CHOOSING SUCCESS? INEQUALITIES AND OPPORTUNITIES IN ACCESS TO SCHOOL CHOICE IN NINE UNITED STATES DISTRICTS

BY

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DISSERTATION

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Abstract

Bowles and Gintis (Bowles & Gintis, 1976) dubbed schools as both the testing grounds and battlegrounds where society seeks to achieve equality of opportunity. This statement cannot be more appropriate to describe the debate surrounding the school choice movement over the past three decades that is yet to be resolved, in a time where school districts face an increasing number of failing schools and a sustained growth in minority students assigned to underfunded, crowded schools. The present study utilizes a spatial approach to analyze the spatial accessibility of schools of choice and how it relates to the racial composition, performance and location of public schools across 9 of the largest school districts in the U.S. In addition, Geographically Weighted Regression –GWR- analysis is used to assess whether the relation between school choice accessibility and school characteristics vary across all public schools in the U.S. Results from the analysis point to the spatial variation of school choice accessibility, whereby for some districts more than others, a spatial mismatch between high quality schools of choice and failing public schools is evident. Attention should be paid to locating choice schools nearby disadvantaged neighborhoods served by underperforming schools, and monitoring and supporting existing and newly created schools of choice to ensure that the surprisingly high number of failing charter and magnet schools can be reduced. Local and disaggregated spatial analysis should inform the allocation of choice policies and complement standard regression analysis that can potentially masked variability across locations in single parameter estimates.
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Chapter One: Introduction

Despite efforts aimed at improving educational outcomes over the past few decades, substantial racial/ethnic and socioeconomic gaps remain (Clotfelter et al., 2006; Glick & Hohmann-Marriott, 2007; Lleras, 2008a; Lleras, 2008b; Lleras & Rangel, 2009; Pong & Hao, 2007; Reardon & Galindo, 2009; Velez & Saenz, 2001). School choice policies have been at the forefront of debates over how to deal with underfunded, underperforming public schools. The variety of school choice programs including intra-district and inter-district open enrollment, charter schools and magnet schools, which have been implemented in school districts the U.S. has spurned interest in assessing whether schools of choice lead to higher achievement compared to traditional public schools (Reardon & Galindo, 2009).

Most studies on the effectiveness of school choice programs have examined one school district or a handful of districts within a particular state and the findings have been mixed (Zhang & Cowen, 2009). On the one hand, research shows that schools of choice increase students access to better schools, lead to improvements and efficiency in public schools, promote innovation in learning, improve student and parent’s satisfaction with school, and lead to higher overall student achievement compared to traditional public schools (Black, 1999; Booker, Gill, & Sass, 2009; Bulkley & Fisler, 2003; Hastings & Weinstein, 2008; Hess, 2002; Hoxby, 2000, 2001, 2002, 2003a, 2003b; Hoxby & Murarka, 2009; Hoxby & Rockoff, 2004; Okpala, Bell, & Tuprah, 2007). On the other hand, studies have also shown that diverting funds from public schools to schools of choice can lead to higher levels of race and class segregation as enrollment is often conditioned on student achievement and performance or parents’ knowledge of choice options.

Furthermore, prior research has suggested that school choice may not only divert monetary resources away from underfunded public schools, but also make it more difficult for troubled schools to recruit and retain higher achieving students. Finally, there are some studies which have found negligible achievement gains in school choice programs at best, relative to public school performance (Archbald, 2004; Clotfelter, 2001; Cobb & Glass, 1999; Cullen, Jacob & Levitt, 2005; Dee & Fu, 2004; Fusarelli, 2007; Howe, Eisenhart, & Betebenner, 2002; Lankford & Wyckoff, 2001; Lauen, 2007; Lubienski & Lubienski, 2006; Mcdermott, Bowles, & Churchill, 2003; Renzulli & Evans, 2005; Saporito, 2003; Saporito & Lareau, 1999).
An important unresolved issue is whether and how schools of choice might be successful in raising student achievement relative to traditional neighborhood public schools. However, the identification of schools and factors for their success alone is not sufficient to close the achievement gap across racial and socio-economic lines. It is equally important, and arguably more, to know how likely disadvantaged students are to have access to high performing schools of choice, or conversely how prone they are to be trapped in low quality schools even as they seek alternative schools. In other words, the location of schools of choice should be driven by the location of failing public schools and are supposed to be working better than the latter (Taylor, Gorard, & Fitz, 2003).

The body of school choice literature that has addressed the role of location and spatial proximity is surprisingly limited. Only a handful of studies have addressed how the spatial arrangements of schools and the characteristics of the underlying area (e.g., neighborhood) relate to educational outcomes (Bifulco, Ladd, & Ross, 2009; Downey, 2006; Lubienski & Dougherty, 2009; Renzulli & Roscigno, 2005; Talen, 2001; Zhang & Cowen, 2009; Zhang & Yang, 2008). The main goal of this study is to test the assertion put forth by school choice advocates, whereby the more school choices are in place, the more options are available for those students that do not have the private resources to gain access to a good education. A fundamental contribution of this study is the inclusion of a spatial perspective in the analysis of the availability and quality of school choice programs available to students in a given school district. By using this method, this study adds to the growing body of literature on school choice programs by examining whether school choice reduces or deepens educational inequalities across different geographic areas.

This study utilizes data from primary and secondary schools in the Common Core of Data combined with information from the U.S. Census and AYP data from the Office of Education in each state the continental United States. The purpose of this study is threefold. First, this study will provide a comprehensive geographical picture of the school choice landscape, with respect to charter and magnet schools, across the U.S. Second, this study will determine how the location of charter and magnet schools are related to the racial/ethnic and socioeconomic distribution of the public school and underlying neighborhood. And finally, this study will examine the geography of opportunity for students in low-performing public schools in terms of accessibility to schools of choice.
Schools of Choice

History of school choice. In the U.S., most students are limited to enrolling in the public school within the neighborhood in which their family lives. As a result, parental choices (or lack thereof) about where to live are directly related to the educational opportunities they are able to provide to their children. Parents can vote with their feet, choosing their residence based on the quality of the public school and even are willing to pay extra to live within the boundaries of a school with higher test scores (Black, 1999). Alternatively, parents could decide to enroll their children in a private school (Fairlie, 2002; Fairlie & Resch, 2002). Also, parents might seek out a non-neighborhood public school (i.e., magnet, charter schools or schools in school districts with open enrollment policies) (Reback, 2005; Saporito, 2003; Saporito, 2009). As a result of these strategies, high performing public schools are more likely to be located in more economically advantaged neighborhoods making it less likely for students from impoverished families to be able to attend high quality public schools (Goyette, 2008).

Schools of choice first emerged in the United States in the late 1960s and 1970s following the court ruling, Brown vs. Board of Education (1954) which effectively ended the "separate but unequal" statute that had governed public schools (Butler & Hamnetta, 2007). Magnet schools, for instance, became a popular way to comply with desegregation requirements, hoping to attract mostly white parents to specialized racially mixed schools with no boundary restrictions (Archbald, 2004). The underlying strategy was to avoid the inflammatory public reaction to coercive integrating alternatives like mandatory busing, by motivating parents to voluntarily enroll their children in attractive schools, offering innovative learning environments backed up by ample district and federal resources. In the 1980s and 1990s, there was a considerable increase in the number of magnet schools and other alternative schools, particularly in urban districts, as the school choice movement strengthened in reaction to the growing race and class inequities in educational outcomes and access to high quality public schools (Linkow, 2011). The overall goal of the initiative was to provide students who attended low performing schools with the possibility of attending a better school independent of their residence.

Charter schools became a visible alternative to traditional public schooling during the 1990s, with Minnesota as the first state to issue a charter school law in 1991, followed by California the next year and expanding to 19 states by 1995 (Linkow, 2011; Manno, 2010).
Since 1997, charter schools have experienced a six-fold increase across the U.S. By 2006, overall student enrollment in schools of choice had already doubled to over 1.5 million, although there is considerable racial/ethnic differences (Imberman, 2011). According to Gastic & Salas (2011), Latinos are still less represented in schools of choice compared to African American whose enrollment in charter and magnet schools have increased while their public enrollment have modestly decreased over the past 2 decades. In 2001, a federal mandate, No Child Left Behind - NCLB- further incentivized the creation of schools of choice as a way out for families whose children were enrolled in persistently low performing public schools. Through this mandate, the federal government sought to address a growing achievement gap, particularly between White and high income students and minority students (André-Bechely, 2007).

Although we can find references to the study of school choice back to the late 1970s, it is the landmark work of Chubb and Moe that constituted (and still does) the backbone of the arguments in favor of school choice, as well as the cornerstone of those arguing against it (Powers & Cookson, 1999). In their 1990 publication: “Politics, Markets, and America’s Schools”, Chubb and Moe explained in detail why a monopolistic public school system was incapable of reforming itself, presenting their argument for a market approach to schooling (Viteritti, 2005). The perspective of market models as they applied it to education suggests that school choice is an effective way to lead to school improvement, as it shifts from a monopoly system to a competitive market system. Friedman considered by many as the school choice founder, particularly for school vouchers, argued that free market competition was far better suited to allocate social services than a state-run bureaucracy (Friedman, 1997). Hoxby made a similar argument in favor of school choice based on her research which showed that public schools in a school district with higher private school concentration (that is higher competition) performed better than their counterparts (Hoxby, 2001, 2002, 2003b). She suggested schools of choice give an incentive for underperforming public schools to compete for the pool of students, leading to school improvement, student and parent satisfaction and better use of school resources. On the other hand, opponents of the school choice movement have contended that such initiatives will lead to the loss of high performing students and involved, informed parents, which in turn will actually reduce the pressure on poor, underperforming schools to improve (Godwin & Kemerer, 2002). Others have suggested that fair allocation of schooling opportunities through school choice might be truncated by challenges in aspects like school space and bussing.
costs for each new student. In California, for example, rapid increases in the student population have forced districts to assign students to schools out of their neighborhood, while the associated burden of transportation has been slowly transferred to families (André-Bechely, 2007).

The school choice movement has been growing rapidly over the past four decades. However, the availability and quality of these programs continues to be at the center of arguments for and against school choice. Central to this debate are issues surrounding allocation—who chooses which school and thus who gains and losses from the exercise of choice, productivity—achievement gains versus spending accountability, and whether school choice diverts funds that should otherwise be used to improve the traditional public school system (Clotfelter, 2001; Godwin & Kemerer, 2002; Hoxby, 2003a; Logan, Oakley, & Stowell, 2008). Until recently, there has been less attention paid to the location of school choice programs and how this relates to issues of accessibility, educational quality and educational outcomes. This study will contribute to the debate over whether school choice is a viable remedy for the growing achievement gaps by examining the location of schools of choice around public schools, as well as their racial composition and quality in the 9 largest school districts across the U.S.

**Defining school choice.** Many families exercise “school choice” when they choose to move into residential neighborhoods which coincide with public schools that they want their children to attend. A smaller, and usually wealthier, proportion of parents opt for private schooling, a choice that accounts for 10 percent of student enrollment in the country. The kind of school choice used in this study is defined by a wide set of educational programs both within the private and public sector. In the private sector, school choice includes secular and non-secular schools that can be accessed financially through school voucher programs. Within the public sector, school choice includes charter schools, magnet schools, and traditional public schools that can be accessed through intra- and inter-district open enrollment provisions. Even within the same type of school choice program (say a charter school) great variation can be found depending on the degree of regulatory oversight, entrance requirement for students, purpose of the school or sanctioning agency that chartered the school. While school choice programs that monitor the distribution of students are designed, in theory, to promote integration

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and discourage further social stratification in the school districts, choice programs that do not control their student composition are thought to seek improvement in school quality and provide different educational alternatives through market-like competition (Cobb & Glass, 1999).

In this study, school choice will refer to the set of alternatives that includes charter school and magnet schools within 9 of the largest U.S. school districts. Charter schools are a public school of choice operating without many of the regulations that public schools operate under. They are usually sponsored by a local or state school board and are held accountable for fiscal and academic results by those entities as well as the parents who choose to enroll their children in them (Mitchell & Mitchell, 2003). Similar to traditional public schools, they do not charge tuition, receive public funds and obey testing and accountability requirements set by the state. However, they differ from traditional public schools in that they receive fees on a per student basis and might be partially or wholly exempt from regulations related to curriculum or teacher certification. The National Center for Educational Statistics (NCES) reports that in 2010, 1.8 million students were enrolled in 5,274 charter schools across 40 states.

Magnet schools are public schools that enroll students outside of their residential boundaries and usually focus on a specialized program or area that makes them attractive to a wide range of students. Unlike charter schools, magnet schools operate under the same public school administration and are known as citywide, focus, vanguard, alternative or magnet schools depending on the state or school district. Given that magnet schools are generally designed with a specialty curriculum such as, arts, science, languages or technology, these schools often implement admission requirements (Linkow, 2011). This alternative has the widest reach, in terms of both the number of students enrolled and the number of school districts implementing it. According to data from NCES, in 2010, there were 2.1 million students enrolled in 2,722 magnet schools across 35 states. Finally, traditional schools are defined as neighborhood public schools to which students are assigned based on residential location within the school zone (Archbald, 2004).

**Organization of the Study**

The overall goal of this study is to evaluate the spatial dynamics of schools of choice and educational inequality within and between nine of the largest school districts in the U.S., highlighting the challenges for minority schools. The spatial approach for this study is used to assess state, district and local school trends and the interplay of location, school choice
accessibility and educational inequality. The data used for this analysis is at the school level which prevents me from determining whether school choice affects individual educational outcomes. However, assessing whether there is a spatial mismatch between the location of schools of choice and the concentration of minority underperforming schools, can inform whether their chief goal of leveling off adequate schooling for all children is being met. Specifically, this study will utilize spatial analytic methods to answer the following questions:

Where are charter and magnet schools located within the 9 largest school districts in the U.S.? Is there evidence of spatial clustering of schools of choice within these school districts?

Is there a statistically significant spatial association between proximity to magnet and charter schools and the racial and poverty composition of any public school, poverty status of the underlying neighborhood, and the academic quality of the school?

Are students in low performing public schools located near high quality magnet and charter schools?

Chapter Two presents the key premises and evolution of the spatial mismatch hypothesis including a discussion of racial segregation and social isolation. In this chapter, I extend this theory beyond jobs to include the proximity and location of schools of choice as important mechanisms of educational inequality.

Chapter Three reviews the debate of school choice and presents prior research on school choice as it relates to access and quality. This chapter ends with a section detailing how the current study contributes to the literature on the school choice debate.

Chapter Four provides a detailed explanation of the methodology used in this study, including a discussion of the data, samples, variables, and statistical analyses.

Chapter Five presents the results from the analysis of the overall spatial distribution of schools of choice and public school quality across the U.S. This chapter also includes the analysis assessing whether there is spatial clustering of failing public schools, charter schools and magnet schools.

Chapter Six provides the results of the analysis of school quality, racial/ethnic inequality and schools of choice within each of the 9 largest school districts. The analysis utilizes data from NCES on school characteristics and a unique dataset compiling Adequate Yearly progress data from the school districts, using an exploratory mapping approach to gain insight into the local distribution of school quality.
Chapter Seven presents the statistical analysis of school choice accessibility through the use of Geographically Weighted Regression –GWR- as an alternative to the traditional nonspatial OLS regression model.

Chapter Eight summarizes the results from the analyses and provides some recommendations for public policy. In addition, shortcomings of the research and directions for future research are discussed.
Chapter Two: Theory

Over past three decades, neighborhood poverty has become more concentrated, racial segregation in neighborhoods and schools has remained and race and class gaps in educational achievement and attainment have persisted. At the same time, there have been various policies and programs addressing of these social inequalities including school choice programs, which have been touted as one of the best strategies to reduce educational disparities and improve public schools. The goal of this study is to examine how geographically based inequalities including neighborhood poverty and school location shape the educational opportunity landscape. This study seeks to determine whether the ability of schools to provide educational opportunities in an equitable manner uniformly distributed across space is affected by differential access to resources which vary substantially by each location and its underlying characteristics. I draw on the theory of spatial mismatch and extend it to include the location of public schools and schools of choice to better understand how school quality, poverty and educational inequality are linked to geography.

Spatial Mismatch and Job Opportunities

Since the urban riots of the 1960s, social scientists have become increasingly concerned with understanding the role racial segregation plays in creating and fostering racial inequality in the U.S. In March of 1968, the Kerner Commission reported the results of its investigation of riots in Los Angeles (1965), Chicago (1966) and Newark (1967). The riots, they claimed, were the result of growing frustration among inner-city African Americans who experienced high unemployment and lack of access to public services (Roisman, 2001). A paper by Kain (1968) later that same year drew even more attention to the impact of racial segregation and its consequences for the labor market opportunities of African Americans by laying out what would be later known as the “spatial mismatch hypothesis”.

According to Kain (1968), the spatial disconnection between the inner city neighborhoods where African Americans were increasingly concentrated and the suburbanization of low skilled jobs was the principal cause of the high unemployment and poor labor market outcomes experienced by African Americans (Kain, 2004). His analysis of employment and residential data for workers in Detroit and Chicago led him to develop the following hypothesis: racial discrimination in the housing market affected the geographic distribution of African American employment, increased their levels of unemployment and this
problem was compounded by the suburbanization of less skilled jobs. Kain suggested that the lack of access to good jobs coupled with the lack of residential choices in the presence of housing market discrimination negatively affected African American’s employment status and earnings (Kain, 1968). Kain places careful attention to the geography of African American residential patterns, noting that despite some evidence for suburbanization growth among African Americans in Chicago, they continue to be spatially concentrated in the southern part of the city, even further away from employment centers moving toward the north and northwest, albeit the better access to housing and education (Kain, 1992). He also pointed to the role of consumer discrimination, commuting cost and job information flows that weaken with distance in African Americans preference for jobs near their residential areas (Ihlenfeldt, 1994).

In the 1980s and 1990s, Kain’s initial spatial mismatch hypothesis was further developed by sociologists Wilson (1978; 1997) and Kasarda (1985, 1989), in which they argued that the movement of jobs from the central cities to the suburbs was the main factor contributing to the increased concentration of urban poverty among African-Americans. In addition, Kasarda argued that the kinds of jobs that were moving to the suburbs were disproportionately entry level, low skilled jobs, while the kinds of jobs that were expanding in the inner city were predominantly high skilled work. Wilson also highlighted the central role that suburbanization of industry and diminished opportunities for low skilled labor in the inner-city played in the high unemployment experienced by African Americans (Wilson, 1990). Furthermore, he contended that racial discrimination in housing and mortgage practices which kept African Americans concentrated in racially segregated urban neighborhoods was the primary reason why African Americans had been unable to follow the shift in demand for labor to high growth suburbs (Wilson, 1990). Discrimination against African Americans coupled with inadequate information about employment opportunities and limited transportation further reduced the ability of African Americans to seek out and secure better job opportunities in the suburbs and other parts of the city. The transformation of cities from manufacturing production centers –that were now relocating to the suburbs- to information, finance and administration hubs providing mostly white collar, high education jobs created a “skill mismatch” for African Americans. Kasarda cautioned that the apparent spatial availability of jobs in the inner city does not imply – functional- job accessibility and further reduced the employment chances of inner-city African
Evidence on Spatial Mismatch Hypothesis

Central to the research on spatial mismatch was the identification of factors affecting job accessibility, such as distance, commuting time and information costs that could act to constrain the likelihood and stability of employment opportunities (Preston & McLafferty, 1999). Several studies have evaluated the spatial mismatch hypothesis using data on commuting behaviors, wages, duration of joblessness and welfare usage rates (Blumenberg & Shiki, 2004). Although the assumption that a shortage of job opportunities around the residential areas of African American–and Latinos–would likely result in longer commute times to places with sufficient job offers, support for spatial mismatch has been mixed and likely due to the confounding effect of other variables. For instance, housing preference and higher levels of car ownership, better access to job information, and the alignment between skills and the local job market of Whites relative to African American and Latinos, could mask the existence of spatial job-housing mismatch (Holzer, 1991).

A similar endogeneity issue can prevent support of spatial mismatch when using direct distance measures between available jobs and employment status, as employed people have higher incomes and may opt to live in areas further from the job clusters obscuring the results (Ihlanfeldt & Sjoquist, 1998). In addition, current urban configurations deemed the inner city–suburbs dichotomy insufficient to account and describe how availability of jobs and residential composition interact together, and the original concept of spatial mismatch have expanded to include the new urban dynamics (Ihlanfeldt & Sjoquist, 1998).

Nonetheless, several reviews of the literature on spatial mismatch hypothesis in the last two decades indicate an overall moderate or strong support for the existence of a spatial job mismatch (Blumenberg, 2004; Kasarda & Ting, 1996; Partridge & Rickman, 2008; Preston & McLafferty, 1999; Weinberg, 2000). Ihlanfeldt and Sjoquist (1998) report six –including their own– out of seven reviews give support to the hypothesis. As Stoll contends (Stoll & Covington, 2011) despite the lack of agreement on the actual impact of spatial mismatch on labor market outcomes, there is sufficient evidence to suggest that spatial mismatch is a viable theory to account for inequality in labor market outcomes. For example, studies have found evidence for the existence of spatial mismatch by demonstrating longer commute times for among African Americans who lack the qualifications to participate in this shifting job market (Kasarda & Ting, 1996).
American and Hispanic women relative to White women in New Jersey (McLafferty & Preston, 1992) and higher than expected mean travel times to work among African Americans in New York (McLafferty & Preston, 1996).

**Racial Segregation and Social Isolation**

This study draws broadly on spatial mismatch theory to better understand how geographic location and segregation affect individual opportunities and life chances. I also incorporate ideas about social isolation and racial segregation developed by Massey and Denton (1993; 1988) and Wilson (1997). They argue that racial segregation and the social isolation in many urban Black neighborhoods matters not only because it isolates African Americans from accessing better employment opportunities but also because it affects the attitudes and behaviors of youth in the neighborhood. According to Wilson, youth in high poverty, racially segregated neighborhoods experience a lack of adult working role models coupled with a lack of access to better schooling opportunities help shape youth’s expectations of the future. Growing up in these kinds of marginalized neighborhoods with limited educational and occupational prospects fosters a sense of hopelessness which contributes to the disengagement from the schooling process.

Herein lies the importance of the spatial mismatch hypothesis to issues of educational equity. As Nancy Denton pointed out, as long as the notion of neighborhood schools remains in existence, residential segregation will shape school segregation. And given that residential—neighborhood-segregation "has been high, continues to be high and can be expected to remain high", questions of the alignment—or match—between the geographic distribution of schooling opportunities and the residential location of African American and Hispanic/Latino students will also remain relevant (Denton, 1995).

**Spatial Mismatch and Schooling Opportunities**

The problem of spatial mismatch, as described by Gobillon et al., could be addressed by bringing jobs to people, bringing people to jobs or connecting these two (Gobillon, Selod, & Zenou, 2007). Hence, the notion of spatial mismatch can be applied to the analysis of differential “access” to schools of choice and high performing schools along race, ethnic and socioeconomic lines. Racial minority, immigrant and low income children are more likely to attend low quality, low resource and failing schools (Lleras, 2008b; Lleras & Rangel, 2009; Logan, Minca & Adar, 2012; Saporito & Sohoni, 2007; Storer et al., 2012; Witte et al., 2007). And school choice
advocates call for resource allocation to these schools on the grounds that they are an alternative to the shortcomings of the public school system, in other words, schools of choice in theory should give access to higher quality education for children who are trapped in a failing public school (Imberman, 2011; Okpala, Bell, & Tuprah, 2007). This study extends the notion of spatial mismatch to include access to schooling opportunities, specifically those provided by schools of choice.

Why should the location of schools of choice matter for student achievement? There are four main mechanisms which help to explain how proximity to schools of choice could affect educational outcomes. First, the presence of schools of choice and in particular, high performing magnet and charter schools, near failing public schools could directly improve student achievement by making it easier for students to “access” these alternative schools. Drawing from Turley’s argument about the proximity to colleges and the spatial mismatch hypothesis, I argue that having a school of choice near the failing public school makes it more convenient for parents in terms of time and the simple logistics of getting their child to the alternative school (Turley, 2009). In other words, there are fewer transactional costs for parents to send their children to a charter or magnet school if it is located near their public school.

Research has shown that the actual and perceived travel times are barriers to the job search process and limit the range of employment options an individual might consider (Holzer, 1991). Similarly, a substantial number of studies have identified the large role that distance to schools, and its associated travel and time costs, play in parent's decision to enroll their children in magnet and charter schools (Bell, 2007, 2009; Goldring & Hausman, 1999). Indeed, parents may choose not to enroll or even apply to charter or magnet schools if the commute time to that school is too long and too costly. Distance can even shape teacher quality at a given school, as they also tend to teach in schools located in neighborhoods aligned with their preferences (Boyd et al., 2005). Perhaps even more importantly, the benefits stemming from applying to and enrolling in schools of choice might be offset by the transactional cost of attending a school out of the residential neighborhood, which at the end of the day can weight on parent's decision to use or not charter and magnet alternatives. Although many schools of choice do provide transportation, the increasing financial constraints in growing large urban school districts have forced many schools to cut down on the provision of such services leaving the burden of transportation on the families. Additionally, parents might perceive as a burden the
establishment and maintenance of peer networks outside the neighborhood, or the higher constraints in seeking and receiving after school child care support from friends and relatives.

Second, the effectiveness of applying to and getting accepted to a charter or magnet school may decrease as the distance to the school of choice from the public school increases. Parents and students might get less information and be generally less aware of school choice opportunities that are located farther away from the public school they are attending. There is evidence that even when schools actively engaged in outreach information strategies about alternative schools, parents might perceived that such options are outside of their reach given these distance and time constraints (André-Bechely, 2007). Parents and students may also not search as intensively for alternative schools if they are farther away because of the high costs associated with searching including travel time to get to the alternative school for meetings with administrators, touring the school, and meeting with school counselors.

Third, locating magnet and charter schools in close proximity to failing public schools could improve student achievement by providing students with role models who have gone to an alternative school. This is similar to the spatial mismatch hypothesis and Wilson’s arguments about the lack of working role models in the neighborhood having a negative impact on youth’s expectations and engagement in school and work. If youth see others attending and succeeding in alternative schools they may begin to want and believe that they can also attend a school of choice and in turn, may improve their learning related behaviors in order to get into a charter or magnet school. The existence of positive peer role models in nearby charter and magnet schools can signal successful educational trajectories that would otherwise be absent in failing public schools.

Fourth, locating schools of choice near failing public schools could also improve student achievement by changing the predisposition of youth. This is similar to Turley’s argument that proximity to college fosters a predisposition in youth to see a college track as a logical and common decision and akin to Wilson's argument about fostering a work attitude and a perception of schooling as having productive returns among youth in those neighborhoods with a healthy presence of working adults. The presence of high performing charter and magnet schools might engage and empower students that have lost their faith in education as a worthy endeavor after years of attending failing, underfunded public schools.
Chapter Three: Review of Literature

Over the past decade, a vigorous debate has ensued between those that support greater choice and alternatives to traditional public schools and those that believe we should focus our resources on improving public schools, particularly schools that are failing to educate their students. The goal of this study is to broaden this debate by examining how geographically based inequalities including neighborhood poverty and school location shape the educational opportunity landscape. The proposed study will extend prior research on school choice programs by determining whether the ability of schools to provide educational opportunities in an equitable manner uniformly distributed across space is affected by differential access to resources which vary substantially by each location and its underlying characteristics.

The debate surrounding schools of choice has been disproportionately focused on winners vs. losers, a polarization leading to two discursive camps that seem to be at a standoff (Hoxby, 2002). Although there is concern surrounding whether students left in public school lose by putting schools of choice in the picture, the current debate puts into question also whether students moving into choice schools are better off after switching schools. Currently, amidst the diversity of methodological approaches, types of school choice or scope, the debate can be placed along two main axis, allocation and productivity, also defined as equity and efficiency or accessibility and quality.

Some scholars argue that the achievement gains benefiting students gaining access to choice schools will offset the imbalances in school enrollment by racial/ethnic groups, thus stressing quality, efficiency or productivity as a criterion to support or not school choice policies (Hill & Lake, 2010; Hoxby, 2003b). Others see equity, accessibility or allocation as the fundamental issue to gauge the benefits of school choice, since achievement without equity carries the danger to further increase the educational divide, by leaving unchecked the barriers preventing those with the least amount of resources from accessing better schooling while draining resources from their already burdened, underperforming public schools (Vopat, 2011). This chapter reviews evidence on the accessibility and quality of schools of choice.

Accessibility to Schools of Choice

One of the critical issues in school choice research is whether these policies and programs increase rather than reduce educational inequality across schools. Advocates of school choice
policies contend that they provide expanded educational opportunities for disadvantaged students that would otherwise be stuck in underperforming schools (Archbald, 2004; Belfield & Levin, 2002). Critics, on the other hand, posit two main arguments suggesting school choice increases inequality: 1) A market based, competitive system among schools lead to cream-skimming of the best students to boost their quality and effectiveness, and 2) families differ in their ability to access the ‘best’ schools depending in their socio-economic status due to financial, time or information constraints (Allen, 2007). Both arguments revolve around questions of access. To date, there is no conclusive evidence on whether schools of choice are equally accessible to disadvantaged, minority underperforming students as to affluent, white, or high performing students may experience. Furthermore, there is little research on the role of location and context on the accessibility to high quality schools of choice for those students that should be the target of these alternative school programs.

Studies have shown, however, differences in student composition between traditional public schools and schools of choice which suggests differential access to alternative schools. For instance, Okpala and colleagues (2007) found higher stratification in schools of choice compared to public, traditional schools in their study of a school district in North Carolina. Howe et al. also observed that the percentage of students on free or reduced lunch, a standard proxy for low SES, was twice as large in traditional middle schools compared to schools of choice. The authors argue that the percentage of lower socioeconomic students in the public middle school increased as a direct result of competition from schools of choice (Howe, Eisenhart, & Betebenner, 2002). Also, previous studies point out that white affluent students are more likely to use school choice or to transfer from their neighborhood school as they become more racially diverse (Holme & Richards, 2009; Lankford & Wyckoff, 2006; Saporito, 2009). On the other hand, there is also evidence that disadvantaged, minority students use choice to transfer out of predominately white and wealthy districts to districts with greater percentage of minority students, and that student transfers to schools of choice do not increase racial stratification (Bifulco, Ladd, & Ross, 2009; Booker et al., 2009).

There is also evidence suggesting that school districts not only reject out-of-district student transfers due to capacity concerns, but also to other factors such as financial constraints, political opposition in the community and fear of school composition changes such as racial and ethnic composition (Fowler, 1996). After analyzing magnet school applica-
tions in Philadelphia, Saporito concluded that wealthy, white students were the ones benefiting from good schooling. Despite the fact that magnet schools were put in place as a desegregation plan, selection criteria like high test scores, good grades, and good behavior can actually leave out students that are coming from underperforming schools (Saporito, 2003). As low quality schools are disproportionately located in poor areas, and as the high levels of segregation translate into higher percentages of African Americans in these areas of the city, magnet schools actually lead to an even more segregated school system than the one in place if students did not move into them.

Likewise, Lauen finds in Chicago, as the percentage of African American in the school and neighborhood and the percentage of poor in the neighborhood increased, the chances of attending a magnet school decreased, although the author points to the variable effect of race on enrollment depending on the type of school choice (Lauen, 2007). Using a national representative survey, Sikkink and Emerson also find that as the percent African American in a residential area increases, whites are more likely to select alternative low minority schooling for their children (Sikkink & Emerson, 2008). Importantly, this effect is amplified for highly educated whites (but not highly educated blacks), although the authors acknowledge the limitations of using aggregated zipcode level data.

Among charter schools there is evidence of underrepresentation of Latinos, African American and other racial/ethnic minority students in California, Florida, and Arizona, and English Language Learners –ELL- students in New York (Buckley & Sattin-Bajaj, 2011; Cobb & Glass, 2009; Crew, 2003; Zimmer & Buddin, 2006). Still, recent research does not point to a resolved diagnostic, arguing that the fear that bright students will flee from poor, underperforming schools is overstated (Lankford & Wyckoff, 2001). In Texas, charter schools enroll higher proportions of minority students (Fusarelli, 2007).

Studies have also presented evidence that charter schools are enrolling minority students as much as their counterparts, but the patterns of enrollment vary by immigrant groups. For instance, the majority of Chinese children enrolled in urban districts attend magnet schools, and among Hispanic immigrants, those more likely to live in inner city neighborhoods, such as Mexican and Cubans, have higher chances to enroll in magnet schools (Pong & Hao, 2007). Also, note that although nationally, charter schools serve more nonwhite students than their
public counterparts (52 percent vs. 41 percent); at the state and district level, charter schools serve minority students in segregated contexts (Renzulli & Evans, 2005).

Studies have also pointed at the unequal access to alternative public school in rural areas where issues of geographic isolation and transportation prevent parents to exercise their right to choose a different school. Similarly, studies have provided evidence pro and against the presence of differences in school choice enrollment by race and ethnicity in rural areas (Okpala, Bell, & Tuprah, 2007).

It is also important to note that any analysis of accessibility to schools of choice should take into account district differences in terms of size, and type (urban, inner city, suburban, rural). For instance, Logan et al. found that school district segregation is affected by the boundaries of districts, as they relate to their size and to whether they span across the central city limits (Logan et al., 2008). The present study proposes that both location and distance can play a role in defining how accessible high quality schools of choice are for disadvantaged students. How far, and how many high quality schools are there to choose from, depends on the size, the type of district and the constraints that white, affluent students might have to easily transfer to other districts with a higher share of high income, non-minority schools.

**Quality of Schools of Choice**

Despite numerous studies on the benefits of school choice for the quality of children’s education, and after several years of school choice policies across the country, it is still unclear whether there is an overall significant advantage of deviating efforts from traditional public schools into alternative programs. Research trying to assert whether charter school produces better outcomes than regular public schools is inconsistent at best. The results across studies vary as much as the methodologies used. For example, some studies opt for comparing charter versus public school performance at varying levels; others seek to evaluate achievement gains for students changing schools, performance changes for those staying in public schools, or the effect of characteristics of parent and children exercising choice on outcomes.

Overall, when considering all the available evidence on student achievement and school choice, there is a lack of consensus. There is evidence that schools of choice have higher achievement outcomes compared to traditional public schools (Booker et al., 2009; Okpala, Bell, & Tuprah, 2007; Witte et al., 2007). For example, Hoxby and Rockoff looked at charter applicants in a big charter school system in Chicago, and found that those who obtained a
seat through the state-required lottery assignment had higher test scores compared to those students that did not win a seat in the charter schools (Hoxby & Rockoff, 2004). Witte et al. (2007) also finds support for better performance of charter schools than traditional schools in Wisconsin.

However, there are several studies that either find no positive impact of school choice on achievement or no differences in educational outcomes between public schools and schools of choice (Booker et al., 2009; Zimmer & Buddin, 2006). For example, Lubienski and Lubienski found no support for differences in scores between charter, private and public schools after accounting for demographics, and lower achievement of charter versus public schools in a later study (Lubienski & Lubienski, 2006, 2007). Godwin et al. analyzed a public school choice policy in one North Carolina district. Despite the fact that almost half of families tried to make use of choice, and transportation was provided and intensive outreach implemented, results did not support achievement gains. In addition, because priority was given to those who chose their home school, African Americans were less likely to gain access to good suburban schools (Godwin et al., 2006). Although Ni and Rorrer find that charter schools in Utah performed, on average, worse than traditional public schools, this is likely due to high student mobility of newly opened charter (Ni & Rorrer, 2012). Other studies also find that when the years of operation of charter schools are taking into account, the performance is similar to public schools, with some studies finding even modest gains (Booker et al., 2007; Hanushek et al. 2007; Sass, 2006).

Alternatively, there is some evidence that under certain conditions charter school have remarkable promise when assessing outcomes other than test scores (Booker et al., 2009; Okpala, Bell, & Tuprah, 2007; Witte et al., 2007). For example, Bulkley and Fisher found that charter schools displayed high parental satisfaction (Bulkley & Fisler, 2003). Another study finds a large, positive effects for Chicago’s multi-grade charter high schools on ACT scores, the probability of graduating, and the probability of enrolling in college (Booker et al. 2009).

There is also mixed evidence on whether the presence of schools of choice is beneficial for traditional public schools. Some studies found support for the positive effect of school choice, on traditional public school student performance when confronted with competition, as well as graduation rates (Booker et al., 2008; Dee, 1998). In contrast, Ni found that charter school competition had a negative effect on student achievement in public schools in Michigan -
smaller in the short term but non-negligible in the long run, while Godwin and Kemerer found public school choice had a small negative effect only for high performing students (Godwin & Kemerer, 2002; Ni, 2009). Interestingly, although Jackson finds that the presence of charter schools does not affect substantially public school teacher turnover, for high minority, low income schools there is a decrease in both the number of teacher hired and teacher performance (Jackson, 2012).

Much of the available research on school choice focuses around individual level issues such as parental preferences, individual differences in the propensity to choose schools or peer effects. These studies typically span only schools within single school districts, a handful of districts within a particular state, or a macro analysis at the state level. Moreover, while the discussion tends to frame school choice as a single issue, research increasingly points to the differences in achievements gains by type of school choice (Okpala et al., 2007). Though consensus on the feasibility of charter as an effective school choice policy to address achievement gaps remains elusive, growth of charter schools and waiting list of families seeking enrollment in one of the over 2000 charter schools across the country is on the rise. This is in part due to the support from president Obama through the “Race to the top” program that recently increased funding allocation to support charter schools.

Summary

This section also outlined a substantial number of empirical studies on charter, magnet and the school choice movement. Despite the extensive body of research on schools of choice over the past decades, the literature is limited in important respects. The bulk of studies taking a quantitative approach does not account for spatial effects in school choice, which is counterintuitive given that location plays a role in several dimensions of schooling outcomes and processes, from funding, to access, to resource allocation. Similarly, research on the degree of clustering of school choice accessibility around failing and achieving public schools is virtually absent, with only a small share of the literature including a macro-level comparison of school of choice and race/ethnic inequalities between school districts.

To date, there is no conclusive evidence on whether schools of choice are equally accessible to disadvantaged, minority underperforming students as to affluent, white, or high performing students. Furthermore, there is little research on the role of location and context on the accessibility to high quality schools of choice for those students that should be the target of
these alternative school programs. In addition, and despite numerous studies on the role of schools of choice on educational outcomes, and after several years of school choice policies across the country, it is still unclear whether there is an overall significant advantage of deviating efforts from traditional public schools into alternative programs. There is still no consensus on whether underserved students differ in their access to high quality schools of choice given the public schools to which they are assigned.

What is clear is that accessibility to good quality schools of choice should continue as a research priority and a decisive factor when considering the future of school choice policies, especially when considering that African American and Latino students are less likely to enroll in private schools, and the high minority public schools they attend are more likely to be labeled in need of improvement (Gamoran, 1996; Reardon & Yun, 2005; Zhang & Cowen, 2009).

**Current Study**

School performance and educational opportunities have been two central concerns in research on education in the U.S. However, little research has addressed the spatial dimension of these issues, despite evidence that educational trajectories vary by where students live and go to school. The lack of attention paid to the effect of context on educational opportunity is unfortunate because the spatial concentration of disadvantage in neighborhoods and school districts clearly plays a role in perpetuating inequality. The goal of the proposed study is to examine the conditions under which schools of choice are accessible to underprivileged students within nine of the largest school districts in the U.S., and whether they provide better, higher quality education than their traditional public school counterparts. However, the focus is not simply confirming whether schools of choice are increasing educational inequalities, but to identify the circumstances under which schools of choice become agents of segregation or effective instruments of educational opportunity. Given the lack of evidence on the role that location and proximity plays on the access to schools of choice, and on their level of quality this study takes a geographical approach to the analysis of individual schools within these school districts across the U.S.
Chapter Four: Methods

School and District Level Data

This study utilizes school and district data across the United States from two sources: The Common Core of Data from the NCES, which include annual fiscal and non-fiscal data about all public schools, public school districts and state education agencies in the United States, and 2010 Census data at the tract level. Specifically, the data were taken from Public Education Agency Universe and Public School Universe of the Common Core of Data (http://nces.ed.gov/ccd/ and http://nces.ed.gov/surveys/SDDB/introd.html). This NCES dataset will provide the school attribute data and school district information that will later be merged with the school and school district geography, as well as demographic variables from the 2010 U.S. Census. There were initially 96815 observations after excluding schools not located in the continental U.S. After excluding observations that have no data or fewer than 15 students reported in the total school population variables, which is used in deriving percent variables for ethnic and racial groups, and missing data on census tract, and AYP, there were a total of 78074 schools.

For the district-wide analysis the Local Education Agency Universe Survey Data (CCD-LEA), a publicly available Common Core of Data – CCD – dataset from the NCES was used. This CCD-LEA dataset includes all Local Education Agency or school districts in the United States for the year 2009-2010, along with student demographic information and geographic coordinates for each district. The dataset was geocoded using the information for latitude and longitude using ArcGIS 10.0., and was merged with the AYP dataset through an attribute join routine to obtain the LEA percent of schools in need of improvement. In addition U.S. SF1 census data on race, ethnicity and percent of rented and vacant units for the year 2010 was geocoded through a join routine using TIGER 2010 shapefiles, and was later merged to the school dataset using a spatial join routine. The initial number of observations was 18439, and after excluding districts with no corresponding information on AYP, coordinates errors and districts outside of the continental U.S., the final number of LEAs was 15486.
Table 1. List of School Districts Included in the Study.

<table>
<thead>
<tr>
<th>District Name</th>
<th>City</th>
<th>State</th>
<th>County</th>
<th>No. Students</th>
<th>No. schools</th>
<th>Poverty rate age 5-17</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York City Public Schools</td>
<td>Brooklyn</td>
<td>NY</td>
<td>Kings</td>
<td>986,967</td>
<td>1,205</td>
<td>29.4</td>
</tr>
<tr>
<td>Los Angeles Unified</td>
<td>Los Angeles</td>
<td>CA</td>
<td>Los Angeles</td>
<td>741,367</td>
<td>721</td>
<td>30.5</td>
</tr>
<tr>
<td>City of Chicago Sch. District</td>
<td>Chicago</td>
<td>IL</td>
<td>Cook</td>
<td>426,812</td>
<td>634</td>
<td>28.5</td>
</tr>
<tr>
<td>Dade County School District</td>
<td>Miami</td>
<td>FL</td>
<td>Miami-Dade</td>
<td>368,933</td>
<td>381</td>
<td>24.6</td>
</tr>
<tr>
<td>Clark County School District</td>
<td>Las Vegas</td>
<td>NV</td>
<td>Clark</td>
<td>283,221</td>
<td>307</td>
<td>14.3</td>
</tr>
<tr>
<td>Broward County Sch. District</td>
<td>Fort Lauderdale</td>
<td>FL</td>
<td>Broward</td>
<td>274,591</td>
<td>272</td>
<td>16.1</td>
</tr>
<tr>
<td>Houston Indep. Sch. District</td>
<td>Houston</td>
<td>TX</td>
<td>Harris</td>
<td>208,945</td>
<td>304</td>
<td>28.8</td>
</tr>
<tr>
<td>Philadelphia City Sch. District</td>
<td>Philadelphia</td>
<td>PA</td>
<td>Philadelphia</td>
<td>187,547</td>
<td>270</td>
<td>26.5</td>
</tr>
<tr>
<td>Fairfax County Public Schools</td>
<td>Fairfax</td>
<td>VA</td>
<td>Fairfax</td>
<td>164,765</td>
<td>204</td>
<td>5.9</td>
</tr>
</tbody>
</table>


The scope of the analysis is limited to 9 of the largest school districts, to allow for an in-depth, local exploration of educational inequalities and accessibility to schools of choice. Although this stage of the analysis did not include districts to represent all the configurations of schools in the country—level of urbanization, region, economic and demographic composition, administrative characteristics—, each of the 9 largest school districts had at least 160,000 students, while 72 percent of all regular school districts had fewer than 2,500 students (Sable, J., Plotts, C., & Mitchell, 2010). Thus, the proposed study area comprises a large portion of school-aged children. Moreover, while the average school district has only around 6 schools, the top 10 school districts have an average of 163 schools (Sable et al., 2010). This ensures a high degree of variability in school characteristic and school contexts that can only be found with a fair amount of observations spanning different locations. Similarly, the top 100 school districts include a higher than average number of minority students, the main focus of this study, given their higher likelihood to be enrolled in underperforming public schools. Table 1 lists the 9 school districts included in the analysis. Fairfax, VA was chosen instead of Orange FL, and Palm Beach, FL, as Florida was already represented by two other school districts. Together, these 9 educational
districts comprise around 3.8 million students or around 10 percent of the total public schools enrollment across the country.

**Measures**

*School quality.* School quality is measured in the present analysis and throughout the document, through AYP indicators at the school level. Adequate Yearly Progress is a measure to determine whether schools are meeting the annual goals under the accountability provisions in the No Child Left Behind (NCLB)\(^2\).

States are required to identify schools receiving Title I\(^3\) funds that are failing to meet Adequate Yearly Progress - AYP - through a multi-stage accountability process. Schools that fail to meet AYP for two consecutive years in the same content areas are labeled as "School in Need of Improvement" - SINE -, with the goal to provide assistance and intervention to get back in track and students should be informed of their right to transfer to a non-SINE school. After four years failing AYP, title I schools are label for corrective actions and districts implement interventions on curriculum, staff, and management among others. After five years failing AYP schools are labeled as restructuring which implies significant changes such as changing staff or granting the control of the school to private or state management. In order for schools to move out of the SINE list, they need to make AYP for two consecutive years. AYP requirements for school districts are similar to those for schools.

Although AYP criteria varies across states, AYP is an important indicator as it signals schools that are failing reading and math standards for the average population, or for specific subgroup, that is, a school where the percent of LEP or poor students below state standards is higher than the target for the school year is label as failing AYP even if the average for the school population is above the standards.

*AYP.* The present analysis combines school demographic and location data obtained from the National Center of Educational Statistics – NCES -, AYP data publicly available from the Consolidated State Performance Report - CSPR - at EdFacts, and census geography and attributes for each of the 50 contiguous states. Although using CSPR data will only capture the AYP status

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\(^2\) NCLB – No Child Left Behind Act of 2001 requires states to set mandatory standards and accountability toward the 2014 goal of 100% math and reading proficiency.

\(^3\) Title I is a federal program that provides funds to school districts and schools with high numbers or high percentages of children who are disadvantaged to support a variety of services
of schools that receive Title I funds, it highlights the spatial inequality for those schools serving children with the least resources. An attempt was made to obtain AYP data for all schools, but the way data is collected and reported varies between states; the latest year available for all states is 2009. ArcGIS 10 Spatial join tool was used to obtain LEA-district- percent of SINE schools. District AYP data was also compiled from each of the State Department of Education data for the 50 contiguous states, and spatial join routines were used to obtain county-level percent of LEAs failing to meet AYP.

AYP. States are required to consolidate the AYP results for all title I schools, and identify Schools in Need of Improvement –SINE status-. To be assigned a SINE status, schools need to fail AYP for two consecutive years, with new categories assigned with increasing number of years failing to meet AYP.

School location. School locational information was obtained from the Common Core of Data –CCD- Public School Universe for all schools and Local Education Agency for all districts, provided by the National Center of Educational Statistics – NCES- for the school year 2008-2009. The dataset was geocoded using the latitude and longitude fields in ArcGIS 10.0, and projected using a Lambert Conformal Conical projection. Select query routines were used to obtain independent shapefile for magnet, charter and public schools. The accuracy of school location and the inclusion of all school points operating in 2009 are limited by the quality of NCES data.

School compositional variables. It was defined as the percent of African American, Hispanic, Asian and White students from the CCD public school universe dataset for the year 2009. Percentage of low income students and percentage of English language learner (ELL) were also derived from CCD Public School Universe data.

Proximity. The variables corresponding to proximity will be constructed as the distance in miles of public schools to charter and magnet schools. ArcGIS 10.0 near neighbor tool was used to derive distances based on projected shapefiles.

Spatial Analysis

There are theoretical and methodological reasons for the spatial turn in social sciences, after technological developments make now possible to manipulate geographical data and to implement spatial analyses with ease (Goodchild & Janelle, 2010; Warf & Arias, 2009). From a substantive standpoint, the notion of propinquity, place attachment, and the social production of
place underscore the contextual nature of social processes embedded in space (Tickamyer, 2000). From a methodological standpoint, data that has a locational component render traditional methodologies insufficient, as they work on the assumption that the location of a given observation has no say on the value it takes on, an unrealistic statement when studying social processes that do not operate in a spatial vacuum (Anselin, 1999b). The spatial analysis framework focuses on understanding how location matters, in other words, the mechanisms through which spatial effects come into play. The two most prominent mechanisms are spatial dependence and spatial heterogeneity.

**Spatial dependence.** Also known as spatial interaction or spatial autocorrelation is the mechanism behind the notion of interaction and distance decay. Distance decay is a central concept in both spatial analysis and geography based on the premise that "everything is related to everything else but near things more so", which is also known as Tobler's First Law of Geography (Tobler, 1970). Spatial dependence, therefore, implies that locational similarity is aligned with attribute similarity (Anselin, 1999a; 2003).

Spatial autocorrelation is similar to the rationale of a Pearson's r coefficient. Pearson's r is a measure of a relationship between two variables, along with its strength and direction. Similarly, spatial autocorrelation is a measure of the relationship of a variable with itself across space. There is positive spatial autocorrelation when high or low values of a variable tend to cluster in space, and there is negative spatial autocorrelation when geographical areas tend to be surrounded by neighbors with very dissimilar values. Massey and Denton's residential segregation thesis also fits well with the process of spatial dependence (Massey & Denton, 1993). Their work focused on how the observed geographic distribution of residential patterns is a result of racial discrimination. It follows from this notion, that the quality of schools and the accessibility to schools of choice for those schools that are failing will be correlated with that of nearby schools.

**Spatial heterogeneity.** Spatial heterogeneity on the other hand, focuses on the notion of outliers, in other words, local areas where values are markedly different from those of their surroundings. Spatial heterogeneity is observed when values are not stable across space and may generate characteristic spatial patterns like a cluster of high values or a cluster of low values. Spatial Analysis allows to identify those locations -schools- that have values for a certain variable or attribute that are higher than expected, showing dissimilar patterns to the rest of the
The spatial mismatch hypothesis is aligned with the process of spatial heterogeneity in school outcomes. The discussion of Wilson's concentrated disadvantage in the inner city, where there is an overrepresentation of ethnic minorities living in poverty and less access to jobs relative to the suburbs, is aligned with the notion of outliers or hotspots (Wilson, 1997).

**Exploratory spatial data analysis -ESDA-.** ESDA is a set of methodological techniques to explore data that has a spatial component, in other words, data for which location, contiguity, topology or distance is important in how outcomes manifest themselves. ESDA aims at describing and visualizing spatial distributions, at identifying atypical localizations spatial outliers-, at detecting patterns of spatial association –spatial autocorrelation-, and clusters or hot spots, -spatial heterogeneity- (Anselin, 1995, 1998, 1999a, 1999b, 2003; Anselin & Cho, 2002; Gatrell et al., 1996; Goodchild & Janelle, 2004; Haining, 1990; Messner et al., 1999). These methods provide measures of global and local spatial autocorrelation.

The present analysis utilizes standard deviational ellipses, LISA and Moran's I to visualize and test statistically significant spatial patterns in the distribution of educational inequality and school choice accessibility across schools and districts in the U.S. To date, few empirical studies on school choice have examined the geography of access to magnet and charter schools using LISA or other localized spatial statistics.

**School neighbors.** ESDA analysis start with the definition of school neighbors for each of the schools included in the analysis. Moran’s I and LISA indicators require a weights matrix -usually denoted as W-. The criteria to define neighboring observations ultimately influence the analysis and speak of the way that the relationships across space are assumed to be. The weights matrix, W, can be constructed by a specified distance band around each school, by the sharing of a common boundary or vertices or by a set number of closest school points. The present study will include an inverse distance weighting –IDW- W matrix, and a K4 -closest 4 schools- and K8 -closest 8 schools- nearest neighbor W matrices, to assess stability of results to choice of weights. However, due to space constraints, not all maps will be included.

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4 The formula for each spatial weight is: \( w_{ij} = \sum_{j=1}^{n} c_{ij} \), with \( c_{ij} = 1 \) when \( i \) is linked to \( j \), and \( c_{ij} = 0 \) otherwise.
Global autocorrelation. Moran’s I is used to determine the degree of spatial clustering across schools within each district. To evaluate the significance of Moran’s I, ArcGIS performs a permutation of the values to generate an empirical distribution of simulated Moran’s I against which it places the value for the observed Moran’s I. The null hypothesis corresponds to a scenario of randomness, which suggests that the arrangement of school values that we observe across the country are a result of chance, and so the value of one school is not associated with the value of nearby schools.

Local indicators of spatial association –LISA-. While Moran's I allows to assess the degree of spatial autocorrelation present in a variable, it assumes that there is a level of stationarity across locations. This presents a challenge when the values for school points are not stable throughout space and "the assumption of stationarity or structural stability over space may be highly unrealistic" (Anselin, 2003), in other words, they show a fair amount of heterogeneity. Under such spatial patterns, Local Indicators of Spatial Autocorrelation –LISA- is a more appropriate approach. LISA analyses will identify hot spots –cluster of outliers- by comparing the values for each school –i.e. distance to schools of choice- to the values of the neighboring (surrounding) schools as identified by the weight matrix, Wij. Positive LISA values indicate that a school –or district- has neighboring schools –districts- with similarly high or low values for a given attribute –variable-; in other words there is a cluster or hotspot of similar

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5 Moran’s I is a global spatial autocorrelation, in other words, it is a measure of the overall clustering of the data within each of the school districts. It can be expressed as:

\[ I = \frac{\sum \sum w_{ij}(x_i - \mu)(x_j - \mu)}{\sum (x_j - \mu)^2} \]

Where \( w_{ij} \) is the row-standardized contiguity matrix, \( x_i \) is the value of variable x for school, \( I \), \( x_j \) the value for the same variable at the nearby school j, and \( \mu \) is the average level of the variable. Moran’s I is similar in interpretation to the Pearson’s Product Moment correlation statistic, it ranges between -1.0 and 1.0 depending on the extent and direction of the correlation. The statistical significance of the Moran’s I is assessed by calculating a pseudo p-value drawn from n permutations (n=99 for a pseudo p-value of 0.05, n=99 for a pseudo p-value of 0.01 and n=999 for a pseudo p-value of 0.001).

6 Local Moran’s I statistic –LISA- can be expressed as:

\[ I_i = \frac{(x_i - \bar{X})}{S_i^2} \sum_{j=1,j\neq i}^n w_{ij}(x_j - \bar{X}) \]

where \( x_i \) is a attribute –variable- for school (or district) i, \( \bar{X} \) is the mean value of x, and \( w_{ij} \) is the spatial weight between i and j, and:

\[ S_i^2 = \frac{\sum_{j=1,j\neq i}^n (x_j - \bar{X})^2}{n-1} \]

with n as the total number of schools (or districts). The statistical significance of the LISA, \( I_i \), is given by the p-values associated with the z-score, which is computed as:

\[ z_i = \frac{I_i - E[I_i]}{\sqrt{V[I_i]}} \]

where \( E[I_i] = \frac{\sum_{j=1,j\neq i}^n w_{ij} |I_j|}{n-1} \) and \( V[I_i] = E[I_i^2] - E[I_i]^2 \)
schools –districts-. On the other hand, negative LISA indicate that a school has neighboring schools with diverging values; in other words the school –or district- point is a spatial outlier.

**Standard deviational ellipses –SDE-.** Standard deviational ellipses are visual descriptions of the distribution of school values along a longitude and latitude dimension, introduced by Furfey to assess geographic concentration (Johnson & Wilson, 2009; Wang et al., 2011). SDE is based on the mean center of the school points, and the shape of the ellipses characterizes the spatial attributes –location, dispersion and orientation- of the values for a given variable across schools.

**Geographically weighted regression.** The geographic nature of research on educational issues such as school choice accessibility is not appropriately addressed by traditional OLS methods. OLS assumes that the coefficients of the independent variables are constant within states/districts, and thus estimates an average effect. This average parameter, or global statistic, gives limited information about the variation across locations, even when including dummies for districts/states, or surface coordinates.

GWR is a method that has been rapidly adopted across the social sciences to study local spatial patterns. It is a modification of the traditional OLS regression model that allows local instead of global parameters to be computed, and, following Tobler’s notion of distance decay assigns more weight to observations nearby. GWR is an appropriate method when the traditional global regression assumption that relationships are constant over space is not met and therefore one parameter for the entire study area is rendered invalid (Bagheri, Holt, & Benwell, 2009; Brunsdon, Fotheringham, & Charlton, 1998, 2002, 2010; Cahill & Mulligan, 2007; Calvo & Escolar, 2003; Demšar, Fotheringham, & Charlton, 2008; Fotheringham, Brunsdon, & Charlton, 2002; Fotheringham, Charlton, & Brunsdon, 2001; Harris et al., 2010) The GWR version of an OLS model, as described by Fotheringham et al (2001) can be expressed as:

\[
y_i(u) = \beta_0(u) + \beta_1(u)x_{1i} + \beta_2(u)x_{2i} + \beta_m(u)x_{mi} \text{ for } i = 1\ldots n.
\]

Where \( y \) is the dependent variable,
\( x_k \), with \( k=1\ldots m \), is a set of independent variables,

\[7\text{ For a detailed explanation of SDE, see Wong (1999).}\\

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are the observations –schools- for which location is available, and (u) indicates that the relationship is specific to location u.

The local model for each school is thus the set of the geographically weighted parameter estimates, the kernel and the bandwidth.

**Parameter estimate.** The parameter estimate or coefficient are localized and based on a weighting matrix that gives more or less weight to observations around each location –school- \( u \) using a distance decay function:

\[
\hat{\beta}(u) = (X^TW(u)X)^{-1}X^TW(u)y,
\]

Where \( y \) is the vector of values of the dependent variable, \( X^TW(u)X \) is the variance covariance matrix that is geographically weighted and \( W(u) \) is a square matrix of weights relative to each of the school locations \( (u) \) in the study, which can be expressed as:

\[
\begin{bmatrix}
w_1(u) & 0 & 0 \\
0 & w_2(u) & 0 \\
0 & 0 & w_n(u)
\end{bmatrix}
\]

**Kernel.** The kernel defines the criteria to weight nearby locations –schools-. GWR 3.0 offers either a Gaussian kernel\(^8\) (fixed distance) or adaptive kernel\(^9\) (constant number of neighbors) are available (See Figure 1). Any observation –school- with a distance greater than the bandwidth is set to zero so that it does not enter into the calculation of the local parameter estimates (Demšar et al., 2008; Fotheringham et al., 2002). The Gaussian kernel is more appropriate for observations that are relatively stable across space, while the bisquare adaptive kernel is a better alternative when the distribution varies across the study area.

\[^8\] \( w_i(u) = e^{-0.5\left(\frac{d_i(u)}{h}\right)^2} \) Where \( w_i(u) \) is the weight of the \( i^{th} \) school relative to the location of school \( u \), \( d_i(u) \), is the distance between the \( i^{th} \) school and the location of school \( u \) and \( h \) is the bandwidth.

\[^9\] \( w_i(u) = \left(1 - \left(\frac{d_i(u)}{h}\right)^2\right)^2 \) where \( w_i(u) \) is zero when \( d_i(u) > h \).

30
**Bandwidth.** The bandwidth refers to the radius (in miles) for the Gaussian fixed
distance- or the number of school points for the bi-square constant neighboring points-kernel around each school point included in the weighting matrix. As bandwidth increases, the GWR results converges to that of an OLS model, and therefore the bandwidth influences the fit of the model more than the shape of the kernel. In other words, if the bandwidth is too large, the model results will be over smoothed and similar across the study area similar to a global model. Conversely, if the bandwidth is too small, the model results will have too much local variation to discern any meaningful pattern. The optimal distance bandwidth used to obtain local coefficients for each school point is determined by an AIC test. Finally, Monte Carlo tests were also done to assess if the spatial variability across schools non-stationarity is statistically significant (Fotheringham et al., 2002).

**Multiple dependent testing.** Given that the GWR model estimates local parameters for each schools, that is, the number of models estimated exceeds one ($m > 1$), we face the problem of simultaneously testing $m$ hypotheses, and normal computation of p-values need to be adjusted. The literature suggests a Benjamini-Hochberg False Discovery Rate procedure is appropriate for GWR, since the alternative ordinary Bonferroni correction affects statistical power, and it has been implemented in the present analysis (Byrne, Charlton & Fotheringham, 2009; Thissen, Steinberg, & Kuang, 2002).
Chapter Five:
Exploratory Spatial Analysis of Educational Inequalities and Schools of Choice Across the United States

This chapter explores educational inequalities across schools and districts in the U.S. To do so, a unique dataset was created from official federal, state and district sources. The focus of this chapter is to explore the spatial distribution of educational inequality – as measured by AYP (Adequate Yearly Progress) in public schools and schools of choice. Of particular interest is the extent to which pockets of failing schools are consistently found in certain parts of the country.

Figure 2 shows the distribution of AYP across states for the last 3 years available from official NCES EdFacts documents. More than one-third (36%) of the nation’s school districts did not make AYP in 2009, up from 29% in 2006. (Usher, 2010), but the state and district share of failing schools contributing to this national percentage varies considerably. As it can be observed, the number of failing schools across states varies significantly, with most states showing a decrease in the number of schools that can be classified as making adequate progress from 2007 to 2009.

When examining the dissimilarity indices presented in Figure 3 and Figure 4, there are clear trends of segregation by school performance and racial composition. The dissimilarity index measures the relative separation of groups in a given geographical unit – school, districts, states-, in other words, it measures the proportion of group members – i.e. white students - that would have to move to another geographical unit – i.e. another public school- to attain an even distribution across all geographical units – i.e. even racial composition across schools. The index is a common measure for estimating segregation, and it ranges from 0 to 1, corresponding to the proportion of people belonging to one category that would have to relocate to balance the composition of all categories across areas, with higher indices indicating higher segregation\textsuperscript{10}.

\textsuperscript{10} The general notation for the index is:
\[ D = 0.5 \sum \frac{P_{ig} - P_{ih}}{P_g}, \]
where \( P_{ig} \) is the population of group \( g \) in geographical unit \( i \), \( P_{ih} \) is the population of group \( h \) in unit \( I \), \( P_g \) is the total population of group \( g \) and \( P_h \) is the total population of group \( h \).
Figure 2. Percentage of public schools making AYP 2007-2010.

Figure 3. Dissimilarity index of schools in need of improvement status between public schools and schools choice by states.

Figure 3 shows how the dissimilarity in performance –SINI status- between public schools and schools of choice –magnet and charter- vary across states, with Virginia, Wyoming, and Missouri markedly departing from the overall trend. As the index of dissimilarity tends toward zero, the geographic distribution of public schools and schools of choice in need of improvement approach evenness, in other words, states with smaller dissimilarity indexes
indicate that the distribution of persistently failing public schools is not markedly different from that of persistently failing schools of choice. Figure 4 also presents dissimilarity indices, but in this case we are now observing the segregation of racial/ethnic groups, and how it differs between private, public, magnet and charter schools. It is worth noting that charter schools are far more segregated according to the index of dissimilarity than other type of schools, and that Magnet schools display lower levels of racial segregation, particularly for African Americans. For instance, for charter schools, a dissimilarity index of 0.77 for African Americans indicates that 77 percent of the other races would need to move between charter schools in order to achieve an even racial distribution between the 4 racial/ethnic groups. It is also interesting to see the lowest African-American-Latino index is in private schools, likely signaling the trend that these two groups enroll in high minority private and/or parochial schools.

**Figure 4.** Dissimilarity indices of racial/ethnic groups by type of school.
Map 1 through Map 4 shifts attention to the SINI – Schools in Need of Improvement – as an indicator of public schools catering to impoverished communities that are truly underperforming, since schools labeled as SINI are those schools receiving Title I funds – schools enrolling low income students – that have been continuously failing to meet adequate yearly progress – AYP – anywhere from 2 to 7 years.

Failing traditional public schools show a distinctive spatial configuration depending on the category of improvement. Most of the schools in the Improvement I stage – 2 years failing AYP – are located in California, Montana, North Dakota, Minnesota, Maryland, Massachusetts, Georgia, Iowa, Ohio, Oklahoma, and Illinois. However, schools in the Corrective Action stage -3 years failing AYP - appear mostly in California, Minnesota, Florida, Massachusetts, and the Midwest.

Map 1. Schools labeled as SINE 2009. School Improvement I.

Map 3. Schools labeled as SINE 2009. Restructuring II.
A similar distribution is observed for public schools in the Restructuring Stage -4 to 5 years failing AYP- with the addition of Michigan and Iowa. When looking only at those public schools in the last stage of State Reconstitution -7 years or more failing AYP we can clearly observe that for the year 2010 they are present only in the states of California, Georgia and Florida. That California and Florida display the worst performance of public schools is cause for concern when considering that they have the highest number of Latino students in the U.S., many of which are ELL –English Language Learner- in need of school support.
When we shift the level of analysis to LEAs – Local Education Agency- or school districts, a pattern of failing districts is clearly concentrated in certain states. Moran's I (0.26) for global spatial autocorrelation confirms that there is an overall moderate positive and significant ($p = 0.000$) clustering of the LEA – or district level- percent of Title I schools in Need of improvement. In other words, LEAs with higher – or lower- percentages of failing schools are significantly more likely to be close to other LEAs with higher – or lower- percentages of failing schools. In order to assess whether local clusters of districts observed in descriptive maps are significant, LISA statistics were also calculated\textsuperscript{11}.

\textsuperscript{11} Moran's I and LISA was performed in ArcGIS 10.0, using 4 different weights matrix criteria, IDW and 4, 6 and 8 nearest neighbors. All three k-nearest neighbor weights displayed consistent results, while IDW show very different results depending on the distance band used. For space constraints only the LISA map using K4 weights matrix is presented.
Map 5 shows the clusters identified as statistically significant, where red points represent a high-high cluster, or a LEA with a high percentage of failing public schools that is the center of a local cluster where its neighboring districts also have high percentages of failing schools. High-high clusters are mostly located in California, Washington, Arkansas, New Mexico, Missouri, Ohio, Massachusetts and New Jersey.

In contrast, the yellow points identify outliers, or atypical districts with high percentages of failing schools surrounded by districts that fare much better and have significantly lower number of schools identified for improvement –SINE status-. These outlier districts are more scattered across the U.S., but are clearly concentrated in Illinois, Minnesota, Vermont and New Hampshire.

Changing the scope of analysis to the county level, allows capturing whether the pockets of educational inequality extend to higher administrative levels and where they are located. Using district level data on AYP provided by NCES, a LISA map of the county level percent of districts that are meeting standards was produced and depicted in Map 6 and Map 7. The data is not a result of aggregation of schools making AYP, but an official assessment according to data by the State Departments of Education.

Map 6. Percent of Districts making AYP within the County.
Map 7. LISA Map of County level Percent of Districts making AYP.

Map 7 shows a quartile map of the county level percent of performing school districts – LEAs-. It is apparent that the distribution of county level performance has a distinctive pattern across the country. To assess if these patterns are statistically significant, a LISA map is presented in Map 7. Due to the variability in county area, a k-8 nearest neighbor weight was used. In Map 7, you can see that there are significant clusters of low-low districts appear tightly located in a handful of states, with California, Missouri and Florida again making the list. A low-low cluster in this case refers to pockets of counties with low percentages of school districts meeting standards.

All the previous maps clearly indicate that failing schools and schools districts are not randomly distributed across the country, but instead, form distinctive and statistically significant clusters of inequality. California, Florida, New Mexico, and Missouri show particularly high numbers of low quality schools and school district clusters, which is a concern as these states serve a high proportion of African American and Hispanic students. A relevant question now is where schools of choice located are and whether they are meeting standards. That is, are they
far better, especially in the geographic areas where there are concentrated pockets of failing public schools.

Map 8 displays only magnet and charter schools according to their SINI status. Pink dots correspond to those identified as need of improvement—charter and magnet schools failing to meet AYP more than 2 consecutive years by 2010. It is evident that there is a fair number of choice schools that are not performing, which runs contrary to the expectation that magnet and charter schools are put in place to make up for the failures of public schools. More importantly, there seems to be a clear pattern of underperforming schools of choice, with a robust number of them located in Nebraska, California, Georgia, Florida, Kentucky, Delaware, and to a lesser extent in other states in the Midwest. There are eleven states that have not implemented a charter law\textsuperscript{12}, and of those 9 do not have charter schools for the year 2009-2010.

\textbf{Map 8. Schools of choice—magnet, charter—labeled as SINI—Schools in need of improvement 2009.}

\textsuperscript{12} Washington, Montana, North Dakota, South Dakota, Nebraska, Maine, Mississippi, Alabama, West Virginia and Kentucky
Map 10 presents separate maps for charter and magnet schools in Need of Improvement across the U.S., for the year 2009-2010. Magnet schools appear to be concentrated toward the eastern states, with only a handful of schools in California, Nevada, Utah, Idaho, New Mexico, Colorado and Kansas. Charter schools, however, seem to be more evenly spread out across states, with a higher number of schools implemented relative to the magnet.

Again, this is a critical issue as schools designated as Title I enroll primarily low-income and minority students. Map 9 and Map 10 reveals an important number of schools of choice that are falling short of being adequate alternatives for failing schools, concentrated in some areas more than others. The number of failing magnet schools in Arkansas, Florida, Georgia and Missouri is particularly high. Similarly, Idaho, New Mexico, Ohio, Arkansas Massachusetts and Florida show a nontrivial number of charter schools that are failing. Conversely, Michigan, Maryland, and Virginia display a high number of achieving magnet schools, with Mississippi, Alabama and Louisiana also showing a healthy number of quality magnet schools; while for charter schools, the states of Minnesota, Wisconsin, California, Arizona, Colorado and Texas fare better.

Taken individually, Map 9 and Map 10 bring attention to the degree to which schools of choice are consistently delivering high quality education in place of failing schools. Although a healthy number of schools of choice across the country are meeting state standards, it is precisely those who are not making progress that raise concerns. The maps draw attention not only to the fact that some schools of choice are not performing adequately, but even more importantly, to where they are located. Taken together with previous maps showing significant clusters of failing public schools, there are specific areas in the country, for instance, California, New Mexico or Florida where both public schools and schools of choice are underperforming. A look at the spatial distribution of public schools and schools of choice will give further insight on the dynamics between spatial, social and educational inequalities.
Map 9. Magnet schools by SINE Category (yes = red; no = green).

Map 10. Charter schools by SINE Category (yes = red; no = green).
Chapter Six:

Local Spatial Analysis of Social, Educational Inequalities and School Choice

This chapter focuses on the analysis of school quality, racial/ethnic inequality and schools of choice within each of nine of the largest school districts. The analysis presented here underscores the importance of a spatial perspective to better assess how educational and social inequalities play out at the school level, particularly for issues such as accessibility and performance, where the nuances of local dynamics can be easily hidden in broader, global analysis. The districts chosen encompass an important number of both schools and students which make them an important target to assess whether the public school system enhances or deters educational opportunities. In addition, as can be seen in Table 2, there are wide variations in the composition, resources and outcomes across these nine districts.
Table 2. Descriptive Statistics

<table>
<thead>
<tr>
<th>School District</th>
<th>Mean school membership</th>
<th>Maximum school membership</th>
<th>% Magnet schools</th>
<th>% Students in magnet schools</th>
<th>% Charter schools</th>
<th>% Students in charter schools</th>
<th>% Asian students</th>
<th>% Hispanic/Latino students</th>
<th>% African American Students</th>
<th>% White students</th>
<th>Dropout rate</th>
<th>Graduation rate</th>
<th>Expenditure per pupil</th>
<th>% Instructional expenditures</th>
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</thead>
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<tr>
<td>New York City Public Schools</td>
<td>648.8</td>
<td>4447</td>
<td>9.4</td>
<td>14.1</td>
<td>0</td>
<td>0</td>
<td>14.5</td>
<td>39.8</td>
<td>30.9</td>
<td>14.4</td>
<td>5.3</td>
<td>56.9</td>
<td>22071</td>
<td>65</td>
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<tr>
<td>Los Angeles Unified</td>
<td>859</td>
<td>4657</td>
<td>16.4</td>
<td>34.8</td>
<td>17.4</td>
<td>8.5</td>
<td>6.3</td>
<td>73.4</td>
<td>10.6</td>
<td>8.7</td>
<td>6.8</td>
<td>48.8</td>
<td>14768</td>
<td>45.1</td>
</tr>
<tr>
<td>City of Chicago</td>
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<td>7693</td>
<td>45.7</td>
<td>46.7</td>
<td>4.8</td>
<td>6.9</td>
<td>3.5</td>
<td>40.8</td>
<td>46.6</td>
<td>8.9</td>
<td>16.3</td>
<td>63.8</td>
<td>12126</td>
<td>51.2</td>
</tr>
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<td>30.1</td>
<td>15.5</td>
<td>6.9</td>
<td>1.2</td>
<td>63.4</td>
<td>26</td>
<td>9.2</td>
<td>6</td>
<td>58.5</td>
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<tr>
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<td>0</td>
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<td>1.3</td>
<td>9.4</td>
<td>40.1</td>
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<td>35.3</td>
<td>6.2</td>
<td>49.1</td>
<td>11859</td>
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<td>39.1</td>
<td>30.3</td>
<td>2.8</td>
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<td>11569</td>
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<td>N.D.</td>
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<td>6.4</td>
<td>3.2</td>
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<td>27.8</td>
<td>7.8</td>
<td>6.8</td>
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<td>0</td>
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<td>19</td>
<td>11.3</td>
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<td>2.2</td>
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<td>0</td>
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<td>17.3</td>
<td>62.5</td>
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<td>8.5</td>
<td>55.5</td>
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<tr>
<td>U.S. total</td>
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<td>13</td>
<td>5.3</td>
<td>2.9</td>
<td>7.7</td>
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<td>28.9</td>
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<td>12572</td>
<td>52.8</td>
</tr>
</tbody>
</table>

Broward School District

The analysis of Broward school district includes 181 public schools, 48 charter schools and 46 magnet schools. Map 11 presents separate standard deviational ellipse for charter, magnet and public schools failing and meeting Adequate Yearly Progress – AYP - along with the ellipse for private schools.

Map 11. Standard deviational ellipse of failing and performing public, magnet and charter schools and private schools in the district.
The spread of the schools presented by the ellipses clearly show differences between performing and failing schools among magnet, charter and public schools. The distribution of failing and performing magnet and public schools does not appear too divergent, but the ellipses for public depart from the trends observed in charter, magnet and private schools. The distribution of magnet schools across the district appears to be the less scattered of all the schools, particularly for those that are underperforming.

It is interesting to observe that magnet and charter schools are tightly distributed in the center-east part of the district, leaving all the schools on the west part of districts without coverage. However, when we look at Map 12 we see evidence that the district is purposely placing schools of choice in disadvantaged communities, with high concentration of African American and Latino students and pockets of underperforming schools. Again, the equitable distribution of schooling does not always mean equal access across the area, but instead, targeted access for those that are truly struggling. This is not always the scenario observed in other districts included in the analysis, like Los Angeles, where charter and magnets are placed in communities with low minority populations, high proportions of performing public schools and ample access to and use of private schooling by white students.

However, Broward district has a critical number of schools underperforming for the school year 2009-2010. Among public schools, only 58 out of 181 schools are making Adequate Yearly Progress –AYP-, while only 14 out of 48 charter schools and 9 out of 46 magnet schools are doing so. If we take a closer look at the geographic distribution of failing and performing public schools as presented in map, schools meeting AYP show a nonrandom distribution across the district, located in the south-west, and along the west side of the district. Most public schools with the largest share of African American student population are not performing. But what makes the picture of the district really critical is the overwhelming proportion of schools of choice that are also failing. Regarding charter schools, it is observed in Map 15 most of the failing schools are located in census tract with a high share of African American, especially in the center and north part of the district. Regarding magnet schools, failing schools tend to have higher shares of African American students relative to performing magnet schools.

When we look at the racial composition of schools across the district in Map 13 through Map 16, there are specific areas where one group is more concentrated than others. For instance, schools on the west and northern part of the district are comprised of white and Latino students, while schools on the east-center of the district are schools that are almost entirely comprised of African American students.


Asian students are just a really small share in some schools of the south-west of the district. However as shown in Map 16, there are several private schools in the south and along the western side of the district where Asian students are a majority, or have a considerable presence. There is also presence of African Americans in the private school system, however, these are private schools comprised almost exclusively by African American students, again the center of the district.

As might be expected, white students have a large presence in the private school system throughout the district. However, in contrast with what is observed in other districts we will see later, the racial composition of private schools seems more aligned with the racial composition of the underlined census tracts. In other words, in areas that are predominately African American, the composition of private schools is also predominately African American. However, despite the high percentage of Latino/Hispanics in the district as in the entire state of Florida, there is a weak presence of Latino students in private school across the district.

LISA maps are very appropriate to show the inefficiency in the placement of schools of choice and with that, the unequal access to adequate alternative schooling. Map 17 and Map 18 presents the results of LISA analysis of the distance to the closest school of choice, using the criteria of 8 nearest schools to define the local neighbors for each school point. The emphasis on local clusters allow LISA maps to rule out observed patterns of disadvantage that seem significant and bring forward significant local clusters that are hard to observe given the large number of schools in each district.

In Map 17 and Map 18, red bullseye circle –buffer- around each school point indicate that the school is the center of a cluster of schools where distance to schools of choice is significantly higher –low accessibility-, while blue buffers indicate that the school is the center of a cluster of public schools where distance to schools of choice is significantly lower –high accessibility-. There is one purple buffer in the LISA map of charters accessibility, denoting the presence of an outlier school with a significantly lower distance to the nearest school of choice that is surrounded by schools with higher distances to schools of choice.
Map 17. LISA map of significant clusters of schools that are significantly distant—red ring buffers—or close—blue ring buffers—from a charter school.

Map 18. LISA map of significant clusters of schools that are significantly distant—red ring buffers—or close—blue ring buffers—from a magnet school.
When we observe both maps, we can see that clusters of low accessibility to magnet schools –high-high distance clusters, red bullseye- are concentrated in the eastern part of the district, while low accessibility to charter schools are more scattered throughout the north, east and center of the district. There are no significant clusters of high accessibility to magnet schools (low-low distance clusters, blue bullseye). In addition, issues of low accessibility for magnet schools, as evident by the significant LISA clusters of high-high distances –shown as red bullseye in the map-, can be observed for both performing public schools –schools represented by green dots are meeting AYP- and underperforming public schools –red school dots-. Although it would be ideal that underperforming or failing public schools are not statistically significantly distant from schools of choice, this scenario is not as concerning and critical as that observed for low accessibility to charter schools, whereby high-high distance significant public schools are almost exclusively observed for underperforming schools –represented again as red dots in the center of the bullseye-. 

Collectively, all the Broward school district maps present a segregated picture of racial/ethnic composition across schools in Broward district. It is observed that areas with a high share of African Americans are served by failing public schools. In addition, the schools of choice that should be in place to compensate or provide viable alternatives to failing public schools are also critically underperforming, rendering the resources and the efforts put into them ineffective.
City of Chicago School District

The analysis for the City of Chicago school district includes 322 public schools, 290 magnet schools and 30 charter schools. Map 19 describes the spread of the distribution of charter, magnet, public and private schools.

Map 19. Standard deviational ellipse of failing and performing public, magnet and charter schools and private schools in the district.

In the case of Chicago, charter schools display the less scattered distribution, with a compact ellipse t toward the center of the district. The rest of the ellipses display a fairly similar spread and direction in the distribution of school points.

Regarding the distribution of performing and failing schools, Map 20 displays the AYP status for charter, magnet and public school points. Similarly to what was observed in the previous school district in Florida (Broward), the number of performing schools is critically low, with only 39 out of 251 public schools meeting AYP. Even more dramatic are the numbers
observed for schools of choice, with 8 out of 30 charter schools are meeting AYP, and only 99 out of 290 magnet schools are making AYP. In contrast to the pattern observed in Broward County, the distribution of failing and performing schools appear to have an overall clustering in the center –mostly failing–, north – mostly performing- and south –mostly performing- parts of the district.

Map 21. Schools by number of years making AYP from 2004-2009.
Map 21 extends the visualization of school quality in Chicago, where the school points display the number of years meeting AYP from 2004 to 2009; a good complement to the cross-sectional data. Again, this map shows the clear geographic pattern of schools that have been consistently performing at least 5 of the 7 years, located mostly in the northern part of the district and to a lesser extent in the southern region of the district, with many of them located in census tracts with small shares of Hispanics and African Americans. Although some schools in African American and Hispanic neighborhoods are performing consistently across time, the number of public schools that met AYP only once, and even never during the last seven years, greatly exceeds the number of performing institutions. As it was mentioned in the literature, the compounding and cumulative effects of inequality across time create enduring effects on children's outcomes.

Given the marked geographic patterns of performing and failing schools in specific and broad areas of the district, it is important to examine whether this patterns are aligned with the minority composition of the schools. Map 22 (public), Map 23 (magnet), Map 24 (charter) and Map 25 (private) display the racial/ethnic composition of public, charter, magnet and private schools in the district. These maps show that there is a very segregated landscape of schools along racial ethnic lines, particularly for African American students. Although there are many schools where Latinos are virtually segregated from other groups, there are also a fair share of schools with a mixed of Latinos and White students. This is not the case for African American students which are distinctly segregated in schools mostly located in the center and south of the district and many of these schools are also failing to meet AYP.


The small population of Asian students is mostly enrolled in schools in the northern part of the district. In this area we can also find schools enrolling white students and for the most part these schools are performing well in the 2009-2010 school year.

Regarding charter schools, they are a much smaller in number than public and magnet schools and tend to be located in the center of the district and in tracts with high percentages of African American residents. However, these charter schools are underperforming, which is contrary to what is expected from schools of choice in an area where most public schools are failing. There is a small cluster of charter schools that are performing but they are located in the same area a similar number of public schools are also performing. Regarding the charter schools that are performing, there seems to be a spatial mismatch between the location of several charter schools and the actual need of alternative schooling for the public schools around them. However, this is not the case for magnet schools. There are many instances where performing magnet schools are located close to pockets of failing public schools. Moreover, the distribution of magnet schools is fairly broad across the district and despite the alarming number of failing magnet schools, it should be noted that performing magnet schools are overall fairly distributed across the district and reaching critical areas.

Map 26 and Map 27 show the results of the LISA analysis for the presence of significant local clusters of public schools with low accessibility –high distances to closest school of choice- and high accessibility –low distances to closest school of choice-, independently for charter and magnet alternatives. As described in Chapter Four, LISA allows us to identify a school point that is at the center of a cluster or hotspot - if the school is surrounded by other schools with similar values. It also allows us to identify outliers or coldspots. That is, if the school is surrounded by other schools with dissimilar values. These hotspots (high-high clusters) are displayed as a red bullseye or red buffer while the coldspots (low-low clusters) are displayed in blue. And the red and green points with or without a bullseye or buffer represent each of the public schools in the district that are failing and meeting AYP respectively.
Map 26. LISA Map of significant clusters of schools that are significantly distant –red ring buffers- or close –blue ring buffers- from a charter school.

Map 27. LISA Map of significant clusters of schools that are significantly distant –red ring buffers- or close –blue ring buffers- from a magnet school.
When looking at the LISA maps for both charter and magnet schools, it is evident that charter schools have lower geographic accessibility relative to magnet schools, as evident by the larger number of hotspots, or significant clusters of high distances to the nearest school of choice, as it is expected given the smaller number of charter schools mostly allocated in the center of the district. Low charter school accessibility hotspots are observed in the north, south and eastern part of the district as shown in Map 26. However, the area that is of greater concern is the southern part of the district where most of the significant hotspots are precisely for public schools that are underperforming, as represented by the red dots in the center of the bullseye. There is no discernible pattern of low charter school accessibility hotspots between low and high minority census tracts.

Chicago ISD has allocated resources to a substantial number of magnet schools, resulting in only a small number of low accessibility significant hotspots as observed in Map 27. There is a small group of low magnet school accessibility hotspots in the northern part of the district that are not a concern as it corresponds to performing public schools. Unfortunately, most of the low accessibility hotspots –clusters of public schools with high distances to magnet choice schools- coincide with public schools that are not meeting AYP, and therefore are underperforming. Again, this shows a spatial mismatch between failing public schools and schools of choice, leaving unresolved the educational disadvantages faced by students assigned to these failing schools.

**Clark County Public School District**

The analysis of Clark County, in the state of Nevada, includes 337 public schools and 13 charter schools. This is one of the smaller districts included in this analysis with the smallest number of charter schools. This prevents statistical clustering from being stable so the focus of this analysis is only exploratory.
Map 28. Standard deviational ellipse of failing and performing public and charter schools and private schools in the district.

Map 28 shows that the distribution of failing and performing public -red and green ellipses- and failing charter schools –pink ellipse- is very similar, with only private schools –blue ellipse- and performing charter schools –dark green ellipse- showing a very narrow distribution in the center of the district, although the ellipse of charter schools meeting AYP is based only on three schools. Again, the number of schools of choice in Clark ISD is quite small, but it is still surprising that less than a third of these are performing schools.

Map 29 shows a clear segregated distribution of Hispanic/Latino and African American students across schools in the East while White and Asian students attend schools in the West and South part of the district. Out of the 337 public schools, there are 121 schools or -35 percent
meeting AYP which are distributed in specific clusters across the district. Despite the evident geographic segregation of the schools enrolling mostly Whites and Asian from schools enrolling mostly Latino and African American, performing schools are equally observed across racial/ethnic lines. When looking at those public schools meeting AYP against the racial composition of the underlying census tracts, clusters of performing schools can be found more often in low minority census tracts—Hispanic/Latinos and African Americans—, and very few in tracts with high shares of African Americans.


Map 30 shows the geographic location, performing status and racial composition of the small share of charter schools in Clark county ISD. While Hispanics, Asians and Whites seem to be attending racially integrated charter schools, African Americans seem to be very segregated in the charter schools they are enrolled. It is also interesting to note that Whites are the majority group in the charter schools they are attending, despite being located in high minority census tracts. Only 3 out of 13 charter schools are meeting AYP, although two of these are catering to
African American students, which could be an example of school choice meeting its mandate of providing schooling opportunities for the most disadvantaged.

Conversely, looking at these two maps we can observed that in the southwestern region of the district there are a group of public schools enrolling mostly white students, located in low minority census tract and that are meeting AYP. Although this does not point to a critical area in

Map 30. Racial composition of charter schools.
need of alternative schooling opportunities for at risk students, one of the 13 charter schools was located here; instead, this choice should have been assigned to the north and eastern part of the district where many minority schools are failing to meet AYP.


It is worth noting that Clark has a robust number of private schools - 347 schools - whose distribution is displayed in Map 31. Virtually all these private schools enrolled White students even in geographic areas where the underlying census tracts are mostly Hispanic/Latino or African American, with the exception of 3 private schools enrolling exclusively African American and 3 schools enrolling exclusively Hispanic.
**Dade County School District**

Overall, Dade school district fares comparatively well in its attempts to provide schools of choice across the district. The analysis includes 350 public schools, 83 magnet schools and 118 charter schools.

Map 32. Standard deviational ellipse of failing and performing public, magnet and charter schools and private schools in -Dade county district.
Map 32 shows the directional distribution of charter, public, magnet and private schools that qualifies the spread of the location of schools across the district, which reveals that only underperforming charter schools and private schools follow a different distribution. The broader directional distribution ellipse observed for failing charter schools –pink ellipse- indicates that although charter schools are allocated throughout the district, charter schools in the northern and southern part of the district are mostly failing. Similarly, the distribution of private schools is spread throughout Dade County school district.

Map 33 shows the location of each public school and school of choice according to the AYP status. Dade County school district fares well in terms of allocation of schools of choice across the district, which is even the case for the performing magnet and charter schools that can be found across the area and across both low –white and lighter hues- and high minority census tracts - darker blue and tan hues-. However, the large number of failing magnet schools – represented as orange dots- in the northern part of the district raises concern, particularly when we observe also large patches –clusters- of failing public schools. This signals a spatial mismatch between failing public schools and viable magnet choice schools, in other words, despite the healthy presence of magnet schools in this northern part of the district, they do not constitute a way out of the subpar schooling offered by their failing public schools. However, it is encouraging to observe performing charter schools in this area and relatively close to both groups –clusters- of failing public and magnet schools.

This exemplifies the contribution of a geographical analysis of school outcomes in identifying issues for further exploration, which for Dade County would involve looking into individual charter and magnet schools in this northern area to explain why charters but not magnet schools are doing well.
Map 33. Adequate yearly progress of charter, magnet and public schools, 2009 -Dade county district.

Map 34 and Map 35 show the racial/ethnic composition of public schools and charter schools and Map 36 and Map 37 show the racial/ethnic composition of magnet schools and private schools. From these maps we can see that magnet schools and charter schools are located
in all areas of the district, but with an important degree of segregation resembling the racial and ethnic composition of the underlying census tracts. For example, charter schools have a higher proportion of Latino students compared to any other racial/ethnic group and magnet schools have a higher proportion of African American students.

When we look at the location and racial composition of private schools in Map 37, we see that private schools extend all along the district but the composition of the school varies throughout. As expected, the composition of private schools reflects the underlying composition of the communities they serve. In other words, in white communities we see private schools where the majority group is white students. And this trend is also observed for communities with higher percentages of Latino and African Americans. The small population of Asian students is also primarily enrolled in private schools in the district. In several census tracts where whites are a minority, as reflected by the percent of African Americans or Hispanic/Latinos in the tract, they have the highest share of enrollment in private schools in the area. This supports previous research which finds that white, high income parents "vote with their feet" by enrolling their children in private schools (Goldring & Hausman, 1999).

In Map 34, we can see that public schools in the northeast part of the district are mainly attended by Latino and white students and the majority are performing schools. There are no magnets in the area and only two charter schools (Map 35 and Map 36). However, when we take into account the performance of schools of choice, there is a change in the picture of accessibility. Out of the 118 charters in the district, only 18 passed AYP. Only one of the charters located in the northern part of the district, where African Americans represent the highest share of the student population, actually meets AYP. In addition, there are only a handful of charter schools accessible in terms of proximity to the communities in the northern part of the district, despite the fact that most of the public schools are failing. In addition, the few schools of choice that do appear in the area are failing except for one charter school, mostly located in the periphery of the area.
Map 34. Racial composition of public schools - Dade county district.

Map 35. Racial composition of charter schools – Dade county district.

Data sources: Department of Education, NCES Common Core Data, U.S. Census.
Map 36. Racial composition of magnet schools - Dade county district.

Regarding the magnet schools in this area (Map 36), we can examine the location of magnet schools relative to the location of failing public schools and find that magnet schools are located really close to the failing public schools. However, when we take into account their AYP status, it is concerning to observe that that most of them are also failing. Only 17 magnet schools out of 83 schools meet AYP requirements across the district, a higher proportion of failing schools relative to charters. And of these failing magnet schools, it is worth noting that those in the northern part of the district that are mostly catering to African American Students are virtually all but one failing to meet AYP, in contrast to the rest of the performing magnet schools enrolling mostly Latino students. Although we cannot rule out the possibility that these magnet schools are failing because they are enrolling students who have left the failing public school and that is why they are not meeting AYP standards.

At the southwestern side of the district, schools are predominately Latino. These tracts show a cluster of failing public schools in Map 34. When we turn our attention to the location, composition and performance status of charter schools in Map 35, we can observe that most of the small numbers of performing charter schools are located along the eastern side of the district where there are a robust number of performing public schools. This points to a mismatch between high quality charters and failing public schools, whereby, high quality charter schools are virtually absent from areas in the district with a high number of failing public schools –i.e. those located toward the center part of the district-.

In the south part of the district, where census tract have moderate percentage of African American and Hispanics, the majority of public schools are underperforming. Again, when we turn our attention to the schools of choice, which are supposedly designed to meet the shortcomings of the traditional public school system, it is worrisome to find most charter and magnet schools are also failing. Working under the assumption that there is equal access to schools of choice, they should be randomly distributed around public schools, and ideally, charter and magnet schools should have a higher presence around failing public schools, in other words, clustered around distressed neighborhoods lacking adequate schooling.

Map 38 (charter) and Map 39 (magnet) shifts to the results of the LISA analysis for the clustering of public schools with low and high accessibility to schools of choice, as measured by the distance to the nearest magnet and charter school.
Map 38. LISA map of significant clusters of schools that are significantly distant—red ring buffers—close—blue ring buffers— from a charter school—Dade county district.

Map 39. LISA map of significant clusters of schools that are significantly distant—red ring buffers—close—blue ring buffers— from a magnet school—Dade county district.
Low school choice accessibility hotspots are represented by the red bullseye around a school point, which indicates that a public school is at the center of a cluster –group- of schools with high distances to charter and magnet schools. The location of low school choice accessibility hotspots does not seem to align particularly with the underlying racial composition of the census tracts. Again, the focus should be on the statistical significant hotspots that correspond to failing public schools as can be observed in several areas of Dade County school district for both charter and magnet schools, as well as the coldspots –blue bullseye- that correspond to performing public schools –green dots-. Taken together, these hotspots and coldspots indicate that a spatial mismatch between schools of choice and public schools is also present in Dade County. All these observations should be place in perspective, where one underperforming school point or dot in the map actually represents many students lacking adequate schooling and an entire community within the school boundaries that are deprived from the academic and social benefits of good schools. Only after placing the output of the spatial analysis within the context of reality, we can grasp the implications of a spatial mismatch between high quality schools of choice and failing public schools for the life trajectories of entire communities.

**Fairfax County Public School District**

The analysis of Fairfax county public school district includes 108 traditional public schools and 68 magnet schools. Map 40 shows the standard deviation of the public and magnet school locations. Unlike the previous district (Dade), this map shows failing and performing public schools have a different distribution. While the distribution of public schools meeting AYP are concentrated in the center of the district, the distribution of the failing public schools are located toward the eastern part of the district which is precisely the area with the highest census tract percentage of Hispanic/Latinos and African Americans. Magnet schools on the other hand are more spread across the west and east part of the districts and are similar for both failing and performing schools.
Map 40. Standard deviational ellipse of failing and performing public, magnet and charter schools and private schools in the district.

Map 41 shows 46 out of 68 magnet schools are meeting AYP, which contrasts with many of the previous districts included in this analysis that have a higher number of schools of choice that are failing. A similar remark can be established for the public schools in the district, with 108 out of 131 schools meeting AYP. However, it is troublesome to observe that this small proportion of failing public and magnet schools are located for the most part in census tracts with
high percentages of African American and Latinos. This is unexpected, given that public failing schools are scattered around the district while failing magnet schools seem to be somewhat clustered.


Map 42 presents the distribution of schools across the districts according to the number of years making AYP between 2005-2009, with green points representing schools that are consistently performing, by meeting AYP between 5 to 7 years from 2004 to 2009, yellow points representing schools that have been performing between 3 to 4 years in the last 7 years, orange points only performing 1 or 2 times, and red points representing schools that are consistently
underperforming and have not met AYP at all since 2004. Again, this map shows that public schools that are failing most or all of the years are predominantly located in predominantly Hispanic census tracts.

Map 42. Schools by number of years making AYP from 2004-2009.

Map 43, Map 44 and Map 45 display the racial/ethnic composition and AYP status of private, public and magnet schools in the district, respectively. The overall racial composition appears to be balanced across schools, with a higher degree of racial integration than the previous school districts. However, there is a discernible geographical pattern where schools that are predominately white and with a moderate presence of Asian students are located in
clusters to the west and center part of the district, while schools with a higher share of minority students are located along the eastern part of the district.

Map 43 shows the distribution of private schools in the district, which are mostly enrolling White and Asian students even in areas where public and magnet schools are enrolling higher shares of Latino and African American students. Again, this is not an alarming observation given that public schools and schools of choice are actually being accessible by minority students.

Map 43. Racial composition of private schools.
Map 44. Racial composition of public schools – Fairfax county district.

Map 45. Racial composition of magnet schools – Fairfax county district.
Magnet schools which are also more integrated than what has been observed in previous school districts we have looked at so far follow a similar geographic distribution described above for public schools in terms of racial composition. It is quite remarkable that magnet schools are more likely to be located in areas where the underlying census tracts have higher percentages of Latinos or African Americans. This geographic accessibility remains even after observing the distribution of failing and performing public and magnet schools – schools meeting AYP are represented by a checkmark. Although visual inspection of these maps can elucidate areas where schools of choice could be allocated to meet the educational needs of the local communities, it is very encouraging to see an example where district wide patterns of inequality – in terms of the overrepresentation of failing schools serving minorities- and segregation - in terms of racial composition of the school/underlying neighborhood- are not present.

Map 46 presents the results of the LISA analysis and identifies hotspots of low accessibility along with the coldspots indicating high accessibility to schools of choice, as measured by the distance to the nearest magnet school. Low accessibility clusters are those school points surrounded by a red bullseye, and high accessibility clusters are those surrounded by a blue bullseye or buffer. Consistent with the previous maps, Fairfax does not have a critical outlook in terms of inequalities and accessibility to schools of choice, as the low accessibility significant hotspots actually correspond to performing schools – green points. Again, these hot and coldspots are those clusters of schools that are identified as statistically significant by the LISA routine.
Map 46. LISA map of significant clusters of schools that are significantly distant –red ring buffers– or close –blue ring buffers– from a magnet –right map– school. Fairfax county district.
Houston Independent School District

The analysis of Houston ISD includes 268 public schools and 24 charter schools. Map 47 shows the distribution of both failing and performing public and charter schools, with most of them displaying a similar direction of spread, with the exception of failing charter schools that seem to be narrower and along the center of the district. Map 48 shows the location of public and charter schools along with their AYP status.

Map 47. Standard deviational ellipse of failing and performing public, charter schools and private schools – Houston ISD.
Similar to what was observed for Fairfax ISD, schools the majority of both public and charter schools are performing, with 218 out of 268 public schools meeting AYP for the year 2009 and 17 out 24 charter schools doing so too. The location of the failing public and charter schools does not appear to be related to the underlying census tract racial composition.

Map 48. Adequate yearly progress of magnet and public schools, 2009 – Houston ISD.
Map 49 and Map 50 presents the location, racial composition and performance status of public and charter schools in Houston ISD, respectively while Map 51 presents the location and composition of private schools. Public schools are mostly enrolling African American and Hispanic/Latino students, which are not integrated across the district, with very marked geographic distributions. Toward the west part of the district we can observe schools with a small share of White and Asian students.

Of particular interest when observing and comparing both Map 49 and Map 50 is the location of failing charter schools near performing public schools. This runs against the logic that schools of choice are supposed to be put in place to compensate for the shortcomings of public schools. Moreover, despite the fact that schools in Houston ISD do not display a pervasive system-wide pattern of unequal access to schools of choice, there is room for improvement in localized cases where charter schools have been placed in areas with a healthy amount of performing public schools, instead of some areas where the local public school is not meeting AYP. It is also worth noting that charter schools enroll nearly only Hispanic/Latinos and African-American students, with the exception of three schools that also have a very small share of Asian students, one school with around 40% White students and another school with a small share to the west.

Conversely, the racial composition of private schools presented in Map 51 indicates a very segregated picture, where mostly white students are enrolled, and with a couple of exceptions, private schools enrolling African American or Hispanics have virtually no white enrollment. In the south and northeastern part of the district there is a strong African American private school enrollment, which is unexpected given that in this same area; public schools have a substantial share of Latino students.
Map 49. Racial composition of public schools– Houston ISD.

Map 50. Racial composition of charter schools – Houston ISD.
Map 51. Racial composition of private school – Houston ISD.

Map 52 presents the LISA clusters of low and high accessibility to schools of choice that for Houston ISD refers only to charter schools. Similar to what was observed for Fairfax district, there is no relationship between the low accessibility hotspots – as indicated by the high-high distances to charter schools and represented by a red bullseye around the school- and the performance of public schools. Again, this indicates that schools of choice are well distributed in the district and that overall, the district proportion of performing schools is robust.
Map 52. LISA map of significant clusters of schools that are significantly distant –red ring buffers– or close –blue ring buffers– from a charter school –Houston ISD.
Los Angeles Unified School District

The analysis of Los Angeles unified school district includes 575 public schools, 136 magnet schools and 151 charter schools. The standard deviational ellipses shown in Map 53 shows the location of failing and performing charter schools follow a different distribution.

Map 53. Standard deviational ellipse of failing and performing public, magnet and charter schools and private schools in the district – Los Angeles unified school district.
This indicates that charter schools –dark green representing performing schools and pink for failing schools-, particularly those that are meeting AYP are not as spread as public schools and raises a red flag in terms of charter schools being accessible from all areas in the district. The ellipses for magnet schools –orange for failing schools and light green for performing schools- show a distribution that is less compact than charter schools, but again, it does not extend to the northern part of the district where census tract indicate a strong presence of African American students.

Turning the attention to the output presented in Map 54 the number of failing public schools in Los Angeles is a major concern, with more than half of the public schools failing AYP in 2009 -371 out of 575 schools-. Major investments and efforts have been put in place by the district to address the issue. Despite the significant number of underperforming schools, there is no major overall clustering of failing and achieving schools across particular areas of the district as has been the case in many other districts included in the analysis. In addition, efforts to provide choice to families attending and living around underperforming schools have resulted in a healthy number of charter and magnet schools located all over the district, and in an efficient manner. Despite this positive outlook, a closer examination of the spatial distribution of failing and performing public, magnet and charter schools reveal areas of concern, where only 64 out 151 charters are making AYP, and only 41 out of 136 magnet schools doing so.

Map 55 shifts the attention to the racial composition of public schools. This map shows that in the center part of the district, where the underlying census tracts have high percentages of African Americans, public schools are generally not meeting AYP. However, looking at the map of charter schools shown in Map 56 indicates that a robust number of performing charter schools are located right where they are needed.
However, this is not the case for magnet schools in this area with most of those schools not meeting AYP requirements, as is shown in Map 57. In the north, east and south areas of the district there is a mixed performance of public schools and overall underperformance of schools of choice with local pockets of magnets and charter schools in these areas are performing well. For instance, in the east and center part of the district where there is a pocket of public schools
failing AYP, magnet schools are not only present, but also performing well. This is an example of schools of choice meeting the goal of providing a relief for communities where public schools are not working.

Map 57. Racial composition of magnet schools - Los Angeles unified school district.

Conversely, in the west side of Los Angeles, conformed mostly of low minority census tract, a fairly good number of charter and magnet schools have been placed in areas where public schools, also with low minority census tracts and high white student enrollment, are meeting
AYP. This might indicate an apparent mismatch whereby schools of choice are assigned to areas that are not requiring alternative schooling options, but further analysis involving multiple years are needed to discern whether this just indicates that the presence of schools of choice have led to public school improvement.


When the attention is shifted to private schools as presented in Map 58 it is evident that the racial composition of these schools – mostly white students- is remarkably different from the racial composition of public schools across the district – mostly Latino. There are pockets of white private schools particularly along the west and north part of the district and a smaller area
in the south, where the surrounding communities are predominately Latinos. In other words, the level of segregation in the district is not negligible. Moreover, the high enrollment of white students in private schools suggests they are not as affected by failing public schools as African-Americans and Latino students.

Despite evident efforts in Los Angeles Unified school district to provide access to schools of choice throughout the district, and the fairly adequate allocation of charter and magnet schools nearby high minority schools and neighborhoods, the district still fall short in terms of productivity. In other words, the overwhelmingly high number of failing public, charter and magnet, greatly impact the efficacy of school choice accessibility. This is problematic as minority students are the ones more affected by underperforming schools and less likely to attend private schools, while white students have access not only to private schools as an alternative to the public system, but also to performing public schools and charter and magnet schools in the area.

Therefore, we can speak of a spatial mismatch between high minority, failing public schools and high quality schools of choice also for the Los Angeles Unified district. It would be ideal and even expected, that the number of underperforming schools of choice would be virtually nonexistent. And when that is not the case as in this district, the small share of high quality schools should be spatially aligned with failing public schools, particularly in low minority communities where white and Asian students are clearly making use of private schools.

Asian students, which constitute a minority across public schools in the district, are mostly enrolled in private schools Map 58 shows two localized pockets of predominantly Asian private schools in census tract with high percent of Latinos and African American.

Finally, Map 59 and Map 60 show the results of the LISA analysis for low and high accessibility clusters, as measured by the distance to the nearest charter and magnet school. Contrasting the results for Fairfax or Houston, there are clusters of low accessibility to schools of choice—symbolized as schools point with a red bullseye that are the center of a high-high distance cluster-that correspond to public schools that are failing AYP.
Map 59. LISA Map of Significant Clusters of Schools that are Significantly Distant – red ring buffers or Close – blue ring buffers from a Charter school – Los Angeles unified school district.

Map 60. LISA Map of Significant Clusters of Schools that are Significantly Distant – red ring buffers or Close – blue ring buffers from a Magnet school – Los Angeles unified school district.
City of New York School District

Map 61. Standard deviational ellipse of failing and performing public, magnet and charter schools and private schools in the district.

The analysis of New city of New York school district includes 1368 public schools, 82 charter schools and 141 magnet schools. Map 61 shows the standard deviational ellipses for public, charter and magnet schools, which show seemingly different geographic spread, with the distribution of charter failing schools more condensed and toward the Bronx and Manhattan Borough—boundaries outlined in pink and purple, respectively. Magnet schools also display distinct distributions for failing and performing schools, the former showing schools spread toward the southern part of Brooklyn borough (boundaries outlined in green).

Map 62 shows the location of public schools and schools of choice across the different boroughs in New York city school district, with failing magnet –orange dots- and public –red dots, located mostly within the Bronx and Brooklyn Boroughs. New York City district presents
a very positive picture with most public schools, 844 out of 1368- meeting AYP for the year 2009 and the majority of schools of choice also performing well. For instance, 78 out of 141 magnet schools are meeting AYP.

Map 63, Map 64, Map 65 and Map 66 show the racial composition and AYP status of public schools across the Bronx, Brooklyn, Manhattan and Queens Boroughs in the school district, respectively. Map 69, Map 70, Map 67, and Map 68 presents the racial composition and AYP status of schools of choice across the Bronx, Brooklyn, Manhattan and Queens, respectively.

When looking at schools in Queens Borough (Map 66 and Map 68), it can be observed that schools are visibly segregated with schools enrolling mostly African American along the eastern part of the borough, while Hispanic/Latino students are enrolled in schools toward the west and center of the borough and are more integrated in schools with modest enrollment shares of Asian and White students. Some schools in the north part of the borough have higher enrollment share of Asian students and are performing schools or the most part. And White students are barely present in schools in the borough, in schools located in the center. Schools of choice can be found mostly along the west and north and have a presence of African American, Asian and Latino students, and to a lesser extent White students, although they are more heavily located in areas with underlying high minority tracts -as evidenced by the tract percent of African Americans and Latinos-. Interestingly, in the western part of the borough there is a group of schools of choice nearby failing public schools that, although it should not be the case, are also underperforming schools, which calls into question the benefit of these choice schools. When looking at the location and racial composition of private schools shown in Map 74 it is evident that White students are opting to enroll in private schools more so than in public schools. Private schools in the eastern part of the borough mirror the racial composition of the underlying census tract -with high percentages of African American.
Map 63. Racial composition of public schools in the borough of Bronx.

Map 64. Racial composition of public schools in the borough Brooklyn.
Map 65. Racial composition of public schools in the borough of Manhattan.

Map 66. Racial composition of public schools in the borough of Queens.
Shifting the attention to schools in the Brooklyn borough (Map 64, Map 68 and Map 72), it is apparent that schools in the borough are enrolling mostly African American students, and that schools mirror the underlying racial segregation of the neighborhoods as represented by the census tract percent of Latino and African Americans. The racial composition of the schools follow a clear pattern across the borough, with schools enrolling mostly Asian and White students along the south part of the borough, and schools enrolling mostly Latino and African American along the eastern part of the borough. A more segregated picture can be observed from the distribution and racial composition of private schools, with mostly White schools in the southwest part of the borough and mostly African American schools along the north east. In some cases, schools with mostly white enrollment can be found in census tracts with high percentages of African Americans, possibly signaling parents’ preference for private schooling as the minority composition of the neighborhood increases. However, the spatial patterns of performance of public and choice schools do not appear to be related to the patterns of racial composition of the school.

Looking at the borough of Bronx (Map 63, Map 67 and Map 71) the racial composition of the schools leans heavily toward Hispanic/Latino students, with varying shares of African American students and very little presence of White or Asian students. Although most schools have a balanced share of Latino and African American students, there is a pocket of schools in the northern part of the borough that are highly segregated enrolling mostly African American students. Schools of choice in this borough are roughly concentrated in the western part of the borough and are for the most part underperforming schools, which contrasts with other boroughs where magnet and charter schools are performing better, and is an indication of the relevance of local disaggregated geographical analysis of schooling outcomes. Although there are areas with virtually no presence of schools of choice like the center part of the borough, it is evident that the focus of the district is on redistributed educational equity, in other words, in locating schools where they are needed, which is not the case for this area where most public schools are performing well. Looking at private schools, they are found in the north west part of the borough where there is little presence of public schools and mostly enrolling white students, that were virtually absent from public schools.

Map 68. Racial composition of schools of choice-charter and magnet- in the borough Brooklyn.

Map 69. Racial Composition of Schools of Choice- Charter and Magnet- in the borough of Manhattan.

Map 70. Racial Composition of Schools of Choice- Charter and Magnet- in the borough of Queens.
For the borough of Manhattan (Map 65, Map 69 and Map 73), we see that the racial composition of the schools is mostly Latino and White students, with a modest presence of African American in schools located in the center part of the island. Schools of choice are located mostly on the center and north parts of the borough and are being utilized mostly by African American, which is encouraging. However, most of these schools of choice are underperforming, calling into question the usefulness of diverting students to alternative schooling options that still do not address their educational needs. In census tracts with very low presence of minorities, public schools are for the most part performing well which explains the absence of schools of choice in the area. Private schools as it has been the case in all the boroughs of the district, are being used mostly by White families, even in areas where nearby public schools have high shares of Hispanic/Latino enrollment.

Lastly, Map 75 and Map 76 show the result of the LISA analysis for significant spatial clusters of high (coldspots) and low accessibility (hotspots) to schools of choice, as measured by the distance to the nearest charter or magnet school, respectively. For the case of the City of New York school district, we can observe how some significant hotspots—red bullseye around a school point—correspond to failing public schools in some areas and performing schools in others. Therefore, students in failing public schools in New York City district have similar accessibility to charter and magnet schools as those attending performing public schools. Recall that if there is a significant relation between the failing status of a public school and the higher distance to schools of choice, schools of choice would be fostering existing inequalities for disadvantage students while taking resources from their already strained failing public schools. In this district, however, the share of spatial mismatch between failing schools and high quality schools of choice is not as large as concerning as in other districts. Still, the map outputs presented here allow isolating areas in need of attention, like the south part of the district, where there is a hotspot of low accessibility to charter schools despite the robust number of public schools failing to meet AYP, or the eastern part of the district where there is a hotspot of low accessibility to magnet schools.
Map 71. Racial composition private schools in the borough of Bronx.

Map 72. Racial composition of private schools in the borough Brooklyn.

Map 73. Racial composition of private schools in the borough of Manhattan.

Map 74. Racial composition of private schools in the borough of Queens.
Map 75. LISA map of significant clusters of schools that are significantly distant—red ring buffers—or close—blue ring buffers—from a charter school—city of New York school district.

Map 76. LISA map of significant clusters of schools that are significantly distant—red ring buffers—or close—blue ring buffers—from a magnet school—city of New York school district.
Philadelphia Independent School District

The analysis of Philadelphia school district includes 249 public schools and 25 magnet schools. Map 77 shows the standard deviational ellipse of magnet, public and private schools and Map 78 shows the distribution of each public and magnet school along with their AYP status for 2009. It is worth noting that the spread of the distribution of magnet schools, both failing and performing, are distinct from public schools and do not extend toward the northern part of the district where there is a strong presence of African Americans, according to the tract percent of these areas. There are a large number of underperforming public schools, with only 100 out of 249 meeting AYP with no discernible geographic pattern, or alignment with the minority composition of the underlying census tracts. Although this indicates a critical situation for children in this district, on a more positive note, most magnet schools are meeting AYP, 16 out of 25, located randomly around performing and failing public schools.

Map 79 shows the public schools in the district according to the number of years meeting AYP since 2004. It is somewhat comforting to see that, despite the large number of failing schools in 2009, the number of schools persistently failing across time is much smaller. The location of consistently performing schools meeting AYP 5 years or more over the past 10 years—represented as green large dots—does not relate to the underlying tract percentage of African Americans, and can be found throughout the district, but we can identify specific areas of the district where they appear to be concentrated. Map 80, Map 81, and Map 82 show the racial composition of each public, magnet and private school in the district, respectively. Public schools mirror the racial segregation of the underlying census tract, with only schools in the northern and southeastern part of the district that are located in low minority tracts showing modest racial integration, with presence of White students and very small presence of Asian students. However, it is encouraging to observe that the distribution of performing public schools is not related to the level of segregation of schools, which indicates that minority students have similar access to performing public schools as White students.
Map 77. Standard deviational ellipse of failing and performing public, magnet and private schools in the district – Philadelphia city school district.

Map 79. Public schools in Philadelphia city SD by number of years meeting AYP between 2004-2010.

When looking at the distribution and racial composition of private schools in Map 82, we observed, as expected, that it mirrors the levels of segregation of the underlying neighborhood as measured by the percent minority in the census tract. It is interesting to note that unlike what was observed in other districts, African American students are enrolling in private schools as much as White students. Also, unlike other districts where private schools have high enrollment of white students even when nearby public schools are mostly minority schools, in Philadelphia City SD, private school white enrollment in high minority census tract is virtually absent, signaling the high levels of residential segregation, where white families are likely not present in these neighborhoods.

Map 82. Racial composition of private schools.

When we look at the output of the LISA cluster analysis of high and low accessibility to magnet schools presented in Map 83, we can observe that the hotspots of low accessibility to magnet school—as symbolized by school points with a red bullseye around—are not systematically related to low performing schools. Still, close inspection to the maps presented here can provide insight about pockets of failing schools that are in need of attention.
Map 83. LISA map of significant clusters of schools that are significantly distant –red ring buffers– or close –blue ring buffers– from a magnet school.
Chapter Seven:  
Using GWR to Explore Place-Specific Associations with Accessibility to Schools of Choice

In this section I present a summary of the GWR analysis which seeks to assess whether the association between our outcome variable, accessibility to schools of choice measured by the distance of any given public school to the nearby magnet or charter school and socioeconomic and racial/ethnic covariates changes across geographic areas. In other words, GWR allows the identification of the varying nature of the effect of minority and poverty composition of the school on school choice accessibility, and identify what areas depart from the overall trend captured by the global OLS regression.

As explained previously in Chapter Four, the geographical weighted regression is based on a given bandwidth and kernel. Akaike Information Criterion -AICc- was used to determine the optimal bandwidth of the model, which seeks a distance between two observations –schools points- that will minimize the loss of information. An adaptive kernel was also chosen for this analysis, as it is more appropriate than a fixed kernel in cases where locations –schools- are more sparse in some parts of the country while closer together in other regions, which is accomplished by specifying a number of nearest school points than ensures a constant size of local samples used in each local regression. The geographically weighted regression was run in GWR 3.0 software, and for ease of presentation and analysis, the output table with the local parameter estimates, t-values, R2, and residuals were imported into ArcGIS 10.0 through a spatial join routine. The resulting map of school points was interpolated using an ordinary Kriging routine using ArcGIS 10.0 Geostatistical Analyst to obtain a smoothed value surface. In addition, the t-values were corrected to account for the multiple testing of local regressions, using a B-H adjustment, which are mapped and included with each of the covariates to identify the areas where the coefficients were non-significant.

Descriptive Statistics and Global OLS Results

Table 3 presents summary statistics for the analysis. The mean school level percent of African Americans is 20%, while for Latinos is 15%, although the standard deviation of African Americans is considerably higher than that of Latinos/Hispanics. The mean percent of vacant units, which is a proxy for poverty, in the census tract is 19%. On average 11 percent of Title I schools, which are receiving funds for their low-income student population, are labeled as schools in Need of Improvement.
Table 3. Descriptive statistics for the variables included in the GWR model of Accessibility to schools of choice across U.S. public schools.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std.Dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>School % African American</td>
<td>75857</td>
<td>20.00</td>
<td>40.00</td>
<td>0.00</td>
<td>100.00</td>
</tr>
<tr>
<td>School % Hispanic</td>
<td>75857</td>
<td>15.69</td>
<td>24.07</td>
<td>0.00</td>
<td>100.00</td>
</tr>
<tr>
<td>Census Tract % Vacant</td>
<td>75857</td>
<td>19.04</td>
<td>25.45</td>
<td>0.00</td>
<td>100.00</td>
</tr>
<tr>
<td>School % Free Reduced Lunch</td>
<td>75857</td>
<td>50.58</td>
<td>26.45</td>
<td>0.07</td>
<td>99.89</td>
</tr>
<tr>
<td>SINI -School in Need of Improvement Status</td>
<td>75857</td>
<td>10.52</td>
<td>8.32</td>
<td>0.00</td>
<td>100.00</td>
</tr>
<tr>
<td>Distance to nearest magnet (mi)</td>
<td>75857</td>
<td>13.56</td>
<td>18.56</td>
<td>0.00</td>
<td>226.43</td>
</tr>
</tbody>
</table>

Table 4 provides the results from the global OLS model and the GWR model. The coefficients for tract level poverty, school level poverty and failing school status –SINI- are all positive and significant, indicating that as these three variables increase, distance to schools of choice also increase, in other words, these schools are less likely to be located near charter or magnet schools.

Table 4. Comparison of Global Regression and GWR Estimates and Diagnostics for Distance to Schools of Choice.

<table>
<thead>
<tr>
<th></th>
<th>Global OLS Estimate</th>
<th>GWR parameter estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>8.843***</td>
<td>-1.334 - 33.517</td>
</tr>
<tr>
<td>Census Tract Ave. Percent Vacant Units</td>
<td>0.469***</td>
<td>-0.313 - 1.855</td>
</tr>
<tr>
<td>School Percent Free-reduced Lunch</td>
<td>0.176***</td>
<td>-0.092 - 0.688</td>
</tr>
<tr>
<td>SINI -School in Need of Improvement-</td>
<td>0.936***</td>
<td>-17.057 - 30.652</td>
</tr>
<tr>
<td>School Percent African American</td>
<td>-0.275***</td>
<td>-1.930 - 0.053</td>
</tr>
<tr>
<td>School Percent Hispanic/Latino</td>
<td>-0.254***</td>
<td>-2.179 - 0.138</td>
</tr>
<tr>
<td>Diagnostic information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual sum of squares</td>
<td>21057133.412</td>
<td>12161911.607</td>
</tr>
<tr>
<td>Effective number of parameters</td>
<td>6.000</td>
<td>283.629</td>
</tr>
<tr>
<td>Sigma</td>
<td>16.423</td>
<td>12.504</td>
</tr>
<tr>
<td>Akaike Information Criterion –AICc-</td>
<td>658584.949</td>
<td>616285.110</td>
</tr>
<tr>
<td>Coefficient of Determination</td>
<td>0.209</td>
<td>0.543</td>
</tr>
<tr>
<td>Adjusted r-square</td>
<td>0.209</td>
<td>0.541</td>
</tr>
</tbody>
</table>

Note: *** Significant at 0.001 level.
On the other hand, the racial and ethnic composition variables appear as having a negative and significant association, indicating that high minority schools are not a disadvantaged in terms of proximity to schools of choice relative to White or Asian students.

The model explains 20 percent of the total variance (R-square = .209), while the GWR model reports a pseudo-R2 of 54, although these two measures are not directly comparable given that pseudo-R squares are derived through maximum likelihood procedures. Of greater relevance is the AIC (Akaike Information Criterion), a measure of relative goodness of fit that focus on minimizing information loss (Brunsdon et al., 1998; Kuha, 2004). As discussed by Burnham and Anderson, the AIC values are not interpretable as they depend on sample size and arbitrary constant, and thus we just focus in observing the model with the lowest AIC as it indicates an improvement over the alternative model. The AIC reported in the table (AIC = 616285.11) suggests that GWR is a better model specification to account for the geographical variability of distances to schools of choice among public schools than a standard Global OLS (AIC = 658584.949) regression approach (Burnham & Anderson, 2004).

**GWR Results**

Map 84. GWR standard residual surface.
Map 84 displays the surface of estimated GWR residuals. Overall, there appear to be areas of over prediction (low residuals in blue hues) and under prediction (high residuals in orange hues) across all the country.

Map 85 shows the local R-square values for all the schools in the U.S. included in the study, which ranges from 0.13 to 0.75. As discussed in the methods chapter, the R² values indicate how well the local regression model fits the outcome, which can range between 0 and 1, with values closer to zero indicating a lower fit of our model for that specific area. In other words, those areas that appear in darker orange hues indicate that the model is a better fit to explain the school choice accessibility dependent variable as measured by the distance to the closest charter or magnet school. The model does not fit well the schools located in Wyoming and the surrounding states, which is to expect given the scarcity of schools of choice implemented in these areas relative to the Midwest, the south and the East coast.

Map 85. GWR local R2 surface.

There are other pockets of low local R² values even in areas with a high rate of school choice adoption, which may benefit from further research incorporating additional covariates that could account for these variations in accessibility of schools of choice. Local R-square values
are particularly low in Arizona, California, Arkansas, Louisiana, Mississippi, Alabama, Georgia and the Carolinas.

Table 5. Summary of local parameter-estimate results for the relationship between distance to nearest school of choice and each of the key covariates.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Minimum</th>
<th>Lower Quartile</th>
<th>Median Quartile</th>
<th>Upper Quartile</th>
<th>Maximum</th>
<th>P-Value</th>
<th>Non-stationarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-1.33</td>
<td>4.82</td>
<td>7.00</td>
<td>9.34</td>
<td>33.52</td>
<td>0.000</td>
<td>Yes</td>
</tr>
<tr>
<td>Census Tract % Vacant</td>
<td>0.31</td>
<td>0.18</td>
<td>0.33</td>
<td>0.58</td>
<td>1.86</td>
<td>0.000</td>
<td>Yes</td>
</tr>
<tr>
<td>School % Free Reduced Lunch</td>
<td>0.92</td>
<td>0.16</td>
<td>0.79</td>
<td>0.21</td>
<td>0.69</td>
<td>0.000</td>
<td>Yes</td>
</tr>
<tr>
<td>SINI - School in Need of Improvement Status</td>
<td>-17.57</td>
<td>-1.23</td>
<td>0.11</td>
<td>0.60</td>
<td>30.65</td>
<td>0.000</td>
<td>Yes</td>
</tr>
<tr>
<td>School % African American</td>
<td>-1.93</td>
<td>0.38</td>
<td>0.22</td>
<td>0.10</td>
<td>0.53</td>
<td>0.000</td>
<td>Yes</td>
</tr>
<tr>
<td>School % Hispanic</td>
<td>-2.18</td>
<td>0.33</td>
<td>0.16</td>
<td>0.61</td>
<td>0.14</td>
<td>0.000</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Local values of R2 can be used to assess informally the goodness of fit of the model. However, GWR also provides a Monte Carlo test of significance to assess the spatial variability of each parameter. The results of Table 5 confirm that the effect of proxy indicators for neighborhood poverty (percent vacant in the census tract), school poverty (percent students eligible for free or reduced lunch), and school racial composition (percent African American and percent Hispanic) on school choice accessibility vary significantly over the country. This is shown on the last column called non-stationarity, which is based on the Monte Carlo test for spatial variability reported in the GWR model output with non-stationary variables reported as significant. In addition, the performance or quality of the school as measured with the very astringent criteria of high poverty -Title I- schools that are already identified for improvement for at least two consecutive years also varies considerably across the country.

Table 6 shows the ANOVA output for the GWR and global OLS model, which tests whether the GWR model offers an improvement over the ordinary global OLS regression model. As the F-value for the test suggest, the GWR model made significantly better predictions over the global model at the 0.00 level of significance.
Table 6. ANOVA test for GWR against the global OLS model.

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>DF</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLS Residuals</td>
<td>21057133</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GWR Improvement</td>
<td>8895222</td>
<td>277.63</td>
<td>32039.9903</td>
<td></td>
</tr>
<tr>
<td>GWR Residuals</td>
<td>12161911</td>
<td>77790.37</td>
<td>156.3421</td>
<td>204.9351</td>
</tr>
</tbody>
</table>

Map 86 also shows the spatial distribution of intercept estimates obtained from the GWR model. Smaller intercepts are seen mostly toward the east and west coast indicating schools in these geographic areas start off with smaller distances to schools of choice relative to those in the Midwest and the Plains and parts of the south. At the bottom of Map 86 the associated BH adjusted significance is presented. Again, pseudo t-values are obtained from each local GWR parameter estimate by dividing the parameter by its corresponding standard error. Given that we are making thousands of significance test, the usual t statistic critical values of +1.96 or 2.58 are not appropriate and a Benjamini-Hochberg (B-H) adjustment was calculated and then mapped. White areas in the B-H significance map indicate non-significant GWR local parameters and black areas indicate significant local parameters, which is a pseudo p-value that takes into account the multiple testing that occurs which showing that the small negative intercept area is non-significant and can be dismissed from further analysis (Thissen et al., 2002). For Map 86, there are three smaller areas of non-significant intercepts in Arizona, California and Texas.
Map 86. GWR local intercept coefficient surface (top) and BH adjusted significance (only black dots are significant).

Map 87 to Map 91 display the spatial distribution of local parameter estimates for each independent variable in the geographically weighted regression model, along with the significance map derived from the H-B adjusted pseudo p-values.
Map 87. Local GWR coefficient surface for school choice accessibility: school % Hispanic/Latino (top) and BH adjusted significance (only black dots are significant).
The statistical association between the school level percent Latino and the distance to schools of choice is indeed spatially non-stationary as can be confirmed in 61, ranging from
negative (-2.18) to positive values (0.14). The BH significance map output indicates that almost all the coefficient surface is significant.

For most states the coefficient surface indicates public schools with higher share of Hispanic/Latino enrollment are associated with higher school choice accessibility (given by the negative sign of the local coefficients). This is particularly stronger for schools in the Midwest, South and some parts of the Great Plains.

It is also interesting that states with high Latino student population such Arizona, New Mexico and Texas have smaller coefficients closer to zero. It is unexpected to see positive GWR local coefficients –in yellow- along California and part of Texas and New Mexico, which signal schools with high Latino enrollment and low accessibility to schools of choice.

This is an example of the advantage of GWR local models over global OLS model, whereas the OLS coefficient reports an overall significant negative coefficient, mapping the GWR local coefficient shows areas this association is reversed and that are masked in the global parameter estimate. Similar trends can be observed for the GWR local coefficient surface of the African American school percent presented in Map 88, where schools with higher percentages of African Americans are overall associated with lower distances to schools of choice. However, there are variations across the country, and schools along California, Florida, and most of the eastern part of the country and part of Michigan display more modest relationships.

Map 89 presents the coefficient surface for the School in Need of Improvement Status, which shows the greatest spatial non-stationarity across schools, with areas displaying a positive relationship with school choice accessibility and areas displaying the opposite trend. Areas in orange hues indicated that SINI schools –schools failing AYP for at least two years- are more likely to have low accessibility –greater distances- to schools of choice. Surface areas in blue hues indicate that failing schools are more likely to be close to schools of choice. Therefore, the focus of attention should be on the Orange areas, along the Midwest, Arizona, New Mexico, Louisiana where children that are currently experiencing subpar schooling are also less likely to have access to a magnet or charter schools. As it has been mentioned before, this is a very conservative indicator, as it is measuring failing schools using the SINI status provided by the NCES, that is assigned to low performing schools only after they have failed to meet AYP for at least two consecutive years, and only for schools that are receiving title I funds, that is, that are schools catering to low income students.
Map 89. Local GWR coefficient surface for school choice accessibility: School in need of improvement status (top) and BH adjusted significance (only black dots are significant).
Map 90. Local GWR coefficient surface for school choice accessibility: School % free/reduced lunch (top) and BH adjusted significance (only black dots are significant).

Map 90 presents the local coefficient surface for the measure of school poverty as measured by the percent of students receiving free or reduced lunch. There is also wide variability of the local coefficients that range from positive to negative values. Orange surface areas indicate a positive association between percent poverty in the school and high distances, that is, low accessibility to schools of choice. However, there are some areas in California,
Nevada, Idaho and part of Texas where the higher the poverty in the school the closer they are to schools of choice, which is the desirable outcome.

Map 91. Local GWR coefficient surface for school choice accessibility: census tract % vacant units (top) and BH adjusted significance (only black dots are significant).

Map 91 shows the map of the local coefficient surfaces for the neighborhood poverty composition as represented by the census tract percent of vacant units. For the most part, there is a positive relationship between distance to nearby magnet or charter schools and percent vacant units in census tract, indicating a low school choice accessibility for schools located in deprived areas. In other words, as neighborhood poverty increases, so does distance to schools of choice. The stronger relationship can be observed for the schools along parts of the Midwest, particularly
Nebraska, Arkansas and Oklahoma, and part of Texas. There is also a pocket where the relationship is reversed between North Carolina and Tennessee, which warrants further detailed analysis.

The analysis presented in this section reveal that the association between school choice accessibility and the social composition of schools and the underlying neighborhoods has a significant and substantive spatial component. GWR constitutes an improvement over traditional OLS global models for the analysis of access to schools of choice. The use of a local regression model allows observing whether there is significant non-stationarity between dependent and independent variables, and in doing so, it depicts how such relationships play out in specific geographic areas. In addition, the school level scope presented here provided a broader picture of school choice accessibility across different parts of the country that would have not been obtained through individual level analyses.

Results from the AICc, ANOVA and Monte Carlo tests indicate that GWR provides a significantly better fit over OLS regression to model accessibility to schools of choice, by allowing the regression coefficients to vary locally. Results point that neighborhood poverty -as proxied by census tract data-, school racial and poverty composition and school quality -captured through a conservative measure of schools identified as in need of improvement for at least 2 years- are associated with the distance to the nearest magnet or charter school.

Thus, as Graif and Sampson concluded through their GWR analysis of homicide rates in Chicago, neighborhoods -and schools- can and do "interact with the spatial geography of the city" (Graif & Sampson, 2009). This study follows their call for analysis of social processes that take into account the local variation that will better reflect the "highly diversified and spatially stratified urban scene" that is otherwise masked by global averages. In addition, both the GWR method and the extensive map output obtained in the course of this research constitute a valuable tool to inform educational agencies. As Qui and Wu conclude in their study of ACT scores, GWR analyses allows to identify key factors and their geographic variation, which can be used by policy makers to allocate education resources or design and implement education policies based on the particular needs of schools and districts (Qiu & Wu, 2011).
Chapter Eight: Discussion and Conclusion

Over the past few decades, numerous policies and programs have been implemented to lessen educational disparities and improve schooling for all students. However, racial minority students continue to be overrepresented in underperforming public schools and the achievement gap between minority and white non-Hispanic students remains substantial (Clotfelter et al., 2006; Glick & Hohmann-marriott, 2007; Lankford, Loeb & Wyckoff, 2002; Liu, 2006; Lleras & Rangel, 2009; Pong & Hao, 2007; Quillian, 2012; Saporito & Sohoni, 2007; Velez & Saenz, 2001). One source of educational inequality has been the confinement of poor, minority students in low income neighborhoods that are required to enroll in public school according to their residential address. Thus, school choice has become one of the most prominent solutions to disrupt barriers to quality education placed by residential race and class segregation. While those in favor of school choice policies believe they will result in a reduction of the achievement gap, higher levels of parent satisfaction, better fit between curriculum and students' strength and interests, and higher quality induced by competition among choice and public schools; critics see schools of choice as an additional burden on already strained school district budgets, a potential way out for families that have better social and economic capital to make use of such alternatives, and an additional venue to further racial segregation and social inequalities.

Utilizing a spatial analytic framework this study set out to contribute to the school choice debate by examining the availability or access to high quality schools of choice available to students in a given school district and whether this varies according to racial and ethnic composition. This study extended spatial mismatch theory to examine whether the geographic location of the rapidly growing number of charter and magnet schools across districts correspond to both the location of failing public schools and high minority neighborhoods. The description and analysis of the spatial distribution of public schools and schools of choice in this study also draw from the notions of social isolation and racial segregation developed by Massey and Denton (1993, 1988) and (Wilson, 1997). Unique to this study was the inclusion of both, a disaggregated spatial analysis of the correspondence between schools of choice and failing public schools and a country level analysis of the distribution and accessibility of schools of choice. The analysis involved a local exploratory spatial analysis of individual schools in 9 of the largest school districts across the country, as well as a countrywide spatial regression analysis of the accessibility to schools of choice and its association with the characteristics of the public
schools. It is a fair claim that analysis based solely on achievement standards might yield an incomplete or even misleading picture of school performance, particularly for those targeting other goals beside test scores (Imberman, 2011). With that in mind, this study included the location, racial composition and performance status of both choice schools and public schools.

Overall, this study demonstrated that far too many students across the different districts, particularly minority students, are attending failing public schools. Even more critical is the larger than anticipated number of these failing public schools that are located farther away from schools of choice, a scenario that in many instances become more precarious once the focus shifts to accessibility to performing or high quality schools of choice. Although the spatial arrangement of school inequalities varies between the 9 school districts included in the analysis, clusters of failing public schools are consistently observed in all districts. Despite the apparent ubiquitous presence of schools of choice across all districts, a closer look at those charter and magnet schools that are performing—meeting AYP—shows a spatial mismatch between minority and underperforming public schools and schools of choice, particularly charter schools. This goes against the belief and expectation that schools of choice are a viable alternative for students enrolled in failing regular public schools.

The spatial mismatch between performing schools of choice and the failing public schools that in theory they should be supporting, creates an additional burden for parents that are already dealing with time and financial constraints. In this case, schools of choice become an added layer of inequality, especially for low income, racially segregated families, that are likely at a disadvantage in their ability to turn the social capital accrued in their neighborhood, into information of and opportunities for quality schooling. Parents do value the level of quality when choosing schools for their children, but issues like safety, time, distance, school peers are more pressing concerns that take a higher precedence in their decision making process (Quane & Wilson, 2011).

The local level analysis discussed in the previous chapter allows to compare and establish what districts—or other geographic areas—are doing a better job at placing schools of choice where needed. For instance, some boroughs in the district of the City of New York, Los Angeles and Broward have managed to place schools of choice across all areas of the district, regardless of racial composition of the neighborhood and schools and close to failing public schools. However, there is still room for improvement as many of these alternative schools are not
performing well. Fairfax, New York -particularly Queens and Manhattan- and Houston ISD are examples of school districts where a healthy number of both public schools and schools of choice are performing.

The results from the GWR regression analysis confirm the importance of explicit spatial analytic frameworks when looking at schools of choice outcomes that are so strongly related to location. This is evident in the statistical significance of the Monte Carlo test for the spatial non-stationarity between distance to the nearest magnet and charter school and the school and neighborhood factors. The GWR analysis finds support for the role of neighborhood poverty (census tract data), school racial and poverty composition and school quality -captured through a conservative measure of schools identified as in need of improvement for at least 2 years- are associated with the distance to the nearest magnet or charter school. More importantly, although minority, poor and SINI schools are related to shorter distances to schools of choice in many areas of the country, a relationship captured by the negative significant OLS coefficient, when I mapped the GWR local coefficients I was able to identify geographic areas where this association is reversed –and thus masked in the global OLS parameter estimate.

Taken together, when considering schools of choice against notions of allocation and productivity, or accessibility and quality, results point to wide variation within districts indicating that quick and broad statements of schools of choice as a policy success or failure are unfounded, inaccurate and do not move the debate forward. In some districts like Los Angeles, Broward and New York, school of choice are being better allocated across the district, rendering efforts more effective as families’ transactional cost to find, consider and use schools of choice are fairly distributed over space, and students are more likely to nurture a predisposition to learn, achieve and attain adequate schooling. In other districts, like Fairfax Philadelphia and Houston, a healthy proportion of schools of choice that are performing is observed, despite a substantial proportion of failing public schools, which is an indication that the diverted resources are indeed being allocated to alternative quality schooling.

A more complicated picture emerged when looking at both accessibility and quality simultaneously, as some of the districts that are faring well in terms of allocation, have a concerning number of failing schools of choice –not meeting AYP- and conversely, some districts with a good outlook in terms of productivity of schools of choice, fell short in terms of accessibility for failing or high minority –often both – public schools. And yet, other districts
like Chicago, Broward and Dade, have an unexpectedly high number of failing schools of choice, with the small set of high quality charter or magnet schools more likely to be found around low minority census tract, low minority schools or performing public schools.

Based on the analysis, I argue that both location and distance play a role in defining how accessible high quality schools of choice are for disadvantaged students, and consequently in identifying schools of choice as agents of segregation or educational opportunity. Therefore, research on the productivity of schools of choice—with a focus on achievement gains vs. public schools—should be complemented by studies on accessibility to schools of choice. More importantly, the spatial variation of school choice accessibility across districts speaks about the need for contextually based research. This study highlights the need to pay attention to the location of schools of choice. It is not possible to assess whether is worthy to divert resources from failing public schools into schools of choice, if no attention is given to where they are located. Performing magnet and charter schools would not make an impact if they are placed far from areas where children are at the highest disadvantage, as it is case for schools of choice in Chicago, Dade and Philadelphia, as supported by results of the LISA statistical analysis. Nevertheless, there are many instances across the 9 districts discussed in this study, where schools of choice are compensating for the shortcomings of failing public schools, which speaks about the potential of choice policies to be beneficial for disadvantaged families.

In sum, it is imperative that the creation and location of schools of choice mirror the location of failing public schools, regardless of race or social composition of the community. It is also necessary to monitor charter and magnet schools on a regular basis, to ensure that the geographic accessibility to schools of choice equals true accessibility to quality schooling. In addition, policies should make provisions to support existing and newly created schools of choice so that the alarming number of failing charter and magnet schools described in this study can be reduced. It runs against common sense to divert resources away from failing and strained public schools to charter and magnet schools that are equally failing. Finally it is worth noting that the fair allocation of schooling opportunities is not adequately captured through the use of conventional statistical models. The statistical significance should not be the sole standard to design or evaluate school choice policy, given the geographic nature of schooling outcomes and the spatial and geographic barriers families encounter in accessing and choosing schools. Traditional non-spatial modeling frameworks should be complemented with visualization and
spatial analysis that allow the identification of which schools are working, as well as where they are working. On a similar note, greater importance should be given to collection of educational data for private schools and schools of choice to allow continuous monitoring of performance and accessibility, and standardization of data reporting of public school data across school districts.

**Limitations and Future Research**

As it is the case with most spatially framed research, the present study has a cross-sectional design, and as such it cannot determine causality from the results, nor can it assess how actual student flows to and from schools of choice. This study is also limited by the use of standard, single indicators of school choice quality as well as by the available census information on neighborhood social characteristics. Similarly, the data that is available might not be completely free of aggregation bias or missing data issues with regards to the measures provided by the NCES and the Census Bureau. The focus on spatial processes also prevent the present study from capturing the characteristics of actual neighborhoods, as it is limited to the existent digital geography of the school districts, and census blocks –as the smallest geographic scale available for these type of analysis. The emphasis of this dissertation on within and between school district spatial inequalities imposes limits on the depth and complexity of the analysis. There are many potential key factors that were not addressed in this study, such as teacher quality, curriculum processes, funding, or school climate.

There are other forms of school choice that are out of the scope of this study. Future research could focus on the contribution of open enrollment and school vouchers as initiatives that improve access to quality schooling for at-risk children. They require local studies since these forms of school choice are not generally implemented across districts. Future research is also needed to complement the assessment of school choice and educational inequalities by including a temporal component. The results presented in these chapters is contained within a cross-sectional approach, and analysis across years is a logical next step to see whether the deficiencies identified in school choice accessibility are compounded by time spells. Also, further analysis is needed on the spatial analysis of schools of choice across districts by school characteristics, given that other non-spatial studies have found support for the role of charter school characteristics on outcomes (Hill & Welsch, 2009). Other potential variables to complement the present analysis of school choice accessibility include school district and
neighborhood characteristics such as levels of human, social and cultural capital, school and district revenue, urban density, or crime. For instance, Ni (2009) pointed out that more than half of Michigan's charter schools are located in urban centers like Detroit, where public schools have lost about a fifth of the students to schools of choice amounting to over $260 million in revenue. In contrast, suburban public schools have not been subject of such intense pressures from school choice competition.

Self-selection of students might impact the overall school and district level patterns of racial composition and school performance. However, the emphasis of the present analysis was not to assess individual gains in achievement or factors behind family's decision to choose a charter or magnet schools. Rather, the main task of this study was to take a step back and assess whether choice schools are actually allocated to the areas that they should be targeting: public underperforming schools in minority neighborhoods where families are less likely to have the financial and social capital resources to enroll in good schools either private or public. Finally, the present study was limited to compare GWR with OLS regression in exploring the spatial dynamics of school choice in the U.S. Using other regression models was out of the scope of the present analysis given that the focus was to show the better fit of GWR as a local spatial method compared to a global approach under the critical presence of non-stationarity in racial composition and performance across schools in the U.S.
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Appendix A: Glossary

Local Educational Agencies (LEAs). Usually referred to as school districts. LEAs are government agencies that oversee the provision of educational services to communities.

No Child Left Behind (NCLB). The No Child Left Behind Act of 2001, enacted during President George W. Bush. It introduced standardized testing and the establishment of AYP to monitor schools and LEAs. It requires states to set mandatory standards and accountability toward the 2014 goal of 100% math and reading proficiency.

AYP. The NCLB law requires all states to assess “adequate yearly progress” (AYP) for school districts and schools that receive Title I federal funds and accomplish the goal of all students reaching the proficient level on reading/language arts and mathematics tests by 2014. Each state must define minimum levels of improvement as measured by standardized tests chosen by the state. AYP measures not only overall achievement but also achievement of students of different subgroups such as major ethnic/racial groups, economically disadvantaged students, limited English proficient (LEP) students and students with disabilities. If a school fails to meet AYP for two consecutive years, the school is designated as in need of improvement and the local district must offer public school choice to students.

Title I. A Federal program that provides funds to school districts and schools with a high number of high percentages of children who are economically disadvantaged.

ESDA. - Exploratory Spatial Data Analysis- Set of techniques aiming at describing and visualizing spatial distributions, at identifying atypical localizations or spatial outliers, at detecting patterns of spatial association, clusters or hot spots, and at suggesting spatial regimes or other forms of spatial heterogeneity.

Shapefile. One of the most common file formats for a vector geographic dataset, including a location component and an attribute set for each observation.