segregation across schools, finding that this too has increased (Altoniji & Mansfield, 2011; Owens, Reardon, & Jencks, 2016). Income segregation between districts increased more than 15 percent from 1990 to 2010, while the between-school segregation of students in large districts who are eligible for FRPL increased by more than 40 percent from 1991 to 2012 (Owens, Reardon & Jencks, 2016). Like racial segregation, income segregation can have a severe detrimental effect on student achievement above and beyond the SES achievement gap, due to individual SES levels. Gregory Palardy (2013) found that, even when controlling for individual student SES, students who attend schools with a large proportion of high-SES students are 68 percent more

likely to enroll at a four-year college than students who attend school with low-SES students have higher graduation rates.

GEOGRAPHY OF OPPORTUNITY

To understand the relationships among school demographics, neighborhood demographics, school choice, transportation, and educational opportunity, this dissertation is motivated by the literature on the "geography of opportunity". The options or opportunities available to students in my conceptual framework are shaped by geography. The following section discusses the "geography of opportunity" framework and the role geography plays in shaping educational opportunity.

GEOGRAPHY OF OPPORTUNITY FRAMEWORK

The term "geography of opportunity" was first coined by Galster and Killen (1995) as a way of analyzing the structural and individual aspects of opportunity. Geography of opportunity has been used as a framework for analysis across the social sciences, and the term is generally used to represent the concept that, "where individuals live affects their opportunities and life outcomes" (Rosenbaum, 1995, p. 231). The framework also has been used to examine the role of geography in explaining employment opportunities, as well as access to adequate healthcare, affordable housing, and safe communities (Briggs, 2005; Drier, Mollenkopf, & Swanstrom, 2013; Powell, Reece, & Gambhir, 2007; Squires & Kubrin, 2005). Various hypotheses relate residence in or among metropolitan areas to individuals' opportunities and life outcomes, but all share two assumptions: that resources are spatially nonuniform and that residential mobility is differentially constrained (Galster & Killen, 1995). In other words, there must be spatial variation in the resources available in markets or from institutions in or across metropolitan areas, and individuals or households must have unequal ability to reside in the locations where they deem these markets and institutions most desirable.

The main hypotheses undergirding the geography of opportunity framework are the hypotheses of spatial mismatch and neighborhood effects. The spatial mismatch hypothesis, which is most

commonly discussed in the economic employment literature, is the idea that through the evolution of, suburbanization of, and within-urban metro movement of cities, the suburbanization of jobs and involuntary housing market segregation have worked together to create a surplus of workers (opportunity seekers) relative to available jobs (opportunities) in neighborhoods with predominantly low-income and Black residents. "Neighborhood effects" refers to the hypothesis that opportunities, goods, and services in a neighborhood community are shaped by the peer influences, indigenous adult influences, and outside adult influences (Jencks & Mayer, 1990). The increasing isolation of poor from non-poor households has driven much of the neighborhood effects literature. The spatial mismatch and neighborhood effects hypotheses coalesce in ways that affect educational outcomes and opportunities for students across neighborhoods.

There are many documented differences in opportunity that have been shaped by geographic differences. Raj Chetty and colleagues (2014), for example, found great disparities in economic opportunity for children across U.S. metropolitan areas: the probability of a child from a family in the bottom income quintile nationally reaching the top quintile is only 4.4 percent in Charlotte, North Carolina, but 12.9 percent in San Jose, California. They found upward mobility to be associated with living in areas that provide opportunity for students, specifically those characterized by (1) less residential segregation, (2) less income inequality, (3) better primary schools, (4) greater social capital, and (5) greater family stability. A popular policy initiative that provided ample evidence for testing the geography of opportunity framework was the Moving to Opportunity (MTO) program. This policy provided families with lottery-based vouchers to move out of high-poverty neighborhoods (Briggs, Cove, Duarte, & Turner, 2011; Chetty, Hendren, & Katz, 2015; Galster, 2011; Gennetian, Sanbonmatsu, & Ludwig, 2011; Rosenbaum, 1995; Rosenbaum, Reynolds, & DeLuca, 2002).

GEOGRAPHY OF OPPORTUNITY AND EDUCATION

Tate (2008) was among the first scholars to apply the term "geography of opportunity" to education as more than just an outcome measure, he did so during his presidential address to the American Educational Research Association (AERA), which he later expanded for publication. Tate described the geography of opportunity in two metropolitan regions of the U.S. that were engaged in significant efforts to transform their local political economies: Dallas and St. Louis. The Dallas case used qualitative methods to give voice to the lives and experiences of children in a traditionally underserved community, while the St. Louis case study used quantitative methods and an ecological approach to analyze the region's geography of opportunity, as researchers explored the interrelationships and spatial nature of interactions among industrial science, employment, and education. Tate argued that uneven geography of opportunity is present in both of these metropolitan areas. His discussions of geography of opportunity and the connection between the location of resources, jobs, technology, and schools were critically important in shaping the lives and trajectories of students in the two metro areas.

Xavier de Souza Briggs, the scholar best known for relating the theory of "geography of opportunity" to education, has examined how location matters for economic returns, quality of life, and beyond. Briggs' work demonstrates how the value of a given location as a place to work, invest, or go to school can shift profoundly as communities grow and their makeup changes. The first chapter of his 2005 edited volume *The Geography of Opportunity: Race and Housing Choice in Metropolitan America,* explored the key forces driving metropolitan growth patterns in America and how these patterns influence the changing geography of race and opportunity. The volume focused on access to good schools and jobs with some evidence on the geography of crime and insecurity, poor health and environmental hazards. Briggs related how segregation in metropolitan areas has shifted as the risks previously associated with inner cities have reached the older suburbs, and how these suburbs have segregated at an increasing rate as they have become more racially and economically diverse. The concentration of poverty in inner cities has declined, but the class divide and segregation by income

have increased for both Blacks and Whites. In the 1990s, between-district segregation became the dominant form of racial segregation in education. As students departed their assigned schools for choice schools, the minority students attending choice schools were more likely to attend segregated schools than were their counterparts in assigned public schools. This dissertation amplifies this important point.

Given the critical role geography plays in shaping the opportunities available to students, it is important for policymakers to consider how to change the inequality inherent in a segregated geographic context. In Briggs' concluding chapter of his edited volume, he discussed core dilemmas, competing objectives, and varied strategies for transforming the geography of opportunity. He discussed the debate on racial integration versus empowerment, and questioned whether the goal of policy should be to integrate or instead to empower a disenfranchised group. He argued that the ideal would be to do both, but that integration should not necessarily be pursued if it does not also empower the disenfranchised in ways that expand their opportunities. He differentiated between policies intending to be cures versus mitigations of segregation:

> Should we emphasize reducing segregation by race and class (through what I term "cure" strategies), or should we emphasize reducing its terrible social costs without trying to reduce the extent of segregation itself to any significant degree (via "mitigation" strategies)? Put differently, should we invest in changing where people are willing and able to live, or should we try to transform the mechanisms that link a person's place of residence to their opportunity set? (X. Briggs, 2005, p. 329)

In terms of reducing school segregation caused by neighborhood segregation by race and class, a "cure" strategy might be to physically move students to disperse them across a metropolitan area, provide vouchers and incentives to move families, or to re-draw attendance zones so that schools are more integrated. Whatever strategy is applied, a student's place of residence would still be critical in deciding where he or she goes to school. Alternative mitigation strategies might include providing additional school choice options or greater access to transportation options so that students are not limited by their place of residence when selecting a school to attend within a choice system. To see how

these mitigations or cures play out, more work needs to be done to analyze of social policies that have been and will be implemented.

GEOGRAPHY OF OPPORTUNITY: HOW EDUCATION CONTEXTS MATTER

Geographic Information Systems (GIS) have been used extensively for several years by those examining the geography of opportunity, particularly in analyzing school choice policies and segregation policies. In a special issue of the *American Journal of Education* focused on geo-spatial analysis and school research, Jeffrey Henig (2009) discussed the value of GIS as definitions of space and place have evolved in the education policy realm. Henig claimed that, as space and place began to lose their relevance and school choice grew, "the high-powered analytical tools afforded by GIS may be coming into play just in time to demonstrate the declining significance of space," (649). He argued that, with technology, distance is no longer the constraint it used to be, but he also recognized that place, and the social and cultural values we attribute to place, matters. Henig noted that complex interaction effects between geography, distance, and human conceptions of place are still highly relevant. While technology can help mitigate the importance of distance, it is still a major factor when considered with other aspects of place and space. The distance to resources of interest has differential effects for marginalized or isolated communities.

Given that the majority of U.S. public school students attend their neighborhood school-- 84.6 percent of attend their assigned school in 2012, according to the National Center for Education Statistics (2015)—it is logical that educational access is closely tied to neighborhood of residence. A good deal of research has been done on the degree to which people factor in neighborhood school quality when selecting a residence or the degree to which residents are willing to pay more to live in a neighborhood with high-quality schools (Black, 1999; Brasington, 1999; Dhar & Ross, 2012; Dougherty et al., 2009; Haurin & Brasington, 1996; Saporito & Sohoni, 2006).

The economics research examining the degree to which home values capitalize on school quality or school characteristics stems from the theory of Tiebout sorting (Tiebout, 1956). This theory asserts that, whether residents have children at the time or not, the quality of the public services (including schools) that become available by purchasing a home in a particular location makes up a significant portion of the basket of features a homebuyer values when choosing where to live. There are mixed findings regarding exactly which characteristics are valued and capitalized in home values; however, there does appear to be a connection between some school characteristics associated with high quality schools and the cost of housing (Chiodo, Hernández-Murillo, & Owyang, 2010; Haurin & Brasington, 1996; Kane, Staiger, & Reigg, 2005; Walden, 1990; Welsch, Statz, & Skidmore, 2010). While this may be true, many parents lack the resources to be selective when searching for a residence, thus this link between residential location and school quality exacerbates the dearth of opportunities available for their children.

Recent research points out the ways geographic boundaries have been drawn to limit educational opportunity based on race and SES. Richards and Stroub (2015) analyzed the degree to which school attendance boundaries have been gerrymandered in order to segregate students racially and socio-economically. Applying methods typically used to test congressional gerrymandering, they examined the boundaries provided by the School Attendance Boundary Information System (SABINS) and school demographic data from the National Center for Education Statistics (NCES) Common Core of Data (CCD). They found that attendance zones are highly gerrymandered and are becoming more so over time. They found that racial gerrymandering is more acute than socioeconomic gerrymandering and is more common in areas experiencing rapid racial change. Thus, educational opportunities are shaped not only by the geographic differences across neighborhoods in terms of demographic makeup and the resources available, but also by geography used expressly to limit opportunities and segregate students.

Genevieve Siegel-Hawley (2013) found similar evidence of attendance boundary gerrymandering in Henrico County, Virginia, a suburban school system that was experiencing increasing racial diversity. She used US Census data, data from NCES, and GIS mapping to show that growing suburban districts with increasing racial diversity could have designed attendance zones in a way that embraced this change and created more integrated schools, but instead chose to draw high school attendance boundaries that solidified extreme patterns of racial isolation.

Even in a school choice system, where the attendance boundary lines should be less critical in terms of which school a student will end up in. The supply of schools located near a a student's residence is important in the final selection. An examination of choice preferences in public school applications in Denver allowed Denice and Gross (2016) to detect how variation in the supply of schools affected which schools parents chose. They found that White, Black, and Latinx parents all had a preference for academic performance and quality, but that their choices reflected variations in the supply of nearby schools. They found that this variation in accessible schools reproduced race-based patterns of stratification.

Suburbanization has had a significant impact on racial segregation across both urban and suburban schools. Suburbanization throughout the mid- to late 20th century was mainly characterized as a trend in upper- and middle-income, mostly White families moving out of city centers into more homogenous communities, with the aid of federal agencies and home mortgage lenders (Frankenberg & Orfield, 2012; Timberlake, Howell, & Straight, 2011). Some school districts have attempted to capture this movement of White families by consolidating districts into countywide entities or using inter-district transfer policies; however, without the option of race-based busing and assignment policies, this has not been successful in districts under unitary status (Diem, Frankenberg, Cleary, & Ali, 2014). As Blacks and Latinx moved into the suburbs, residential and school segregation emerged across suburban

communities, racial enclaves were formed, and gerrymandering of attendance boundaries continued (Orfield, 2002; Siegal-Hawley, 2013; Timberlake et al., 2011).

Given how residential segregation is tied to segregated attendance boundaries and inequality in educational access, it may be reasonable for someone interested in educational equity and integration to feel their options are either to directly address residential segregation or to break the link between where one lives and where one goes to school. This dissertation examines a policy that attempts to sever the link as much as possible between where one what and their education options are available through access to transportation.

TRANSPORTATION EXPANSION AND SCHOOLS

The main policy change being examined in this project is one that provides fare-free public transportation to public school students. This section discusses the limited literature on the expansion of public transportation and the impact this type of policy has on student enrollment patterns. While there is considerable work showing that many parents view a lack of transportation as a hindrance that limits their options as they choose a school for their children, much less work has been done on the impact of providing access to free transportation on these choice sets. Most of the work that looks at school transportation has focused on the health benefits of walking, biking, and reduced emissions from cars as more students ride buses, or on students' participation in extra-curricular activities.

A 2010 work by Wilson and Colleagues is one of the few papers to examine both the forms of transportation students use to get to school and how they differ by the type of school attended. This paper provides a descriptive picture of the transportation context under school choice when yellow school bus transportation is provided for magnet school students (Wilson, Marshall, Wilson, & Krizek, 2010). It looks at modes of transportation used by students in two Minnesota school districts—Roseville and St. Paul—and how those modes differ in terms of whether students attend a neighborhood school or a magnet school. Surveys are analyzed from 100 parents and children, and found that children who

attend magnet schools tend to have longer commute times than those who attend neighborhood schools, are less likely to walk or bike to school, are more likely to take the school bus, and similarly likely to go by car. This reliance on bus and car travel for the longer commutes to magnet schools suggests that having access to these modes of transport is important in determining whether a magnet school is an option. Differences were also noted in the transportation used and parents' concerns regarding transportation by race and income. Nonwhite parents were more concerned than White parents about students' safety while walking or biking to school or waiting for the bus. This could have been due to the conditions in high-minority neighborhoods, particularly those that were low-income.

Teske, Fitzpatrick, and O'Brien (2009) looked at the critical role transportation plays in where parents choose to send their children to school. They conducted and analyzed 600 surveys from parents in Denver and Washington DC. and found that transportation is a barrier to choice for many low- and moderate-income families; 25-40 percent of respondents said transportation issues influenced their choice of school, while more than 25 percent said they did not enroll their child in the school they preferred due to transportation difficulties. Two-thirds of respondents, including 80 percent of the lowest income respondents, reported that they would choose a better school farther from home if transportation were provided.

A group of scholars recently formed the Urban Institute Student Transportation Working Group to examine the critical role transportation to school plays in shaping students educational realities. In February 2017, the working group produced a report on the role transportation plays in five choice-rich cities: Denver, CO; Detroit, MI; New Orleans, LA; New York, NY; Washington, DC. This descriptive report argues that the lack of transportation is a key barrier to equitable access to high-quality education; however, the report does not address the impact or influence student transportation policy has on the level of school segregation. This dissertation aims to address this gap in the research.

Gross and Denice (2017) examine the public transit system in Denver, CO to determine how its design differentially constrains the school options of low-income and minority students. They found that the transit system design encouraged migration from the outskirts of town toward downtown, where workers were needed, but that the high-quality schools located in affluent neighborhoods were more difficult to reach by public transit. While the authors broke out their analysis by race and affluence, they did not examine the role transportation plays in the level of school segregation students experienced, and they did not examine the impact of changing transportation access. For example, what happens when transportation access is changed? And when the system design presents significant hurdles, are there feasible policy changes that could begin to break down these hurdles and increase equity?

Many metropolitan areas have for some time offered student discounts for transit passes, but only in recent years have some begun pilot programs that provide public school students with free transit passes, including (among others) Cincinnati; Montgomery County, VA; Fairfax County, VA; Denver, CO; Tempe, AZ; and the San Francisco Bay area. Most of these programs were implemented in the last few years, thus the published academic research on their impact is limited.

Although the research in this area is scant, an evaluation of the program to provide free access to public transportation for students was conducted in the San Francisco area (McDonald, Librera, & Deakin, 2006). The paper examined the impact of the Bay Area pilot program, which was targeted at low-income students, who were the ones to receive free passes. To understand the impact of the policy, the authors conducted interviews, surveys and focus groups as well as an analysis of attendance records. They found that student ridership and participation in after-school activity increased, but no changes were seen in attendance rates. Some differential patterns were found between metropolitan areas, with heavier use of the passes in areas with denser transit lines. The study, which is one the only studies to evaluate a policy similar to the one examined in this dissertation, did not examine how the policy may have affected student choice sets. There is a lack of studies providing an extensive evaluation

of the impact free access to public transportation for students has on the formation of school choice sets. This dissertation will fill this gap by examining the degree to which the StrIDe transportation policy is related to school choice sets, and how such a policy policy can mitigate the limitations related to the geography of opportunity.

EDUCATIONAL OPPORTUNITY: ACADEMIC AND SOCIAL IMPACTS OF (DE)SEGREGATED SCHOOLS

In this dissertation, I draw from the geography of opportunity framework to discuss educational opportunity. The term "educational opportunity" connotes unequal access to high-quality and diverse school options. I make no assumption that having greater access to education options will necessarily lead to better education outcomes; however, without this access, many students are more likely to be isolated in racially identifiable schools that have fewer academic resources. This section discusses the implications of school segregation and resegregation for student outcomes and the achievement gap. An increase in school segregation or in the proportion of non-White students attending a school has been found to have negative effects on both short-term student achievement and longer-term student outcomes (Billings, Deming & Rockoff; 2014; Boozer, Krueger, & Wolkon, 1992; Guryan, 2004; Hoxby, 2000; Lutz, 2011).

While James Coleman (1966) was the first to document the negative relationship between attending a predominantly Black school and lower student test scores, his work was largely associational and did not examine the role of desegregation. Other studies have examined the effects of desegregation policies, as well as the effects of resegregation, particularly after a district has been granted unitary status. The studies focused on desegregation policies found that Black students who attended segregated high schools had lower educational attainment and lower eventual wages than their peers in integrated schools (Boozer et al., 1992; Braddock, 2009), and that the implementation of desegregation plans reduced dropout rates for Black students by about three percentage points (Guryan, 2004).

Lutz (2011) examined multiple regions of the United States where desegregation orders were dismissed by the courts. He found that the school districts involved tended to resegregate and notably, that there was a behavioral response among White and Black students that varied by region. Black students in resegregated school outside of the South saw higher dropout rates. Lutz did not find the same pattern in the Southern census region. In the Southern census region, where he instead noted a "reverse white flight," with formerly desegregated districts seeing a return of some White students to the district.

After the Charlotte-Mecklenburg, North Carolina, school district ended race-based busing, Billings, Deming and Rockoff (2014) took advantage of changing school assignment boundaries to test the impact attending at segregated schools had on academic outcomes. They found that, when assigned to schools with more minority students, White and minority students had lower exam scores; White students had lower high school graduation rates and four-year college attendance; and minority males had a large increase in criminal activity. The authors found that the resegregated schools contributed to a widening of inequality of outcomes between White and minority students, thus exacerbating (or at least perpetuating) the Black-White achievement gap. This is consistent with earlier findings by Crain and Mahard (1981), who found school desegregation was generally associated with modest gains in academic achievement of Black students, particularly for students attending integrated elementary schools.

Wells and colleagues (2005) found additional long-term effects of school desegregation. In their examination of 500 members of the class of 1980, they found that desegregation made the vast majority of students in the six desegregated schools they examined less racially prejudiced and more comfortable around people of different backgrounds. This is consistent with earlier evidence regarding school desegregation and students' intergroup relations (Hallinan, 1998; Schofield & Sagar, 1983; Sonleitner & Wood, 1996). This is particularly relevant given the current political culture around race relations and

political polarization. Even if there were not large academic impacts associated with school integration, it is important for our democracy that students learn to communicate with people different from themselves.

The differences in student outcomes that are tied to school integration can be caused by one of several factors including peer effects, financial resources, and teacher sorting. First, outcomes can differ due to the effects of having more affluent, motivated, less mobile, and more academically prepared peers or peers with different social networks regarding later job prospects. In order to isolate the impact of peers as schools resegregated, a few scholars have used school fixed effects models that should control for economic resources, and for any between-school differences in the teacher labor market; however, this would not control for within-school teacher or student sorting. Hoxby (2000) and Hanushek, Kain, and Rivkin (2004) used school fixed effects in their analysis of Texas public schools, where they found that the racial composition of a school has a significant impact on student achievement. Hanushek and colleagues (2004) found that a 10 percent increase in the number of Black students was associated with a drop in test scores for Black students of .025 standard deviations, and a non-significant drop of .01 standard deviations for White students. Hoxby (2000) found that a 10 percent increase in the number of Black students was associated with a .1 standard deviation drop in reading scores and .06 standard deviation drop in math scores for Black students; the impact for White students was a quarter as large. Hoxby also found that the effects were larger for schools that already had a student population that was at least one-third Black.

Second, differences can be attributed to the allocation of financial resources, as predominantly White schools have historically received more funding than predominantly non-White schools. Card and Krueger (1996) found that increased resources, such as financial resources, in Black schools relative to White schools in the pre-Brown years helped to narrow the Black-White wage gap. Reber (2010), who examined the post-*Brown* years, argued that the benefits of desegregation for student performance is at

least partly the result of increased school resources. She examined districts in Louisiana that were adopting desegregation policies as the state attempted to equalize school spending across predominantly White and predominantly Black schools. This involved "leveling up" funding to the levels previously experienced only in predominantly White schools. Reber found that a 42 percent increase in funding led to a 15 percent increase in high school graduation rates. Unfortunately, the impact of school segregation on long-term outcomes cannot be entirely compensated for simply through by providing funds. Billings, Deming and Rockoff (2014) found that the additional funding given to predominantly non-White and low-income schools could perhaps compensate for some of the short-term academic gap, but that the long-term impact on criminal activity, which they argue is more closely related to peer interactions, remains unchanged despite the additional funds.

Third, differences can be attributed to the teacher labor market and the differential sorting of teachers across predominantly White or non-White schools. There is extensive research suggesting that teachers with strong credentials, more experience, and better value-added scores are more likely to take jobs in schools (and to be assigned classes) serving more advantaged, affluent, and predominantly White students. This leaves low-income, low-achieving, and non-White students (particularly those in urban schools) with the least skilled teachers (Goldhaber, Lavery, & Theobald, 2015; Hanuschek, Kain, & Rivkin 2004; Lankford, Loeb, & Wykoff, 2002). In his study of the Charlotte-Mecklenburg public schools after the end of racial busing, Jackson (2009) found that schools experiencing a repatriation of Black students also experienced a decrease in multiple measures of teacher quality: teachers not only sort by race, income, and academic ability, they change their sorting as schools resegregate.

While racial demographics and socioeconomic status are often aligned, policies that affect segregation along one dimension (racial vs. socioeconomic) may impact the other dimension in different ways. Yancey and Saporito (1995) found in their analysis of Philadelphia and Houston public schools (specifically magnet schools) that some choice policies intended to decrease racial segregation, in fact

exacerbate socioeconomic segregation. The authors found further that the class-based achievement gap was exacerbated by the socioeconomic segregation. If school districts are going to have school choice policies, which appear to be a part of the US education reality, perhaps providing more affordable transportation options would help to limit the income segregation that may result from these policies. Providing transportation could limit the negative impact of segregation on students' academic performance.

Unfortunately, just because a school has a diverse student body does not mean that students will benefit from integration. Many integrated schools, particularly secondary schools, have highly segregated or tracked classes (Vigdor, 2011). If students and teachers are racially sorted within the schools, it is unlikely that a student will benefit as much from integration at the school level. Vigdor and Nechyba (2007) used administrative data from North Carolina to examine the relationship between peer composition and test scores at both the school and classroom level. Once they were able to look at classroom demographics rather than school demographics alone, they did not find that peer composition had a significant impact on student performance. Their model did not address funding disparities or examine the role of the teacher labor market, but it does suggest that students may not benefit simply from having diverse peers in their school. However, if a school is not integrated, there is no chance that the classrooms will be integrated. Therefore, it is worth striving for integrated schools as a first step, even if it is a limited step. Even as students are no longer limited to the racially isolated schools closest to their home, families will not necessarily choose to take advantage of educational opportunity. However, when such opportunity is available to some students and not others, it is reasonable to expect unequal educational outcomes.

SCHOOL CHOICE AND SEGREGATION

Proponents of expanded school choice policies—including magnet and charter schools, vouchers, intra- and inter-district choice—tend to rely on three main arguments regarding how school

choice can contribute to school desegregation or increase diverse enrollments. First, proponents argue that expanding school choice can reduce school segregation by giving students the opportunity to attend schools outside their segregated residential neighborhoods (Holme & Wells, 2008; Viteritti, 1999, 2003; Wells & Crain, 2005). Second, proponents argue that some families already practice school choice by enrolling their children in private schools and selecting residential locations that provide access to the schools they want their children to attend. These options are only available to families with the means to afford private tuition or a home in a desirable attendance zone, so expanding options allows more students to have school choice (Holme, 2002). The third argument is that providing school choice options can attract back into the district those high-income and White students who had left to attend private schools or schools in other districts in hope of finding higher quality schools that met their educational preferences. This was the main argument for creating of magnet schools as a desegregation tool (Blank, Levine, & Steel, 1996; Christenson et al., 2003; Wells, 1993).

Critics of school choice who argue that it may contribute to greater levels of segregation or at best maintain prior levels of, typically rely on the following counter-arguments. First, choice can be a way for parents to self-sort their students into racially homogenous schools, as they did under "Freedom to Choose" plans. One fear is that choice schools (charter, magnet, and voucher) could participate in "cream-skimming" and draw high-performing or White students out of traditional public schools, leaving behind low-performing minority students. Choice schools also can be used in ways that segregate students by catering specifically to the low-income Black students who can be easiest to educate and discipline, while avoiding English Language Learners (ELL) or students with disabilities who often require additional supports and services. This argument suggests that these schools cater to a specific demographic in a way that does not attract sub-groups with different demographics, thus creating racially isolated schools through what has been termed "cropping" (Lacireno-Paquet, Holyoke, Moser, & Henig, 2002). Second, institutional constraints such as school admissions policies and limited access to

transportation can prevent some students from participating in school choice. If these challenges differ across racial or socioeconomic groups, continued segregation can be expected (Lubienski, Gulosino, & Weitzel, 2009). Third, enrollment in choice schools requires time and information, which not all parents have equal access to. Parents must obtain information about their school of choice and take time to apply. If oversubscribed schools use a rolling admissions process, it can be expected that those with the most means will be able to acquire this information and submit applications in a more timely manner than parents who have lesser means and are working multiple jobs. If access to time and information differs racially or economically, a further stratification across schools can be expected as a result of school choice (Lacireno-Paquet et al., 2002; Schneider, Teske, Marshall, & Roch, 1998).

Evidence of Role of School Choice in School Segregation

Evidence of how school choice policies have impacted the level of segregation in schools is mixed. Some research compares the level of segregation in Traditional Public Schools (TPSs) to the level in choice schools. The majority have found that choice schools are less representative of the district demographics as a whole and that students in choice schools are more racially isolated than those attending a TPS (Frankenberg & Lee, 2003; Frankenberg, Siegel-Hawley, & Wang, 2010; Fusarelli, 2002; Lacireno-Paquet, Holyoke, Moser, & Henig, 2002; G. N. Miron & Nelson, 2002; Renzulli & Evans, 2005; Siegel-Hawley, 2014; Sohoni & Saporito, 2009). Some research compares districts with new choice policies to similar districts without them, or to overall state demographics. They find that charter schools are more racially isolated and that districts that offer school choice are more segregated than districts without school choice (International, 2000; Rapp & Eckes, 2007).

Other studies follow students as they switch from a TPS to a choice school in order to trace the school demographic changes they experience. Some of these studies find that those who switch to charter schools end up in more racially isolated schools with a widening Black-White Achievement gap (Bifulco & Ladd, 2007; Garcia, 2008; Stein, 2015). Researchers have found that some choice schools with

specific themes enroll a more racially integrated student body, while other themed schools do not. Some studies find mixed or neutral evidence regarding integration for school choice and segregation (Booker, Zimmer, & Buddin, 2005; Ni, 2007; R. Zimmer, Buddin, Jones, & Liu, 2011). And finally one study found that charter schools are less likely to be hyper-segregated than TPSs and that the students who switch experience improved overall integration levels across schools (Ritter, Jensen, Kisida, & Bowen, 2016). This method used in this last study allows for a counterfactual that economists argue is a superior comparison group, as the other studies required a leap of faith that the comparison district is indeed similar to the district with school choice (Zimmer, Gill, Booker, Lavertu, & Witte, 2011). However, this method does not explore the larger systemic impact on students who do not choose to participate in choice or provide an estimate of effects for students who enter a choice school in kindergarten rather than switching to a choice school after first attending a TPS. It is likely that the students who switch schools are significantly different in some unobservable way from those who do not.

Overall, the evidence is mixed in terms of the potential of school choice to contribute to greater racial and economic integration. There is some evidence that intentional siting schools in locations accessible to students from different racial groups can allow choice schools to be integrated, but that a theme school may not be enough to draw families a long distance or into a neighborhood with a high-minority or low-income population (Smrekar & Honey, 2015). However, if school siting does not take simultaneous account of geography, residential segregation and transportation simultaneously, choice schools can become segregated due to residential segregation, as parents tend to choose schools close to their homes absent reliable transportation options (Jacobs, 2011). Most choice plans in fact do not include sufficient safeguards against segregation, such as equal access to transportation, information, and admissions (Scott, 2005). Expanding choice without these safeguards may have contributed to the increased segregation of students in schools (Wells, Holme, Lopez, & Cooper, 2000), but if these needs

were to be met, school choice policies could contribute to greater levels of opportunity and integration. As school choice policies are likely to continue for the foreseeable future, it is prudent that the policies implemented ensure equitable access in order to avoid racial stratification.

HETEROGENEITY IN SCHOOL CHOICE SET FORMATION

Student enrollment patterns and the experience of segregation or isolation in schools within a school choice context is necessarily shaped by the choice sets each individual student has. Many studies have explored parents' priorities when forming their school choice set and selecting a given school from within that set. Many of these studies, which attempt to better understand parental priorities, are based on interviews or surveys with parents. The four broad categories of priorities parents provided when asked how they identified their choice sets and eventually selected the school where they sent their child include academic/curriculum, discipline/safety, transportation/proximity/convenience, and religion/values for public schools; cost is then added to the equation when studying public and private school choice (Smrekar, 2009). These values have been consistent throughout the literature since the early 1980's when a large amount of school choice research began to be conducted. Of these four categories, academic quality and safety have been found by some scholars, including Schneider et al (1998) to be the factors parents cited most often when choosing schools. Academic quality is the most common factor cited by parents when choosing to use school vouchers (Greene, Howell, & Peterson, 1998; Heise, Colburn, & Lamberti, 1995; Witte, Bailey, & Thorn, 1993).

While academic quality is generally parents' top priority, proximity and familiarity are two other critical factors for parents. Smrekar and Goldring (1999) found that when examining parental preferences for active choosers (students whose parents do not choose their assigned neighborhood school) among the student population at large proximity and familiarity with the schools were two of the most important factors. This could be due to ability to attend a school (access to yellow bus

transportation or ability to walk to school, for example), personal preference for schools near the home, or a combination of the two.

There are slight differences in the choices parents make that depend on their background. High- or middle-income White parents cite values, and lower income Black or Hispanic parents more commonly cite issues of safety and discipline. However, most parents cite many of the same factors; the differences are in the degree of importance they attribute to each factor (Smrekar, 2009). As Bell (2009) found in her longitudinal study of parents in a Midwestern town with an option-demand school choice system, parents from different social classes gave similar responses in terms of their priorities when selecting a school. However, poor and working-class parents had to look at more schools, and they included a higher proportion of failing, nonselective, free schools in their choice sets than middle-class parents, who were able to focus on higher performing, selective, and sometimes expensive schools.

In practice, parents' behavior suggests somewhat different priorities when selecting a school from the factors they claim to prioritize in surveys or interviews. One of the priorities parents commonly mention in surveys as the most important factor when choosing a school is a vague notion of academic quality. Multiple studies have attempted to track parents' actual choices and have found no evidence that parents actually switch from poorly achieving schools to higher achieving schools when they participate in active school choice (Weiher & Tedin, 2002). Stein, Goldring and Cravens (2011) found that only one-third of students switching schools in Indianapolis chose to enroll in a school that passed adequate yearly progress (AYP) benchmarks (p.122). On the other hand, more than 60 percent of switching students did leave schools that were failing AYP. This suggests that academics may have been a key push factor, and that parents might be prioritizing academic quality based on a school's reputation or pedagogy, rather than on its actual performance on quantifiable measures such as exam scores. This does not mean that parents do not prioritize academic quality, but I argue that it shows that, if parents do indeed prioritize school quality, at least one of the following is likely true:

1. Parents' ideas of academic quality are not necessarily reflected in what researchers and policy makers consider measures of academic quality.
2. Parents may not know enough about school quality measures to make educated decisions.
3. Parents' limitations in terms of financial, social, or cultural capital may constrain them in such a way that they cannot select high-achieving schools.

What is most likely occurring is an interaction among these explanations. The following sections address the literature associated with each of these three possible explanations for why researchers often do not see parents' final school selections aligning with their stated interest in academic quality.

Parent and Researcher Conceptualizations of Quality

One reason researchers may find that parents' stated desire for academic quality is not reflected in their final school selection may be due to differences in how researchers and parents evaluate school quality. Researchers are limited to measures that are unlikely to capture the vague notion of quality that a school gains through reputation and social networks. Quantitative researchers are limited to operationalizing school quality through test scores, value-added scores, and teacher credentials, or perhaps principals' evaluations of teacher quality. It is likely that these measures do not capture a school's general academic reputation within a district or within parents' social networks. This inability to capture a school's reputation in quantitative analyses is critical. Smrekar and Goldring (1999) found in their surveys of magnet school parents in St. Louis and Cincinnati, that more parents utilize social networks than any other source of information (including formal school information outlets) when selecting a school; school visits were the second highest ranked source of school information. Teske, Fitzpatrick and Kaplan (2007) also found that while parents use multiple sources of information on schools, they trust information from their social networks more than official reports from school and district officials.

Parents may participate in school choice in order to select a school other than their assigned zone school, not simply because they are attracted (or pulled) to a school with characteristics they desire, but because they also feel a push to exit a school they are dissatisfied with. Witte, Bailey, and Thorn (1993) found that parents applying for vouchers to private schools were largely motivated by their dissatisfaction with the public schools. This parental dissatisfaction can only be gauged quantitatively through surveys and will not be apparent in the published school report cards researchers often rely on. While this lack of dissatisfaction data may be concerning for researchers, the number of families that used the school exit options provided under No Child Left Behind (NCLB) was very small; less than 1 percent of eligible families in the U.S. took advantage of NCLB school choice options in the first three years (Stulich, Eisner, & McCrary, 2007).

Even if parents use publicly available data to evaluate the quality of their school options, these school report cards can be difficult to interpret, which may help explain why this is not a more popular source of information. The report card generally includes many (sometimes conflicting) measures that even researchers are unsure how to interpret (proficiency scores, value-added scores, student demographics, one-year estimates, three-year estimates, subgroup breakdowns, etc). Some states have elected to utilize an A-F or color-coded evaluation scheme, much as Florida has had for several years, in order to make the school report cards easier to interpret.

Lack of Information and Differential Access to Information

A second reason researchers may find that parents' stated interest in academic quality is not necessarily reflected in the final school selected may be due to parents lacking sufficient information to assess school quality. The report card accountability system that has been in place since NCLB is based on the premise that parents can make more informed decisions or assert more pressure on the school attended if they are provided with school performance data (Dee, 2011). This is based on the argument that parents operate as rational consumers within a school choice system and that schools will respond

to the consumers' (parents') demands (Loeb & Strunk, 2007). This argument has been critiqued, particularly in light of the role social and cultural capital play in parents' ability to make a "rational" decision that truly reflects their school preferences. School performance data has been increasingly available online for over two decades, but this data is difficult to interpret and many parents remain uninformed. In addition, accessing the data requires parents to have access to the Internet and they must know the data is available in the first place.

Political Science scholars have argued consistently that the general populace is not well informed about political facts or about how to assess the quality of public services or politicians (Converse, 1962). Evidence of this lack of political knowledge is so consistent that Bartels (1996, p.194) has declared that, "the political ignorance of the American voter is one of the best documented data of modern political science." This assertion is consistent in the education literature. Clinton and Grissom (2012), for example, used telephone surveys in Tennessee to find that the public was not well-informed about the performance of their local schools. They found that this trend held for parents with children attending public schools. However, they also found that, when respondents were given information about school performance, they altered their opinions and evaluations of their local schools.

Unfortunately, when parents are unable to interpret the complex array of school and student performance data presented to them, it is possible that they make assumptions based on student demographics as a proxy for school quality. Hamilton and Guinn (2005) proposed that parents may use race as a sign of school quality, the assumption being that schools with a large proportion of Black students would have safety concerns, a weaker academic focus, and the low-quality teachers often associated with high-minority or inner-city schools. Many parents do not mention race as a factor in their school choice as it is not considered socially appropriate, unless referred to in terms of diversity. However, a few studies have found that White parents often (sometimes un-consciously) eliminate high-

minority schools from their choice set before choosing a school based on academic performance or reputation (Henig, 1990; Saporito, 2003).

Rich and Jennings (2015) found that more students transferred out of schools assigned to "probation" when school performance information was made public, but that low-income families were likely to leave for another school in the district while non-poor families were more likely to leave for another district or enroll in private school. Thus, parents may respond to publicly accessible information on school quality and academics may be a push factor, but families that have limited capital may not be able to select a school with the academic characteristics they prefer.

Schneider and colleagues (1998) found that, while most parents are ill-informed about the qualities of the schools they can choose from, many parents (even low-income parents in inner-city districts) still end up putting their children in schools that match their declared interests. However, in for these parents to end up in select schools that match their stated interests the parents had to rely on their social networks, which hopefully included at least one parent who was familiar with the quality of the schools. Thus, a parent who has well-informed friends can sometimes makeup for their own lack of school knowledge and familiarity. In general, however, many parents are not well informed about the quality of their school options, and if they do not have well-informed friends they could end up sending their children to schools that do not reflect their stated desires for high quality academics.

Disparities in Capital

A third explanation researchers find for why parents do not necessarily select schools that reflect their stated interest in academic quality may be related to their capital limitations. Sociologist Pierre Bourdieu (1986) categorized the main forms of capital associated with social class into three main groups: financial, social, and cultural. These forms of capital shape student enrollment patterns. Financial capital was addressed above as it pertains to Tiebout sorting of residential options and access to transportation. Financial capital also shapes parents' access to private schools, tutoring services, and

test-preparation assistance. However, while financial capital is one of the more obvious forms of capital that shapes parents' access to high-quality schools, social and cultural capital also play a critical role in shaping access and enrollment patterns.

SOCIAL CAPITAL

Social capital refers to the economic resources one has as a result of being a part of a social network. Coleman (1988) was one of the first scholars to discuss how social capital shapes the educational experiences of parents and students alike, and how it influences the processes associated with students' enrollment patterns and parent choice sets. There are distinct differences in access to information, and in the prioritization of that information or of school characteristics associated with different social networks.

As noted earlier, Schneider and colleagues (1998) found that parents who lack complete or accurate information about schools in their district are often able to overcome this lack by relying on a better informed member of their social network. These authors found that the average public school parent has little accurate information on the conditions in their local schools, yet they end up choosing schools that rank higher on the dimensions they claim to prioritize. The subset of parents who are well informed about conditions in the schools have a closer match between their wants and the conditions of the school where their child enrolls. Thus, social networks help but do not necessarily entirely overcome parents' lack of knowledge about school characteristics.

Parents from different social classes rely on different sources of information when selecting a school, one being their social networks. Schneider and colleagues (1998) found that lower-income families utilize social and friendship networks less frequently and at a lower rate than their higher income peers. Teske, Fitzpatrick and Kaplan (2007) found that parents of lower income families put less trust and value on information gathered from official sources rather than through social networks. However, they had to rely more than wealthier families on official school reports as their networks tend

to be less informed. This difference in reliance on social networks for information can be tied to differences in the types of resources available through the social networks of parents from different social classes or income levels. Schneider and colleagues (2000) found, for example, that higher-income parents had larger social networks that included people well connected to more information, including education professionals who could provide trustworthy advice about school options and insider hints on how to navigate within the school system.

In addition to being useful for gathering information about schools, social networks can also help parents overcome obstacles that may otherwise eliminate some schools from their consideration. Bell (2007) interviewed 36 urban parents and found that geography played a complicated role in their school selection. Bell found that parents saw a lack of access to transportation as a significant constraint on their school choice, but some were able to overcome it by carpooling with other families in their social network. Transportation and the resources available within parents' social networks are often limited for low-income families, leaving them facing the limitations of both their financial and social networks when selecting a school. Enrollment patterns are clearly influenced by parents' social capital, which is also true of their cultural capital.

CULTURAL CAPITAL

Cultural capital stems from Bourdieu's theories surrounding the role of cultural distinctions including the non-economic resources that enable social mobility. This capital, which includes knowledge, skills, and education shapes parents' priorities when selecting a school (or how they conceptualize school quality) and how they interpret information about schools.

There are subtle differences between parents who have a college education and parents who do not in terms of the factors they emphasize most when conceptualizing school quality. Schneider and his colleagues (1998) found that college educated parents (and White parents) emphasized academic inputs (such as teacher quality), while non-college-educated parents (and Hispanic, Black, or Asian parents)

were more likely to focus on academic outputs (such as test scores). This could be tied to college-educated parents' cultural understanding of the value of academic inputs in helping their children succeed, or to their cultural expectation that their child will be expected to succeed in any school but that high-quality inputs could help them do so. This is congruent with Lareau's (2002) assertion that middle-class parents conform to a cultural logic of childrearing that she refers to as concerted cultivation, whereby parents organize age-appropriate activities for their children that emphasize individualism and performance to help them develop important life skills. Finding appropriate school inputs are viewed as critical for cultivating successful children.

Lower-income and less educated parents have been found to place more emphasis on outcomes they view as benchmarks or "gatekeeping points" for joining the middle class, such as test scores, as well as on safety and discipline in the schools (Delpit, 1995). Their focus on safety and discipline could reflect the level of violence often found in lower-income neighborhoods, and Lareau's (2002) theory that working-class and poor parents emphasize the "accomplishment of natural growth". This emphasis suggests that these parents believe their children will thrive if they are provided with love, food, and safety. Discipline, obedience, and a respect for authority are also associated with the argument that lower-income parents tend to have a more authoritarian approach to parenting than their middle-class counterparts, who tend toward more authoritative child-rearing tactics.

A student's place of residence is fundamental in shaping their opportunities in terms of school choice sets, but even if priorities are similar across classes, not all parents have an equal ability to consider neighborhood school quality when choosing a residence. In their chapter in Annette Lareau's *Choosing Homes, Choosing Schools,* Rhodes and DeLuca (2014) examined the decision-making processes low-income parents use as they "choose" a residential location and a school for their children. Rhodes and DeLuca conducted interviews over three summers with low-income African American families in Mobile, Alabama. These interviews revealed that many families had to make multiple last-minute moves

with little time to research quality, affordable living arrangements in a desirable school attendance zone. Most of the families interviewed had bad credit and lacked the funds to pay a high security deposits, and therefore had to quickly settle for whatever affordable housing they could find. School decisions were necessarily secondary and disconnected from residential decisions; however, their housing decisions directly shaped the school options available to their children. Few of the families had the resources or capital to send their kids to their first-choice schools across town, as they were limited by access to transportation and busy work schedules. The families that sent children to non-zoned schools often sent them to schools of similar quality located close to their social network of extended family or close to their place of employment.

Several scholars have found that race and class are critical to parents as they form their school choice set, as they tend to seek cultural familiarity and racial consistency. While parents may choose schools that have demonstrated academic success (as measured through test scores or perceived teacher quality), they also tend to choose schools where the racial majority reflects the race of their child (Glazerman, 1998; Saporito & Lareau, 1999; Schneider & Buckley, 2002; Weiher & Tedin, 2002). Schneider and Buckley (2002) found that parents use the Internet to explore the racial composition of schools when selecting a school. Saporito and Lareau (1999) found that the majority of White families they examined followed a two-tier process whereby they first delete majority Black schools from consideration before applying their values regarding academic quality or school safety. More recently, Billingham and Hunt (2016) found that some White parents may purposefully avoid schools with large non-White populations, even when considering hypothetical schools.

The desire for racial consistency can pose significant hurdles in a district where a minority of students are White. In a review of magnet school enrollment patterns in post-unitary contexts, Smrekar (2009) found that, as schools saw an increasing number of minority students enrolling, and districts were no longer allowed to use race-based lotteries, it became harder and harder for magnet schools to

attract White parents. These findings align with the proposed 40 percent minority tipping point, where a school is considered to be "tipping" toward having more minorities than many White families are comfortable with as they seek racial consistency (Rossell, 1976). In districts where 60 percent or more of the students are non-White, it becomes difficult to maintain integration across schools in a way that pleases White parents seeking cultural familiarity, and this can lead to further White flight. It is possible (and perhaps even likely) that, when parents say they are looking for a high-quality school, race and class are entangled in their views on what represents high quality in schools.

Parents not only seek cultural familiarity and racial consistency in the school they select for their child, they also consider their child's academic history. Bell found that a child's academic history often plays into parents' school decisions in unexpected ways, as low-income parents sometimes avoid high-performing schools where they feel their child will be "set up for failure amongst a bunch of high performing students" (Bell, 2009). It is clear that cultural capital shapes students' enrollment patterns, as their parents seek cultural familiarity (particularly White parents) and schools with characteristics that reflect their cultural values. This is important and highly relevant to the shape of school choice plans and policies, and to the potential application of school choice policies intended to promote desegregation. This dissertation does not seek to primarily analyze enrollment patterns shaped specifically by social or cultural capital. Nor is this study designed to understand why families select a given school. Rather, this dissertation attempts to better understand students' general enrollment patterns and how these patterns relate to geography and access to transportation, with some discussion of distinctions by race, FRPL status, and neighborhood characteristics.

In summary, parents from different backgrounds often value many of the same factors when choosing a school, but some must settle for schools that do not fulfill their preferences if their situation provides insufficient social, cultural and economic capital. Parents may have to prioritize schools they can afford, that are close to home, and/or where help with transportation may be available. At first

glance, parents' decisions may not seem to reflect their stated desires and values related to academic performance and school characteristics, but this may be due to constraints on their actual choice sets prior to selection. A family's final choice set is determined by the extent of these constraints in conjunction with personal preferences.

Figure 2: Choice Set and School Selection Model

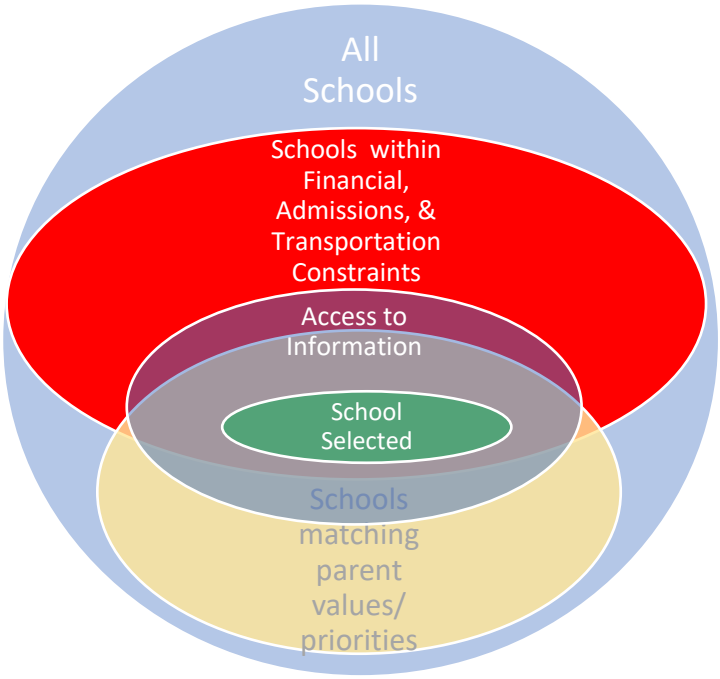


Figure 2 presents a simplified model of how parents may select a school for their child and the factors that shape this decision. Constraints (such as school tuition, lack of school transportation, or restrictive admissions policies) shape the available options of schools from which parents must choose. The available schools are refracted by access to information, which is also shaped by their capital. Parents' personal preferences tend to further limit their choice sets, not make them larger. A parent may be able to afford a private school, but prefer not to spend their money on tuition; they may have affordable public transportation that can get their child to a school across town but prefer not to put their child on a bus for two hours; a child may be able to get into a gifted and talented school but the

parent prefers a student body with more diverse learning abilities. If limitations and differences in enrollment patterns are influenced by external barriers or constraints rather than entirely due to parents' personal preferences, a policy that limits the schools excluded from a choice set due to these constraints should change enrollment patterns. This dissertation examines neighborhood distinctions in terms of access in a school choice system, as well as the changes in enrollment patterns that result when transportation constraints are partially lifted for some students.

CHAPTER 3

DATA

The data for this dissertation is derived from five sources. Student level individual data and school-level data were provided by MNPS. Neighborhood demographics were drawn from the American Community Survey (ACS) three-year estimates. Crime data were derived from the 2015 crime index provided by Applied Geographic Solutions using the FBI Uniform Crime Report. Public transportation routes and schedules were collected using a Google Maps API from github, which allows for the downloading of real travel time data during the actual travel times when students would ride the bus to school. Census tract and block shapefiles come from the U.S. Census Bureau Tigerfiles.

OPERATIONALIZATION AND MEASURES

SEGREGATION AND INTEGRATION

There are many indices for measuring the level of segregation across a school district or a metropolitan area. One of the most common measures of segregation in education literature is the dissimilarity index. However, this measure is not appropriate for providing individual school level or individual neighborhood level measures of segregation or integration within the larger district.

This dissertation utilizes measures of isolation from other groups of students and a measure used to declare schools racially identifiable by the Department of Justice (DoJ) . A measure for Extreme Isolation is utilized, which has also been referred to as “extreme segregation”, “hyper-segregation”, and “one race” in the literature (Frankenberg et al., 2010; Ritter, Jensen, Kisida, & Bowen, 2016) . This extreme isolation is a binary variable that flags all schools where 90 percent or more of the population is of one race, as well as schools where 90 percent or more of the student population is non-White.

A binary measure that considers the demographics of the district as a whole is used to determine whether or not a school is segregated according to the DoJ. This measure declares a school segregated if its percentage of White students is more than 20 percentage points higher or lower than the district percentage White. A 15 percentage point robustness check is included in Appendix C.

The models measuring the associated influence of StrIDe on integration are presented using the indicator for whether the school is within 20 percentage points of the district average. This allows for better model fit, as there is a large proportion of students attending each type of school. An additional measure of segregation was tested using a continuous variable for the difference in percent White of a school from the percent White in the district (this is presented in Appendix C). Racial isolation was not examined in Part II, due to the relatively low number of students attending a racially isolated school. Finally, a measure for racial congruence or students' exposure to the same or a different race is also included in Appendix C. This represents the proportion of students in a school who are of the same race as a given student.

DISTANCE

The API for Google Maps was used to calculate the shortest travel time between every census block population centroid in Davidson County and each secondary school; this was calculated for 7am on a public bus in normal traffic for that hour using python code. This data includes the minutes it would take a student to arrive at the school; however Google Maps does not calculate distances for students who reside so far from a bus stop that Google has decided it is unreasonable for them to choose to ride public transportation. In short, it would require those students to walk for hours just to reach a bus stop. Therefore, these students are listed as not residing within 90 minutes or less of the nearest school using public transit. To account for these students, the results are presented using cut-points and an indicator for whether a student falls within that cut-point in minutes (30 minutes or 60 minutes to the school).

Student Characteristics

Administrative files were used for student gender, race, FRPL status, school of enrollment, assigned zone school, and student geocoded address. Using their address, students were placed within neighborhoods and attendance zones. The school and residence selected for each student were based on which school they were enrolled in and the address they were listed as living at on November 15 of each year.

School Characteristics

School level (middle versus high school), school type (charter, magnet, enhanced option, traditional public school), school location/address, percentage FRPL eligible, and racial breakdown of students were collected from administrative data. A search of the district website also was used to gather data on whether a school required students to place high on an academic test or have an audition to be admitted. This information is critical in understanding if a school has selective admissions and thus may not be an option for some students, even if it is the nearest integrated or high-performing school.

To operationalize school quality, Tennessee Value-Added Assessment System (TVAAS) composite scores and proficiency rates were drawn from the Tennessee Department of Education report cards. A school is labeled as having high value-added if it receives a four or five out of five on the TVAAS. This measure approximates the quality of instruction and schooling provided at the school. The percentage of a school's students who are proficient or advanced in English and math performance is provided as a measure of the educational competence and quality of the students in the school. This measure provides insight into the quality of the peers within the school. Due to the fact the TVAAS exam was not completed across all Tennessee schools (due to technical difficulties) in the 2015-16 school year, lag scores are used for the test scores. These reflect the scores of a school that families could have seen on report cards as they were selecting a school for the following year.

NEIGHBORHOOD CHARACTERISTICS

Neighborhood characteristics are drawn from the American Community Survey at the census tract level and from aggregating student demographics within each attendance zone, census tract, and census block. Data is pulled for the percentage of residents under the age of 18 living in poverty, percentage White, percentage Black, percentage Latinx, percentage Asian, median household income, percentage of residents who ride public transportation to work, percentage of residents who rent versus own their home, and percentage of school-age students who attend public versus private schools. Additional neighborhood data was pulled from the FBI Uniform Crime Report. Applied Geographic Solutions, Inc has used the national crime database to create an index that compares the relative level of crime by census tract against the national average. For this measure, a number below 100 represents a level of crime that is less than the national average, while a number greater than 100 is above the national average.

SAMPLE/ POPULATION

The sample includes all public-school students in MNPS secondary schools from the 2011-12 school year to the 2015-16 school year who have a real address listed in the administrative records (less than 5 percent of students did not have a mappable address and were dropped for this analysis). The breakdown of the raw data to the analytical sample is included in Appendix B. GIS was used to place student addresses and school addresses into school attendance zones, census blocks and census tracts. There were 238,949 total secondary school students over the five years, with each year having between 46,395 and 49,959 students. About 52 percent of the students were in middle school (grades 5-8), and 48 percent in high school (grades 9-12). In Part II, the analysis is broken down by cohort and grade, with the main analysis limited to students in grades 7 through 11 during the 2014-15 and 2015-16 school years. The sample is further limited to students by cohort or by grade for certain models. The sample for Part II is limited to these students in order to target the treated students and a reasonable comparison

group of students who are close in age and experience to the treated students but are not being treated.

CHAPTER 4

PART I

PART I METHODS

First, descriptive analyses were conducted that include the use of conditional means and proportions to evaluate the extent to which geography and residential segregation are associated with the enrollment patterns of MNPS secondary school students over the five school years.

Analytical Procedure: What are the baseline secondary school enrollment patterns of students from neighborhoods with different racial majorities or levels of affluence?

The first analysis describes the enrollment patterns of students from neighborhoods with different racial and economic makeups. The questions examined in this section include to what extent the level of integration or isolation in the school where students enroll, the academic performance of the schools where students enroll, and the diversity or number of schools attended by students in a given neighborhood differ based on the demographic makeup of students' neighborhood of residence. I examine proportions and means with standard deviations conditional on measures of neighborhood demographics. These are presented as overall district characteristics and then broken out into subgroups.

Analytical Procedure: What are the characteristics of students and their residential neighborhoods of those who attend integrated schools?

Next, in order to understand where integrated schools draw their student bodies from, I compare the residential patterns of students who are enrolled in relatively integrated schools to those in non-integrated schools. I use descriptive statistics (proportions, means, and standard deviations) to explore the demographics of students who attend integrated schools, how long it would take them to

arrive using public transit, and the demographics of the neighborhoods students come from. The analytical sample is limited to students attending integrated schools, defined as having a percentage White enrollment within 20 percentage points of the White population in the district.

Analytical Procedure: Where do students zoned to attend integrated secondary schools enroll and what are the demographic characteristics of the school they ultimately attend?

Descriptive statistics (proportions, means, and standard deviations) of school characteristics are calculated for the students who live in an attendance zone with an integrated school. Subgroup analyses are based on whether or not a student attends the integrated school they are zoned to attend and on neighborhood characteristics for their neighborhood of residence.

PART I RESULTS

To best understand how enrollment patterns differ by neighborhood, it is critical to first examine the districts overall characteristics. Table 3 presents student characteristics for secondary school students overall and broken down by school level for the 2011-12 through 2014-15 school years. The demographics are very similar for middle and high school students; the largest racial group is Black students, followed by Whites and then Latinx. There are about 20,000 more middle schoolers than high school students in the district, but they are fairly comparable in terms of racial background. A slightly lower proportion of students is listed as eligible for FRPL, which could reflect a difference in the reporting rates, as high school students may be less likely to report needing a free lunch than middle school students, due to the stigma attached. The breakdown of secondary student characteristics by school can be found in Appendix A.

Table 3: Characteristics of Secondary School Students 2011-2014 (Means/Proportions and SD)

	All Secondary Students		High School Students		Middle School Students	
	Mean/ Proportion	SD	Mean/ Proportion	SD	Mean/ Proportion	SD
Female	0.49	0.50	0.49	0.50	0.49	0.50
White	0.31	0.46	0.31	0.46	0.32	0.47
Black	0.47	0.50	0.48	0.50	0.46	0.50
Latinx	0.17	0.38	0.16	0.37	0.18	0.39
Asian	0.04	0.20	0.04	0.20	0.04	0.20
FRPL	0.75	0.43	0.72	0.45	0.77	0.42
N	188990		90319		98671	

Mean/ Proportion

GIS maps are also used to present the residential segregation in the district, which is critical in understanding how geography of opportunity shapes the educational opportunity in the district. As Figure 3 shows, there are clear neighborhood pockets with distinct racial majorities and high levels of racial segregation and isolation. On this map, each small colored dot represents one student in secondary school in 2014. The school demographics (represented by the larger pie charts) show that the student bodies largely mirror the demographics of the neighborhood where schools are located. Figure 4 shows the same map zoomed into the more densely populated downtown portion of the district.

Figure 3: Secondary School Students and Schools by Racial Demographics (2014)

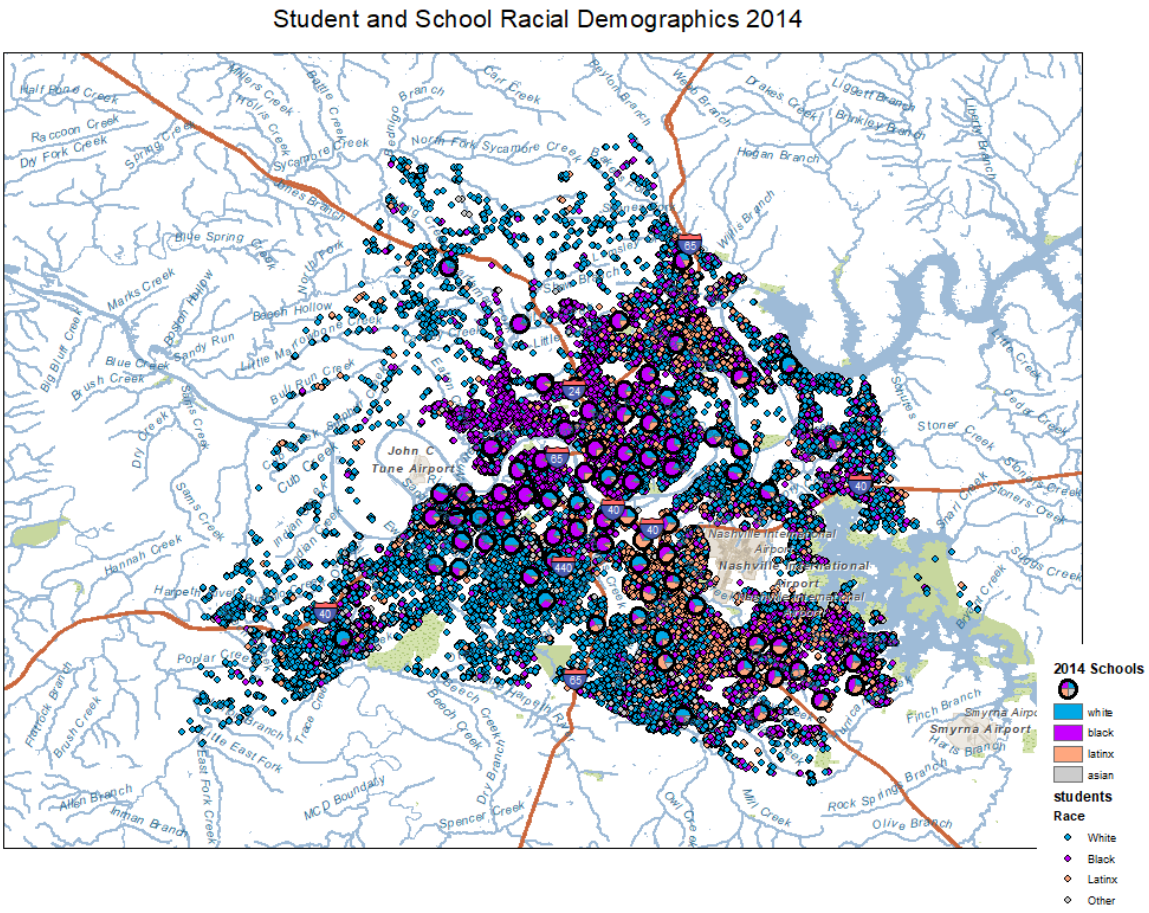
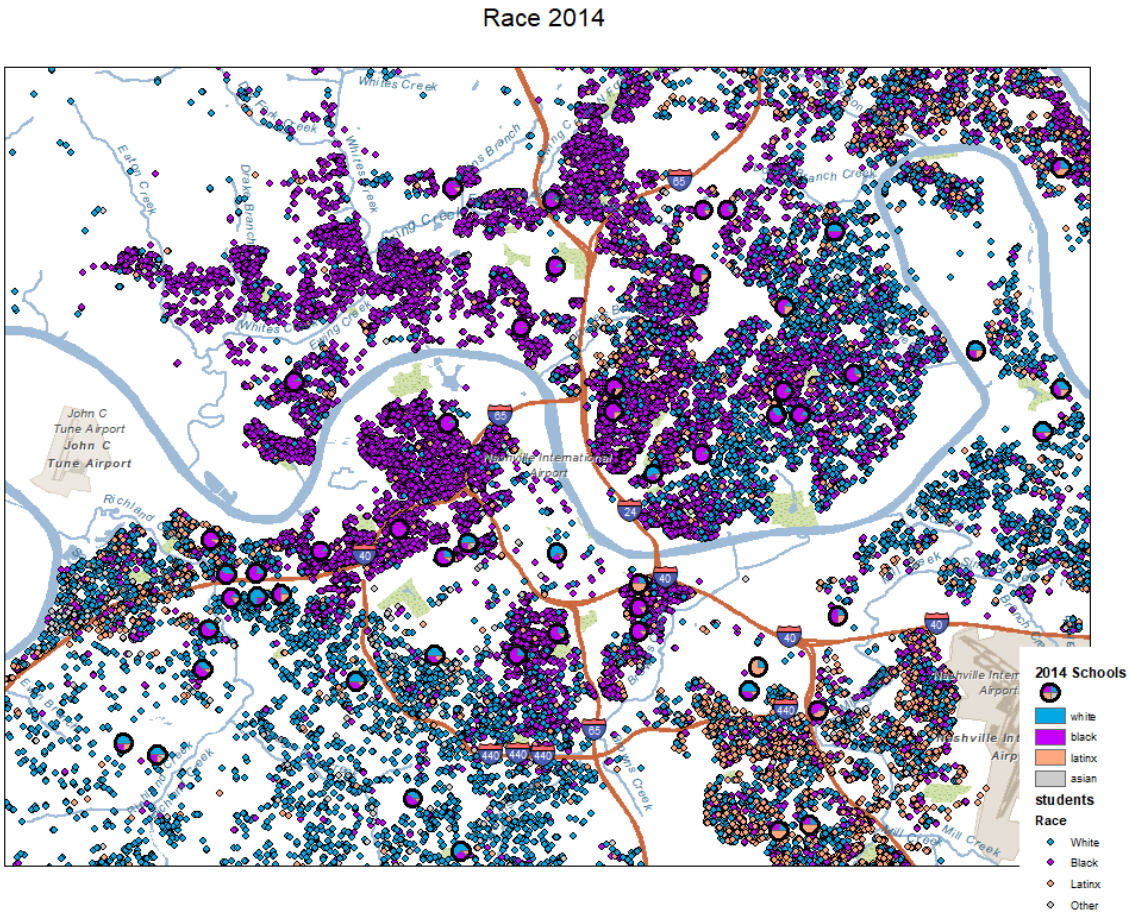


Figure 4: Secondary School Students and Schools by Racial Demographics -Zoomed to Downtown (2014)



` The district also has distinct pockets where students who are and are not eligible for free or reduced-price lunch reside. Figure 5 shows the percentage of students in each census block who are listed as eligible for FRPL; the shading of the large circles represents the proportion of students by FRPL status. The schools again reflect the neighborhood demographics of the neighborhoods. In other words, students are largely distributed across the district in such a way that they are likely surrounded by students of similar race and economic status, and they also are likely to end up in a school where their peers mirror their race or economic status. Thus, these students are not integrated in school or at home.

Figure 5: Secondary School Students and Schools by FRPL Status (2014)

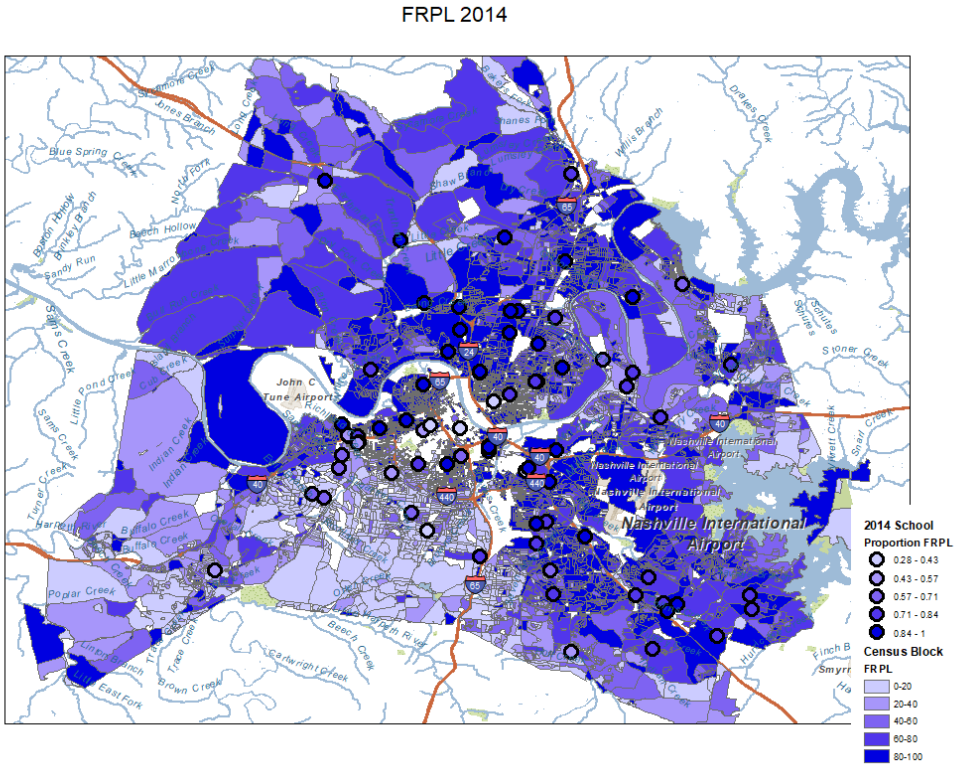
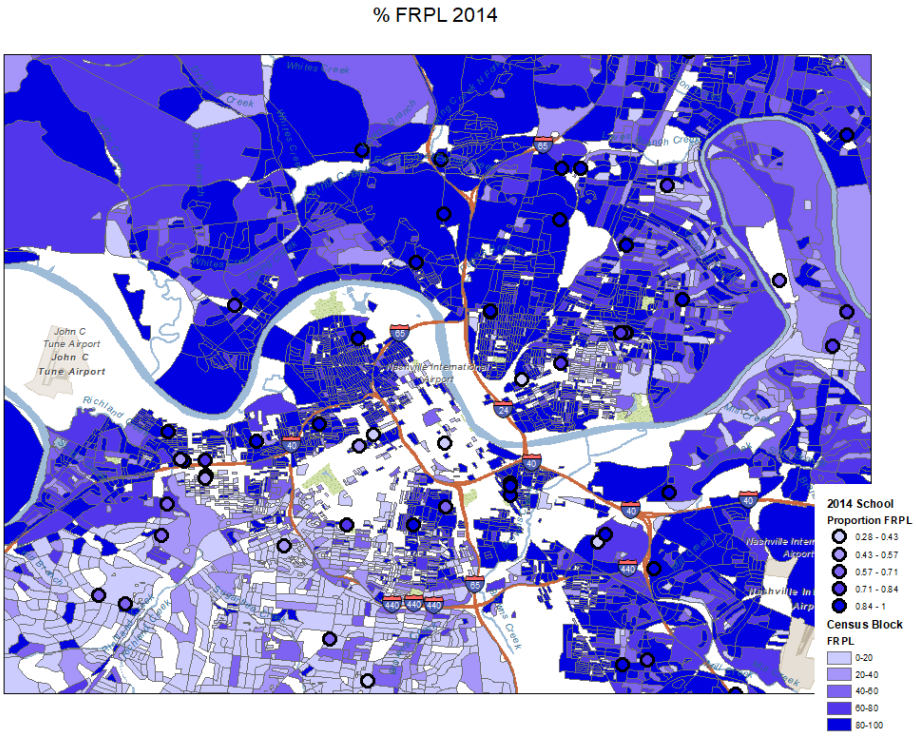


Figure 6: Secondary School Students and Schools by FRPL Status Zoomed to Downtown (2014)



The overall district enrollment patterns are presented in Table 4, which includes the averages for the school characteristics experienced by students in the district. These differ from the overall school characteristics, as they are calculated at the student level in order to present the school characteristics as experienced by the average student. This allows for an examination of school characteristics in a way that accounts for some schools being larger than others. In essence, this approach weights the characteristics by the number of students in the school. They are again presented overall and broken down by school level.

Again, there are some consistent trends across the high school and middle school experiences, but with some notable distinctions. The average high school student attends a school that is somewhat more likely to be integrated and less likely to be extremely racially isolated than the average middle school student. More census tracts and blocks are represented in high schools than in middle schools, which makes sense given the high schools' larger attendance zones. While the likelihood of attending a

school with a four or five composite TVAAS score and where the proportion of students declared proficient or advanced in English is comparable for the average high school and middle school student, the percentage of students proficient or advanced in math differs considerably, with an average of 27.47 percent for the average high school attended by an average high school student and 44.07 for the average middle school attended by an average middle school student. Finally, the average high school student is less likely than their average middle school counterpart to attend a charter school and more likely to attend a magnet school or a selective admission magnet school.

Table 4: Characteristics of the School Attended by Average Secondary School Student (2011-2014)

	All Secondary Students		High School Students		Middle School Students	
	Mean/ Proportion	SD	Mean/ Proportion	SD	Mean/ Proportion	SD
Assigned Zone School	0.69	0.46	0.70	0.46	0.68	0.47
Integrated	0.81	0.39	0.87	0.33	0.76	0.43
Extreme Racial Isolation	0.07	0.26	0.05	0.22	0.09	0.28
Charter	0.07	0.26	0.01	0.10	0.13	0.33
Magnet	0.19	0.39	0.21	0.41	0.17	0.37
Academic Magnet	0.06	0.24	0.08	0.27	0.04	0.20
Audition Magnet	0.03	0.17	0.04	0.20	0.02	0.14
Proportion Black	46.89	20.31	48.13	18.95	45.75	21.42
Proportion Latinx	17.18	13.10	15.93	11.04	18.32	14.64
Proportion FRPL	74.76	18.17	71.78	17.69	77.49	18.17
# Tracts Represented	58.19	37.96	71.94	36.39	45.61	34.88
# Blocks Represented	317.40	184.91	430.62	172.48	213.77	125.64
# Zones Represented	15.47	8.87	12.96	7.02	17.78	9.72
Lagged 4 or 5 Composite TVAAS	0.39	0.49	0.40	0.49	0.38	0.49
Lagged % Prof/Adv Math	36.07	20.11	27.47	17.26	44.07	19.26
Lagged % Prof/Adv English	38.78	17.97	37.56	18.13	39.91	17.76
N	188990		90319		98671	

Mean/ Proportion
Standard Deviation in second row

While yellow bus transportation is provided to access to one's assigned zone school and a few charter schools have used their own budget to provide school bus transportation, many students wishing to exercise their school choice options would need to rely on public transportation to reach

their desired school. Furthermore, any student wishing to use the StrIDe program (which is discussed in Part II of this paper) would rely on public transportation. Table 5 provides the proportion of students who would live within 30 or 60 minutes of various types of schools they may wish to attend. While 70 percent of students live within 60 minutes of the closest school and 47 percent within 30 minutes, considerably fewer students live within 60 and 30 minutes of the school they actually attend using public transit. This has implications for the use of StrIDe to enable more students to participate in extracurricular activities. More than half of the students in MNPS are within an hour bus ride of a magnet or charter school, and almost 70 percent are within 60 minutes of an integrated school. A policy that provides bus passes for students and encourages them to ride a public bus could make it easier for students to attend a different school, perhaps a more integrated school, as more students live close to an integrated school than to the school they attend using public transit. This would also allow the students to participate more easily in extracurricular activities, as they would not rely on yellow bus transportation, which is only provided during regular school hours. They could take advantage of public transportation to travel between home and school on a more flexible schedule that would accommodate before- or after-school activities.

Table 5: Proportion of Students Residing within 30 or 60 Minutes via Public Transit by School Type (2011-2014)

	Proportion	SD
30 min to Attended School	0.21	0.41
60 min to Attended School	0.46	0.50
30 min to Closest School	0.47	0.50
60 min to Closest School	0.70	0.46
30 min to 2nd Closest School	0.39	0.49
30 min to 2nd Closest School	0.68	0.47
30 min to Charter School	0.25	0.43
60 min to Charter School	0.56	0.50
30 min to Magnet School	0.20	0.40
60 min to Magnet School	0.51	0.50
30 min to School w/o Admission Test/ Audition	0.45	0.50
60 min to School w/o Admission Test/ Audition	0.69	0.46
30 min to Integrated School	0.38	0.48
60 min to Integrated School	0.68	0.47
30 min to Integrated School w/o Admission Test/ Audition	0.38	0.49
60 min to Integrated School w/o Admission Test/ Audition	0.68	0.47
30 min to School with Lag 4/5 Composite TVAAS	0.19	0.39
60 min to School with Lag 4/5 Composite TVAAS	0.34	0.47
30 min to School with Lag 4/5 Composite TVAAS w/o Admission Test/ Audition	0.19	0.39
60 min to School with Lag 4/5 Composite TVAAS w/o Admission Test/ Audition	0.33	0.47
N	188990	

Mean/ Proportion
Standard Deviation in second row

Unfortunately, a policy that merely provides fare-free access to public transportation would likely have a limited impact on enrollment in high-achieving schools. Only 34 percent of MNPS secondary school students live within an hour of a school with a 4 or 5 value-added score, and only 19 percent are within a half hour, which suggests that fewer students are likely to use public transportation to attend a school with high value added. Some students could benefit from access to a high value-added school, but fewer than those who would likely have easier access to an integrated school.

While many students live within an hour of an integrated school using public transit, there are distinct neighborhood-based differences regarding access. Figures 7 and 8 indicate students who live within an hour of an integrated school using public transit, measured by the number of minutes it would

take them to make the trip during morning traffic. Students who live in neighborhoods on the outskirts of town are isolated in terms of access to public transportation. Students who reside closer to an integrated school via public transit tend to live closer to the city center, where buses pass more frequently (the bus terminal is located downtown). These are the students most likely to benefit from a policy providing fare-free bus passes, whereas students living farther from downtown may would likely need a significant transit overhaul to increase their access to schools. More bus lines, a change in bus routes or an expansion of yellow school bus provision may be required in order to change the enrollment patterns of students farther from the city center.

Figure 7: Secondary School Students and Schools by Minutes to Nearest Integrated School for Students within 60 Minutes (2014)

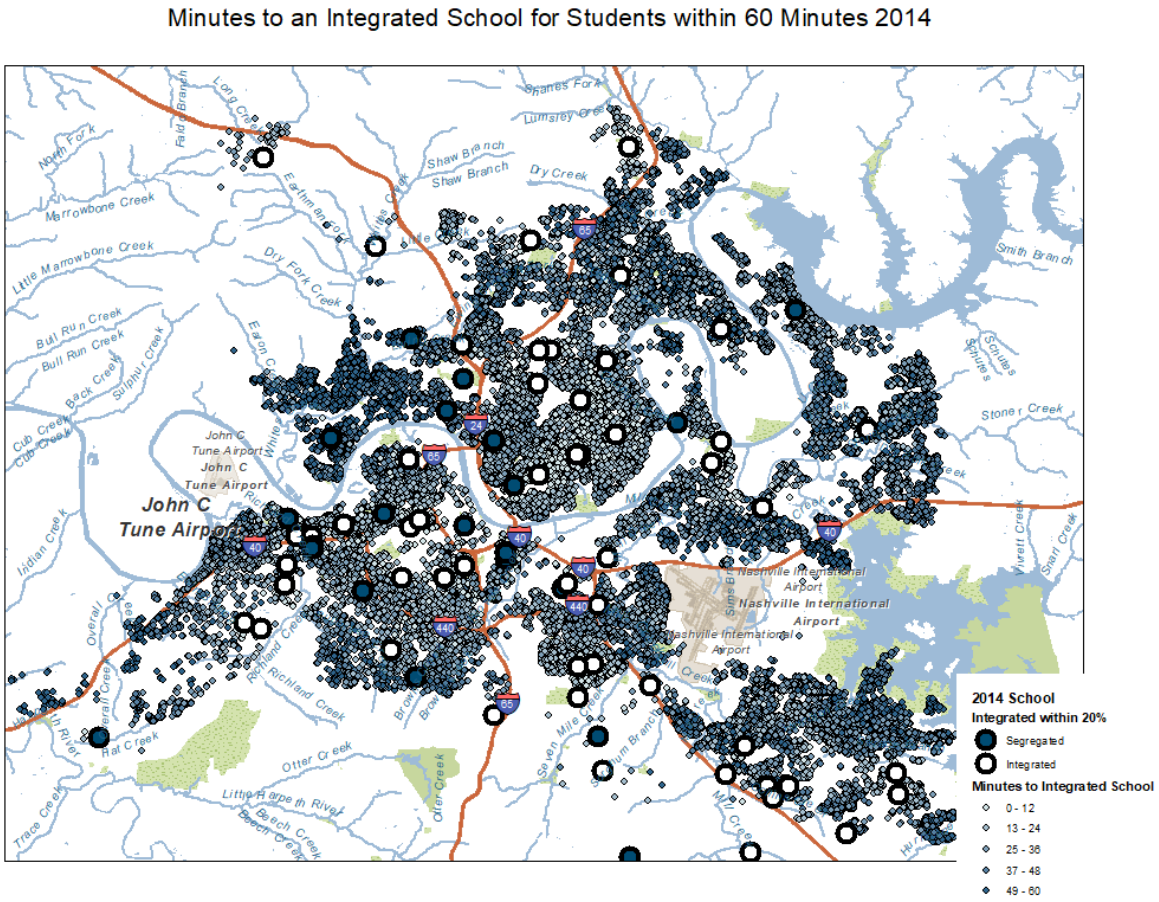
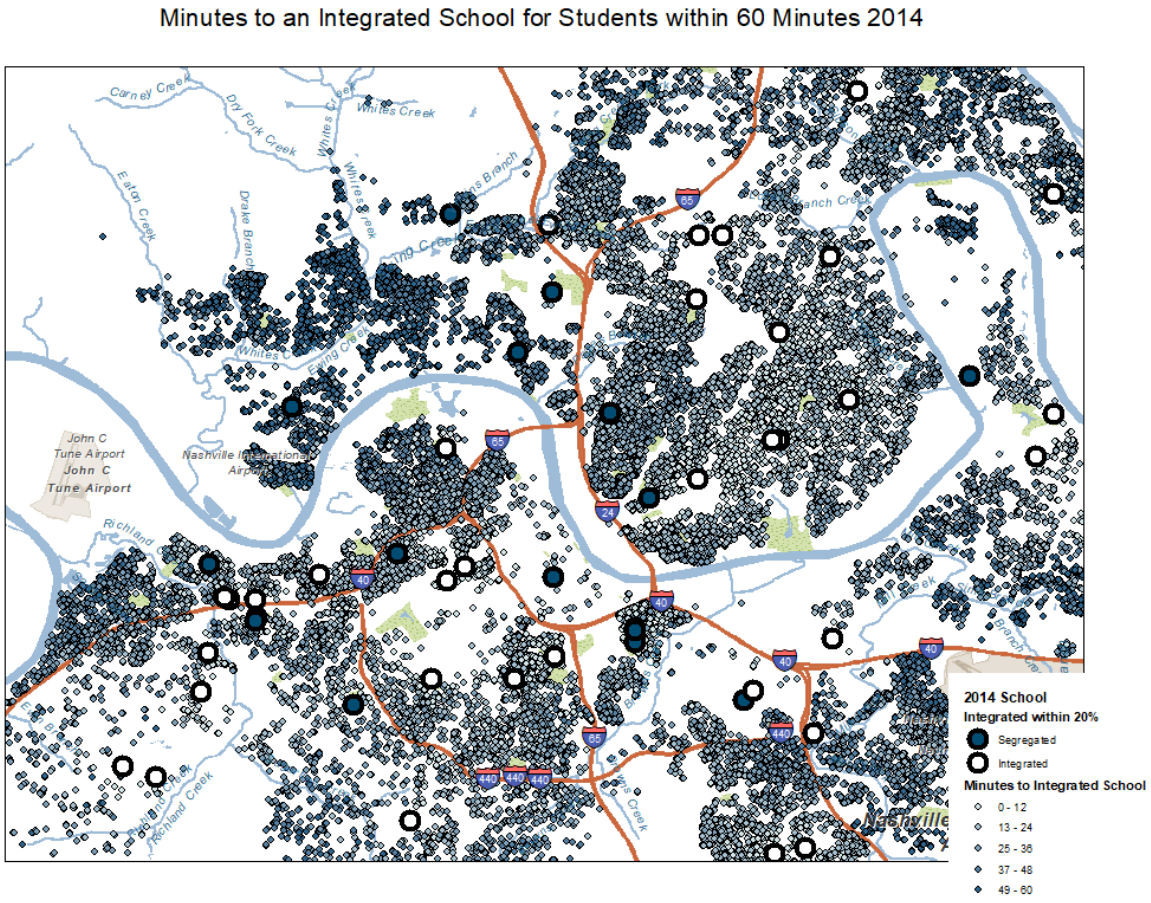


Figure 8: Secondary School Students and Schools by Minutes to Nearest Integrated School for Students within 60 Minutes- Zoomed to Downtown (2014)



1. *What are the baseline secondary school enrollment patterns of students from neighborhoods with different racial majorities or levels of affluence?*
    a. To what extent does the proportion of students attending integrated schools differ based on the demographic makeup of their residential neighborhood?
    b. To what extent does the academic performance of the school attended differ by the demographics of a student's residential neighborhood?
    c. To what extent does the number of schools attended by students from a given neighborhood differ across neighborhoods with different racial and economic demographics?

To answer the extent to which the enrollment patterns of students from neighborhoods with different racial majorities or varying levels of affluence differ the average and range of student characteristics and of the school they attend are presented in Table 6. Students reside in neighborhoods with a variety of demographics. While the average percent White in a students' neighborhood is 31, percent Black is 46, and percent Latinx is 18 for the average student, these demographics range considerably for students in different neighborhoods. Some students reside in neighborhoods where there is zero representation of other races of students in secondary school. Thus, there are neighborhoods where students are completely racially isolated. However, the percent of students residing in these isolated neighborhoods is quite small (6 percent in isolated attendance zones, 18 percent in isolated census tracts, and 38 percent in isolated census blocks).

Table 6: Characteristics of Neighborhood of Residence of Secondary School Students (2011-2014)

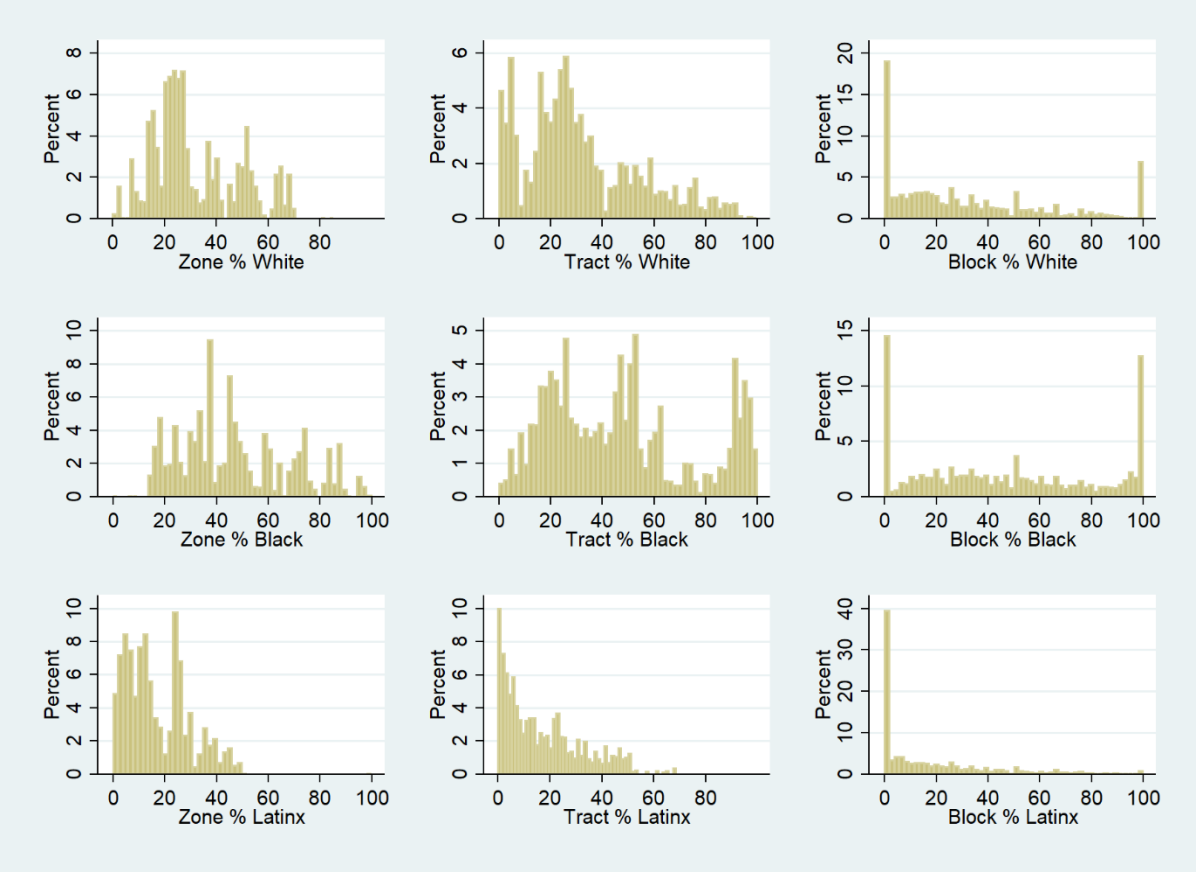
Attendance Zone	Mean	SD	Min	Max
% White	31.46	16.459	0.00	85.45
% Black	46.89	21.09	0.00	100.00
% Latinx	17.18	12.09	0.00	100.00
% FRPL	74.76	14.98	33.41	100.00
Neighborhood Extreme Isolation	0.06	0.24	0.00	1.00
% Attend Zone School	69.04	12.34	0.00	100.00
# Schools Attended	28.89	6.25	12.00	92.00
Census Tract				
Total Crime Index	287.06	109.06	5.00	502.00
Median Age	38.59	4.33	20.60	52.00
% Private School K-12	12.74	14.33	0.00	100.00
% Below Poverty 5 to 17	31.68	21.82	0.00	98.70
% Workers Commute on Public Transit	3.25	4.50	0.00	28.98
% Own House	52.40	21.62	2.50	98.29
% White	31.46	22.30	0.00	100.00
% Black	46.89	27.48	0.00	100.00
% Latinx	17.18	15.08	0.00	100.00
% FRPL	74.76	19.11	0.00	100.00
Neighborhood Extreme Isolation	0.18	0.39	0.00	1.00
% Attend Zone School	69.04	12.79	15.29	100.00
# Schools Attended	31.86	10.24	1.00	57.00
Census Block				
% White	31.46	29.98	0.00	100.00
% Black	46.89	34.31	0.00	100.00
% Latinx	17.18	22.50	0.00	100.00
% FRPL	74.76	26.55	0.00	100.00
Neighborhood Extreme Isolation	0.38	0.48	0.00	1.00
% Attend Zone School	69.04	22.63	0.00	100.00
# Schools Attended	8.31	6.38	1.00	36.00
N	238949			

Mean/ Proportion
Standard Deviation in second row

To better understand students' range of experiences across neighborhoods, Figures 9-11 present histograms of the percentage of students in neighborhoods with varying racial, economic, and enrollment-based demographics. While there is a range in students' experience of racial isolation, there is a large percentage of students who reside in neighborhoods with very low representation of at least one racial group. There is, for example, a particularly high level of isolation from Latinx students in the

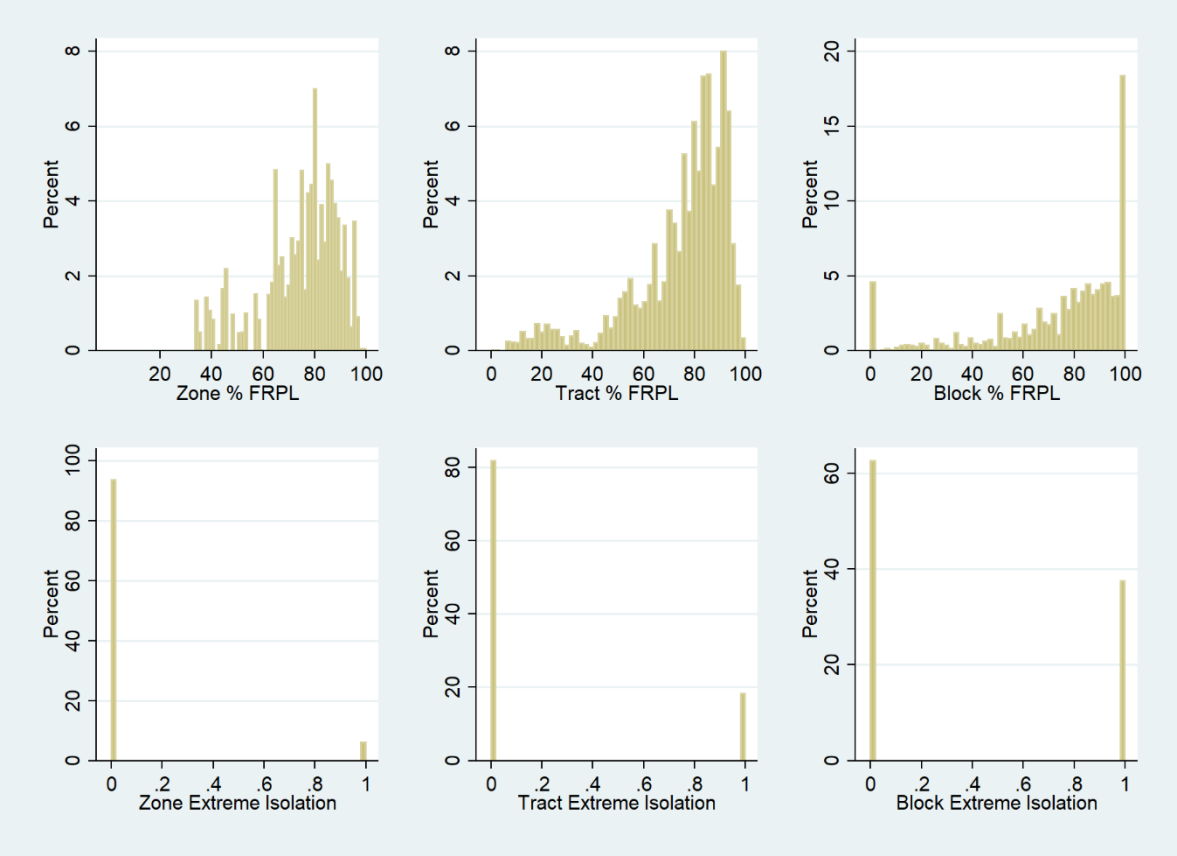
district. The isolation trend becomes more pronounced as the size of the neighborhood measure gets smaller (zones being geographically largest and blocks smallest).

Figure 9: Histogram of % of Students Residing in Neighborhoods with Varying Racial Populations (2011-2014)



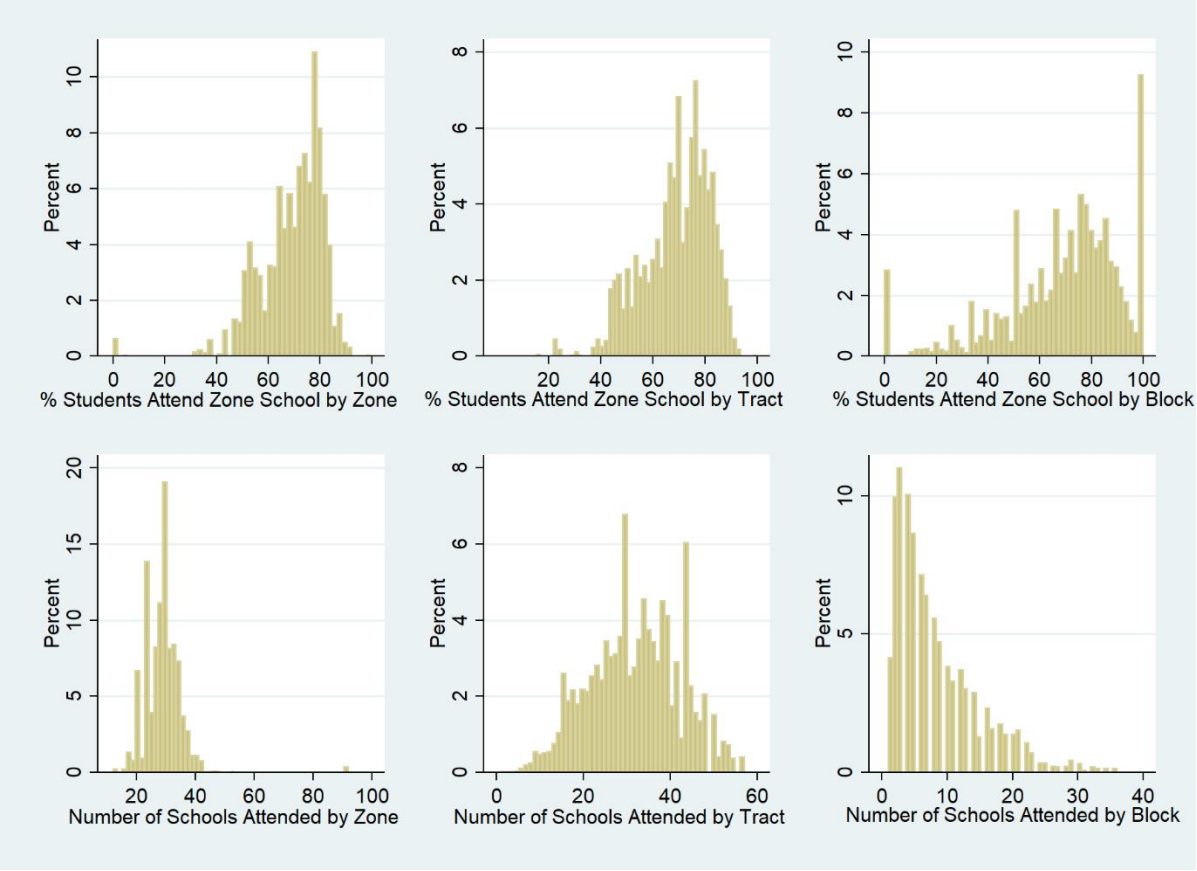
The trends in economic isolation are in the opposite direction from racial isolation. The percentage of students residing in neighborhoods with a high proportion of students on FRPL is higher than the percentage of students residing in neighborhoods with a low proportion of students on FRPL. There are significantly more students residing in neighborhoods that are not extremely racially isolated than in neighborhoods that are extremely racially isolated. Again, the smaller the geographic size of the operationalization of neighborhood, the larger the percentage of students residing in an extremely racially isolated neighborhood.

Figure 10: Histogram of % of Students Residing in Neighborhoods with Varying % FRPL and Level of Racial Isolation (2011-2014)



Finally, while there are students residing in neighborhoods where close to zero percent or almost 100 percent of students attend their assigned zone school, most students reside in neighborhoods where between 60 percent to almost 100 percent of students do so. While there is a large range in the number of schools attended by zone, the majority of students reside in an attendance zone where the number of secondary schools attended is between 20 and 40. This trend also holds for census tracts as the operationalization of a neighborhood.

Figure 11: Histogram of % of Students Residing in Neighborhoods with Varying Enrollment Patterns (2011-2014)



Neighborhood distinctions in enrollment patterns are presented through GIS maps in order to show not only that there are differences across neighborhoods, but to see how these differences are shaped spatially. Figures 12 and 13 show where students attending their assigned zone school versus a school of choice reside. A higher proportion of students residing closer to the city center appear to utilize school choice rather than attend their assigned school. The schools located closer to the city center also have a smaller proportion of students attending their zone school. These trends make sense, as the city center has a higher density of students, a higher density of schools, and more accessible public transportation options. The nearest non-assigned school is likely to be much closer in the city center than for students in the outer perimeter of the district.

Figure 12: Secondary School Students and Schools by Attendance at Assigned Zone vs Choice School (2014)

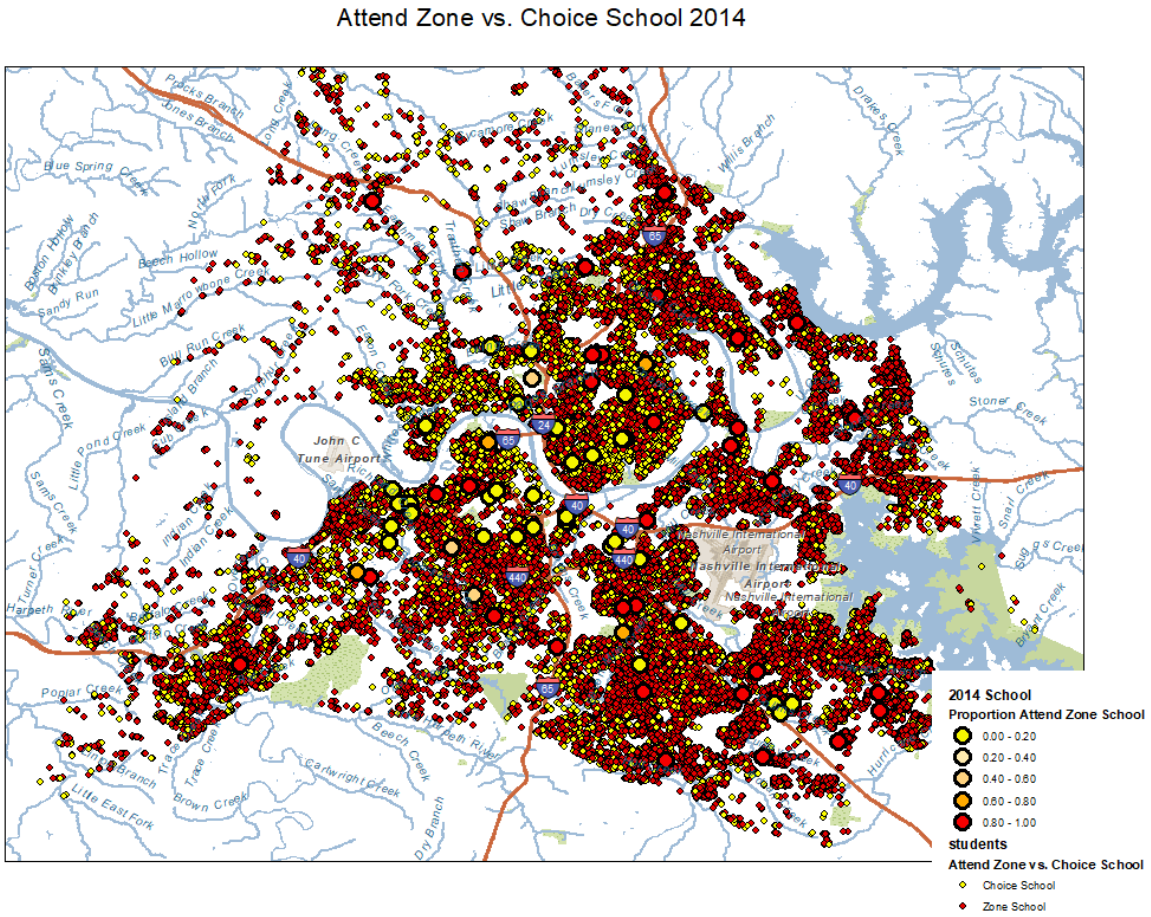
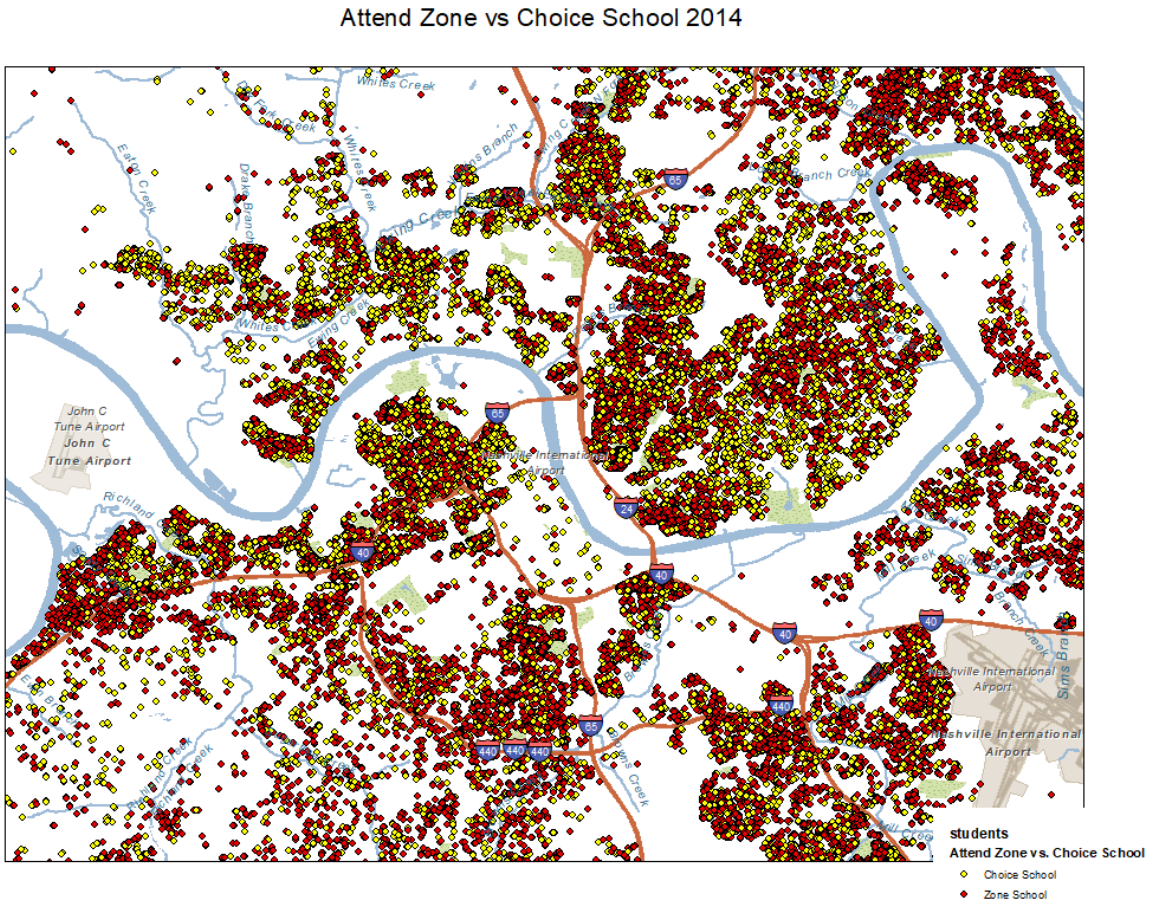


Figure 13: Secondary School Students and Schools by Attendance at Assigned Zone vs Choice School- Zoomed to Downtown (2014)



Figures 14 and 15 present geographic differences in students' enrollment patterns in terms of attending an integrated versus a racially identifiable school. Students attending racially identifiable schools tend to be located in the city center or in the southwest sector of the city, with another pocket on the far northeast edge of the district, where students are isolated by the Cumberland River (which has few bridges that are located to the east of downtown). Returning to Figure 3 and comparing the racial distribution of students with students' school integration patterns reveals that many of the students attending racially identifiable schools tend to also live in the neighborhoods with majority

White populations, the exception being students who attend racially identifiable schools and reside in the city center.

Figure 14: Secondary School Students and Schools by Attendance in Integrated vs Racially Identifiable School (2014)

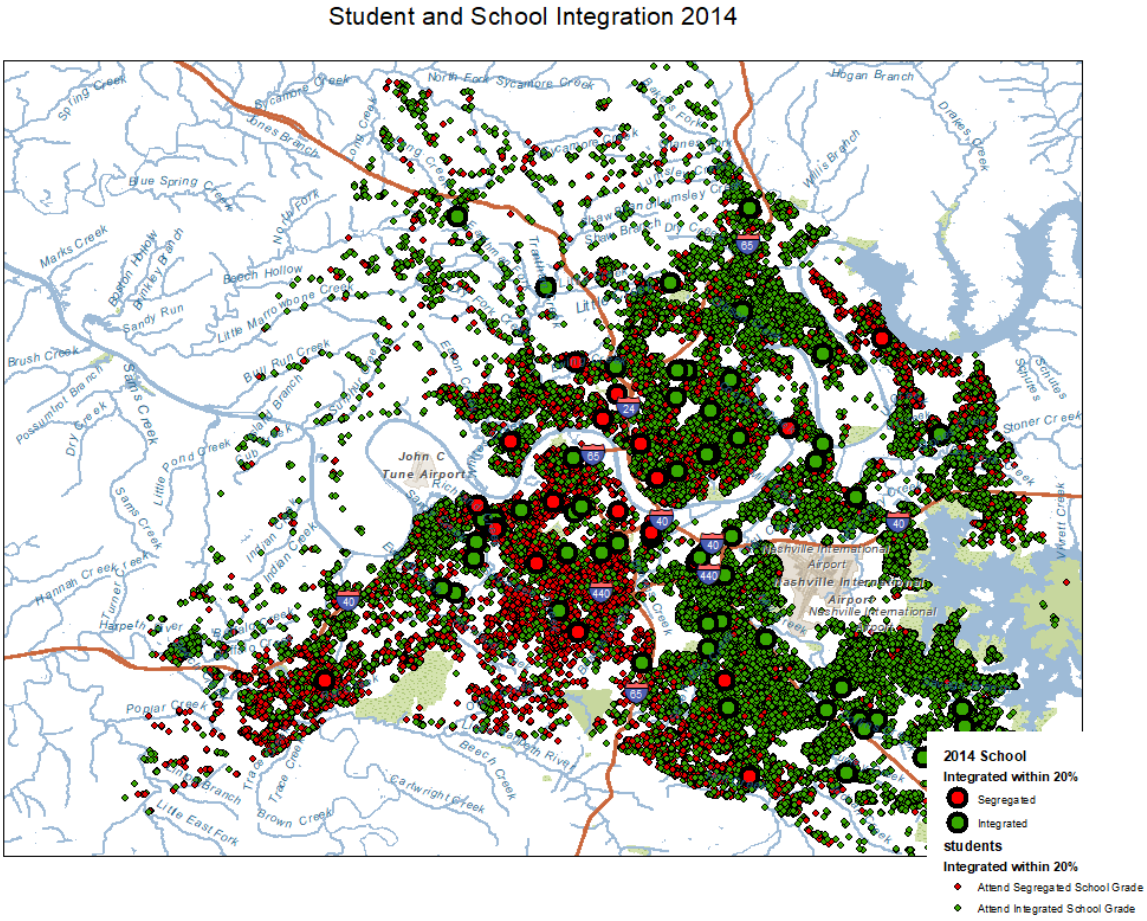
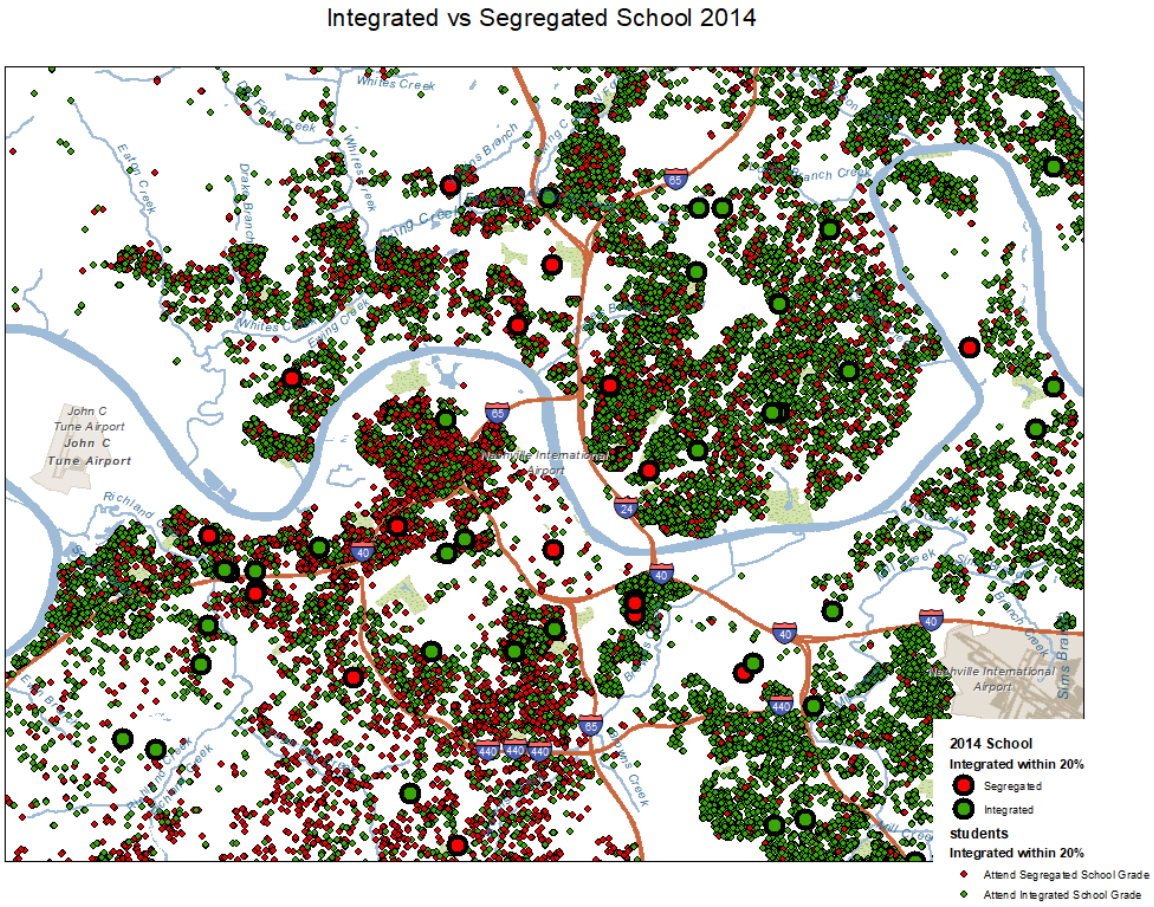


Figure 15: 2014 Secondary School Students and Schools by Attendance in Integrated vs Racially Identifiable School- Zoomed to Downtown (2014)



While the percentage of students attending a racially isolated school in the district is low (8 percent), these students are concentrated in certain neighborhoods. Figures 16 and 17 show that these students primarily live near the city center (particularly in the neighborhoods known as North Nashville and the west side of East Nashville). If you compare these maps with the maps in Figures 3 and 4, you will note that these neighborhoods also have some of the highest concentrations of Black students in the district. While many of the students attending racially identifiable schools reside in majority White neighborhoods, the majority of students attending racially isolated schools that are 90 percent or more minority or one race reside in predominantly Black neighborhoods.

Figure 16: Secondary School Students and Schools by Attendance in Racially Isolated School (2014)

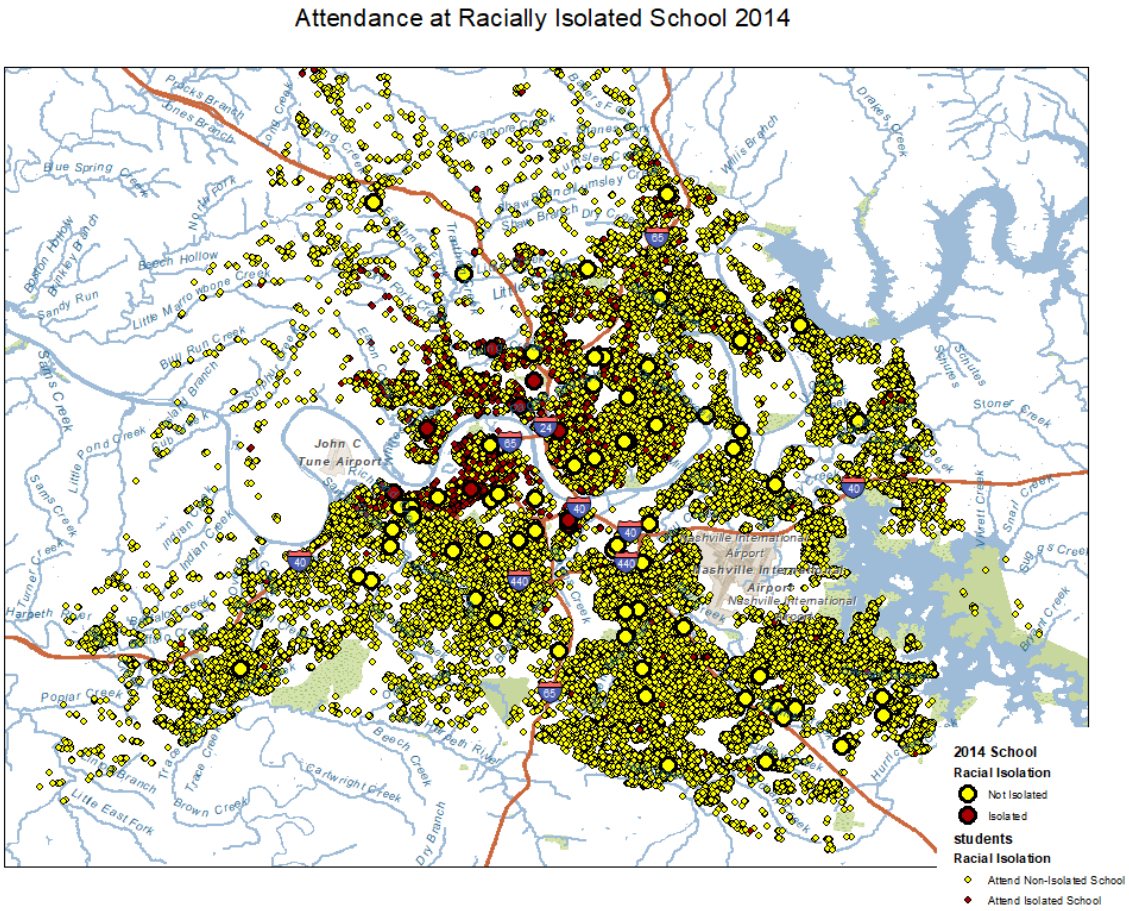
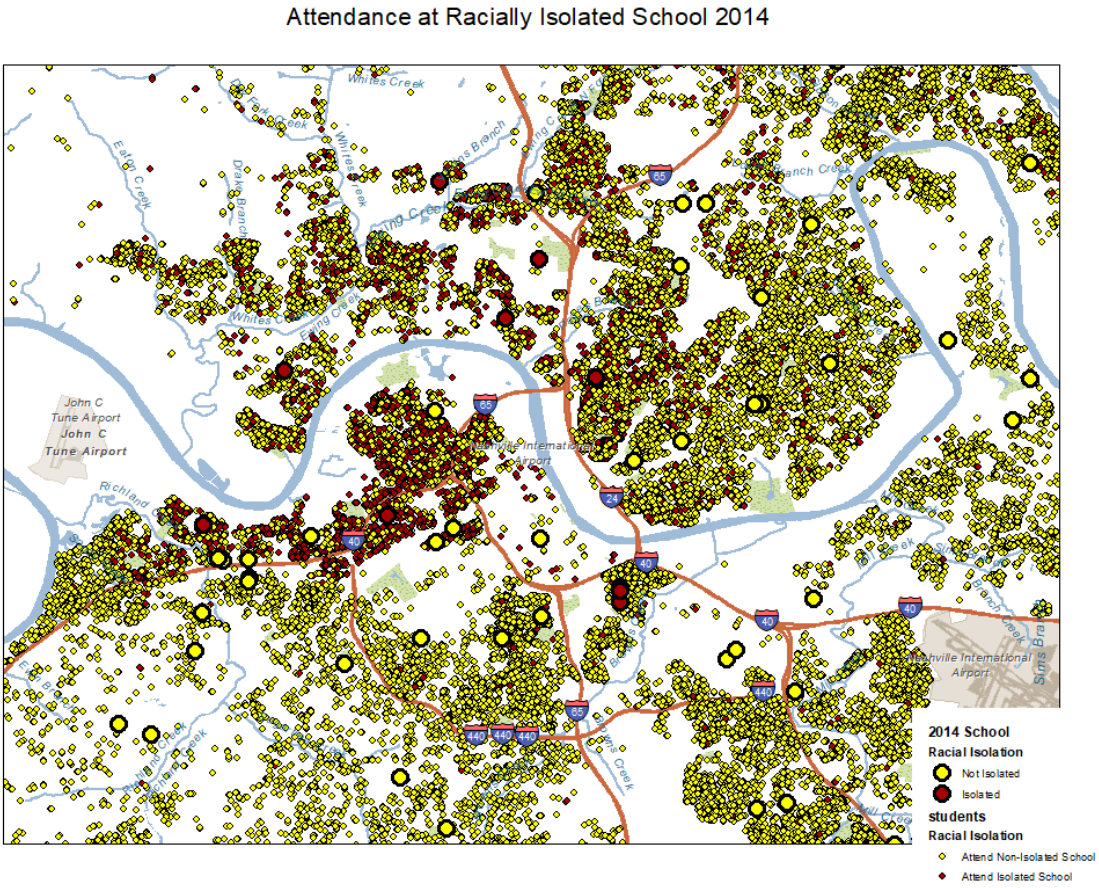


Figure 17: Secondary School Students and Schools by Attendance in Racially Isolated School- Zoomed to Downtown (2014)



The geographic distribution of the students attending schools with a score of 4 or 5 out of 5 for a value-added score versus attending a school with a lower score are presented in Figures 18 and 19. While there are not many clear geographic trends, it appears that the neighborhoods with the highest proportion of students attending high value-added schools are located in the south-east sector of the district. This also happens to be one of the more diverse neighborhoods in the district.

Figure 18: Secondary School Students and Schools by Value-Added Score (2014)

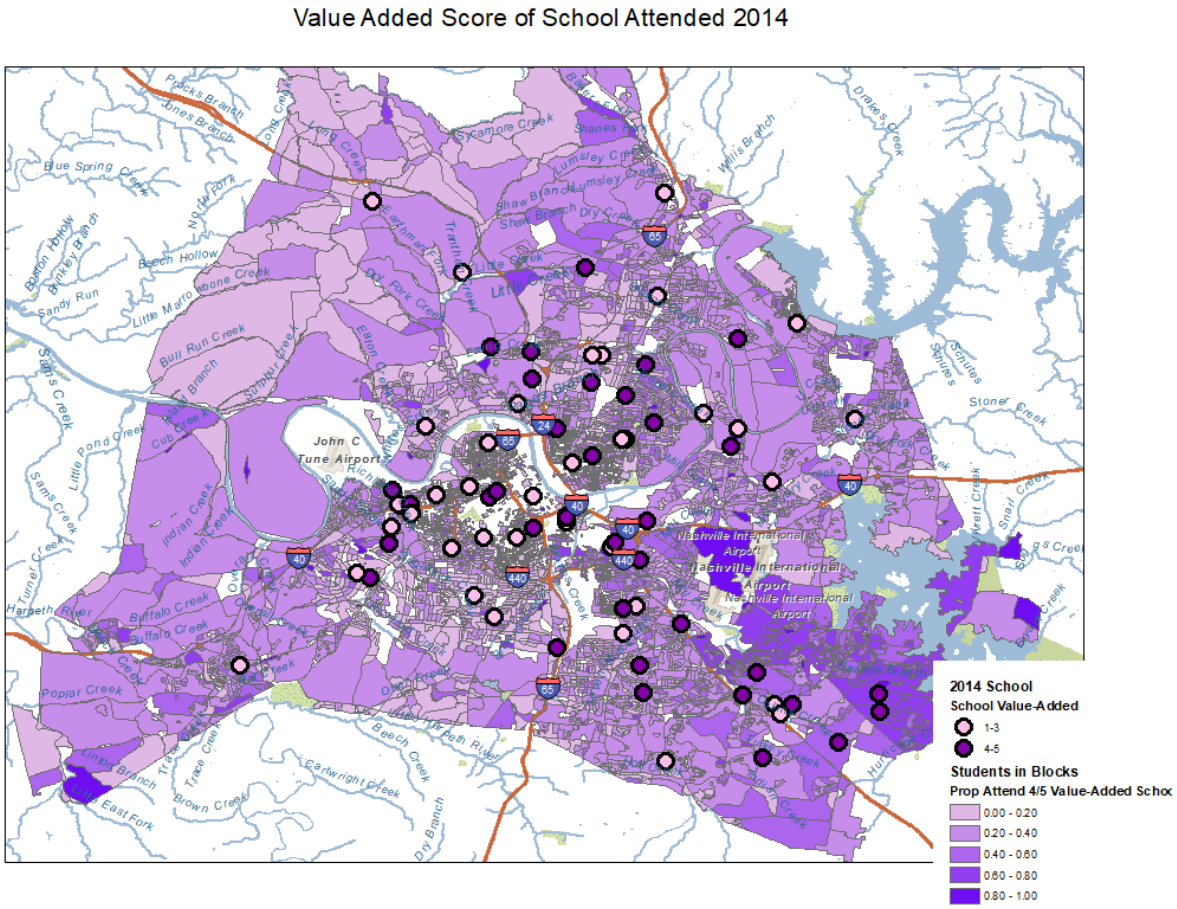
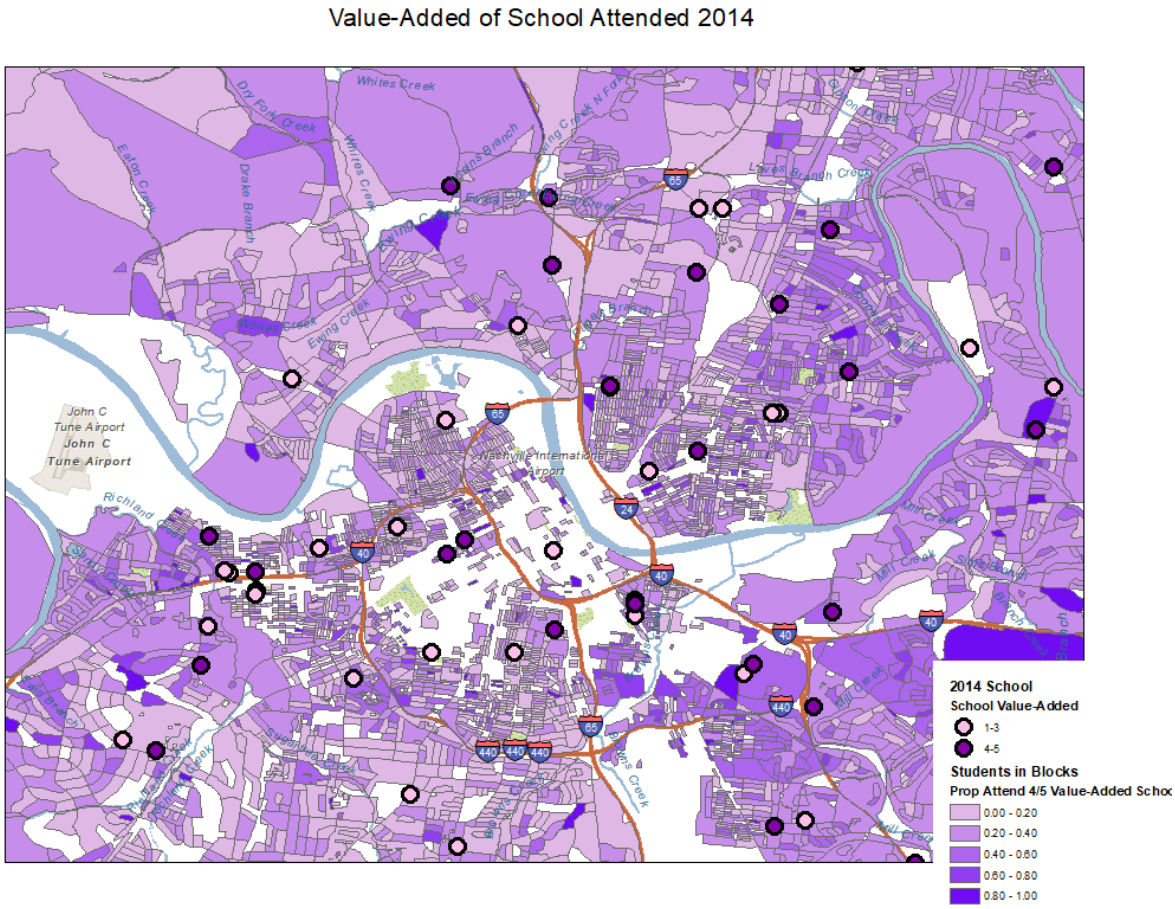


Figure 19: Secondary School Students and Schools by Value-Added Score- Zoomed to Downtown (2014)



In order to understand further how enrolment patterns differ by neighborhood characteristics, I calculated proportions, means, and standard deviations broken down by subgroups of students in different types of neighborhoods. Table 7 shows the breakdown of these descriptive statistics for attendance zones, census tracts, and census blocks that have different racial and economic breakdowns. Students residing in racially isolated neighborhoods are less likely to attend their assigned zone school or an integrated school than their counterparts residing in a non-isolated neighborhood. In racially isolated attendance zones approximately 20 percent fewer students attend their assigned zone school than their counterparts in non-isolated attendance zones. This pattern is consistent for racially isolated census tracts, where approximately 17 percent fewer students attend their assigned zone school, and

racially isolated census blocks, where approximately 11 percent fewer students attend their assigned zone school than their counterparts in non-isolated neighborhoods. In racially isolated neighborhoods there are fewer students in the neighborhood (approximately 38 percent in isolated attendance zones, 18 percent in isolated census tracts, and 10 percent in isolated census blocks) who attend an integrated school than there are in neighborhoods that are not racially isolated. These students are also considerably more likely to attend an isolated school. The average student residing in a racially isolated neighborhood attends school with a lower percentage of students who are proficient or advanced in math and English, and a smaller proportion of students in racially isolated neighborhoods attend schools with a 4 or a 5 composite TVAAS score.

No students reside in an attendance zone with less than 25 percent of students on FRPL, and very few students reside in an attendance zone with more than 75 percent White students. More students who reside in neighborhoods with less than 25 percent White students attend integrated schools than those in neighborhoods with a higher proportion of White residents, while considerably fewer students who reside in neighborhoods with more than 75 percent White residents enroll in schools considered integrated. When examining economic disadvantage, fewer students who reside in a neighborhood with less than 50 percent of students on FRPL attend an integrated school than their counterparts in neighborhoods with more students on FRPL. Thus, students residing in Whiter neighborhoods and more affluent neighborhoods are less likely to attend an integrated school.

Similar trends continue in terms of the number of schools attended and percentage of students in the school who are proficient or advanced in math and English in neighborhoods with different proportions of White and FRPL students. Students in neighborhoods with fewer White students and with more students on FRPL are surrounded by neighbors who attend a greater variety of schools. Students who live in Whiter and more affluent neighborhoods are more likely to attend a school with a higher proportion of students designated proficient or advanced in math and English. However, the opposite

trend holds for attendance at a school with a high value-added score. This suggests that students in Whiter and more affluent neighborhoods are more likely to attend schools with academically proficient peers but less likely to attend schools with a high level of value-added.

Table 7: Average Student Enrollment Patterns by Demographics of Neighborhoods (2011-2014)

Attendance Zone	Racially Isolated	Not Racially Isolated	% White >75	50< % White ≤75	25< % White ≤50	% White ≤ 25	% FRPL >75	50< % FRPL ≤75	25< % FRPL ≤50	% FRPL ≤ 25
	Mean/ Prop (SD)	Mean/ Prop (SD)	Mean/ Prop (SD)	Mean/ Prop (SD)	Mean/ Prop (SD)	Mean/ Prop (SD)	Mean/ Prop (SD)	Mean/ Prop (SD)	Mean/ Prop (SD)	Mean/ Prop (SD)
Attend Zone School	.489	.704	.364	.728	.681	.631	.648	.773	.681	-
	(.500)	(.457)	(.483)	(.445)	(.466)	(.483)	(.478)	(.419)	(.466)	-
Attend Integrated School	.434	.818	.081	.550	.485	.812	.835	.818	.486	-
	(.496)	(.386)	(.274)	(.497)	(.500)	(.391)	(.371)	(.386)	(.500)	-
Attend Isolated School	.498	.047	0	.014	.014	.141	.118	.015	.014	-
	(.500)	(.212)	(0)	(.116)	(.116)	(.348)	(.322)	(.123)	(.116)	-
Attend School w/ 4/5	.200	.401	.081	.331	.292	.367	.426	.350	.292	-
Composite TVAAS	(.400)	(.490)	(.274)	(.471)	(.455)	(.482)	(.495)	(.477)	(.455)	-
% Prof/Adv Math in School	28.806	36.503	72.829	45.803	44.332	32.343	34.185	37.686	44.335	-
	(21.340)	(19.953)	(12.315)	(22.626)	(26.440)	(19.199)	(18.848)	(19.347)	(26.436)	-
% Prof/Adv English in School	30.210	39.285	59.850	51.092	53.510	32.059	34.225	44.844	53.504	-
	(18.851)	(78.792)	(11.457)	(18.744)	(22.979)	(16.965)	(16.290)	(15.366)	(21.627)	-
# Schools Attended	29.411	28.858	22.889	23.619	22.979	31.059	31.147	26.577	22.983	-
	(4.703)	(6.335)	(.999)	(3.690)	(3.520)	(7.133)	(6.428)	(4.136)	(3.525)	-
N	11750	177240	99	34607	19199	84361	110869	58915	19206	0
Census Tract										
Attend Zone School	0.560	0.733	.623	.687	.646	.645	.679	.736	.677	.608
	(0.496)	(0.442)	(.485)	(.464)	(.478)	(.478)	(.467)	(.441)	(.468)	(.488)
Attend Integrated School	0.656	0.826	.497	.617	.523	.815	.832	.805	.597	.433
	(0.475)	(0.380)	(.500)	(.486)	(.499)	(.388)	(.373)	(.396)	(.491)	(.495)
Attend Isolated School	0.260	0.0439	.005	.013	.008	.135	.107	.023	.011	.004
	(0.439)	(0.184)	(.073)	(.112)	(.089)	(.341)	(.309)	(.148)	(.105)	(.065)
Attend School w/ 4/5	0.378	0.585	.304	.335	.280	.376	.418	.358	.273	.288
Composite TVAAS	(0.485)	(0.493)	(.460)	(.472)	(.449)	(.484)	(.493)	(.479)	(.445)	(.453)
% Prof/Adv Math in School	33.15	36.92	45.832	43.133	47.255	32.894	33.829	38.294	45.483	48.866

	(21.22)	(19.76)	(27.800)	(24.376)	(27.075)	(18.710)	(18.235)	(20.480)	(25.566)	(28.280)
% Prof/Adv English in School	33.08	39.94	50.702	48.597	54.070	34.146	35.196	43.335	52.310	55.668
	(19.22)	(17.48)	(25.260)	(21.553)	(23.342)	(16.389)	(15.862)	(17.225)	(21.096)	(25.102)
# Schools Attended	38.53	32.48	13.992	20.169	16.337	37.680	36.049	27.579	18.794	13.312
	(9.796)	(10.38)	(3.886)	(6.841)	(5.5490)	(8.091)	(8.718)	(7.062)	(5.362)	(4.091)
N	34694	154296	10751	35973	18941	85897	120614	49434	10449	8493
Block Tract										
Attend Zone School	.621	.732	.655	.653	.616	.672	.709	.704	.650	.554
	(.485)	(.443)	(.475)	(.476)	(.486)	(.469)	(.454)	(.456)	(.477)	(.497)
Attend Integrated School	.731	.832	.598	.616	.598	.824	.834	.819	.713	.512
	(.443)	(.374)	(.490)	(.486)	(.490)	(.381)	(.372)	(.385)	(.452)	(.500)
Attend Isolated School	.144	.034	.013	.011	.013	.120	.099	.043	.032	.014
	(.351)	(.181)	(.113)	(.106)	(.113)	(.325)	(.299)	(.203)	(.177)	(.118)
Attend School w/ 4/5	.330	.424	.332	.333	.327	.383	.403	.399	.328	.321
Composite TVAAS	(.470)	(.494)	(.471)	(.471)	(.469)	(.486)	(.403)	(.490)	(.470)	(.467)
% Prof/Adv Math in School	34.797	36.812	42.466	43.461	45.041	33.473	33.641	37.271	42.133	47.319
	(21.249)	(19.380)	(25.010)	(24.892)	(26.251)	(18.570)	(17.734)	(19.836)	(23.938)	(28.274)
% Prof/Adv English in School	36.615	40.039	47.492	48.945	50.588	35.156	35.302	41.448	47.021	52.941
	(194082)	(16.907)	(23.027)	(22.112)	(23.275)	(16.131)	(15.327)	(17.120)	(20.562)	(25.439)
# Schools Attended	7.798	8.613	3.495	5.308	5.085	9.504	9.167	8.441	5.983	3.870
	(7.177)	(5.829)	(2.227)	(3.698)	(3.420)	(7.002)	(6.933)	(5.533)	(3.718)	(2.671)
N	70875	118115	21440	31887	28083	100801	118495	38384	16777	15334

Mean/ Proportion

Standard Deviation in second row

The above analysis provides answers to the first research question and the associated sub-questions. Student enrollment patterns vary considerably, depending on their neighborhood of residence and location within the district. Students in more isolated neighborhoods are more likely to attend a racially identifiable school, a school with a lower value-added score, and a school with fewer proficient or advanced students than their counterparts in non-isolated neighborhoods. More students in Whiter and more affluent neighborhoods attend racially identifiable schools, and schools with a lower value-added, but also schools with a higher percentage of proficient or advanced students.

2. *What are the characteristics of students and their residential neighborhoods of those who attend integrated schools?*
    a. What are the demographics of students who attend integrated schools and how long would it take them to attend if they commute via transit?
    b. What proportion of these students are zoned to attend these integrated schools?
    c. What is the racial and economic makeup of the neighborhoods of students who attend integrated schools?

To analyze the characteristics of students and their neighborhoods for students who attend integrated schools, means and proportions were calculated for the subgroup of students who attend an integrated school, as compared to the subgroup of students who do not attend an integrated school. The proportion of students in the integrated school group who attend their zone school is higher than for students who attend a racially identifiable school, with a difference of nearly 30 percent of the students in the subgroup. More than 73 percent of secondary school students who attend an integrated school are attending their assigned zone school. Only 26.4 percent of students attending integrated schools are White, 19.7 percent are Latinx, and 50.7 percent are Black. The proportion of White and Black students is somewhat lower in the subgroup of students attending integrated schools than for those attending racially identifiable schools, while the percentage of students listed as Latinx is more

than double the percentage among students attending racially identifiable schools. A higher proportion of students attending an integrated school are on FRPL than students attending a racially identifiable school, with a difference of nearly 15 percentage points. This suggests that, whether intentional or not, integrated schools may be catering to more Latinx and FRPL students than racially identifiable schools.

Table 8: Characteristics of Students Attending Integrated School vs. Racially Identifiable School (2011-2014)

	Attend Racially Identifiable School	Attend Integrated School
Attend Zone School	0.456	0.746
	(0.498)	(0.435)
Female	0.521	0.497
	(0.500)	(0.500)
White	0.344	0.264
	(0.475)	(0.441)
Black	0.542	0.507
	(0.495)	(0.500)
Latinx	0.083	0.197
	(0.276)	(0.398)
Asian	0.029	0.029
	(0.169)	(0.167)
FRPL	0.696	0.847
	(0.460)	(0.360)
W/in 30 min of School Attended	0.383	0.298
	(0.486)	(0.457)
W/in 60 min of School Attended	0.734	0.675
	(0.442)	(0.468)
W/in 30 min of Integrated School	0.586	0.549
	(0.493)	(0.498)
W/in 60 min of Integrated School	0.941	0.932
	(0.236)	(0.252)
W/in 30 min of 4/5 Composite TVAAS School	0.439	0.358
	(0.496)	(0.480)
W/in 60 min of 4/5 Composite TVAAS School	0.702	0.581
	(0.457)	(0.493)
N	38884	150106

Mean/ Proportion
Standard Deviation in second row

A slightly smaller percentage of the students attending an integrated school live within 30 or 60 minutes of the school attended, of an integrated school, and of a school with a high value-added score

than the percentage of students attending a racially identifiable school. However, a majority reside within an hour of the school attended (but not within a half hour), and more than 90 percent of students live within an hour of the nearest integrated school to their residence (be it the school selected or not).

The demographic and economic characteristics of the neighborhood of residence for students attending an integrated school as compared to students not attending an integrated school are presented in Table 9. The neighborhoods of students attending integrated schools are slightly less White and less Black (by 2-9 percentage points) than the neighborhoods of students attending racially identifiable schools. Correspondingly, the neighborhoods of students attending integrated schools have about 9 percentage points more Latinx students and 7-10 percentage points more students on FRPL than the neighborhoods of students attending racially identifiable schools.

Table 9: Characteristics of Neighborhood of Residence of Students Attending Integrated vs. Racially Identifiable Schools (2011-2014)

	Attend Racially Identifiable School	Attend Integrated School
Attendance Zone		
% White	34.51	28.29
	(23.26)	(13.45)
% Black	51.55	49.54
	(26.01)	(17.70)
% Latinx	10.66	19.13
	(9.50)	(12.20)
% Asian	3.03	2.76
	(2.85)	(2.11)
% FRPL	73.13	79.80
	(20.05)	(11.20)
Neighborhood Extreme Isolation	0.161	0.031
	(0.37)	(0.17)
% Attend Zone School	65.46	66.66
	(13.51)	(9.82)
# Schools Attended	29.05	31.80
	(5.72)	(4.46)
Census Tract		
% White	33.05	27.27
	(28.26)	(18.38)
% Black	53.75	51.17
	(32.98)	(25.12)
% Latinx	9.96	18.73
	(11.19)	(14.72)
% Asian	2.94	2.55
	(3.99)	(3.00)
% FRPL	73.27	80.06
	(23.72)	(13.14)
% Below Poverty 5 to 17	35.23	32.33
	(23.81)	(21.57)
Total Crime Index	329.0	287.8
	(101.7)	(113.9)
Median Age	38.38	38.56
	(4.713)	(3.803)
% Private School K-12	14.87	10.77
	(17.85)	(10.92)
% Workers Commute on Public Transit	4.009	3.783
	(4.55)	(4.94)
% Own House	51.57	50.76
	(20.83)	(19.93)
Neighborhood Extreme Isolation	0.34	0.18
	(0.47)	(0.38)

% Attend Zone School	63.74	67.20
	(13.63)	(11.33)
# Schools Attended	31.18	36.19
	(12.17)	(9.86)
Census Block		
% White	34.10	26.66
	(36.32)	(26.52)
% Black	52.98	51.48
	(39.84)	(33.11)
% Latinx	9.69	18.88
	(19.66)	(23.71)
% Asian	2.99	2.69
	(9.33)	(7.74)
% FRPL	71.28	81.31
	(32.85)	(20.54)
Neighborhood Extreme Isolation	0.55	0.37
	(0.50)	(0.48)
% Attend Zone School	60.68	68.58
	(26.99)	(20.84)
# Schools Attended	7.24	9.16
	(6.29)	(6.95)
N	38884	150106

Mean/ Proportion
Standard Deviation in second row

Integrated schools draw slightly fewer White and Black students and more Latinx and FRPL students, and they draw from neighborhoods with fewer White and Black students and more Latinx and FRPL students than schools that are not integrated. More students who attend an integrated school attend their zoned school and come from neighborhoods where a larger percentage of the students attend their zone school than for students who attend a racially identifiable school.

3. *Where do students zoned to attend integrated secondary schools enroll and what are the demographic characteristics of the school they ultimately attend?*
    a. What proportion of students zoned to integrated schools actually go to an integrated school?
    b. If students are zoned to an integrated school but attend a different school, what are the demographic characteristics of the schools they attend?

c. What are the demographic characteristics of the school students attend if they are zoned to an integrated school, attend a different school, but end up in a different integrated school?

To examine the type of school attended by students zoned to an integrated school, I again examine the means and proportions of subgroups of students. Table 10 presents the average school characteristics for students zoned to an integrated school and those not, then further breaks these groups down by whether they attend this zone school, and again for students who do not attend the zone school but do end up in a different integrated school. The first two columns show the means and proportions of students in schools with various characteristics, split by whether or not the student is zoned to an integrated school. The group of students zoned to an integrated school and those not zoned to an integrated school have a similar proportion of students who choose to attend their zone school. However, the proportion who end up in an integrated school is much larger for students zoned to an integrated school than for students not zoned to an integrated school (over 55 percentage points more). Fewer students zoned to an integrated school end up in a racially isolated school or a magnet school (other than magnet schools that require an audition for admission). The average student zoned to an integrated school attends a school that is less White and less Black, and has a higher percentage of Latinx and FRPL students than the average student zoned to a non-integrated school.

Students zoned to an integrated school attend a school where more of the student body is attending their assigned zone school, and fewer neighborhoods are represented by the student body than students not zoned to an integrated school. Therefore, while students are zoned to an integrated school, they end up in a school with less neighborhood diversity represented. Finally, a higher proportion of students zoned to integrated schools attend a school with a high value-added score, but with a lower percentage of proficient or advanced students.

Columns three and four of Table 10 present the means and proportions for students who are zoned to an integrated school and do not attend that school, which helps to understand where these students chose to enroll if not in their zone school. They are compared with students zoned to attend an integrated school who choose to attend that school). More than 62 percent of these students still end up attending an integrated school; however, more than 15 percent end up in a racially isolated school (this figure is high when compared to the district average of 8 percent). More than 21 percent of these students end up in a charter school and 44 percent in a magnet school (the majority attend an academically selective magnet school that requires either an audition or academic test).

On average, students zoned to an integrated school who do not attend said school end up attending schools with a higher proportion of White and Black students and a lower proportion of Latinx and FRPL students than students zoned to an integrated school who choose to attend said school. They also attend schools where a smaller proportion of the students are attending their zoned school and more neighborhoods are represented. Finally, a higher proportion of these students attend a school with a high value-added score and where higher proportions of students are proficient or advanced in math and English.

The last two columns of Table 10 explore whether or not students zoned to an integrated school who do not choose to attend that school end up in a different integrated school. Of the students who are zoned to an integrated school, choose not to attend it, and end up in a non-integrated school, more than 33 percent end up in a racially isolated school, which again, is much higher than the district average of 8 percent. Of the students who are zoned to an integrated school, do not attend it, and end up in an integrated school, a smaller proportion attend a charter or magnet school than of their counterparts who do not end up in an integrated school. The average student from this group who attends a different integrated school ends up in a school with a smaller percentage of White students, and a higher percentage of Black, Latinx, and FRPL students than their counterparts who do not attend an integrated

school. This suggests that the racially identifiable schools these students are attending may be so designated because they have too much White representation rather than too little. The students who end up in an integrated school on average attend a school with a slightly higher proportion of students attending their zone school (still very low at just over 26 percent) and they end up in schools where fewer zones and tracts are represented than their counterparts.

Table 10: Characteristics of School Attended by Students Zoned to Attend Integrated School by Type of School Attended (2011-2014)

			Zoned to Integrated School		Zoned to Integrated School & Don't Attend Zone School	
	Not Zoned to Integrated School	Zoned to Integrated School	Don't Attend Zone School	Attend Zone School	Don't Attend Integrated School	Attend Integrated School
Zone School	0.695	0.714	0	1	0	0
	(0.460)	(0.452)	(0)	(0)	(0)	(0)
Integrated School	0.324	0.875	0.624	1	0	1
	(0.468)	(0.331)	(0.484)	(0)	(0)	(0)
Racially Isolated	0.213	0.046	0.156	0	0.333	0
	(0.409)	(0.210)	(0.362)	(0)	(0.471)	(0)
Charter	0.055	0.0781	0.218	0	0.235	0.209
	(0.227)	(0.268)	(0.413)	(0)	(0.424)	(0.406)
Magnet	0.305	0.157	0.449	0	0.572	0.377
	(0.460)	(0.364)	(0.497)	(0)	(0.495)	(0.485)
Academic Magnet	0.083	0.0585	0.205	0	0.322	0.136
	(0.276)	(0.235)	(0.404)	(0)	(0.467)	(0.343)
Audition Magnet	0.0192	0.0307	0.107	0	0.185	0.0618
	(0.137)	(0.172)	(0.310)	(0)	(0.389)	(0.241)
% White	41.56	29.98	32.16	29.10	39.40	27.93
	(23.97)	(14.00)	(19.65)	(10.83)	(26.66)	(12.14)
% Black	46.58	44.82	49.90	42.79	48.53	50.70
	(26.32)	(18.55)	22.45	(16.29)	(27.41)	(18.92)
% Latinx	7.589	20.49	13.54	23.27	7.982	16.80
	(5.067)	(13.91)	(14.52)	(12.64)	(6.925)	(16.65)
% FRPL	64.76	77.96	67.82	82.01	58.78	73.12
	(21.55)	(16.16)	(23.20)	(9.644)	(26.58)	(19.08)
% Students in School Zoned to School	65.83	71.55	21.59	91.51	12.64	26.83
	(34.80)	(37.73)	(35.87)	(9.071)	(28.72)	(38.51)
# Tracts Represented	68.19	57.01	91.33	43.30	102.3	84.88
	(36.57)	(38.16)	(42.70)	(25.52)	(40.34)	(42.73)
# Blocks Represented	352.2	313.2	389.3	282.7	412.5	375.8
	(161.2)	(191.6)	(219.6)	(169.9)	(193.1)	(232.7)
# Zones Represented	19.71	15.05	22.50	12.07	21.89	22.85
	(9.567)	(8.271)	(11.05)	(3.996)	(10.09)	(11.56)
Lagged 4 or 5 Composite TVAAS	0.419	0.571	0.520	0.592	0.323	0.635
	(0.493)	(0.495)	(0.500)	(0.491)	(0.468)	(0.481)

Lagged % Prof/Adv Math	46.16	34.67	46.42	29.97	41.68	49.20
	(22.92)	(19.08)	(29.85)	(9.989)	(29.03)	(28.38)
Lagged % Prof/Adv English	44.84	38.00	49.20	33.52	49.76	48.88
	(21.43)	(17.15)	(25.70)	(8.791)	(31.51)	(21.58)
N	24096	161760	48413	113347	17877	30536

Mean/ Proportion
Standard Deviation in second row

In summary, student enrollment patterns differ in accordance with their neighborhood of residence, as students residing in neighborhoods with distinct racial majorities or varying levels of affluence end up in schools with distinct demographics. Students living in majority Black neighborhoods, for example, are more likely to attend racially isolated and racially identifiable schools. Students living in more isolated neighborhoods are more likely to attend a racially identifiable school, a school with a lower value-added score, and a school with fewer proficient or advanced students than their counterparts in non-isolated neighborhoods. More students who live in neighborhoods with a large proportion of White and affluent peers attend racially identifiable schools and schools with a lower value-added score, but also schools with a higher percentage of proficient or advanced students (which suggests that parents may be selecting schools based on student composition and proficiency scores rather than on the value-added or diversity of the school). Students living in neighborhoods with fewer White students and more students on FRPL are surrounded by neighbors who attend a larger variety of schools (students in these neighborhoods attend a larger variety of schools) than students living in neighborhoods with more White students and fewer students on FRPL.

Integrated schools draw slightly fewer White and Black students and more Latinx and FRPL students than schools that are not integrated, as well as students from neighborhoods with fewer White and Black students and more Latinx and FRPL students. The majority of students attending integrated schools have to travel more than 30 minutes but less than 60 minutes on public transit to reach their school. More students who attend an integrated school are attending their zoned school (71 percent)

and come from neighborhoods where a larger percentage of the students attend their zone school than the proportion of students attending a racially identifiable school.

The last section of Part I examines the enrollment patterns of students who are assigned to a racially integrated zone school. These students are slightly more likely (3 percent) to attend their zone school than students zoned to a non-integrated school; however, they are significantly more likely to end up in an integrated school than their counterparts zoned to a non-integrated school. More than 62 percent of students zoned to an integrated school who choose not to attend that school still end up attending an integrated school, with more than 21 percent attending a charter school and 44 percent attending a magnet school (the majority attend an academically selective magnet school). These students also attend schools with more White and Black students and fewer Latinx and FRPL students, and more of these students end up in schools with a high value-added score and a higher proportion of students proficient or advanced in math and English than their counterparts attending their integrated zone school (suggesting perhaps that they are favoring measures of academic quality over measures of integration when selecting a school).

Finally, students zoned to an integrated school who choose not to attend that school but still end up in an integrated school attend a school where a slightly higher proportion of students is attending their zone school and where fewer students are attending a charter or magnet school, a school with a smaller proportion White students, or a higher proportion of Black, Latinx, and FRPL students than students who are zoned to an integrated school, choose not to attend it, and end up in a non-integrated school. Where a student lives and the type of school they are zoned to attend has considerable implications for the demographics and characteristics of the school they are likely to attend.

PART I DISCUSSION

This descriptive analysis has several limitations, but it also has several important implications for both scholars and policymakers. This section discusses some of those limitations and then presents the implications that can be derived from the findings. Finally, this section discusses some of the future areas of research that have emerged as a result of this study.

As with any research study, there are limitations to this project. First, I am limited by the available measures. For example, a students' FRPL status is used to measure their SES level; this is known to be a blunt measure, but is also widely used in the literature. In addition to the usual limitations of this measure, it was poorly collected during the years examined, as the district began to provide free lunch to all students regardless of their eligibility; moreover, students were designated as eligible through a system of paperwork that provided less clarity for parents than previous systems.

In addition, the American Community Survey only provides estimates for neighborhood demographics, and these estimates are based on small samples over five years. I am somewhat able to overcome this by placing students in neighborhoods and using their characteristics for race and FRPL status; however, I am not able to improve on these for other characteristics, such as the percentage of students 18 and under living below the poverty level or with a median income measure. Although I am limited to students in the public-school system, it would also be useful to understand the enrollment patterns of students who choose to enroll in a private school of interest as a way to leave the public-school system.

This study focuses on secondary school students. Considerably different patterns are likely to be present for elementary school students, who may be less likely to travel as far to attend a school but for whom there are more school options. The results of this study therefore should not be extrapolated to elementary school policy.

While this study examines students' residential locations, it is not able to assess how a residence was selected or what characteristics of a neighborhood were prioritized, preferred, or sacrificed when a residential decision was made. This information could only be acquired through a survey or interview, which was not an option for this project. It is certainly likely that attendance patterns are shaped not only by where a student resides but also by the family's ability to select a different residence if it would change their educational opportunities. This would help in understanding differences based on economic status. Future analyses should examine the mobility patterns of students across neighborhoods in order to see how enrollment patterns differ between students whose families are highly mobile during their academic tenure and those with a more stable housing situation.

Finally, this study is a purely descriptive analysis of one school district. While it includes a census of public secondary school students in MNPS, the work does not take advantage of any causal mechanisms. Therefore, the results are purely associational, and have no assumptions of causation. However, a descriptive analysis can be of great value in understanding students' enrollment patterns and how those patterns are shaped by geography.

While previous work has shown that students' educational opportunities are shaped and limited by their residence and their familial means (Rosenbaum, 1995; Rhodes & DeLuca, 2014; Siegel-Hawley, 2013), work that specifically examines which students attend integrated schools (and the characteristics of their neighborhoods) or the enrollment patterns of students zoned to attend an integrated school is more novel for the field. This work provides insight into enrollment trends that can inform theories on distinctions between students residing in integrated and racially identifiable neighborhoods or attendance zones, or in neighborhoods with differing levels of affluence and racial demographics. Students zoned to an integrated school are more likely to both choose to attend their zone school and to end up in an integrated school whether or not they attend their zone school. This suggests either that students living in neighborhoods zoned to an integrated school are different from their counterparts in

terms of the level to which they value neighborhood schools or integrated schools, or that it may be worth exploring if there is a way to carefully draw attendance zones so that more students are zoned to integrated schools. Further work should be done to test these possibilities and to provide additional explanation of the trends observed in MNPS.

These findings clearly fit within both the literature on geography of opportunity, and the literature on the role of school choice for shaping educational opportunity. In terms of the contribution this research makes to the literature on geography of opportunity, it demonstrates that where a student lives is indeed tied to where they attend school, even in a school choice system, particularly in a school choice system where transportation access is not provided for students who wish to attend choice schools. Students who live in isolated neighborhoods are less likely to end up in integrated schools with high-performing peers. This is consistent with the main theories of geography of opportunity, which suggest that inequality of opportunity will exist when resources are unevenly distributed and that residential neighborhoods with readily available access to these resources are not equitably accessible to all students (Galster & Killen, 1995).

This work fits within the school choice and equity literature, as it illustrates differences in the take-up of school choice, the proportion of students who end up in integrated schools and are utilizing school choice, how participation in school choice for students zoned to an integrated school is related to their likelihood of ending up in an integrated school, and how participation in school choice is geographically constrained. Just over 30 percent of secondary school students in the district utilize school choice options, but a larger proportion of those who reside in neighborhoods that are racially isolated choose to utilize school choice. These are the same students school choice proponents claim to be aiming to help (Holme, 2002; Viteritti, 2003; Wells, 1993). A larger proportion of students who reside close to the city center, and in neighborhoods with more non-White students choose to attend choice schools than the proportion of students farther from the city center or majority White neighborhoods.

Students zoned to an integrated school are more likely than the average student in the district to end up in an integrated school, whether or not they choose to attend their zone school, although if they choose not to attend their integrated zone school they are less likely than the average student to attend an integrated school. Of the students who end up in an integrated school, less than 30 percent attend a choice school, which is relatively low in a district where students not only have the choice to attend charter and magnet schools but also to attend zone schools that are not oversubscribed. While some of the choice schools students attend are integrated, the access to these schools remains limited, and attending a choice school is unfortunately associated with a lower likelihood of attending an integrated school.

There are specific ways district leaders and policymakers can use this study to shape their decisions. While the results are not causal in nature, they do provide a descriptive analysis that can inform decisions made in mid-size districts that have a robust school choice system, and a limited transportation system. MNPS students are residentially segregated by race and income, which shapes their enrollment choices. If districts understand that students under these conditions are likely to attend schools that reflect the neighborhood where they reside, they may be able to plan attendance zones in a way that zones more students to integrated schools. Or districts may consider ways to break the connection between residence and school attendance for students who reside in segregated and isolated zones. Given that students residing in isolated zones are less likely to attend an integrated school, these may also be the students for whom a district will see the greatest improvement in school integration, either through creative zoning or by providing of alternative school transportation options.

Residential location shapes educational opportunities, thus districts should consider ways to mitigate this connection by providing additional ways for students to choose schools outside their segregated neighborhood (perhaps additional transportation options), to “cure” this connection by redrawing attendance zones in a creative way inspired by gerrymandering, or to somehow change the

distribution of students across neighborhoods (likely a much more difficult option). The first of these three options may be more politically feasible for districts interested in expanding educational opportunity and equity on a limited budget.

Future research should explore the distinctions between enrollment trends across neighborhoods to better understand the causal mechanisms at play. Are the distinct patterns due to differences in the preferences of families living in distinct neighborhoods. Are the differences in patterns due to the way zones are drawn or to another factor that could be adjusted by policymakers? Could school access be changed in a positive way by changing transportation access?

CHAPTER 5

PART II

PART II METHODS

Using multiple comparison groups and a differences-in-differences modeling approach, I conduct a quasi-experimental analysis of the StrIDe program's associated influence on student enrollment patterns and the role geography plays in these patterns.

Analytical Procedure: Influence of no-fare busing on student enrollment patterns

To evaluate the associated influence of the StrIDe program on the degree to which geography restricts school choice and enrollment patterns, I first run OLS and logistic regression models on the treated students using a pre-test post-test design. I then run multiple student-level differences-in-differences models. The outcomes of interest include participation in "active" school choice (a binary for whether the student is enrolled in a school other than their assigned zone school), attendance in an integrated school, school academic performance (attending a school with a 4 or 5 composite value-added score, and percentage proficient or advanced in English), and the number of neighborhoods represented at the chosen school. Treatment is anticipated to be associated with an increase in the use of school choice (a drop in likelihood of attending one's assigned zone school). The influence on integration could be mixed, depending on who utilizes the policy and what they prioritize when selecting a school. I anticipate a possible increase in the likelihood of selecting and attending a high-quality school, and an increase in the number of neighborhoods represented in a given school.

Two different specifications for treatment are examined for the pre-post regression models. First, models are run for each outcome of interest for students who enter tenth grade in 2015. OLS and logistic regression models are run with student controls and clustered standard errors.

Model 1: Linear Regression and Logistic Regression

$$y_{it} = \beta_0 + \beta_1 Stride_{it} + \delta_2 Student_{it} + \varepsilon_{it}$$

In model 1, y_{it} is the outcome of interest (attend zone school, attend integrated school, attend 4/5 composite TVAAS school, percentage proficient or advanced in English in school, number of attendance zones/ tracts represented in school). $\beta_1 Stride_{it}$ is an indicator for being post-treatment, and $\delta_2 Student_{it}$ is a vector of available student-level controls including indicators for Black, Latinx, Asian, Indian, FRPL status, and the proportion of exams with proficient or advanced rating. Ideally, I would like to have a more precise measure of students' family income, parents' education level, and the characteristics their parents are looking for when selecting a school, but these measures are available in the administrative data and have been used frequently in the school choice and school integration literature. Clustered standard errors are utilized to reflect the nested nature of the data. In this model the null hypothesis is that there is no change in the outcomes associated with treatment, while the alternative hypothesis is that there is an influence of StrIDe that does not equal zero.

It is reasonable to expect that the influence StrIDe has on enrollment choices will be largest for students going into ninth grade, rather than for students who have already selected and enrolled in a high school prior to the implementation of the StrIDe policy. Students going into ninth grade are entering a structural change year, where they are no longer able to select to default to attending the school they attended the previous year. While the complete choice set a student considers is unknown, these new ninth grade students are likely to consider a larger set of schools than students who are already in high school and have an option to default to their previously attended and familiar school for the next year. Unfortunately, it would be inappropriate to include students going from eighth to ninth grade in the above model, as these students will be switching from one choice set of schools in middle school to a different choice set of schools for high school. To deal with this and still examines the year in

which it was most likely that a change in transportation policy influenced student enrollment patterns, an alternative model is presented that approaches the data differently.

In this model, pooled cross-sectional data is examined for ninth graders before and after the policy change. In these models, all five years of available data are included in the analysis, with fall 2011 through fall 2014 being pre-treatment observations, and fall 2015 being post-treatment observations. Again, the policy was implemented during the 2014-2015 school year, after students had begun school, and before they had to select the school they would attend for the 2015-2016 school year.

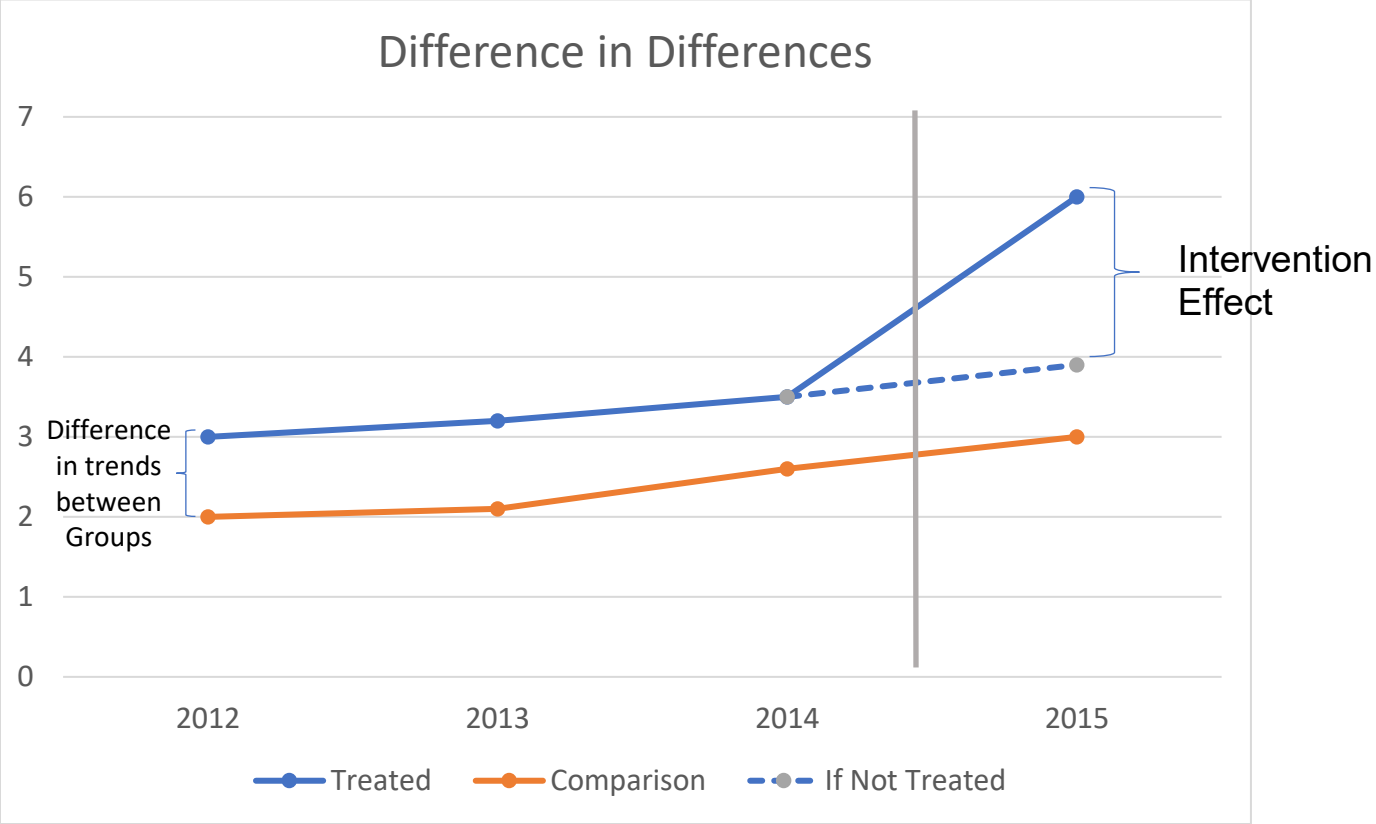
Model 2: OLS Regression and Logistic Regression 9th Grade

$$y_t = \beta_0 + \beta_1 Stride_i + \delta_2 Student_i + \varepsilon_i$$

In model 2, multiple cross sections of ninth graders are examined, rather than a panel of students over time. Again, y_t is the outcome of interest (attend zone school, attend integrated school, attend 4/5 composite TVAAS school, percentage proficient or advanced in English in school, number of attendance zones/ tracts represented in school). $\beta_1 Stride_t$ is an indicator for being post-treatment, and $\delta_2 Student_t$ is a vector of student-level controls including Black, Latinx, Asian, Indian, FRPL status, and the proportion of exams with proficient or advanced rating. Clustered standard errors are again utilized to reflect the nested nature of the data. Again, the null hypothesis is that there is no change in the outcomes associated with treatment, while the alternative hypothesis is that there is an effect of StrIDe that does not equal zero.

Differences-in-differences models take advantage of a comparison group that has pre-treatment trends comparable to those of the treated students in order compensate for potential bias due to the effects of changes that occurred simultaneously with the policy effect of interest that is expected to impact both untreated and treated students equally.

Figure 20: Hypothetical Difference-in-Differences Plot



In the first year of the StrIDe program, only high school students were eligible to participate. Therefore, only high school students knew that they would be able to use the StrIDe program as a transportation option when selecting a school for the 2015-16 school year. Middle school students provide a logical comparison group, as they would be equally likely to be affected by other district policy changes but would not be eligible for treatment. Students going from ninth grade in 2014 to tenth grade in 2015 are compared with students going from seventh grade to eighth grade in 2015. Students transitioning into ninth grade are not included, as a student going from eighth grade to ninth grade is going to have significant differences in the types of schools available from one year to the next, due to it being a structural change year and to the fact the students will be considering a different set of schools (middle versus high schools).

Model 3: Differences-in-Differences

$$y = \beta_0 + \beta_1 StrIDeEligible + \beta_2 Post + \beta_3 (StrIDe * Post) + \varepsilon$$

The variable of interest is the interaction term (β_3). The outcomes examined are the same outcomes from above. β_1 is an indicator for whether the student is eligible for StrIDe once the policy is implemented (in this case they are in high school versus not in high school). β_2 is an indicator for the year being before or after the implementation of StrIDe. The null hypothesis is that the change in the outcome from pre-treatment to post-treatment for treated students is equal to the change in the outcome from pre-treatment to post-treatment for untreated students. Clustered standard errors are again used to reflect the nested nature of the data. The alternative hypothesis is that the change in the outcome from pre-treatment to post-treatment for treated students is not equal to the change in the outcome from pre-treatment to post-treatment for untreated students.

Again, it is reasonable to expect that the effect of StrIDe on enrollment choices will be largest for students going into ninth grade, rather than for students who have already selected and enrolled in a high school prior to implementation of the policy. In the differences-in-differences models, it would be inappropriate to include students going from eighth to ninth grade, as these students will be switching from one choice set of schools for middle school to a different choice set for high school. To deal with this and still conduct an analysis that examines the year with the highest chance that a change in transportation policy will affect enrollment patterns, an alternative differences-in-differences model is presented that approaches the data differently.

For this alternative differences-in-differences model, students are grouped by grade rather than by cohort. In this way, ninth-grade students in 2014 (before treatment) are differenced with ninth-grade students in 2015 (after treatment). These students are then differenced with the difference between eighth-grade students in 2014 and eighth-grade students in 2015. For these models $\beta_1 StrIDeEligible$ is a binary with ninth-grade students assigned a 1 for being treatment eligible, and eighth-grade students

assigned a 0 as they are not treatment eligible. Again, the interaction term $\beta_3(StrIDe * Post)$ is the variable of interest.

Subgroup analysis models are run for the differences-in-differences models in order to explore differential impacts of the policy on various groups of students, who may be more or less likely to be impacted by a free bus pass. The subgroups presented include groups split by travel time to an integrated school, race, and FRPL status. It is expected that students residing where they would have reasonable travel time on a bus to an integrated school would be more likely to utilize a bus program like StrIDe to attend a school of choice than students for whom the bus ride would be prohibitively long. Students with more accessible transit options are expected to see greater effect sizes than students with less accessible transit options. Lower income students are more likely to rely on more affordable methods of transportation than their more affluent peers who may have access to cars or parents with more flexible schedules. Low-income students are also more likely to have seen bus fares as inaccessible and to change their school decision based on the elimination of bus fares. Thus, students on FRPL are more likely to have greater effect sizes than their more affluent peers. Finally, seeing as students are not evenly distributed racially across schools and neighborhoods, that students in racially isolated neighborhoods are more likely to attend racially isolated schools, and that predominantly Black, isolated neighborhoods are closer to integrated schools of choice, it could be hypothesized that the StrIDe policy would have a larger effect on Black students.

PART II RESULTS

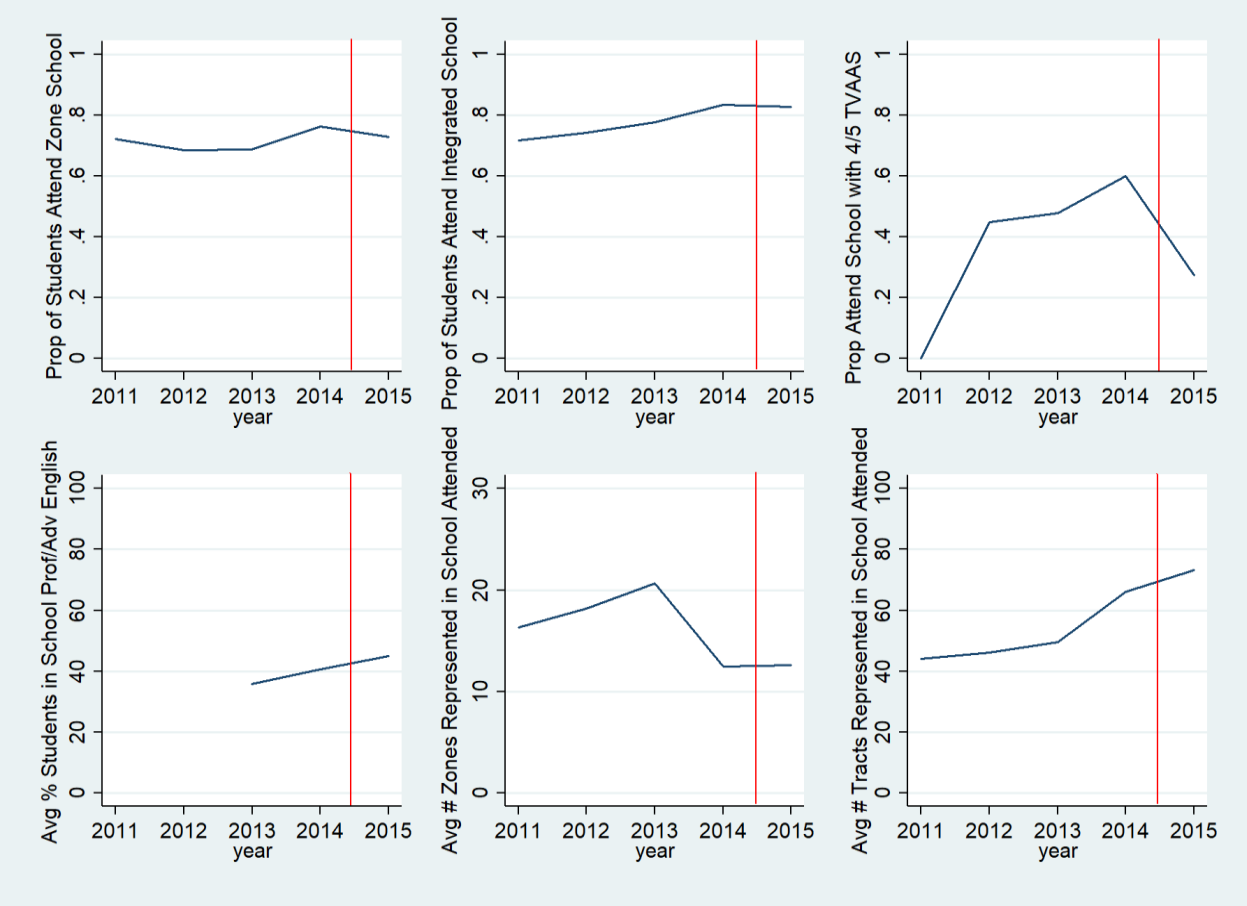
GROUP TRENDS AND COMMON TRENDS ASSUMPTION

The trend lines for the outcomes of interest for students who enter tenth grade in 2015 are presented in Figure 21. Over time the proportion of students attending their assigned zone school has held fairly constant, with a slight uptick in 2014 (the year these students entered high school) and a drop

in 2015. The proportion of students attending an integrated school increases slightly over the first four years, with a slight leveling off in 2015.

Trends for the academic quality of schools attended show distinct results, which depend on how one measures academic quality. The proportion of students attending a school with a high value-added score (4 or 5) increased considerably between 2011 and 2012, with a slight increase through 2014 and a large drop in 2015, suggesting that fewer students are attending high value-added schools since the policy change. However, the trend for the proportion who are proficient or advanced in English shows a steady increase before and after treatment.

Figure 21: Average Characteristics of School Attended by Students Pre- and Post-Treatment



Between 2014 and 2015 (from pre- to post-treatment), there is an increase in both the average number of attendance zones represented in the school attended and the average number of census

tracts represented in the school attended. Between 2011 and 2013, there is also a slight increase in the number of attendance zones and tracts represented; however, the trends differ between 2013 and 2014. Once again, this is the year when this cohort of students transitioned from middle school to high school. The number of zones represented dropped in 2014, which makes sense given that high school zones are larger than middle school zones and there are fewer total zones. The number of tracts represented rises in 2014, which again is logical given that the zones are larger in high school and would therefore likely contain more census tracts than middle school attendance zones.

Without an untreated comparison group, one cannot tell to what extent the changes over time are due to treatment or to other factors affecting students in the district that are unrelated to the StrIDe policy change. Figure 22 includes the trends of a comparison group that is not eligible for StrIDe, but that would be affected by other unrelated changes in the district that occurred over the same time period. The cohort of students who transition from seventh grade to eighth grade in 2015 have trends prior to treatment for the outcomes of interest that are fairly similar to the trends for students who transition from ninth grade to tenth grade in 2015. This suggests that they may make a reasonable comparison group.

The top left graph in Figure 22 shows the trend lines for the proportion of students who attend a zone school (rather than utilize school choice options) for the cohort that transitions from seventh to eighth grade compared with the cohort transitioning from ninth grade to tenth grade in 2015. There are some slight deviations over the years, but they are consistently between just over 80 percent and just under 70 percent of students attending a zone school over the five years. The graph in the middle of the top row shows a clearer parallel trend for the two groups regarding attendance at a school within the Department of Justice definition of an integrated school, with a very slight increase in the proportion of students attending integrated schools over the five years. Without the comparison group, one might infer that the slight decrease in the slope of the change line from 2014 to 2015 is evidence that StrIDe

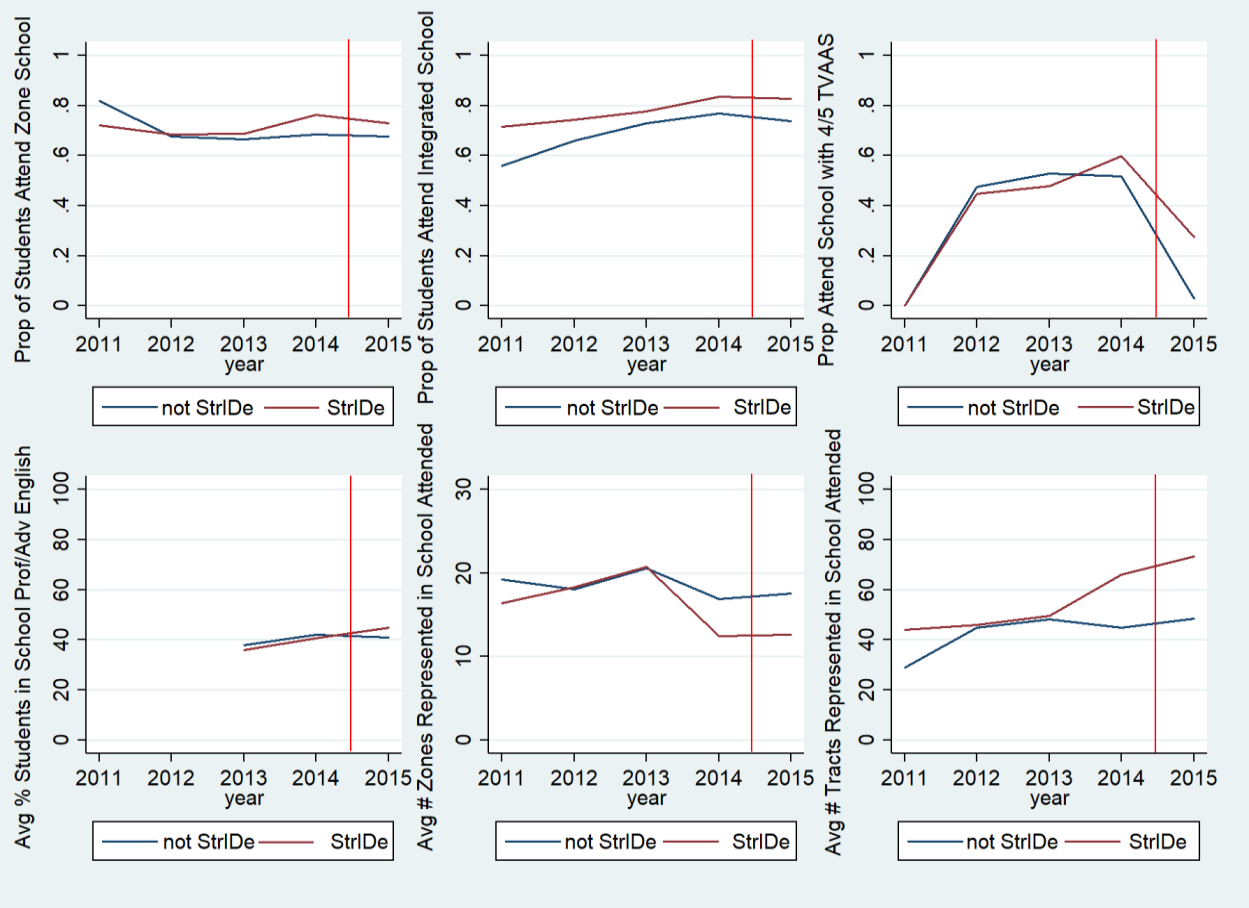
could lead to a smaller proportion of students attending integrated schools. However, it is evident with the comparison group that there was also a decrease for un-treated students over that time period, with the treated students seeing a smaller drop in the proportion attending an integrated school.

Unfortunately, I do not have a record of the proportion of students who were proficient or advanced in English in the schools prior to 2013. Thus it is more difficult to assess group comparability. However, we can see in the bottom left graph that between 2013 and 2014 (the years prior to treatment) the groups had very consistent trends, and that the comparison group does not see the same continued upward trend post-treatment that is seen by the treated students. While the trends appear very consistent, there are some apparent differences in the slope. The trend lines are also similar over time for the two groups in terms of attendance at a school that received a 4 or a 5 composite score for student achievement the previous year (rather than a score of 1-3). Other than a small jump for StrIDe eligible students in 2014, the trends are closely aligned. Therefore, this comparison group should be adequate for this measure of school quality. In this case, it is clearly evident that it would be a mistake to attribute the large drop in the proportion of students attending an integrated school post-treatment to StrIDe, as this large drop is also seen in the comparison group. Without this comparison group the estimate would be negatively biased. Therefore, even if the comparison group is not perfect, it can help reduce bias in the estimates.

The last two graphs in Figure 22 show the trend lines for the average number of neighborhoods represented at the school attended with two different measures for neighborhood. These measures provide an estimate for the level of neighborhood-based isolation at a school. Are the students attending the school from a large variety of neighborhoods, or do they mostly come from only a few neighborhoods? While the comparison group is again not perfect, the trend lines follow similar trajectories for the number of attendance zones represented in the school attended, and for the

number of census tracts represented in the school attended by the average treated student versus average untreated student.

Figure 22: Average Characteristics of School Attended by Students Entering 10th Grade in 2015 vs 8th Grade in 2015



While visually examining the trend lines can be useful for evaluating the extent to which a comparison group has consistent trends to the treated group prior to treatment, this can be improved upon by testing whether significant effects would be found for placebo treatments in prior years. In other words, this test allows one to test if the change in slope would provide a false positive or type one error, falsely rejecting the null hypothesis of no effect. Ideally, to have confidence in quasi-causal results there should be no significant effects on the interaction term for the year and placebo treatment interaction. For the differences-in-differences methodology, the coefficients for the treatment placebo

or the non-interacted year indicators can be significant or insignificant, without affecting the overall result of interest. Table 11 presents the results of this placebo test for the common trends assumption for the model that compares the cohort that enters tenth grade in 2015 as the treated group and the cohort that enters eighth grade in 2015 as the comparison group. Columns 1-3 present the odds ratios for logistic regressions, while columns 4-6 present coefficients from linear regression using panel data.

Unfortunately, the comparison group is an imperfect comparison group that does not entirely pass the placebo test. A highly significant estimate (at the .001 level) is detected for the outcome of the number of zones represented in the school attended in 2014. A significant estimate (at the .01 level) is found for the number of tracts represented in the school attended in 2014. Finally, there is a slightly significant effect (at the .05 level) found for attendance at the assigned zone school rather than at a school of choice. These results are concerning, but the significant effects in 2014 are not surprising, due to the fact that, in that year, the treated students switched from middle school to high school (entered ninth grade). There are likely to be differences in base enrollment patterns for middle school versus high school students, and therefore there would be significant changes in the slope for students transitioning from middle to high school that differ from the slope for students moving from sixth grade to seventh grade. Therefore, while this comparison group would not be practical in 2014, it could still be relevant in 2015 or prior to 2014.

While this middle school comparison group may present bias in the differences-in-differences estimates and is an imperfect counterfactual, for many variables it appears to meet the parallel trends assumption while failing to meet the assumption for other select outcomes. These results are not without bias, but they may help with the bias inherent in a single group study. If some of the bias in a single group design is due to simultaneous changes in the district that would affect both middle school and high school students, this comparison group could help minimize this bias. This type of bias was noted for some outcome variables in the trend lines from Figure 22, which suggests that some value

could be derived from this differences-in-differences approach. Due to the possibility of type one error, the results of the differences-in-differences estimates are discussed in terms of patterns and trends, rather than as confident effect sizes.

Table 11: Placebo Treatment Tests for Common Trends Assumption

	(1)	(2)	(3)	(4)	(5)	(6)
	Logistic Regression (Odds Ratio)			Linear Regression		
	Attend Zone School	Grade Integrated within 20% White	Lag School Composite 4/5	Lag School % Prof/Adv English	Number of Tracts Represented in School	Number of Zones Represented in School
Treat	1.041	1.495	0.899	-2.722***	1.522	0.435
	0.093	0.331	0.067	0.455	0.885	0.330
2014	0.980	1.834**	1.226	3.640***	-0.038	-1.142*
	0.088	0.377	0.413	0.793	1.061	0.499
Treat #2014	1.507*	0.951	1.501	1.024	20.139**	-4.589***
	0.311	0.529	0.812	2.777	7.037	1.059
2013	0.982*	1.354*	1.262	0.000	2.862***	2.144***
	0.066	0.169	0.398	.	0.779	0.414
Treat #2013	1.071	0.891	0.894	0.000	0.386	0.241
	0.075	0.187	0.086	.	0.560	0.227
Constant				38.632***	44.517**	17.731***
				1.444	2.408	0.863
Observations	50639	50639	50639	36843	50639	50639
R^2				0.016	0.043	0.075
Pseudo R^2	0.004	0.013	0.006			

Standard errors in second row
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

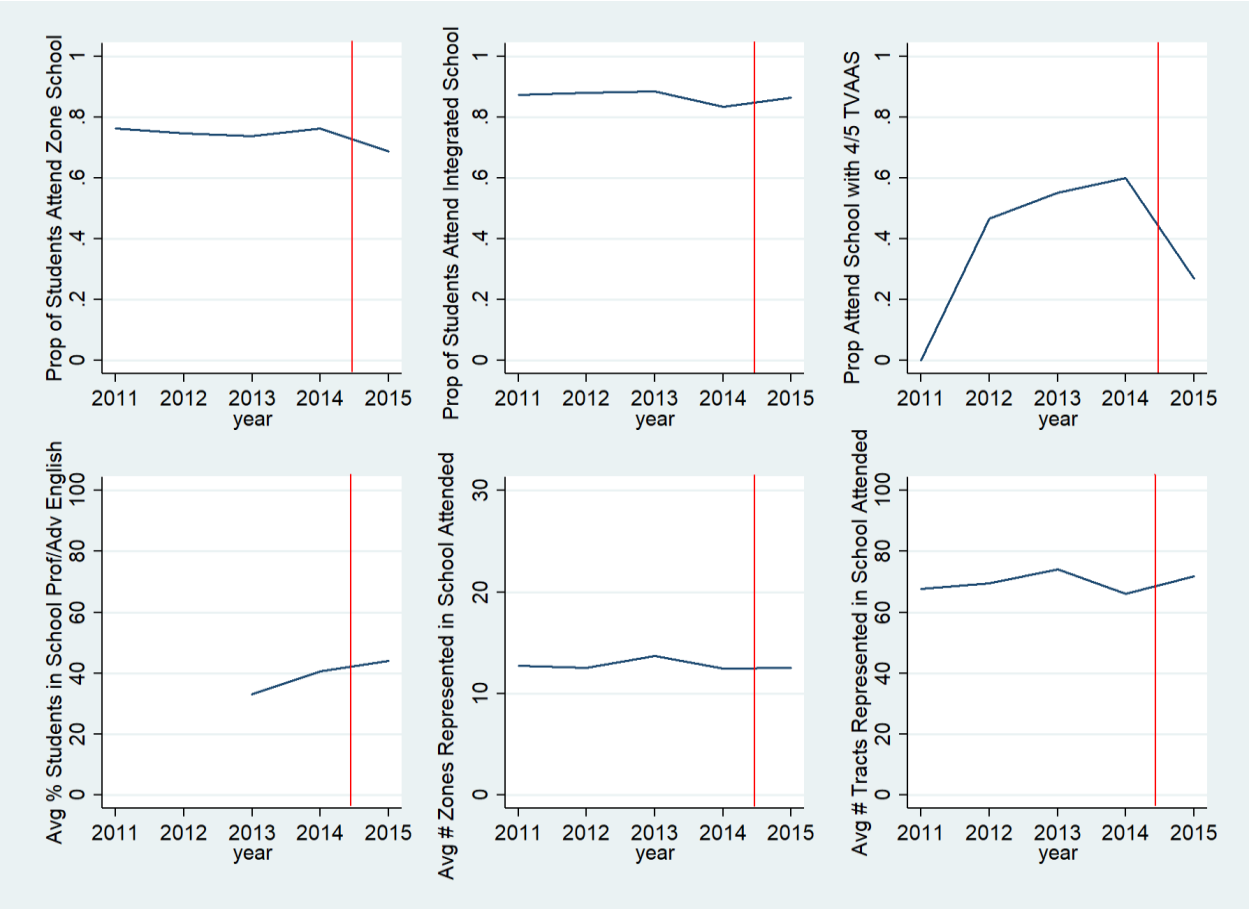
StrIDe's effect on student enrollment patterns would be expected to be larger for students who have not yet selected a high school prior to treatment. These students are more likely to consider their entire choice set than a student who has already selected a school and has become familiar and comfortable with that school. The effects of the policy change on students' enrollment decisions are more likely to be noted for students entering high school after the policy is implemented (students

entering ninth grade in 2015). In order to consider ninth graders without the results being biased by the differences in schooling options between middle school and high school, the following section explores the degree to which grades rather than cohorts could be used for comparative analysis.

Figure 23 presents the trends for ninth grade students over the five years of data. Again, the proportion of students attending their assigned zone school is steady from 2011 to 2014, with a slight drop post-treatment in 2015. There is also a consistent trend for the proportion of students attending an integrated school from 2011 to 2013, a slight drop in 2014 and, again, a slight increase post-StrIDe in 2015. The proportion of ninth graders attending a school with a high value-added score increased between 2011 and 2014, with a large drop in 2015. The average percentage of students who are proficient or advanced in English increased between 2013 and 2014, and again saw a smaller increase post-StrIDe in 2015.

The average number of neighborhoods represented in the school attended by ninth graders held mostly constant over the five years. The average number of attendance zones represented in the school had a very small uptick in 2013, but otherwise holds constant, while the number of census tracts represented saw a very slight increase in 2013, a slight drop in 2014, and again a slight increase in 2015.

Figure 23: Average Characteristics of School Attended by 9th Grade Students Pre- and Post-Treatment



In order to include an untreated comparison group, the trends for students in grade eight are compared over time with the trends for students in grade nine. Figure 24 shows that the trends in attendance in students' assigned zone school (versus use of school choice) are overall fairly consistent, particularly prior to treatment in 2015. The trend lines for attending an integrated (versus racially identifiable) school are also relatively consistent until post-treatment; however the slight changes in trend lines are not entirely consistent, which provides some room for caution in interpreting changes in slopes.

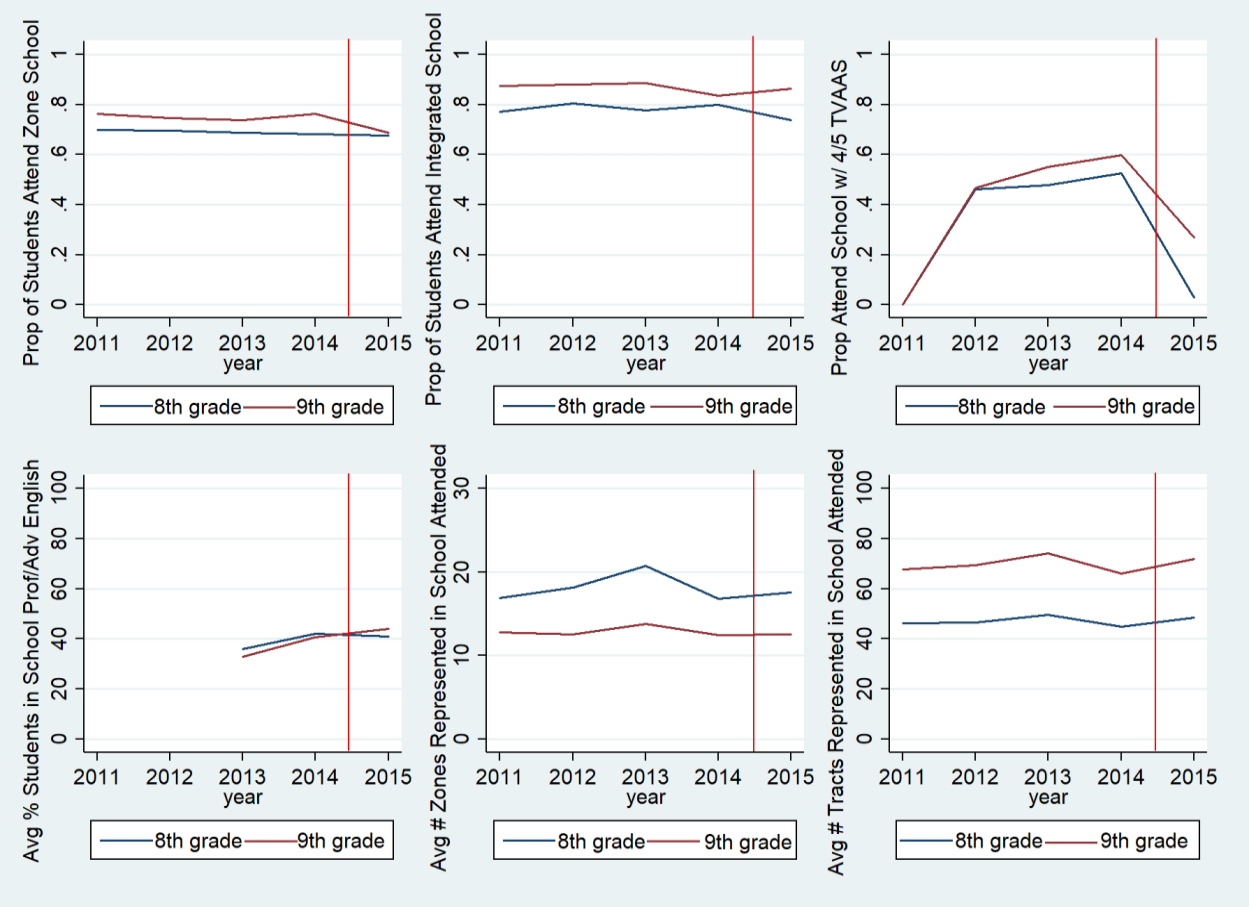
Again, the measures for the proportion of students performing at the proficient or advanced level in English in the previous year were only available for 2013-2015. Therefore, the trend lines are more limited than for the other outcomes of interest. With the limited timeline of data available, it

appears that prior to treatment (in 2015-16) the trend line for the percentage of students proficient or advanced in English for the schools eighth graders attended is parallel to the percentage proficient or advanced in English for the schools ninth graders attended.

Regarding the diversity of neighborhood representation in the school attended, there are fairly parallel trend lines for the treatment and non-treatment groups prior to treatment. The trend line is relatively consistent for attendance zones, but it is clearly parallel for the number of census tracts represented in a student's school. While the magnitude is distinct, the trend lines are consistent, which is the aspect of the trend that is of concern when selecting a comparison group for differences-in-differences models.

In terms of attendance at a high-performing school, the trend lines are consistent for attendance at a school with a composite score of at least 4 prior to treatment. Again this measure provides evidence for the need to consider a comparison group, as without one it would appear that StrIDe has a large negative effect on attendance at a high-scoring school. With the comparison group it is evident that something else happened in the district associated with this drop and, if anything, StrIDe may be associated with a smaller drop in magnitude. Therefore, for these measures the treatment group of ninth graders compared to a comparison group of eighth graders appears to be a reasonable option in order to follow two groups with parallel trends but differences in assignment to treatment, even if they are not perfectly comparable.

Figure 24: Average Characteristics of School Attended by 8th & 9th Grade Students Pre- and Post-Treatment



While the trend lines appear relatively consistent, there are cases of type one error when testing for placebo effects for one outcome of interest (Table 12). There is a highly significant (at the .001 level) false rejection of the null hypothesis for the number of attendance zones represented in students' schools in 2013 and another significant (at the .01 level) false rejection of the null hypothesis for the same outcome in 2012. Therefore, while the trends are somewhat similar and by comparing the trends for ninth graders (who become eligible for treatment under StrIDe) with eighth graders (who do not become eligible for treatment under StrIDe) one is able to control for bias due to any congruent policy changes that would affect all secondary students in MNPS, it is still possibile some bias remains in a differences-in-differences approach. These models can improve upon the simple regression models but should still be considered associational, due to the potential for remaining bias in the model. For this

reason, models are presented with a one-group design and models using the differences-in-differences approach. Due to the possibility of type one error, the results of the differences-in-differences estimates are discussed in terms of patterns and trends, rather than as confident effect sizes.

Table 12: Placebo Treatment Tests for Common Trends Assumption (9th grade)

	(1)	(2)	(3)	(4)	(5)	(6)
	Logistic Regression (Odds Ratio)			Linear Regression		
	Attend Zone School	Grade Integrated within 20% White	Lag School Composite 4/5	Lag School % Prof/Adv English	Number of Tracts Represented in School	Number of Zones Represented in School
Treat	1.388	2.040	1.024	-2.859	21.512***	-4.100***
	0.255	0.889	0.568	2.624	5.445	0.862
2014	0.924	1.175	1.304	6.084***	-1.448	-0.155
	0.064	0.214	0.410	0.898	1.225	0.575
Treat # 2014	1.080	0.623	1.316	1.440	-0.064	-0.175
	0.099	0.253	0.853	1.327	3.018	0.618
2013	0.987	1.034	1.078		3.147**	3.685***
	0.050	0.207	0.344		1.147	0.533
Treat# 2013	0.939	1.095	1.346		3.314	-2.780***
	0.063	0.230	0.622		2.206	0.579
2012	0.988	1.221			0.261	1.260**
	0.060	0.169			0.934	0.405
Treat# 2012	0.927	0.878			1.528	-1.474**
	0.071	0.130			1.771	0.447
Constant				35.910***	46.140***	16.867***
				1.598	2.453	0.800
Observations	52900	52900	40032	26272	52900	52900
R^2				0.044	0.094	0.099
Pseudo R^2	0.004	0.015	0.008			

Standard errors in second row

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

RESULTS OF REGRESSION AND DIFFERENCES-IN-DIFFERENCES MODELS

Results of the models pertaining to this outcome or students' attendance at their assigned zone school are presented in Table 13 in the form of odds ratios. For these models, the effect is considered negative in direction if the odds ratio is less than 1 and is positive in direction if the odds ratio is greater than 1. For the logistic regression models without differences-in-differences the outcome of interest is in the top row; for the differences-in-differences models the coefficient of interest is the interaction term. Each of the models estimate that StrIDe is associated with a drop in the likelihood of students attending their assigned zone school. Models show an estimated change in odds for students eligible for StrIDe attending their zone school that is a 10-30 percent larger drop than their counterparts' change in odds. The association is actually magnified in models with controls included. Each model has significant results, with a significance level between .05 and .001. Therefore, it appears that the StrIDe policy is associated with a greater use of active school choice among students eligible for treatment.

Table 13: Logistic Regression Models for Attendance at Zone School (Odds Ratios)

	(1) 9th-10th Grade 1 Group Pre-Post	(2) 9th-10th Grade 1 Group Pre-Post w/ Student Controls	(3) 9th Grade Pooled Cross Section Pre-Post	(4) 9th Grade Pooled Cross Section Pre-Post w/ Student Controls	(5) DiD 7-8 vs 9-10	(6) DiD 8 vs 9
StrIDe	0.908*	0.854*	0.713***	0.684***	1.471*	1.499*
	0.041	0.063	0.057	0.073	0.282	0.288
Post					0.953	0.972
					0.028	0.046
StrIDe*Post					0.878**	0.706***
					0.035	0.065
Observations	53934	38285	37082	22242	25973	27259
Pseudo R^2	0.000	0.134	0.003	0.135	0.005	0.005

Standard errors in second row
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

While there appears to be strong evidence that StrIDe is at least associated with an increase in the use of school choice by secondary school students in MNPS, the evidence is less convincing regarding attendance in a school considered integrated according to Department of Justice guidelines (within 20 percentage points of the district average percentage White). There are no significant results for attending a school designated as integrated, which suggests that there is no clear pattern regarding the potential influence of the StrIDe policy on students' attendance in an integrated school. It appears that, while students may be more likely to attend a school other than their assigned zone school, the proportion of students choosing to attend an integrated school is canceled out by the proportion of students choosing to attend racially identifiable schools.

Table 14: Logistic Regression Models for Attendance at Integrated School w/in 20% (Odds Ratios)

	(1) 9th-10th Grade 1 Group Pre-Post	(2) 9th-10th Grade 1 Group Pre-Post w/ Student Controls	(3) 9th Grade Pooled Cross Section Pre-Post	(4) 9th Grade Pooled Cross Section Pre-Post w/ Student Controls	(5) DiD 7-8 vs 9-10	(6) DiD 8 vs 9
Post StrIDe	1.195	1.122	0.962	0.935	1.531	1.270
	0.122	0.155	0.148	0.148	0.796	0.669
Post					0.855	0.709
					0.108	0.146
StrIDe*Post					1.112	1.772
					0.157	0.620
Observations	53934	38285	37082	22242	25973	27259
Pseudo R^2	0.001	0.063	0.000	0.067	0.005	0.014

Standard errors in second row
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The first measure of academic quality presented is for the outcome of attendance at a school with a TVAAS score of 4 or 5 out of 5 in the previous year. The odds ratios for the logistic regressions are

presented in Table 15. The one group models would suggest a large negative estimate associated with eligibility for StrIDe; however once the trajectory of a comparison group is included (in the differences-in-differences models) the estimates maintain their statistical significance, but are instead positive in direction with a very large magnitude for the estimated association. This measure has very large odds ratios, which suggests that the likelihood or odds of attending a school with a high value-added score is more than 800 percent greater for treatment-eligible students than non-treatment-eligible students. Unfortunately, it is unlikely that there would be an effect this large due purely to a small policy change, such as a fare-free bus pass. Thus, this measure may have bias that is not accounted for with the comparison groups in the differences-in-differences models.

Table 15: Logistic Regression Models for Attendance in 4/5 Composite TVAAS School (Odds Ratios)

	(1) 9th-10th Grade 1 Group Pre-Post	(2) 9th-10th Grade 1 Group Pre-Post w/ Student Controls	(3) 9th Grade Pooled Cross Section Pre-Post	(4) 9th Grade Pooled Cross Section Pre-Post w/ Student Controls	(5) DiD 7-8 vs 9-10	(6) DiD 8 vs 9
Post StrIDe	0.288*	0.310*	0.529	0.297*	1.395	1.347
	0.151	0.153	0.261	0.149	0.753	0.723
Post					0.029***	0.028***
					0.011	0.010
StrIDe*Post					8.694**	8.792**
					6.281	6.356
Observations	53934	38285	37082	22242	25973	27259
R^2						
Pseudo R^2	0.065	0.066	0.011	0.058	0.191	0.187

Standard errors in second row
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The measure for the average percentage of students who are proficient or advanced in English from the prior year in the school attended has more consistent results with a more believable magnitude. The one group models all have significant results, that have slightly smaller magnitudes for

the coefficient in the models with student controls included. The models following students going from ninth grade to tenth grade in 2015 have coefficients just over 3, which suggests an association of a change of just over 3 percent more students with proficient or advanced scores in English for students eligible for StrIDe than the change for non-eligible students. The magnitude of the association is larger for the ninth grade models with about 7 percent more students proficient or advanced in English in the school attended by students eligible for StrIDe. The differences-in-differences model that compares students going from ninth to tenth grade with students going from seventh to eighth grade in 2015 again have positive highly statistically significant estimates, with an estimate that the change in means for StrIDe eligible students is five percentage points higher than the change for non-eligible students. The differences-in-differences results comparing the change for ninth grade students with the change for eighth grade students have a slightly smaller, but still positive, estimate for the change in the proportion of proficient or advanced peers for treatment-eligible students than for non-eligible students with a change of slightly over 4 percent of students considered proficient. Thus, eligibility for StrIDe appears to be positively associated with the proportion of proficient or advanced students in the school a student attends.

Table 16: Regression Models for Lag % Prof/Adv English for School Attended

	(1) 9th-10th Grade 1 Group Pre-Post	(2) 9th-10th Grade 1 Group Pre-Post w/ Student Controls	(3) 9th Grade Pooled Cross Section Pre-Post	(4) 9th Grade Pooled Cross Section Pre-Post w/ Student Controls	(5) DiD 7-8 vs 9-10	(6) DiD 8 vs 9
Post StrIDe	3.245**	3.024**	7.119***	6.842***	-1.463	-1.420
	0.975	0.898	0.783	0.775	2.767	2.804
Post					-0.943	-0.900
					0.529	0.700
StrIDe*Post					5.358***	4.314**
					0.872	1.057
Constant	41.720***	41.006***	36.870***	37.128***	42.038***	41.995***
	1.619	1.187	2.010	1.439	1.993	2.046
Observations	51493	37198	21521	16981	25227	26086
R^2	0.007	0.369	0.037	0.254	0.008	0.005

Standard errors in second row
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The last two outcomes examined are measures of the number of neighborhoods represented in the school attended. These measures attempt to assess the extent to which students may have the opportunity to interact with students from different neighborhoods from their own. This is particularly relevant given the residential segregation across the city. There is a positive estimate for the number of census tracts represented in the school attended by students going from ninth to tenth grade in 2015. Without student controls the estimate is for over nine more tracts represented in the schools of treatment-eligible students. Once student-level controls are added the estimate increases to over 11 more census tracts represented in the schools of treatment-eligible students. The ninth grade models have a smaller magnitude and are not significant at the .05 level, but they are consistently positive in direction (ranging from 1.1 to 2.6 more tracts represented). The differences-in-differences models also suggest that there is a positive effect associated with StrIDe eligibility. The first differences-in-

differences model suggests a change that is 3.5 tracts larger than for non-eligible students. While, the model with ninth graders was expected to have a larger effect than for students already in high school, the model instead finds that treated students see a change that is just under two tracts more than the change for their untreated peers, and the estimate is not statistically significant. Overall, it appears that StrIDe is associated with a positive change in the number of neighborhoods represented in a student's secondary school. While this does not necessarily mean that they will interact with students from more neighborhoods, the chance that they might goes up in association with this transportation policy change.

Table 17: Regression Models for Average # of Census Tracts Represented in School Attended

	(1) 9th-10th Grade 1 Group Pre-Post	(2) 9th-10th Grade 1 Group Pre-Post w/ Student Controls	(3) 9th Grade Pooled Cross Section Pre-Post	(4) 9th Grade Pooled Cross Section Pre-Post w/ Student Controls	(5) DiD 7-8 vs 9-10	(6) DiD 8 vs 9
Post StrIDe	9.374***	11.784***	2.608	1.161	21.220***	21.448**
	2.225	2.710	1.828	1.601	6.974	6.984
Post					3.567***	3.796***
					0.699	1.059
StrIDe*Post					3.534*	1.973
					1.518	1.422
Constant	64.811***	61.214***	69.301***	72.401***	44.921***	44.692***
	5.140	6.053	5.439	0.756	2.754	2.779
Observations	53934	38285	37082	22242	25973	27259
R^2	0.014	0.270	0.001	0.259	0.092	0.089

Standard errors in second row
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The estimates for the associated influence of StrIDe on the representation of attendance zones in a school attended are those that had the most placebo effects when testing the leads for the

differences-in-differences models. Only one model has a statistically significant estimate, which is in the opposite direction from the census tract estimates. This statistically significant estimate is for the ninth to tenth grade one group model with student controls, and the coefficient suggests an association of just over one less attendance zone represented in the school of treatment-eligible students. While more tracts may be represented in the school attended by StrIDe-eligible students, the policy may be associated with fewer attendance zones represented. This negative estimate on the number of attendance zones, paired with the positive estimate on the number of census tracts represented, suggests that there may be movement across more of the tracts within attendance zones already represented in schools. Perhaps the most proximal attendance zones, where students may not have to travel by bus as far or for as long on their commute are the ones represented. However, the majority of models do not show a significant change in the number of very large attendance zones represented in students' schools that are associated with eligibility for treatment under StrIDe.

Table 18: Regression Models for Average # Attendance Zones Represented in School Attended

	(1) 9th-10th Grade 1 Group Pre-Post	(2) 9th-10th Grade 1 Group Pre-Post w/ Student Controls	(3) 9th Grade Pooled Cross Section Pre-Post	(4) 9th Grade Pooled Cross Section Pre-Post w/ Student Controls	(5) DiD 7-8 vs 9-10	(6) DiD 8 vs 9
Post StrIDe	-0.852	-1.224*	-0.337	-0.553	-4.348***	-4.276***
	0.425	0.476	0.500	0.472	0.986	1.008
Post					0.708	0.781
					0.385	0.436
StrIDe*Post					-0.552	-0.703
					0.505	0.604
Constant	13.460***	11.731***	12.851***	11.428***	16.784***	16.711***
	0.449	0.570	0.343	0.521	0.900	0.924
Observations	53934	38285	37082	22242	25973	27259
R^2	0.003	0.152	0.000	0.133	0.069	0.069
Pseudo R^2						

Standard errors in second row
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

SUBGROUP ANALYSIS RESULTS

I conducted subgroup analyses in order to examine the specific groups that were more or less likely to be influenced by the StrIDe policy implementation. The final section of this chapter presents the results of these subgroup analyses. Table 19 presents the odds ratios and OLS coefficients for each of the outcomes of interest for subgroups based on the time it would take a student to commute to an integrated school without admission restrictions (entrance exam or audition) on public transit. The top third of the table presents results for students who reside more than 60 minutes from the nearest integrated school without admission restrictions. The second third of the table presents results for all students who live between 30 and 60 minutes of an integrated school without admission restrictions,

and the bottom third of the table shows results for students living within 30 minutes of an integrated school without admission restrictions.

For students residing over 60 minutes away by public transportation from the nearest integrated school, only one outcome of interest has a statistically significant coefficient. The significant result is for a small increase (four percentage points larger change than for their non-eligible peers) in the percentage of students in the school attended who are proficient or advanced in English. This measure has slightly larger estimates for students living closer to an integrated school using public transit and has more statistically significant results for students living closer to an integrated school. This suggests that a policy such as StrIDe is not associated with significant changes in enrollment patterns for students for whom public transit routes would require long commute times.

The estimates have a larger magnitude and more of them have statistically significant findings for students living within 30 minutes or between 30 and 60 minutes of an integrated school. The change in the likelihood or odds of a student attending their assigned zone school is almost 39 percent lower for StrIDe-eligible students living between 30 and 60 minutes of an integrated school, and about 28 percent lower for StrIDe-eligible students living within 30 minutes of an integrated school than for non-StrIDe-eligible students living within this distance. The change in the likelihood of or odds of attending an integrated school is over 300% higher for StrIDe eligible students within 30 minutes of an integrated school than the change for non-eligible StrIDe students living within 30 minutes of an integrated school. This suggests that, while I do not find significant effects on integration in overall models or for students who would have to ride a bus longer than 30 minutes to attend an integrated school, StrIDe is associated with increased odds of attending an integrated school for some students with more accessible public transit lines.

The change in the likelihood of attending a school with a high value-added score for StrIDe-eligible students who live between 30 and 60 minutes from an integrated school is associated with a

1200 percent higher change in odds. In addition, the magnitude of the estimate is even higher and is highly statistically significant for students residing within 30 minutes of an integrated school, are eligible for StrIDe, and are associated with a change of more than 1800 percent greater odds than the change for their non-eligible peers who reside within 30 minutes. Again, this variable has very large estimates that may suggest the remaining presence of bias that has not been accounted for, consistent with the overall results above.

These results suggest that, while this policy appears to be associated with some changes in students' overall enrollment patterns, the policy influence appears to depend on the availability of transit routes that allow a student to arrive at a desired school in a timely manner. Otherwise the policy does not appear to expand access for students or significantly change most enrollment patterns.

Table 19: Logistic and OLS Regression Difference in Differences Models 8th Grade vs 9th Grade by Distance from Integrated School on Bus

	(1)	(2)	(3)	(4)	(5)	(6)
	Logistic Regression (Odds Ratios)			Regression Models		
	Attend Zone School	Grade Integrated within 20% White	Lag School Composite 4/5	Lag School % Prof/adv English	Number of Tracts represented in School	Number of Zones represented in School
Not Within 60 Minutes of an Integrated School by Bus						
StrIDe	1.396	2.572	2.338	-2.125	23.372*	-2.523
	0.849	2.369	1.716	4.607	9.385	1.813
Post	0.981	0.983	0.028***	-0.232	4.373	1.489
	0.124	0.113	0.018	1.596	2.295	0.968
StrIDe*Post	0.839	1.219	2.339	4.127*	-0.930	-1.869
	0.060	0.438	2.391	1.875	2.692	0.990
Constant				45.955***	44.490***	15.494***
				4.085	4.987	1.764
Observations	8600	8600	8600	8373	8600	8600
R^2				0.007	0.086	0.043
Pseudo R^2	0.003	0.038	0.290			
30-60 Minutes to an Integrated School by Bus						
StrIDe	1.583	1.664	1.241	-4.330	19.355*	-4.912***
	0.517	0.909	0.877	3.149	8.228	1.365
Post	0.960	0.717*	0.036***	-1.753	2.744	0.086
	0.062	0.101	0.017	1.084	1.726	0.623
StrIDe*Post	0.615***	1.195	12.184**	4.755**	2.958	-0.244
	0.068	0.339	10.339	1.400	2.010	0.814
Constant				43.761***	43.616***	16/848***
				2.403	3.979	1.270
Observations	8128	8128	8128	7744	8128	8128
R^2				0.009	0.067	0.075
Pseudo R^2	0.010	0.016	0.128			
Within 30 Minutes of an Integrated School by Bus						
StrIDe	1.315	0.564	0.826	-1.110	22.997**	-4.878***
	0.242	0.379	0.467	3.336	8.223	1.175
Post	0.972	0.610	0.025***	-0.856	3.946**	0.703

	0.068	0.206	0.011	0.719	1.173	0.412
StrIDe*Post	0.719**	3.185*	18.651***	4.293**	3.790	0.075
	0.082	1.890	13.074	1.238	2.019	0.699
Constant				38.981***	45.284***	17.313***
				1.849	3.276	1.047
Observations	10531	10531	10531	9969	10531	10531
R^2				0.004	0.114	0.070
Pseudo R^2	0.003	0.014	0.188			

Standard errors in second row
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

There are racial differences in terms of the association between the StrIDe policy and use of school choice, attendance at an integrated school, and attendance at a high-performing school. Table 20 presents the results of subgroup analyses for White, Black, and Latinx students. White students see the largest increases for the change in the percentage of students in their school who were proficient or advanced in English during the previous year for treated students (5.288 percentage point increase) relative to the change for un-treated students. This suggests that White students may respond to the policy change in a way that allows them to attend schools with higher performing peers. StrIDe-eligible Latinx students see the greatest relative increases in the odds of attending an integrated school and a school with a composite value-added score of 4 or 5 (odds ratios of 2.311 and 60. 653 respectively). Latinx students also see the greatest relative decreases in the likelihood of attending their assigned zone school associated with the policy change (odds ratio of 0.614). Therefore, Latinx students appear to respond in a way that allows them to attend more choice schools, more integrated schools, and schools with a higher value-added. All three subgroups see positive estimates for the change in odds of participating in active school choice, and attending a school with a high value-added score, and the impact is positive for the percentage of students in the school attended who are proficient or advanced in English.

Table 20: Logistic and OLS Regression Difference in Differences Models 8th Grade vs 9th Grade by Race

	(1)	(2)	(3)	(4)	(5)	(6)
	Logistic Regression (Odds Ratios)			Regression Models		
	Attend Zone School	Grade Integrated within 20% White	Lag School Composite 4/5	Lag School % Prof/adv English	Number of tracts represented in school	Number of zones represented in school
White Students						
StrIDe	1.263	2.367	2.244	-2.436	26.211**	-4.280***
	0.235	1.139	1.350	3.652	9.294	1.203
Post	1.010	0.873	0.049***	-1.709	2.374	0.491
	0.071	0.117	0.017	0.958	1.711	0.598
StrIDe*Post	0.760*	1.618*	4.258	5.288***	3.704	-0.777
	0.093	0.358	3.372	1.335	2.060	0.723
Constant				48.781***	49.829***	17.404***
				2.998	4.278	1.129
Observations	7733	7733	7733	7574	7733	7733
R^2				0.005	0.106	0.063
Pseudo R^2	0.002	0.046	0.184			
Black Students						
StrIDe	1.655*	0.975	1.327	-2.021	18.547**	-5.451***
	0.360	0.551	0.694	2.478	5.953	0.995
Post	1.001	0.600	0.035***	-0.897	3.415***	0.489
	0.053	0.185	0.012	0.864	0.886	0.394
StrIDe*Post	0.690***	1.863	8.523**	4.384***	2.878	-0.349
	0.063	0.879	6.097	1.155	1.451	0.472
Constant				39.400***	47.014***	17.995***
				1.513	2.314	0.929
Observations	12547	12547	12547	11846	12547	12547
R^2				0.005	0.076	0.094
Pseudo R^2	0.007	0.009	0.163			
Latinx Students						
StrIDe	1.640*	0.962	0.709	1.076	21.756***	-1.832
	0.337	0.659	0.563	2.122	5.013	0.962
Post	0.791*	0.778	0.003***	-0.156	6.299***	1.717**
	0.077	0.192	0.002	0.810	1.364	0.551

StrIDe*Post	0.614*	2.311*	60.653***	3.376*	-0.044	-1.246
	0.122	0.971	65.698	1.364	2.125	1.094
Constant				36.855***	30.987***	12.727***
				1.633	2.175	0.858
Observations	5749	5749	5749	5470	5749	5749
R^2				0.020	0.164	0.045
Pseudo R^2	0.013	0.011	0.276			

Standard errors in second row

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

Finally, analyses were conducted on subgroups of students based on their eligibility for FRPL. These results are presented in Table 21, with students eligible for FRPL in the top half of the table and students not eligible for FRPL in the bottom half. The trends are fairly consistent across the two groups, with students eligible for FRPL having a somewhat larger estimate for the odds of treatment-eligible students attending an integrated school, with more than a 90 percentage point larger change in the likelihood of attending an integrated school than the change for students not eligible for StrIDe. The difference in the change for non-FRPL-eligible students who are eligible for StrIDe versus not eligible for StrIDe has a statistically significant result with a 37 percentage point larger change in odds for treated versus non-treated, non-FRPL students. FRPL-eligible students also see a larger estimate for the difference in the change in the odds of attending a school with a high value-added score that is notably larger in magnitude than the differences-in-differences estimate for StrIDe-eligible students who are not eligible for FRPL. However, students not eligible for FRPL see a larger increase in the percentage of students in their school who are proficient or advanced in English for treated students over untreated students than do students who are eligible for FRPL (see column four).

Table 21: Logistic and OLS Regression Difference in Differences Models 8th Grade vs 9th Grade by Eligibility for FRPL

	(1)	(2)	(3)	(4)	(5)	(6)
	Logistic Regression (Odds Ratios)			Regression Models		
	Attend Zone School	Grade Integrated within 20% White	Lag School Composite 4/5	Lag School % Prof/adv English	Number of tracts represented in school	Number of zones represented in school
FRPL Eligible Students						
StrIDe	1.601	1.062	1.308	-0.726	21.554***	-3.652***
	0.390	0.023	0.737	2.252	6.113	0.949
Post	0.882*	0.645	0.021***	-0.130	5.676***	1.231***
	0.048	0.163	0.008	0.604	0.974	0.400
StrIDe*Post	0.690**	1.929	10.554**	3.607***	1.182	-1.068
	0.083	0.805	8.200	1.009	1.389	0.592
Constant				38.312***	39.077***	15.518***
				1.474	2.254	0.871
Observations	20192	20192	20192	19279	20192	20192
R^2				0.007	0.115	0.070
Pseudo R^2	0.009	0.011	0.203			
Non-FRPL Eligible Students						
StrIDe	1.395	2.090	1.538	-5.227	18.135	-6.676***
	0.246	0.922	0.812	3.761	9.231	1.349
Post	1.324***	0.941	0.057***	-5.241***	-4.874*	-1.199
	0.102	0.132	0.019	1.274	2.234	0.756
StrIDe*Post	0.683***	1.373**	5.754*	7.687***	6.829*	0.955
	0.071	0.309	3.945	1.115	2.690	0.870
Constant				54.272***	63.547***	20.719***
				2.998	4.578	1.241
Observations	7067	7067	7067	6807	7067	7067
R^2				0.008	0.056	0.084
Pseudo R^2	0.003	0.033	0.147			

Standard errors in second row

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

Overall, the analyses show that the StrIDe policy is likely associated with a modest significant change in the use of active school choice and the likelihood of attending a high-achieving school, with mixed results regarding the diversity of neighborhoods represented within the school attended and a possible positive association for some subgroups with attending an integrated school. The policy appears to be associated with a differential influence on students based on their access to timely transit routes, race, and income level, with a larger association for students living relatively close to an integrated school, Latinx students, and students eligible for FRPL. These differential results are consistent with the expected changes, as these are also the students most likely to benefit from a policy aimed at expanding educational opportunity by expanding access to public transit.

PART II DISCUSSION

These findings have many important implications for both the field and for policy. However, there are also many limitations to consider as one interprets these implications. This section will discuss these limitations and what scholars and policy makers can infer from these results, as well as areas for future research that emerge from this work.

Ideally, I would want to measure the changes in the choice sets selected by students by measuring the changes in which schools students apply to. However, this data is not maintained over time by the district, thus I must rely on the actual school a student ends up in after they form their choice set, apply, and are granted admission at a given school. It is possible that the policy had an impact on the set of schools a student considered and applied to, even for students who in the end attended their assigned zone school or a school they would have attended without the policy change.

It would be preferable to follow exactly which students are using the StrIDe bus pass to attend school. Without this information, I am able to test whether the policy change is associated with changes for students in the district (the intent to treat), but I am unable to test the change by focusing directly on the treatment on the treated students (specifically on the students who actively choose to use the bus

pass). I also am unable to test to what extent the changes in terms of enrollment patterns are due to use of the bus pass or to some other change that happened to occur at the same time that would affect the StrIDe-eligible students differently from non-StrIDe-eligible students. This is of particular concern, given that the comparison students are middle school students who would not be influenced by other changes that affect only high school students. The subgroup analysis that breaks down the effects for students who are closer to integrated schools using public transit versus students who reside in areas less accessibile to integrated schools using public transit provides some consistent evidence to address and alleviate some of this concern. The subgroup breakdown shows larger associated influence for students who reside in areas with better access to transit than for students who do not, suggesting that while there may be something else happening in the district, the influence is differential by access to timely transit, and the other policy change would also have to contribute to a differential influence based on access to timely transit.

The differences-in-differences groups did not pass the common trends assumption test using placebo tests in prior years for all outcomes of interest. Thus, estimates should be interpreted in terms of patterns and trends, rather than effect sizes. Additional research on similar policy changes will need to be conducted to test for direct effect sizes associated with expanding access to public transportation.

Perhaps my largest limitation is that this policy change was not a part of a randomized control trial. Assignment to treatment was made for all students above a certain grade level. This means I must rely on an imperfect comparison group to control for outside factors that may have changed at the same time. The study could be improved if a new district phased in a similar policy by randomly assigning the bus pass to some students one year and the rest in future years, and future studies could be conducted in this way. The trends found in this study could be used to justify the future implementation of experimental research examining the impact of expanding access to transportation.

While the school integration measure used in this analysis is consistent with the measure used by the Department of Justice, it is limited in its lack of nuance. It is a binary measure that is fails to capture the multiple races that form the diversity of the district. In addition, even if a student attends a school that is considered to be integrated, it does not mean the student is not tracked into racially homogeneous courses. Future work should examine distinctions for schools not considered integrated that are split by whether they have too many or too few White students to be designated integrated by the department of justice. Some additional measures of integration are included in Appendix C, but more nuance should be explored.

I also am limited in terms of my ability to estimate school quality. I certainly do not have an accurate measure of the overall reputation of a school or the prestige of each school within familial social networks, which is critical in shaping school enrollment decisions. I also am limited by not having English proficiency rates from the 2011-12 or 2012-13 school years, or any achievement data for the 2015-16 school year (MNPS did not conduct the state exams for all schools in that year due to technical difficulties across the state). The measures I rely on are lagged scores (the score from the previous year, which may be informative as a student is deciding whether or not that school is a high-quality school worth attending). I have a value-added composite measure, which allows me to estimate how well the school uses the teachers and resources provided to help students improve over the year. I also have student English proficiency rates, which provides a measure of the quality of students' peers within a given school. Each of these factors can be important for parents and shape the educational experience of students, but they may not necessarily be the most important measures for secondary school parents to use to denote school quality.

While I have a very specific measure for transit time, which takes advantage of time-tables and typical traffic to estimate how long it would take a student to travel to school during typical morning traffic via a public bus, this measure is not perfect. Ideally, I would like to test a variety of measures for

distance and travel time. I would like to have walking time, driving time, the range of times one might expect to face on a light traffic versus heavy traffic day, as well as the travel time after-school (rather than just before school). Most of the work examining schools and transportation does not utilize measures for transportation time as advanced as the one I utilize, but I would like to explore additional operationalizations for distance and transportation times.

Finally, this policy was implemented in a district that is struggling with transit ridership and has some limitations with the public transit system. Plans are being made for a major overhaul of the public transportation system in Nashville. The effects of a policy granting fare-free public bus transportation may be greater in a district with a more developed transportation system, including light rail, and a system that allows for easier transportation across neighborhoods rather than requiring riders to go downtown before traveling out to a different residential neighborhood with an attractive school. The system is designed to transport passengers between the outskirts of town and the center, and is not necessarily designed to transport passengers laterally between neighborhoods (without first requiring them to go downtown). Gross and Denice (2017) found that a similar transportation system in Denver may provide adequate transportation options for workers in the area, but not for students with a desire to attend a school in a neighborhood that is not located between the student and downtown, but one that travels laterally across neighborhoods. Perhaps transportation changes that add lateral routes between neighborhoods that have schools could allow a policy change such as StrIDe to increase opportunity for more students at a more reasonable cost to the metropolitan area.

While some recent work has examined transportation limitations as a barrier to access to educational opportunity, no published work has examined the impact of a specific policy that expands access to public transportation on enrollment patterns, level of segregation experienced in schools, or enrollment in a high-achieving school. Until recently, work examining transportation and school enrollment has been primarily descriptive, showing the types of transportation used by students

(Wilson, Marshall, Wilson, & Krizek, 2010) and the uneven access to high-quality schools for students who rely on public transportation (Gross & Denice 2017). This paper expands this work to examine access not only to high-performing schools, but also to integrated schools, and then goes beyond that to examine how enrollment patterns change when changes are made to the affordability of public transportation.

The modest significant results suggest that even a small policy change to expand access to public transportation may have a real influence on school options for some students. However, the subgroup analyses also suggest that larger changes to transportation availability or access would be necessary to truly make school choice options available to many students living in neighborhoods where residents are more dependent on individual cars for transportation. A bus pass is a relatively inexpensive option that expands access for some students, but larger changes to student transportation policy would need to be made to allow all students to utilize school choice. Otherwise, school choice will remain a policy of school choice for some but not for all.

These results are consistent with the theories associated with the geography of opportunity framework. The policy examined is one that Briggs (2005) would term a mitigation strategy rather than a cure for the costs of geographic segregation. The policy does not redistribute students so they would no longer reside in racially identifiable neighborhoods, but it instead attempts to break down some of the ties limiting students to a particular school based on their residence. When a policy is put in place to mitigate the barriers students face as a result of their residential location, the students are able to take advantage of opportunities to leave their neighborhood and find resources elsewhere, such as integrated and higher performing schools. The bus pass serves as a ticket to break the ties that limit students to the resources in their residential neighborhood; therefore, where a student lives is no longer the definitive factor deciding where they will go to school if they lack access to a personal vehicle. However, due to the limited transit system, where a student lives remains a large factor in deciding

where they will attend school, as only a limited number of schools will be within a reasonable commute, and some students live quite far from the nearest bus stop. This policy mitigates the inequality of opportunity that is shaped by residential segregation, but only partially and only for some students.

The analyses in Part I provide the larger contextual background to frame and interpret the results in Part II. Part I presented geographic disparities in terms of where students who attend racially identifiable or racially isolated schools reside. While the overall proportion of secondary school students in the district who attend a racially isolated school (with 90 percent or more one race or non-White) is low (approximately 8 percent), these students are largely isolated in specific neighborhoods that are also racially isolated and contain predominantly Black and FRPL-eligible students. The neighborhoods with the majority of the students in the district who attend a racially isolated school are located near the city-center and close to public transit routes. The public transit has the potential to transport students to integrated and higher performing schools, which make these students some of those most likely to benefit from a policy granting students fare-free bus passes. Thus, it is not surprising to find some positive significant results associated with the policy change.

The policy change is likely to have the largest impact on students who consider bus fares prohibitively expensive, who reside near transit routes, and who are unsatisfied with their assigned zone school or schools within walking distance. In that a monthly bus pass for youth under age 19 could be purchased for as little as $38 per month or $380 per school year, it is likely this policy change would largely impact only students of relatively modest means. The results in Part I show that many (but not all) of the neighborhoods that are isolated from attractive bus routes and face prohibitively long transit times via public transportation are also neighborhoods with some of the lowest proportions of students on FRPL and are predominantly White. This suggests that a policy like StrIDe may be able to efficiently target the students for whom the largest impact is likely and the students who may most be in need of the policy. The literature on parents' preferences for racial consistency suggests that the desire for racial

consistency is largely displayed among White parents, as they drop majority non-White schools from the choice sets before considering academic quality (Billingham & Hunt, 2016; Saporito & Lareau, 1999; Schneider & Buckley, 2002). Therefore, it is not surprising that short-term outcomes do not appear to contribute to significant decreases in school integration. Future work should explore the long-term impact of this policy to see if there is later White flight in a response to the policy. Given the small number of schools that already had student bodies less than 40 percent non-White (seven secondary schools), it is possible that the White families in this district may be less sensitive to small increases in non-White student compositions.

In Part II the results suggest that students eligible for StrIDe may have a larger positive change in their likelihood of utilizing school choice to attend a school other than their assigned zone school after the policy change, but the results for the likelihood of attending an integrated school are slightly less convincing. This reflects a couple of findings in part I. First, while the 8 percent of students in the district who attend a racially isolated secondary school are located near the city center and have access to shorter transit routes, a large subset of the students attending a racially identifiable school (not within 20 percent of the district percentage White) reside in the southwest part of the district, where transit access is less frequent or encompassing. These students are less likely to benefit from a policy based on the existing public transit system, as many of them would have to travel over an hour on public transit to arrive at an integrated school, and the subgroup who had to travel that far saw small and non-significant results associated with the impact of StrIDe.

The other result from Part I that helps to explain why some models do not show significant results for integration while others do deals with the likelihood a student will attend an integrated school if they attend a choice school. Students attending a school of choice are less likely to end up attending an integrated school than the district average. The school integration measure may be picking up on some of the disparities regarding take-up of school choice for students whose zone school is

considered integrated versus racially identifiable. Obviously, a student zoned to attend a racially identifiable school is more likely to attend an integrated school if they utilize school choice rather than attend their zone school. However, a student zoned to an integrated school is not only less likely to attend an integrated school if they use school choose rather than attend their zone school, they are also less likely than the average student in the district to end up attending an integrated school. Therefore, the integration outcome may depend on which students are utilizing school choice, as it is possible that some families are self-sorting and are finding schools that are more racially consistent, while other students are seeking out schools that are more integrated or diverse. The significant positive results for the integration measure suggest that perhaps more of the latter is occurring than the former.

These results make an important contribution to the scholarly debate regarding the role of school choice in shaping inequality and segregation for students. These results lend support to the claim that providing school choice alone is really only providing school choice for some. Proponents of school choice as an expansion of opportunity for students, should be aware that without also providing access to transportation, school choice is unlikely to expand opportunity for all students. These results suggest that even a modest policy change that expands access to public transportation can have a significant influence on the use of school choice and a positive influence on the likelihood that some students attend an integrated or high-quality school. Public transportation can expand opportunity for some, but additional transportation options must be explored in order to reach all students.

It is critical to keep in mind that these results should not be interpreted as saying that school choice with transportation access will necessarily lead to more students attending integrated schools. This analysis looked at a system that already had school choice, but did not make transportation available so students could utilize this choice. Only students with access to individual transportation or willing to pay for a bus pass could utilize the school choice options (other than the few charter schools providing bus service). This policy is not expanding school choice; it is expanding the set of students who

can access the existing school choice system. It is not possible to know if the likelihood of a student attending an integrated school would be better or worse in a system where each student had an assigned school that they must attend or else leave the public-school system or district.

Proponents of more equitable access to educational opportunity within a residentially segregated system who are searching for the policy implications of this project's findings may need to consider the policymakers in question and the context of a given district. On one level, a city-wide expansion that is inclusive of housing, transportation, public safety, and school policy may be a valid final goal, and this project has significant implications that public transit agencies and school districts could benefit from working together. On another level, one of the implications of this project suggests that school districts considering expanding school choice must view transportation as a critical component of school choice for their students. Therefore, while an eventual goal of desegregating neighborhoods is desirable and may be a long-term goal in which school districts may play a critical role, districts must also be cognizant of the need to provide transportation within the district until this extensive neighborhood desegregation can take place.

While I mentioned above that one limitation of this study is that the Nashville transit system has significant limitations, this situation is common for many metropolitan areas and school districts across the country. Thus, the results of this study are likely to resonate with many districts facing similar limitations. Student transportation represents a large component of a district budget, particularly for more suburban or rural districts where students may live a significant distance from their school (Chingos & Blagg, 2017). In the 2012-13 school year, school districts spent approximately $23 billion on student transportation (Chingos & Blagg, 2017). If a modest policy change that expands access to public transportation in a city like Nashville can significantly influence student enrollment patterns and use of school choice, it is worth consideration by many districts with similar transit limitations. The significant

results that are found, despite the limitations in the transportation system, suggest that other mid-size districts across the country may want to consider expanding students' access to transportation.

In addition to considering policies similar to StrIDe (which could be implemented in a way that allows for more careful testing of effect sizes), cities or districts may consider additional policy options regarding access to transportation. Transit agencies wishing to work with school districts may consider adding lateral routes that pass between neighborhoods with stops conveniently located at neighboring schools. These routes could allow students to attend schools in neighboring zones without having to first travel downtown. They also may want to consider improving the quality of bus stops to ensure the safety of students waiting for the bus or walking between a bus stop and their school. Some transit agencies, such as the Nashville MTA, have considered partnering with rideshares as a first- or last-step component of public transit (it would allow riders to get from their home to a transit line). Alternative rideshare apps designed specifically for children with more stringent driver regulations have been created and utilized in some districts, such as "Carpool to School" in Dallas. A student-specific carpool could be utilized at least to transport students to a public transit line, or directly to a school of choice.

Another transportation policy related to yellow school buses could include the implementation of a school bus system with multiple hubs so that students are picked up at home, transported to a hub (or one of multiple hubs), and then students board busses that eventually take them to their school. This "spokes" design could provide a safe transit option that would also be attractive for students without adding exorbitant transit times or an outrageous financial burden for the district, while still providing transportation options for all public school students to attend a public school of their choice. While districts such as the New Orleans Public Schools have found that having each school provide transportation for each student in a choice system is quite expensive, a hub or spokes system could be more efficient while meeting the students' needs. This kind of system could be particularly useful for younger children, who are less likely to view public transit as an attractive and safe option.

Additional studies should be conducted to examine the impact of similar transportation policies in other districts. Beyond this, comparisons should be made of the degree to which a policy like StrIDe impacts enrollment patterns across districts of different size and with varied access to public transportation routes. Studies that examine the impact of implementing different transportation policies that are perhaps more extensive than StrIDe would be critical in advising districts of options that might best suit all students. In order to ensure that districts have all the information necessary to address issues of inequality in educational opportunity most effectively, studies should be conducted of the impact various school transportation policies have on segregation and educational opportunity for students. Finally, additional qualitative analysis (such as interviews or surveys of parents and students) should be conducted to better understand what makes students decide whether or not to utilize public transportation to attend school, what concerns families have that may make them hesitant to utilize public buses, or what changes could be made to make public buses a more attractive transportation option for students.

As one might expect, the policy does not influence all students equally. The policy is specifically crafted in such a way to have the greater potential influence on lower income students, minority students, and students living in dense urban areas where public transportation routes are more readily available. When looking to address inequality in access to educational opportunity, it could be argued that these students are most in need of policy changes. However, this policy will have a smaller impact on students who have been pushed into the peripheries of the district as a result of metropolitan evolution or gentrification. There are many low-income and minority students whose families have been forced to choose a residence on the outskirts of town where public transportation access is more limited, as this is often where lower priced housing is available (as access to public transportation can be considered an asset worth paying for). In the end, this analysis suggests that a simple cooperation between public transit agencies and public schools could lead to improvements for some students,

however other transportation options may be needed to reach all students who are limited by the barriers involved in geographic inequality of educational opportunity.

CHAPTER 6

CONCLUSION

Where students live shapes their enrollment patterns in terms of whether they attend an integrated or high-quality secondary school. Students zoned to integrated schools are associated with a higher likelihood of attending their zone school and ending up in an integrated school. Students attending isolated schools are largely concentrated in an urban neighborhood in the core of the city that has relatively good public transportation, which makes these students prime targets for a policy that provides fare-free access to public transportation. StrIDe is associated with a positive influence on the take-up of school choice, enrollment in an integrated school, enrollment in a high value-added school, and attendance in a school with a higher proportion of peers who are proficient or advanced in English. The influence of this policy is greater for students eligible for FRPL, Latinx students, and for students residing within an hour of an integrated school using public transit.

While Part I does not include any causal analyses, the descriptive statistics of the enrollment patterns of students from different neighborhoods and the characteristics of students who eventually end up in an integrated school can be of critical value to both the Metro Nashville public school district, and similar size county districts that are residentially segregated. Seeing that many urban districts have high levels of residential and school segregation (Glenn, 2012; G. Orfield & Lee, 2007), and that many of these districts also have school choice policies that likely do not include universal transportation options for students exercising active school choice, there are many districts that could benefit from understanding how geography critically shapes the educational opportunities of their students.

Previous studies have illustrated how residential segregation is tied to school segregation, but no studies have examined neighborhood differences in terms of who attends integrated schools or enrollment patterns for students who are zoned to attend an integrated school. Most students attend

their zone school, suggesting that even with school choice options, many students stay close to home. Students who are zoned to an integrated school are likely to attend their zone school and to end up in an integrated school whether or not they choose to attend their zone school. If districts are more creative in drawing attendance zones so that more students are zoned to integrated schools, perhaps more students will end up staying in their attendance zone and attending an integrated school. While this has not been tested in this analysis, creative drawing of attendance zones could be worth testing, particularly if it could be done in a way that does not significantly increase the transit time for students attending their zone school.

The analysis in Part I provides critical findings on the enrollment patterns of students in a segregated mid-size city. These results also provide a context to frame the need for a policy reform, like StrIDe that could expand access to transportation and help break the ties between neighborhood of residence and school attended. Students' educational opportunities are shaped by their neighborhood of residence, therefore expanding access to transportation options may allow students to attend a different set of schools with a different set of characteristics.

While it may be unrealistic for school districts to aim to break down residential segregation and also for districts to create a system where all students attend an integrated high-quality school, there may be feasible ways to expand opportunity for some students in the district. StrIDe appears to have had a positive impact on the level of integration and the academic quality of the school attended by students eligible for the program. A transportation program that relies on existing public transportation routes will be limited to students residing in areas with easy access to these transit routes. Fortunately for Nashville, many of the students residing in racially identifiable neighborhoods and attending racially identifiable schools also reside in neighborhoods where public transportation routes pass on a regular basis (that is, students residing near the core of the city). Thus, there is great potential for a modest

transportation reform to have a significant impact on the enrollment patterns of these students and to increase the likelihood that these students will enroll in an integrated or a high-quality school.

There are distinct implications for other mid-size districts with a school choice system, but also limitations in terms of transportation access for students. Given the expense of providing yellow school bus transportation for all students attending choice schools, perhaps partnering with public transportation agencies and focusing on expanding public transportation routes could allow more students to participate in active school choice. However, further expansion of transportation options may be needed to expand educational opportunity for students residing on the outskirts of a district, where public transportation is less prevalent.

Overall, where a student resides shapes their educational opportunities, expanding access to transportation can also expand a student's access to educational opportunity, including access to integrated schools and to schools with a high value-added (schools with high-quality of education provided). However, in order to reach all students, it may be necessary to consider an extensive transportation policy that goes beyond a simple subsidy for the use of an existing and limited public transportation system.

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APPENDIX A: SCHOOL CHARACTERISTICS

School	White	Black	Latinx	Asian	FRPL	Charter	Magnet	Academic Magnet	Audition Magnet	Total Students
Antioch High School	0.258	0.424	0.283	0.034	0.776	No	No	No	No	10801
Antioch Middle School	0.239	0.352	0.350	0.055	0.860	No	No	No	No	3578
Apollo Middle School	0.226	0.361	0.379	0.031	0.857	No	No	No	No	4509
Bailey STEM Magnet Middle	0.147	0.759	0.071	0.022	0.928	No	Yes	No	No	2272
Bellevue Middle School	0.632	0.249	0.057	0.056	0.468	No	No	No	No	3854
Boys Stem Enhanced Option Prep	0.198	0.617	0.171	0.005	0.887	No	No	No	No	222
Brick Church Middle School	0.102	0.841	0.050	0.007	0.941	Yes	No	No	No	1940
Cameron College Preparatory	0.257	0.274	0.444	0.023	0.897	Yes	No	No	No	2998
Cane Ridge High School	0.198	0.487	0.265	0.048	0.764	No	No	No	No	8939
Cora Howe School	0.419	0.518	0.049	0.006	0.821	No	No	No	No	515
Croft Middle Design Center	0.417	0.218	0.305	0.057	0.711	No	No	No	No	3943
Donelson Middle School	0.442	0.400	0.125	0.029	0.748	No	No	No	No	3916
DuPont Hadley Middle School	0.657	0.227	0.095	0.016	0.662	No	No	No	No	3568
DuPont Tyler Middle School	0.430	0.370	0.172	0.020	0.744	No	No	No	No	3545
East Nashville Magnet High School	0.134	0.814	0.044	0.007	0.749	No	Yes	No	No	3695
Glencliff High School	0.250	0.283	0.411	0.054	0.846	No	No	No	No	7526
Goodlettsville Middle School	0.371	0.441	0.152	0.028	0.841	No	No	No	No	2848
Gra Mar Middle School	0.165	0.730	0.086	0.018	0.938	No	No	No	No	2240
H G Hill Middle School	0.476	0.259	0.172	0.091	0.714	No	No	No	No	3326
Harris Hillman	0.425	0.419	0.130	0.027	0.738	No	No	No	No	301
Haynes Health Medical Science Design Center	0.025	0.961	0.010	0.004	0.897	No	No	No	No	1345
Head Middle Mathematics Science Magnet School	0.298	0.583	0.038	0.079	0.516	No	Yes	No	No	3062
Hillsboro Comprehensive High School	0.385	0.526	0.056	0.028	0.577	No	No	No	No	6232
Hillwood Comprehensive High School	0.477	0.351	0.093	0.076	0.630	No	No	No	No	6421
Hume Fogg High Academic Magnet	0.643	0.219	0.054	0.081	0.273	No	Yes	Yes	No	4602
Hunters Lane High School	0.225	0.559	0.197	0.014	0.836	No	No	No	No	8941
I. T. Creswell Arts Magnet Middle School	0.101	0.866	0.024	0.008	0.792	No	Yes	No	Yes	2355
Intrepid College Preparatory Charter School	0.214	0.275	0.491	0.016	0.934	Yes	No	No	No	574
Isaac Litton Middle School	0.427	0.492	0.058	0.018	0.789	No	No	No	No	2022

Jere Baxter Middle School	0.171	0.592	0.219	0.019	0.949	No	No	No	No	2251
Joelton Middle School	0.354	0.600	0.040	0.002	0.851	No	No	No	No	2030
John Early Middle School	0.109	0.848	0.024	0.019	0.874	No	Yes	No	No	2479
John F. Kennedy Middle School	0.261	0.452	0.249	0.035	0.793	No	No	No	No	4438
John Overton High School	0.355	0.231	0.277	0.134	0.728	No	No	No	No	9870
John Trotwood Moore Middle School	0.647	0.276	0.040	0.035	0.356	No	No	No	No	3673
Johnson ALC	0.092	0.775	0.122	0.007	0.934	No	No	No	No	271
K I P P Academy Nashville	0.030	0.772	0.193	0.005	0.925	Yes	No	No	No	1683
K I P P Nashville Collegiate High School	0.052	0.700	0.247	0.000	0.885	Yes	No	No	No	287
KIPP Nashville College Prep	0.046	0.833	0.119	0.002	0.868	Yes	No	No	No	544
Knowledge Academies High School	0.170	0.500	0.319	0.011	1.000	Yes	No	No	No	94
Knowledge Academy	0.223	0.440	0.328	0.007	0.969	Yes	No	No	No	964
Lead Academy	0.084	0.797	0.102	0.015	0.910	Yes	No	No	No	2645
LEAD Prep Southeast	0.350	0.335	0.287	0.028	0.874	Yes	No	No	No	683
Liberty Collegiate Academy	0.148	0.565	0.275	0.010	0.905	Yes	No	No	No	1438
Madison Middle School	0.189	0.634	0.166	0.009	0.903	No	No	No	No	3850
Maplewood High School	0.141	0.715	0.130	0.014	0.893	No	No	No	No	5202
Margaret Allen Middle School	0.326	0.355	0.285	0.032	0.868	No	No	No	No	2580
Martin Luther King Jr. Magnet High School	0.431	0.399	0.045	0.121	0.366	No	Yes	Yes	No	6039
McGavock High School	0.470	0.373	0.129	0.023	0.699	No	No	No	No	12387
McKissack Middle School	0.148	0.758	0.093	0.000	0.958	No	No	No	No	1927
McMurray Middle School	0.192	0.137	0.483	0.185	0.886	No	No	No	No	4144
Meigs Middle Magnet School	0.609	0.259	0.042	0.086	0.316	No	Yes	Yes	No	3546
Metro Nashville Virtual School	0.723	0.225	0.031	0.008	0.440	No	No	No	No	386
MNPS Middle College High School	0.375	0.557	0.037	0.026	0.603	No	No	No	Yes	546
Murrell School	0.218	0.718	0.058	0.000	0.910	No	No	No	No	156
Nashville Academy of Computer Science	0.154	0.718	0.127	0.000	0.884	Yes	No	No	No	259
Nashville Big Picture High School	0.364	0.541	0.078	0.007	0.680	No	No	No	Yes	899
Nashville Prep School	0.080	0.794	0.116	0.010	0.902	Yes	No	No	No	1386
Nashville School of the Arts	0.557	0.351	0.065	0.022	0.430	No	Yes	No	Yes	3353
Neely's Bend Middle School	0.249	0.375	0.363	0.010	0.899	No	No	No	No	2865
New Vision Academy	0.083	0.608	0.300	0.009	0.869	Yes	No	No	No	871
Pearl Cohn Entertainment Magnet High School	0.054	0.898	0.043	0.004	0.907	No	Yes	No	No	4501
Republic High School	0.090	0.729	0.175	0.006	0.819	Yes	No	No	No	166
Rose Park Math & Science Middle Magnet School	0.269	0.605	0.091	0.032	0.669	No	Yes	No	No	2137

Smithson-Craighead Middle School	0.020	0.955	0.025	0.000	0.937	Yes	No	No	No	601
STEM Prep High School	0.239	0.147	0.615	0.000	0.945	Yes	No	No	No	109
STEM Prep Middle	0.169	0.170	0.645	0.015	0.957	Yes	No	No	No	1432
Stratford STEM Magnet High School	0.257	0.657	0.064	0.019	0.857	No	Yes	No	No	3757
The Academy at Hickory Hollow	0.171	0.371	0.408	0.048	0.802	No	No	No	No	520
The Academy at Old Cockrill	0.293	0.614	0.080	0.014	0.648	No	No	No	No	738
The Academy at Opry Mills	0.373	0.371	0.233	0.019	0.589	No	No	No	No	579
The Cohn Learning Center	0.145	0.735	0.111	0.009	0.863	No	No	No	No	117
The Cohn School	0.195	0.637	0.155	0.011	0.872	No	No	No	No	446
Thurgood Marshall Middle School	0.221	0.461	0.261	0.056	0.772	No	No	No	No	4368
Two Rivers Middle School	0.382	0.438	0.154	0.022	0.799	No	No	No	No	3211
Valor Collegiate Academy	0.644	0.145	0.155	0.056	0.574	Yes	No	No	No	427
Valor Voyager Academy	0.504	0.193	0.241	0.057	0.640	Yes	No	No	No	228
West End Middle School	0.511	0.394	0.048	0.043	0.476	No	No	No	No	2507
Whites Creek High School	0.164	0.802	0.029	0.004	0.861	No	No	No	No	4559
William Henry Oliver Middle School	0.499	0.303	0.107	0.088	0.578	No	No	No	No	4255
Wright Middle School	0.233	0.248	0.456	0.062	0.908	No	No	No	No	4528

APPENDIX B: WORKING SAMPLE

This section walks through the derived working sample as the data from the MNPS district was cleaned for analysis. The data provided had multiple observations for the same student within the same year for any student listed as residing in a different address in different months, being listed as enrolled in a different school in different months, or if there were data input errors that were later corrected during the year. This data also includes preschool through twelfth grade students, including non-traditional students.

Table 22: Original Observations Pre-Cleaning

	11/12	12/13	13/14	14/15	15/16
# Observations	128,125	129,226	121,337	132,923	132,324

Duplicate observations are dropped, and students are assigned the characteristics listed for November 15th of any given school year.

Table 23: Observations After Dropping Duplicates

	11/12	12/13	13/14	14/15	15/16
# Observations	88,733	90,753	93,347	94,149	96,664

Observations for grades below middle school are dropped from the working sample.

Table 24: Observations in Secondary School

	11/12	12/13	13/14	14/15	15/16
# Observations	48,339	48,860	49,742	50,438	51,827

Finally, observations are dropped from the analytical sample if they do not have an accurate mappable address in Davidson County listed in the school administrative data.

Table 25: Observations with Addresses

	11/12	12/13	13/14	14/15	15/16
# Observations	46,395	47,098	46,614	48,883	49,959

APPENDIX C: ALTERNATIVE INTEGRATION MEASURES

This section provides models for two alternative integration measures. The first being an indicator for the school being within 15 percentage points of the district percent White. The second measure is a continuous measure for the difference between the percent White in the school from the percent White in the district.

Table 26: OLS and Logistic Regression Models for Alternative Integration Measures 9th-10th Grade

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		9th-10th Models				9th-10th Models w/ Student Controls		
	Integrated w/in 15%, Odds Ratio	Difference from District % White	Racial Congruence	% White	Integrated w/in 15%, Odds Ratio	Difference from District % White	Racial Congruence	% White
post	1.088	-0.503	-0.932	-0.503	1.236	-0.296	-0.588	-0.296
	0.129	0.644	0.631	0.644	0.205	0.793	0.621	0.793
	53934							
Constant		-1.200	43.086***	29.800***		4.038*	40.093***	35.038***
	0.000	2.426	2.473	2.426		1.950	2.378	1.950
Observations	1.088	53934	53905	53934	38285	38285	38267	38285
R^2	0.129	0.000	0.000	0.000		0.237	0.372	0.237
Pseudo R^2	53934				0.052			

Standard errors in second row
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 27: OLS and Logistic Regression Models for Alternative Integration Measures 9th Grade

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		9th Grade Models				9th Grade Models w/ Student Controls		
	Integrated w/in 15%, Odds Ratio	Difference from District % White	Racial Congruence	% White	Integrated w/in 15%, Odds Ratio	Difference from District % White	Racial Congruence	% White
post	0.755*	-1.849**	-0.717	-3.081***	0.765*	-2.049**	0.206	-2.951***
	0.100	0.590	0.636	0.592	0.096	0.529	0.460	0.529
Constant		-2.434	42.686***	29.797***		2.595	38.463***	34.477***
		3.016	3.124	3.017		2.798	3.103	2.793
Observations	37082	37082	37047	37082	22242	22242	22228	22242
R^2		0.003	0.000	0.008		0.227	0.380	0.232
Pseudo R^2	0.002				0.069			

Standard errors in second row

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

Table 28: Differences-in-Differences Models for Alternative Integration Measures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		8th vs 9th DiD Models				7th-8th vs 9th-10th DiD Models		
	Integrated w/in 15%, Odds Ratio	Difference from District % White	Racial Congruence	% White	Integrated w/in 15%, Odds Ratio	Difference from District % White	Racial Congruence	% White
StrIDe	2.481	0.127	-1.792	0.127	1.968	-2.159	-2.603	-2.159
	1.287	3.708	3.722	3.708	1.028	3.880	3.759	3.880
Post	1.557*	1.245	0.011	1.245	1.235	-1.040*	-0.800*	-1.040*
	0.293	0.766	0.895	0.766	0.163	0.472	0.359	0.472
StrIDe # Post	0.473**	-3.233***	-0.227	-3.233***	0.890	2.103***	-0.040	2.103***
	0.138	0.911	0.985	0.911	0.122	0.557	0.535	0.557
Constant		-2.424	43.978***	28.576**		-0.138	44.788***	30.862***
		2.363	2.123	2.363		2.623	2.181	2.623
Observations	27259	27259	27244	27259	25973	25973	25960	25973
R^2		0.006	0.002	0.006		0.003	0.004	0.003
Pseudo R^2	0.018				0.017			

Standard errors in second row

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

Table 29: Placebo Tests with Leads for Alternative Integration Measures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		7th-8th vs 9th-10th				8th vs 9th		
	Integrated w/in 15%, Odds Ratio	Difference from District % White	Racial Congruence	% White	Integrated w/in 15%, Odds Ratio	Difference from District % White	Racial Congruence	% White
StrIDe	1.099	-1.831	-0.162	-1.831	1.999	-1.699	-2.177	-1.699
	0.240	1.254	1.398	1.254	1.063	3.914	3.902	3.914
2014	1.026	-1.494	-1.099	-3.494***	0.741	-1.653	-1.682	-3.653***
	0.157	0.805	1.060	0.805	0.237	0.830	0.931	0.830
StrIDe # 2014	1.923	-0.329	-1.939	-0.329	1.241	1.826	0.384	1.826
	1.040	3.616	3.996	3.616	0.402	0.989	1.107	0.989
2013	1.203	-0.010	-1.499	-1.010	1.116	1.024	-2.317**	0.024
	0.143	0.648	0.777	0.648	0.300	0.942	0.680	0.942
StrIDe # 2013	0.996	0.737	-0.382	0.737	0.605	-0.809	1.230	-0.809
	0.212	0.631	0.774	0.631	0.205	1.068	0.870	1.068
2012					0.921	-0.905	-0.141	-0.905
					0.220	0.793	0.582	0.793
StrIDe # 2012					1.169	0.653	-0.623	0.653
					0.585	1.070	0.800	1.070
Constant		1.357	45.386***	34.357***		-0.771	45.660***	32.229***
		2.919	1.971	2.919		2.443	2.085	2.443
Observations	50639	50639	50621	50639	52900	52900	52856	52900
R^2		0.005	0.002	0.010		0.004	0.003	0.007
Pseudo R^2	0.010				0.022			

Standard errors in second row
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

APPENDIX D: SUBGROUP PLACEBO TESTS

Subgroup Placebo Tests for Common Trends Assumption

Table 30: Travel Time Subgroup Placebo Tests for Common Trends Assumption

	(1)	(2)	(3)	(4)	(5)	(6)
	Logistic Regression (Odds Ratios)			Regression Models		
	Attend Zone School	Grade Integrated within 20% White	Lag School Composite 4/5	Lag School % Prof/adv English	Number of Tracts represented in School	Number of Zones represented in School
Not Within 60 Minutes of an Integrated School by Bus						
StrIDe	1.376	4.189**	1.262	-4.916	24.691***	-3.322**
	0.359	2.275	1.114	3.079	5.634	1.028
2014	1.018	1.860	1.079	4.316	-2.338	-0.582
	0.090	0.758	0.861	2.151	1.975	1.241
StrIDe*2014	1.044	0.670	2.018	3.323	-2.268	0.675
	0.104	0.277	2.395	2.728	5.047	1.292
2013	0.937	1.331	0.598		2.847	3.489**
	0.098	0.477	0.426		2.012	1.191
StrIDe*2013	0.980	0.867	1.823		0.410	-2.724*
	0.122	0.325	1.372		3.884	1.233
2012	1.076	1.925			-0.782	0.471
	0.106	0.780			1.367	0.947
StrIDe*2012	0.909	0.557			0.850	-0.810
	0.111	0.234			3.023	0.969
Constant				41.206***	46.575***	16.065***
				2.748	3.810	0.905
Observations	17075	17075	12878	8641	17075	17075
R^2				0.047	0.103	0.070
Pseudo R^2	0.004	0.055	0.035			
30-60 Minutes to an Integrated School by Bus						

StrIDe	1.420	2.214	1.495	-3.299	18.044***	-3.322**
	0.376	0.991	1.085	3.264	5.048	0.974
2014	0.880	0.889	1.501	6.238***	-1.616	0.588
	0.119	0.171	0.433	1.187	2.190	0.659
StrIDe*2014	1.069	0.633	0.857	-0.169	-1.058	-1.432*
	0.172	0.346	0.741	1.785	2.625	0.706
2013	0.926	0.719	2.113*		4.683*	3.881***
	0.082	0.249	0.625		1.830	0.701
StrIDe*2013	0.968	1.537	1.033		3.059	-3.214***
	0.125	0.564	0.657		2.294	0.782
2012	0.813*	0.831			1.889	1.989**
	0.071	0.082			1.465	0.579
StrIDe*2012	1.095	1.454*			0.154	-2.320***
	0.127	0.231			1.809	0.616
Constant				35.969***	43.130***	15.933***
				1.671	2.637	0.865
Observations	16674	16674	12617	8221	16674	16674
R^2				0.043	0.069	0.097
Pseudo R^2	0.006	0.034	0.022			
Within 30 Minutes of an Integrated School by Bus						
StrIDe	1.189	1.016	0.467	-2.770	22.827*	-4.963***
	0.196	0.612	0.229	3.191	10.005	1.280
2014	0.911	1.018	1.339	7.524***	-1.381	-0.459
	0.083	0.211	0.377	1.029	1.765	0.710
StrIDe*2014	1.068	0.584	1.427	1.290	7.556**	0.337
	0.140	0.315	0.912	1.838	2.811	0.745
2013	1.046	1.108	1.021		2.363	3.739***
	0.076	0.150	0.357		1.356	0.565
StrIDe*2013	0.941	1.057	1.444		6.503*	-2.410***
	0.086	0.186	0.675		2.732	0.636
2012	1.066	1.136			-0.282	1.196**
	0.069	0.076			1.208	0.405
StrIDe*2012	0.843	0.876			4.671*	-1.101

	0.077	0.085			2.043	0.565
Constant				32.361***	47.793***	17.943***
				1.461	3.500	1.227
Observations	19151	19151	14537	9410	19151	19151
R^2				0.057	0.129	0.106
Pseudo R^2	0.001	0.006	0.019			

Table 31: Racial Subgroup Placebo Tests for Common Trends Assumption

	(1)	(2)	(3)	(4)	(5)	(6)
	Logistic Regression (Odds Ratios)			Regression Models		
	Attend Zone School	Grade Integrated within 20% White	Lag School Composite 4/5	Lag School % Prof/adv English	Number of Tracts represented in School	Number of Zones represented in School
White						
StrIDe	1.264	2.848*	1.042	-3.804	26.017***	-4.012***
	0.251	1.229	0.620	2.876	7.239	0.928
2014	0.955	1.231	0.763	9.241***	0.145	0.563
	0.070	0.262	0.306	1.652	1.986	0.690
StrIDe*2014	0.999	0.831	2.154	1.368	0.194	-0.269
	0.105	0.239	1.449	2.489	3.932	0.725
2013	0.936	0.829	1.312		3.787*	4.170***
	0.093	0.222	0.521		1.859	0.659
StrIDe*2013	0.959	1.293	1.179		3.107	-3.127***
	0.136	0.381	0.656		2.971	0.769
2012	1.032	1.363			-0.498	1.111*
	0.083	0.273			1.380	0.482
StrIDe*2012	0.848	0.686			2.244	-1.262*
	0.083	0.145			2.365	0.528
Constant				39.539***	49.683***	16.841***
				1.993	3.011	0.852
Observations	16070	16070	12045	7910	16070	16070
R^2				0.072	0.107	0.096
Pseudo R^2	0.002	0.041	0.014			
Black						
StrIDe	1.513*	1.560	0.929	-2.794	17.772***	-5.185***
	0.282	0.788	0.496	2.585	4.425	0.962
2014	0.947	1.018	1.357	5.386***	-1.218	-0.227
	0.101	0.200	0.337	0.876	1.552	0.587
StrIDe*2014	1.094	0.625	1.428	0.773	0.776	-0.265
	0.151	0.295	0.717	1.132	3.122	0.645

2013	1.049	1.359*	1.127		2.399	3.352***
	0.075	0.191	0.337		1.199	0.438
StrIDe*2013	0.885	0.862	1.234		5.167**	-2.255***
	0.082	0.138	0.538		1.893	0.476
2012	1.001	1.082			0.905	1.614***
	0.076	0.102			1.222	0.387
StrIDe*2012	0.946	1.096			1.649	-1.661***
	0.101	0.138			2.042	0.471
Constant				34.014***	48.232***	18.222***
				1.345	2.369	0.929
Observations	25096	25096	18860	12084	25096	25096
R^2				0.036	0.078	0.121
Pseudo R^2	0.007	0.010	0.009			
Latinx						
StrIDe	1.342	3.175	1.612	-0.581	24.912***	-1.097
	0.295	1.913	1.265	2.321	4.702	0.751
2014	0.500***	1.218	2.763*	3.523***	0.311	0.259
	0.095	0.560	1.299	0.931	1.829	0.883
StrIDe*2014	1.222	0.303	0.440	1.657	-3.156	-0.735
	0.278	0.228	0.526	1.338	3.480	0.938
2013	0.624**	1.016	0.866		6.090**	4.627***
	0.107	0.472	0.385		1.919	1.000
StrIDe*2013	1.334	0.959	1.795		-0.938	-4.116***
	0.276	0.468	1.142		3.200	1.048
2012	0.802	1.619			0.374	0.796
	0.128	0.666			1.504	0.808
StrIDe*2012	0.946	0.474			0.828	-1.394
	0.181	0.215			2.401	0.876
Constant				33.331***	30.677***	12.469***
				1.384	2.008	0.665
Observations	9461	9461	7409	5109	9461	9461
R^2				0.038	0.209	0.103
Pseudo R^2	0.014	0.023	0.030			

Table 32: FRPL Status Subgroup Placebo Tests for Common Trends Assumption

	(1)	(2)	(3)	(4)	(5)	(6)
	Logistic Regression (Odds Ratios)			Regression Models		
	Attend Zone School	Grade Integrated within 20% White	Lag School Composite 4/5	Lag School % Prof/adv English	Number of Tracts represented in School	Number of Zones represented in School
FRPL						
StrIDe	1.444	1.917	1.059	-1.850	21.281***	-3.509***
	0.350	1.051	0.635	2.572	4.526	0.912
2014	0.868	1.099	1.549	4.620***	-1.641	-0.285
	0.078	0.235	0.471	0.688	1.334	0.598
StrIDe*2014	1.109	0.554	1.235	1.124	0.273	-0.143
	0.131	0.274	0.847	1.073	3.134	0.652
2013	1.018	1.316	1.046		2.473*	3.629***
	0.067	0.307	0.364		1.222	0.587
StrIDe*2013	0.959	0.955	1.524		3.642	-2.913***
	0.085	0.241	0.765		2.225	0.649
2012	1.036	1.251			-0.367	0.934*
	0.089	0.191			1.108	0.457
StrIDe*2012	0.919	0.906			2.134	-1.211*
	0.099	0.157			2.053	0.520
Constant				33.692***	40.718***	15.802***
				1.352	2.225	0.856
Observations	40809	40809	31332	20405	40809	40809
R^2				0.036	0.129	0.101
Pseudo R^2	0.006	0.014	0.013			
Not FRPL						
StrIDe	1.364	2.463*	0.921	-6.041**	20.705**	-5.968***
	0.242	0.929	0.436	2.068	7.326	1.010
2014	1.026	1.290	0.713	9.996***	1.434	0.717
	0.109	0.213	0.300	2.046	2.554	0.821
StrIDe*2014	1.023	0.849	1.669	0.814	-2.570	-0.708
	0.147	0.218	1.005	2.874	4.235	0.885

2013	0.796	0.541**	1.213		9.986***	4.743***
	0.100	0.113	0.454		2.343	0.652
StrIDe*2013	0.771	1.387	0.808		6.629	-2.316**
	0.136	0.331	0.384		3.483	0.800
2012	0.765**	1.038			6.736***	3.282***
	0.076	0.148			1.752	0.553
StrIDe*2012	0.836	0.767			3.222	-2.566***
	0.109	0.125			2.291	0.637
Constant				44.276***	62.113***	20.002***
				1.675	3.273	0.874
Observations	12091	12091	8700	5867	12091	12091
R^2				0.065	A	0.124
Pseudo R^2	0.010	0.043	0.005			

APPENDIX E: STUDENT FIXED EFFECTS MODELS

Table 33: Logistic and OLS Regressions 7th-8th vs 9th-10th with Student Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	2 Group Logistic Regression (Odds Ratios)				2 Group OLS Regression					
	Attend Zone School	Grade Integrated within 20% White	Grade Integrated within 15% White	Lag School Composite 4/5	Lag School % Prof/adv English	Number of Tracts represented in School	Number of Zones represented in School	Proportion White	Racial Congruence	Difference from District % White
main										
stride	0.559***	0.701**	1.924***	0.200***	17.596***	0.850**	160.688***	1.592***	0.744*	1.592***
	0.063	0.087	0.292	0.011	1.973	0.048	34.185	0.153	0.091	0.153
Observations	1506	1386	1552	10480	25227	25973	25973	25973	25960	25973
R^2					0.059	0.001	0.051	0.002	0.001	0.002
Pseudo R^2	0.027	0.009	0.018	0.171						

Standard errors in second row

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