

The Power of Policy Defaults: A Behavioral Economics View of Public School Assignment Policies & Educational Equity

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I. Abstract

The school assignment process plays a central role in shaping a student's educational experience, which subsequently influences his or her future opportunities. Thus, school assignment policies have an impact on social equity. Over the past seventy years, public school district assignment policies have undergone significant change as a result of evolving national attitudes towards segregation, legal changes stemming from Supreme Court rulings, and the growing popularity of parental choice. Though school assignment policies are constantly evolving, some consideration of area of residence has always played a role in the process. Given the equity implications of school assignments, it is important to recognize that the design of an assignment policy plays a critical role in determining the pattern of outcomes generated.

My goal in this thesis is to examine the structure of school assignment policies using the lens of behavioral economics. Behavioral economics highlights the importance of the system designated outcome, commonly known as the "default" option, in complex decision making environments. Specifically, I examine the type of default school assignment during three distinct assignment policy years within the Charlotte-Mecklenburg School District. I hypothesize that as the default school assignment becomes more dependent on residential proximity, that is, the neighborhood school 1) the demographic similarities between schools and their surrounding neighborhoods will increase at the district-level with 2) the greatest increases in the most segregated neighborhoods, and 3) that levels of racial imbalance across district schools and racial isolation within schools will increase. A test of these hypotheses using school-level racial data from the second largest school district in North Carolina, Charlotte-Mecklenburg, strongly supports my theoretical predictions.

II. Background

A Brief History of School Assignments and Choice in America

Public school districts traditionally determined school assignments based entirely on a student's area of residence. Though parents often lacked formal channels to express their preferences for which school their child should attend, families could always indirectly influence school assignments by choosing where to live. As a result, exercising choice of residence became a mechanism through which families could obtain an assignment to their preferred schools. However, not all households have an equal capacity to exercise this type of informal, residence-based choice due to financial constraints. In the context of school assignments, I define inequity as unequal access or opportunities to attend quality schools. This inequity is exacerbated by the fact that neighborhoods containing top performing schools also tend to have the highest cost of housing (Figlio & Lucas, 2002). As a result, obtaining a preferred school assignment through residential choice became a tool reserved for families who had the financial means to translate their preferences into a reality (Moe, 2002). Many higher income families could also opt to send their children to costly private schools.

For districts comprised of racially and socioeconomically mixed neighborhoods, the use of residence to determine school assignment is not inherently problematic. However, when neighborhoods themselves are segregated, residence-based assignment contributes to a sorting of economically advantaged children into the best schools and low income children into low performing schools. Thus the traditional school assignment system perpetuated a large variance in school quality within districts that were homes to heterogeneous populations. Breaking the link between school assignments and a family's area of residence may seem like a clear-cut mechanism to remedy inequitable access to quality schools. I broadly characterize formal school choice within public school assignments as policies that

provide parents with opportunities to send their child to a school outside their immediate neighborhood, in effect decoupling assignments and residence. Formal choice can be particularly beneficial to low income students by giving them access to higher performing schools located in neighborhoods they cannot afford to live in. However, assignment policies that allow parents to exercise formal choice have had a controversial past.

Districts introduced school choice in response to the historic 1954 *Brown vs Board of Education* Supreme Court ruling that ended *de jure* segregation in public schools (Schneider et al., 2000). Districts implemented open enrollment policies that allowed students to attend any school within a district instead of the student's neighborhood school. In the South, white parents utilized open enrollment as a tool to avoid the desegregation by transferring their children out of schools in racially changing or mixed neighborhoods (Rossell & Glenn, 1988). In the 1960's, the introduction of school choice policies served to obstruct instead of enhance racial integration and social equity goals. As a result, districts reverted to mandatory assignment policies and promoted racial balance by creating attendance zones that paired non-contiguous, racially polar neighborhoods (Rossell & Glenn, 1988). Beginning in the 1970's however, attitudes evolved and districts began to view parental choice as a tool to promote social equity and integration. Districts introduced magnet schools as an alternative to mandatory assignments that voluntarily reduced racial imbalance (Blank, 1990; Bifulco, Ladd, & Ross, 2009). In recent decades, districts have experimented with different forms of choice, including charter schools and voucher programs. A few districts have even placed formal limits on the degree of racial imbalance permitted in schools. However, a 2007 Supreme Court ruling (*Parents Involved in Community Schools vs Seattle School District*) now prohibits school districts from using the race of individual students as a factor in the assignment process.

Making the Link: How School Assignments Affect Equity

School assignment policies impact educational equity by influencing the distribution of students across schools and the composition of individual schools. In the absence of formal choice, the criteria or structure used to determine mandatory assignments can generate highly segregated or relatively balanced schools.

The racial composition of a school affects student achievement via two primary mechanisms: teacher sorting and the peer effect. Teacher sorting refers to the pattern of high quality teachers opting to work in low poverty, typically white schools, leaving students in high poverty, typically minority schools taught disproportionately by lower quality teachers (Ladd, 2008; Jackson, 2009). Researchers find that highly qualified teachers tend to move out of schools with increasing shares of black enrollment and into schools with smaller minority enrollments (Boyd et al., 2005; Jackson, 2008). These patterns have disproportionately negative consequences for students attending high minority schools because poor teacher credentials and inexperience have a negative causal impact on student achievement (Clotfelter, Ladd, & Vigdor, 2005). Clearly, patterns of teacher sorting contribute to the inequitable wedge between the educational achievement of students attending primarily white schools and students attending heavily minority schools.

The second mechanism, the peer effect, indicates that classroom composition, which is often closely related to school composition, has a significant spillover effect on the educational achievement of an individual student (Zimmer & Toma, 1999). Numerous studies suggests that attending a school with high performing peers, typically advantaged students, can improve the educational achievement of disadvantaged students without adversely affecting the achievement of other students (Hanushek et al., 2003; Cooley, 2006; Ding & Lehrer, 2007; Hoxby, 2000). In the opposite direction, attending a school with high concentrations of minorities has a strong negative effect on the achievement of minority

students within the school (Hanushek, Kain & Rivkin, 2004). The combination of these findings suggests that creating racial and socioeconomically balanced schools can improve social equity.

III. Overview of the Behavioral Economics Framework

Applying Behavioral Economics to School Assignment

General Overview: How Behavioral Economics Compares to Traditional Economics

Behavioral economics can provide a useful lens through which to examine the individual and district-level outcomes generated by school assignment policies. Discerning the differences between traditional and behavioral economics is necessary to understand when the latter can provide additional insight to the former. Most traditional economic models operate under the key assumptions of perfect rationality, perfect information, and perfect competition (Camerer et al., 2003). The rational actor paradigm assumes that when making decisions people have complete information, a computer-like capacity to evaluate all available options, and always act to maximize their self-interest (Camerer et al., 2003; Simon, 1955). Furthermore, the most traditional economic models assume decision making is uninfluenced by the environment and the addition or removal of sub-optimal alternatives (Samuelson & Zeckhauser, 1988).

Behavioral economics draws on insights from psychology to provide a richer picture of the cognitive and environmental influences on the decision making process. Behavioral economics suggests that in certain decision environments, human behavior systematically deviates from theoretical economic assumptions. That is, actors behave “boundedly rational” by making choices that fail to maximize their self-interest. Bounded rationality suggests that there are limits, or bounds, in people’s capacity to gather all the decision-relevant information and subsequently compute the tradeoffs

between all available options in order to make the “optimal” decision. Though traditional economics views the availability of more options as singularly positive, experimental research has shown that too many options disrupts the “rational” decision making process (Iyengar & Lepper, 2000). As the complexity of a decision increases, people rely more heavily on mental heuristics or shortcuts to simplify the decision making process (Samuelson & Zeckhauser, 1988). The use of heuristics prevents people from considering all the available information or assessing all the tradeoffs, which contradicts the assumptions of the rational man paradigm (Tversky & Kahneman, 1974; Kahn & Baron 1995). Consider this simple example: when shopping for laundry detergent in a store, consumers are faced with an enormous amount of options. Instead of computing the tradeoffs between price, ingredients, smell, or cleaning power of each detergent as theorized by traditional economics, people tend to use the recognition heuristic (Goldstein and Gigerenzer, 2002) and select the option most familiar to them.

School Assignment Environment Ideal for Behavioral Economics Study

Behavioral economics is most insightful when applied to fields with highly complex decision environments, such as personal finance or medicine. When faced with complexity, humans are more prone to engage in boundedly rational decision making. When picking a school for their children, parents must make a decision in an equally complex choice environment. Parents must not only mentally evaluate an abundance of options, but also weigh an array of considerations, such as academic performance, location, racial balance, and teacher quality. Furthermore, the time commitment and effort required to gather the amount of information needed to create informed preferences can be very high. These conditions will likely induce many parents to bypass the resource consuming process of “rationally” evaluating all the options and instead use mental shortcuts. The complexity of the choice environment increases the likelihood of parents behaving boundedly rational, which suggests school choice is a ripe field for study through the lens of behavioral economics.

The Behavioral Economics Paradigm of Default

The specific application of behavioral economics within this paper centers on the importance of the policy default. In the design of a policy, the default is the system's pre-designated decision. The type of policy default strongly influences outcomes in two major ways. Most directly, the default wholly determines the outcome when there are no avenues to exercise choice. Defaults also influence outcomes in situations where uncertainty and the cost of making a decision are high, and thus dissuade individuals from actively making a choice. When individuals fail to choose, they are automatically assigned to the default decision pre-specified by the policy.

Traditional economic models assume that the designation of defaults is unimportant because rational people will always actively make a decision and opt-out of the default if it is truly sub-optimal. However, behavioral economics suggests that because of bounded rationality, complex decisions often result in indecision or poor decisions (Samuelson & Zeckhauser, 1988). As previously discussed, the number and diversity of available options represents the primary source of complexity within the school choice environment. In complex situations, individuals do not actively make decisions and instead passively live by the defaults chosen by others (Beshears et al., 2006). Experimental evidence suggests that even when faced with major decisions, such as enrolling in a pension plan (Sethi-Iyengar et al., 2004) or taking a loan (Bertrand et al., 2006), the difficulty of choosing between many options induces individuals to refrain from participating, procrastinate (Tversky and Shafir 1992), or keep doing what they are doing (Heiner 1983). The human tendency to avoid making a decision or simply choose what one already knows is referred to as the status quo bias. When actors succumb to the status quo bias, in effect failing to choose, the type of policy default matters because the default now wholly determines the outcome (Camerer et al., 2003).

The design of the default can have a profound impact on program outcomes. To illustrate, consider the simple but powerful example of the importance of the default within the context of organ donation. Johnson and Goldstein (2003) showed that the proportion of people with organ donor status in countries where everyone is a donor by default and those who wish to abstain must “opt out” is 90%. In contrast, the proportion of people with organ donor status in countries where the default is that everyone is a non-donor (must opt-in) is below 20% (Johnson & Goldstein,2003). Clearly, people are far less likely to actively opt-out than traditional economic models would assume. In some instances, simply changing the default can generate a completely different outcome.

Implications of Home-School Defaults on Low Income Families

In the context of school assignment, the design of a policy defaults represents both a major opportunity and challenge for policy makers. Given people’s tendency to engage in the status quo bias or fail to opt-out of a sub-optimal default, policy defaults can essentially decide student assignments even when choice is available. Given the link between school assignments and equity, it is important that the default not adversely affect disadvantaged families. Research indicates that low income households face higher time and resource costs when making complex decisions (Winter et al., 2006; Bertrand et al. 2006; Duflo et al., 2006). Furthermore, low income households face structural disadvantages in gathering information because they have lower quality networks to compile information on education choices (Schneider et al., 1997). Due to the intrinsic complexity of choosing schools, researchers argue that low income parents exhibit the strongest tendency to make ill-informed decisions (Schneider & Buckley, 2002). Research has shown that low income families are less likely to commit the time or resources needed to full evaluate all the options (Sawady & Tescher, 2008; Teske & Schneider, 2001). Thus low income families are most at the mercy of the designated default and also the least likely to opt-out of a sub-optimal default assignment.

The behavioral economics view suggests the type of default designed by school districts plays an important role in determining the equity of school assignments. The default within traditional school assignment policies is the neighborhood school. Not all neighborhood schools are equal, however, because the worst schools tend to be located in the poorest neighborhoods. This type of default disadvantages low income families because it places the largest burden of action on the families who most benefit from opting out of their default assignment. In contrast, privileged families can obtain a quality school assignment without taking any action by virtue of living in the neighborhood. Such a policy creates a safety net for wealthy families who are already better positioned to navigate the complexity of the assignment process. Thus, default assignments determined the neighborhood school can generate outcomes that worsen educational inequity.

IV. Case Study: Charlotte-Mecklenburg

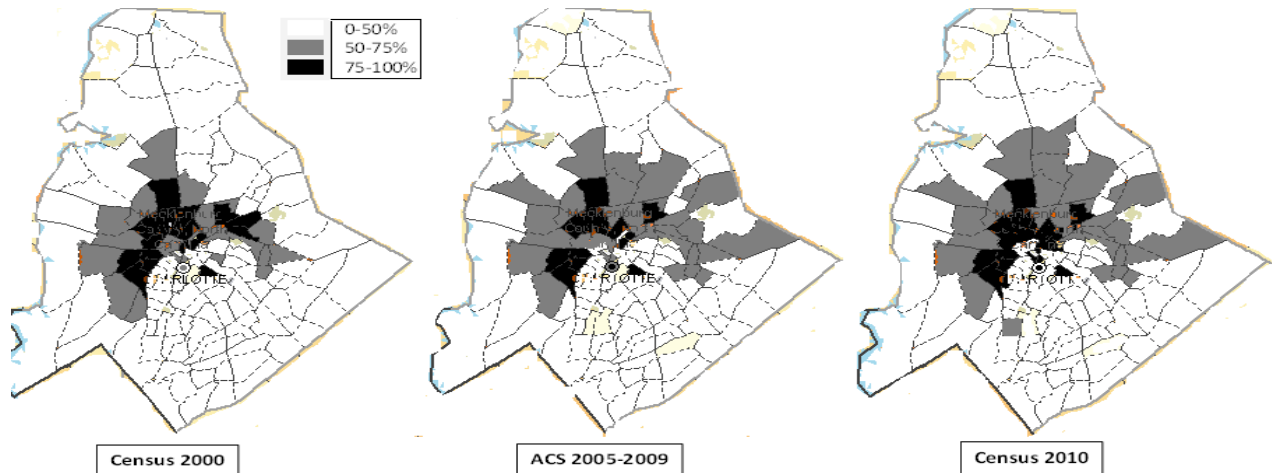
All policies operate within a structure, or set of rules. Thus a policy's structure influences the type of outcomes it generates. An analysis of the school assignment environment through the lens of behavioral economics suggests that the default assignment is an important structural component. I assert that examining the type of default assignment can provide valuable insight into the types of student distribution outcomes generated by the policy. This paper uses the Charlotte-Mecklenburg Public School District (CMS) as a case study to examine the relationship between the default assignment and the racial distribution of students in the district. I selected CMS for study because the district employed three distinct types of assignment policies within the last decade, making it both timely and relevant. In the following section, I outline the assignment policies in place during each of the three periods and then analyze the student-level and district-level implications of the default from the angle of behavioral economics. I then present the rationale, approach, and hypothesis for the subsequent

empirical examination of the relationship between defaults and the racial distribution of students across schools.

General Background on Charlotte-Mecklenburg

The Charlotte-Mecklenburg School District is the second largest district in North Carolina with over 140,000 students enrolled in 2011 (CMS, 2012). Mecklenburg County's population of over 900,000 consists of roughly 55% Whites, 31% Blacks, and 12% Hispanics (US Census Bureau, 2010). Despite the changing demographic composition of the area, the county remains highly residentially segregated by race (Leibowitz & Page, 2011; Richards, 2002). African-American families are particularly residentially concentrated. Black families represent over 75% of the population of many inner city census tracts, as seen in Figure 1 below. For racially mixed neighborhoods, using residence to determine the default school assignment is not inherently problematic. However, in counties such as Charlotte-Mecklenburg, where residential segregation is pervasive, the use of residence-based default assignments can lead to highly segregated schools.

Figure 1. Mecklenburg County Percent Black Composition By Census Tract^{1,2}



¹ Data Sources: The 2000 Census, 2005-2009 American Community Survey, and 2010 Census as viewed on Social Explorer

² The figure depicts the percent of individuals who are Black within each census tract of Mecklenburg County

CMS Assignment Policies: Prior to 2001

From 1970 to 2002, the Charlotte Mecklenburg public school district operated under a court-mandated racial desegregation order (Hastings et al., 2006 & 2006a). During this period, CMS used a mandatory assignment policy for all students that was based on residence, but not the neighborhood school. Formal choice was limited and magnet schools were the only option for students who wished to opt-out of their default assignments. Assignment to these elective schools was through a separate process. To achieve racial balance in schools, CMS used race-based busing and deliberately created assignment zones that paired non-contiguous black and white residential neighborhoods (Hastings et al., 2006).

Of the three policy periods, the default school assignment during the era of mandatory desegregation was least linked to a student's neighborhood school and thus most likely to generate racial balance at the district level and equal access to quality schools at the student level. Due to the district's policy of pairing of non-contiguous neighborhoods, the "default" school assignment was not determined by proximity to a school. The design of the default deliberately mitigated segregation and thus disadvantaged families did not carry the burden of avoiding highly segregated schools. Even schools in the wealthiest neighborhoods enrolled students from low income neighborhoods. As a result, the likelihood of obtaining a default assignment to a quality school was relatively equal for most students. At the district level, decoupling default assignments from neighborhood schools likely contributed to more racially balanced schools. Despite the fact that formal choice was limited to magnet schools, the default during the desegregation era had positive implications for both student-level equity and district racial balance.

CMS Assignment Policies 2002-2005

In 2001, a US Circuit Court of Appeals declared CMS “unitary” and ordered CMS to dismantle its race-based bussing policies, meaning the district could no longer strategically draw assignment boundaries based on the racial composition of residential neighborhoods (Hastings et al., 2006). To comply with the court order, CMS undertook a major redistricting of attendance zones. The district was split into four choice zones and each student was assigned and guaranteed a spot at the “home school” directly within his or her neighborhood. Approximately 50% of students were assigned to a different home school than they would have attended under the bussing system (Hastings et al., 2006). For the 2002-2003 school year, CMS implemented a district-wide formal choice plan (Hastings, Van Weelden, & Weinstein, 2007). Parents were asked to submit their top three school preferences and assignments to oversubscribed schools were determined by a lottery. A student whose home school was oversubscribed automatically bypassed the lottery because of the homeschool guarantee. For students applying to attend non-home schools, the lottery system was based on the follow priority order: 1) students who attended the school in the previous year 2) free-lunch eligible (FLE) students applying to a school where less than 50% of students were eligible for free lunches and 3) students applying to schools within their choice zone (Hastings et al., 2006). Children who did not receive any of their three preferences were automatically assigned to their respective “home schools”.

Under this choice policy, the neighborhood school default assignment somewhat favors wealthier families and likely results in increased segregation at the district level. By automatically assigning students to the neighborhood school, the default placed low-income and minority students at a relative disadvantage. The default placed the burden of “opting out” on families who faced the highest cost of exercising choice but stood to gain the most from avoiding their default schools. Given the policy guarantee of a spot in one’s “home school,” wealthy typically white families could do nothing and

automatically receive an assignment to one of the district's better schools. In contrast, disadvantaged, usually minority, families needed to submit strategic preferences and participate in the lottery due to the poor quality of their default assignment. As previously discussed, behavioral economics suggests low income, minority families are less likely to actively choose or choose well. At the district level, moving to a neighborhood school default will result in an increase in the number of racially polarized schools. However, because parents had formal avenues to opt-out of the default assignment and some would likely exercise choice, the magnitude of the increase in racial imbalance across schools is likely smaller than it would have been without formal choice.

CMS Assignment Policies: 2006-Present

In response to excessive demand for certain schools and in the interest of minimizing parental discontent, CMS changed its choice policies again in 2006. For the 2006-2007 school year, only magnet schools and schools with a non-zero probability of assignment were offered under the limited choice plan³ (Hastings, Van Weelden, & Weinstein, 2007). From 2009 onwards, CMS further limited the scope of parental choice by restricting it to magnet and specialized schools. As a result of these changes, CMS used mandatory assignments based on neighborhood schools for nearly all its students. Unlike the CMS desegregation era during which residence determined assignment but not always to the closest school, the current policy directly links school assignment with the nearest neighborhood school. Additionally, unlike the formal choice era, assignments are mandatory with extremely limited options to "opt-out."

The default within the current CMS policy is a combination of the most inequitable aspects of the previous two policies. The current default assignment is completely tied to neighborhood schools and thus has the most unfavorable implications for both equity at the individual level and racial balance

³ Non-zero probability of assignment refers to schools that historically did not fill all their spaces with guaranteed home school students alone

at the district level. First, the default assignment is directly linked to the neighborhood school which could create a sorting effect of white schools in wealthier neighborhoods and minority schools in poorer neighborhoods. Second, the policy of eliminating choice for non-magnet/non-specialized schools consequently eliminates most opportunities for disadvantaged families to opt-out of the default and send their kids to better schools. By designating an inequitable default and limiting opportunities to opt-out of it, the current CMS assignment policy contributes to what are likely the highest levels of segregation across district schools of all three years.

V. Empirical Analysis

Approach & Hypothesis

The previous section examines CMS assignment policy defaults from the micro, student-level perspective and the macro, district-level perspective. Ideally, one could examine the assignment outcomes and demographic characteristics of each student in the district in each year to directly examine the effect of the default on individual outcomes⁴. However, in the absence of student-specific assignment data, I will focus on the macro, district-level implications of the default. I examine trends in the levels of racial imbalance and isolation across the entire district as the policy default changes. As the default school assignment becomes more dependent on residential proximity (ie the neighborhood school), I hypothesize that 1) the demographic similarities between schools and their surrounding neighborhoods will increase at the district-level with 2) the greatest increases in the most segregated neighborhoods and 3) that levels of racial imbalance across district schools and racial isolation within schools will increase. Additionally, I predict that the district will become increasingly imbalanced during each subsequent assignment period.

⁴ A direct test of behavioral economics ideas requires student-specific data on race, family income, exact residence, and ultimate assignment which is unavailable to undergraduates.

II. Methodology

The analysis outlined in this paper seeks to answer two main questions. First, as the default assignment places greater weight on the neighborhood schools, do schools become more demographically similar to their immediate neighborhoods? This question serves to establish a link between the policy default and school composition. I calculated the correlation coefficient between the racial compositions of each school sampled and its corresponding local neighborhoods for two different categories: % White and % Black. Hispanics and Asians are excluded from the correlation analysis because the two groups did not make up a large percentage of CMS students in each of the three years studied. See the Appendix for the district's aggregate racial composition for each year. The correlation analysis is then broken down by neighborhood quintiles based on percentage Black composition. At the quintile level, I can examine differences in how the policy default influences local school composition in mostly Black, mixed, and mostly White neighborhoods.

The second question asks if the hypothesized increase in the demographic correlation between schools and their proximal neighborhoods corresponds to an increase in segregation and racial imbalance across district schools. In districts with highly segregated residential neighborhoods, like CMS, one can reasonably expect racial polarization in schools to increase as schools more closely resemble the racial compositions of their immediate neighborhoods. To assess the degree of racial imbalance across elementary schools in the CMS district, I draw upon methodology used in previous literature on school segregation (Bifulco, Ladd, & Ross, 2009; Ladd, Fiske, & Ruijs, 2010). I employ six of the most widely recognized measures of segregation to determine if CMS experiences higher levels of district-wide segregation as the default assignment becomes more closely linked to the neighborhood school. The six measures each shed light on one of two aspects of segregation: racial isolation and imbalance. Isolation refers to the extent to which minority students are concentrated in schools with

students similar to themselves. Racial imbalance refers to the unevenness of the distribution of different racial groups across schools. The first three measures studied, the Gap-Based Segregation Index, Theil's Entropy Index, and the Dissimilarity Index, all quantify the degree of demographic imbalance across schools during each year studied. These point measurements are then used to analyze district trends over time. The last three measures, namely the isolation index, number of $\geq 70\%$ minority schools, and the number of $\geq 90\%$ minority schools, all quantify the degree of isolation experienced by disadvantaged minorities and minorities in general.

Data: Sources, Rationale, and Approach

I use enrollment data from three different school years, 2001-2002, 2004-2005, and 2010-2011, to examine trends in racial isolation and imbalance as the default assignment becomes more closely linked to the neighborhood school. The school years selected are representative of each of the three distinct assignment policy periods.

This paper focuses exclusively on elementary schools within the CMS district for two main reasons. Focusing on elementary schools provides more points for analysis because there are 103 elementary schools versus 42 middle and 32 high schools in the district. Second, the assignment areas for elementary schools are smaller and draw heavily from local neighborhoods in contrast to the multiple feeder neighborhoods for middle and high schools. Given these two realities, the increasing weight of the neighborhood school in determining default assignments has a greater potential to increase segregation across elementary schools than across middle or high schools.

The data used in the analysis presented in this paper are publically available and draw from various administrative and governmental sources. The North Carolina Department of Public Instruction provided data at the school level on total student attendance and demographic composition of each

school (Grade, Race, Sex files⁵). These racial categories are simplified to Black, White, Hispanic, and Other for the purpose of analysis. The initial set of 103 elementary schools in the CMS district is filtered down to 69 elementary schools in the final data set. In total, 34 elementary schools are excluded on the basis of housing a magnet program, targeting a specific type of student, or not existing during the entirety of 2000-2012. The majority of exclusions are magnet schools, such as language academies, Montessori schools, or creative arts academies. As previously stated, magnet schools use a separate assignment process (parents must opt-in) and some have entrance requirements. As a result, the magnet assignment process does not reflect the school assignment experience of the typical elementary school student in the CMS district⁶. Schools that targeted certain students, such as behavioral academies, were also excluded for similar reasons. Schools that did not exist during the entire time period studied were naturally excluded because gaps in the data prevent a comparable analysis.

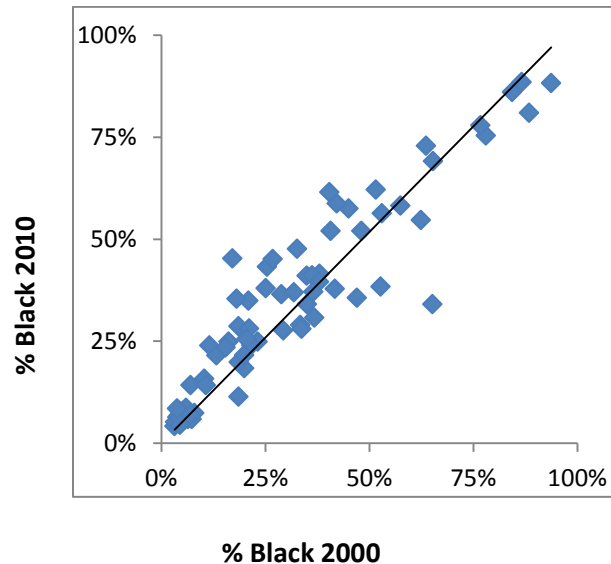
I use school-level data to analyze the district-wide racial distribution of students and to compare the racial composition of schools with their immediate neighborhoods. For the neighborhood component of analysis, I defined “neighborhoods” by the boundaries laid out in the 2010-2011 elementary school assignment map provided by the Charlotte Mecklenburg School District. The boundaries comply with the 2007 court decision prohibiting the district from drawing of assignment zones based on race. As a result, the neighborhoods are contiguous and presumably closely reflect the “natural” geographic boundaries of local neighborhoods. The neighborhood racial composition data for the 2001-2002 and 2010-2011 school years were drawn from the decennial census of 2000 and 2010 respectively. The data used to determine the neighborhood composition for 2004-2005 draws from the

⁵ <http://www.dpi.state.nc.us/fbs/accounting/data/>

⁶ Note that though magnet school assignments go through a separate process, the aggregate composition of magnet schools does not markedly differ from the aggregate composition of the schools included in the sample. See the appendix.

2005-2009 American Community Survey 5 year estimates. Also note that the composition of the average neighborhood did not dramatically change between 2001 and 2011, as seen in Figure 2 below.

Figure 2. Percent Black Composition by Neighborhood^{7,8}



Data Limitations & Considerations

The analysis uses *ArcGIS* geospatial mapping software to precisely determine the racial mix of each neighborhood containing one of the 69 schools studied. For the 2001-2002 and 2010-2011 school years, I linked a shapefile consisting of all the census blocks (2000 and 2010 respectively) in the Charlotte Mecklenburg district with the underlying census racial data for each census block (2000 and 2010 respectively). Similar to using a cookie cutter, I overlaid another geospatial layer consisting of the neighborhood boundary polygons, defined by the 2010-2011 elementary school zones, over the census blocks layer. Blocks are the most detailed level of data available in the census and there were roughly

⁷ The neighborhoods are defined by the 2010-2011 elementary school zones. The underlying racial data aggregates the composition of all the 2000 and 2010 census blocks that fall within each neighborhood. The same data is later used for the neighborhood portion of the correlation analysis.

⁸ Each point in the graph represents one of 69 neighborhoods. Points to the left of the 45 degree line represent neighborhoods that are becoming more Black whereas points to the right are becoming less Black. Points on the line represent neighborhoods whose percent Black composition has not changed from 2000 to 2010.

100 blocks in each neighborhood. In order to get the aggregate racial data for each neighborhood, I consolidated all the census blocks within a neighborhood. This process allowed me to obtain quite precise data on the racial composition of each of the 69 neighborhoods. The 2004-2005 neighborhood data set is less precise primarily because it relies on data from the American Community Survey. The American Community Survey is the only data source that provides detailed demographic information in the years between the decennial census. However, the ACS data is an average of surveys conducted over a 5 year timeframe as opposed to the one year census. Using data that consists of five year averages should not significantly alter the results because the neighborhood analysis is primarily directional and the neighborhood compositions did not dramatically change between 2005 and 2010. Furthermore, the most detailed level in the ACS data is the block group level, which is much larger than a census block, but smaller than a census tract. If a census block group was spread 30% over neighborhood A, 10% over neighborhood B, and 70% over neighborhood C, I attributed the same percentage of the demographic data to each neighborhood.

II a. Measures of Isolation

Isolation Index:

The Isolation Index measures the extent to which students of a particular racial group, in this case non-whites, are in schools primarily attended by students like themselves. The Isolation Index is commonly interpreted as the proportional representation of a racial group in the school of a typical student of the same racial group (Ladd, Fiske, & Ruijs, 2010). The minimum value of the index is essentially zero whereas the maximum value is 1, indicating complete isolation. The weakness of this measure is that it can only calculate the isolation of one racial group at a time. To counteract this weakness, I calculated the isolation index for a broader racial group consisting of all traditional minorities, or non-white, students.

Calculation:

The Isolation Index is calculated as below, where NW_i and t_i indicate the non-white and total populations of each school.

$$I = \sum (nw_i / NW) * (nw_i / t_i)$$

Proportion of Elementary Schools with $\geq 70\%$ Minority Enrollment

An advantage of this measure is its simplicity.

Proportion of Elementary Schools with $\geq 90\%$ Minority Enrollment

See above.

II b. Measures of Racial Imbalance

Gap-Based Segregation Index (G):

The segregation index is defined as the percentage gap between the percentage of Non-White students at the district-level, otherwise known as the maximum exposure rate, and the actual exposure rate of white students to non-white students at the school-level. Thus the index measures the extent to which the actual distribution of students across schools differs from a racially balanced distribution (Clotfelter, Ladd, & Vigdor, 2002). In a perfectly balanced district, each racial group's proportional representation within each school would be identical to the group's proportional representation in the CMS district as a whole. That is, each unit exactly mirrors the broader district. An advantage of this index is that "ideal" proportions are determined by the actual pool of enrolled elementary students, not a theoretical or ideological ideal composition. This definition of racial balance controls for differences in

the racial composition of the school district over time and thus allows for a meaningful comparison of the degree of segregation across different years.

Calculation: The index is based on the exposure rate, defined as the percentage of non-white students enrolled with the typical white student. The exposure rate for the district (E_k) is calculated as the weighted average of the racial compositions of each elementary school (j) in the district with its share of the district's white enrollment used as weights. The maximum value of the exposure rate is the non-white percentage of the district. The minimum value attainable is 0, indicating that the average white and non-white students never attend the same school.

$$E_k = \sum (W_j * \%NW_j) / W_k$$

The segregation index is then calculated as:

$$S_k = (\%NW_k - E_k) / \%NW_k$$

If the racial composition of each elementary school reflected the overall composition of students enrolled in the district, S_k would take on its minimum value of 0. If each school were entirely segregated, the index would take the maximum value of 1.

Theil's Entropy Index(H):

Similar to the Gap-Based Segregation Index, the Entropy Index measures the evenness of the distribution of racial groups across a school district (Iceland, 2004). The Entropy Index (H) calculates the difference between the diversity, or entropy, of a system and the weighted average diversity of the individual units within the system to express a measure of diversity of the system as a whole (Reardon & Firebaugh, 2002). Theil defines the Entropy Index as tool to measure the average difference between

the composition of a unit, in this case a school, and the composition of the system, in this case the district (Theil, 1972). As with the Gap-Based Segregation Index, the measure of segregation within a district is based on the actual composition of the district at the time.

Calculation:

First, the entropy score is calculated for the district overall and for each individual school. In the formula below, π is the racial group's proportion within the school (i) or district population, depending on the calculation (Massey & Denton, 1988).

$$E^* = \sum [(\pi_i) \ln (1/\pi_i)]$$

The Entropy Index (H) is then calculated as the sum of the weighted average deviations of each school's entropy score from the district entropy score. In the formula below, t_i and T represent the total population of each school (i) and the district, respectively. In parallel, E_i and E represent the diversity, or entropy of each school (i) and the district. The Entropy Index range from 0, representing maximum integration, to 1, representing maximum segregation.

$$H = \sum \{ [t_i (E - E_i)] / (ET) \}$$

Dissimilarity Index (DI):

The Dissimilarity Index is one of the primary statistics used to measure the extent to which historically disadvantaged minorities, in this case Black and Hispanic students, are evenly or unevenly distributed across different organizational units, in this case elementary schools (White, 1983). The Dissimilarity Index (DI) is commonly interpreted as the percentage of disadvantaged students who would need to be moved to different schools in order to achieve perfect balance (Ladd, Fiske, & Ruijs, 2010). Similar to

Thiel's Entropy Index, the Dissimilarity Index ranges from 0, indicating perfect integration, to 1 indicating perfect segregation.

Calculation:

The Dissimilarity Index is calculated as below, where d_i and w_i represent the disadvantaged minority (ie Black and Hispanic) and white populations of each school (i) (University of Michigan, 2000). Analogously, D and W represent the black and white populations of the district as a whole and the brackets indicate absolute value. The measure is the average deviation of each school's share of a disadvantaged minority group and traditionally advantaged group from the entire district (Ladd, Fiske, & Ruijs, 2010).

$$DI = \frac{1}{2} \sum [d_i/D - w_i/W]$$

VI. Results and Findings

VI a. School & Neighborhood Composition: Analysis & Discussion

District-Level Analysis

The goal of this section is to examine the extent to which the default shapes assignment outcomes, as summarized by the correlation between the racial mix of schools and the racial mix of their neighborhoods⁹. The empirical analysis determines if the progressively greater weight of the neighborhood school on default assignments corresponds to increased similarities between the racial composition of schools and their surrounding neighborhoods. An analysis of the data suggests that the positive linear relationship between the school and neighborhood composition grew progressively

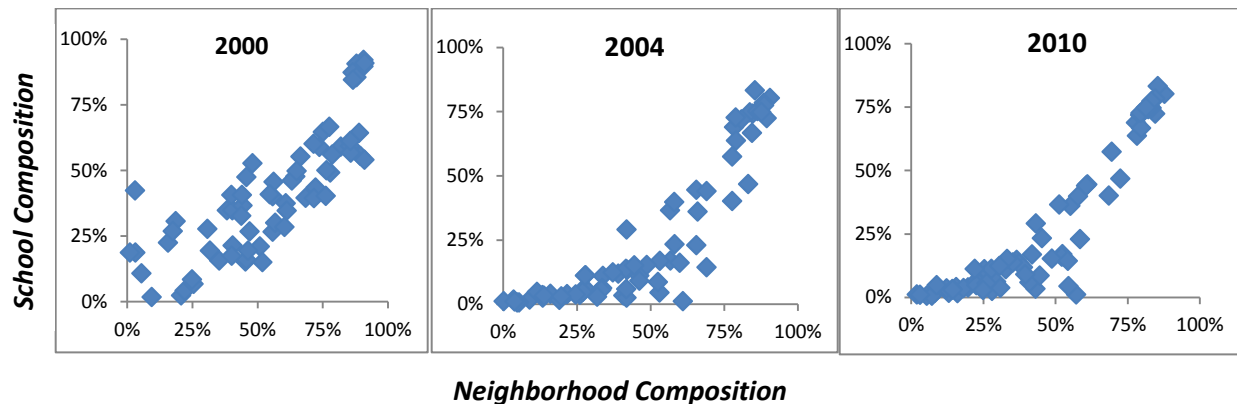
⁹ An ideal analysis would directly examine assignment outcomes at the individual student level based on racial, socioeconomic, and familial backgrounds. Given the lack of student-specific data, my analysis takes an indirect approach by examining changes to the publically available data on the racial compositions of individual schools and the district as a whole.

stronger during each successive year studied, lending support to the hypothesis (see Table 1). As previously stated, the policy default becomes increasingly tied to the neighborhood school during each progressive assignment policy for the years 2001, 2004, and 2010. As the default assignment becomes increasingly linked to the neighborhood school, I expect more students to end up in a neighborhood school. Over time, this would lead to an increase in the correlation between the racial composition of schools and their proximate neighborhoods. In Table 1 below, each entry represents the correlation between the racial characteristics of the school (% White in column 1 and % Black in column 2) and its corresponding neighborhood.

Table 1: District Correlation Coefficients: Neighborhood & School Composition¹⁰

<i>r</i>	% White	% Black
2001-2002	0.82	0.77
2004-2005	0.88	0.88
2010-2011	0.91	0.90

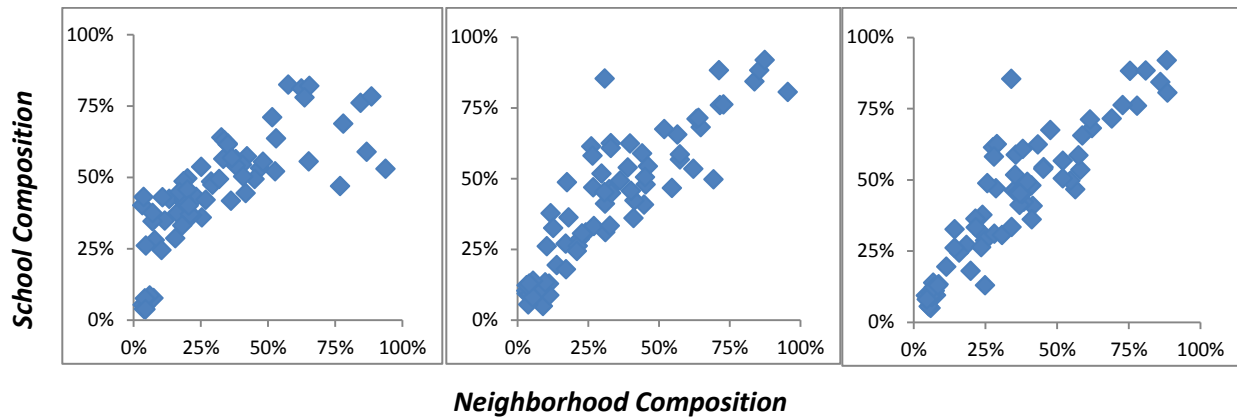
Figure 2 a. School vs. Neighborhood Composition (% White) By Year¹¹



¹⁰The two variables used to calculate the district correlation coefficient are the racial compositions of each elementary school and the racial compositions of each corresponding neighborhood. Percent White refers to Non-Hispanic Whites as defined by the Census Bureau and Percent Black refers solely to African Americans and excludes other minorities. N=69

¹¹ Figures 2a and 2b plot the racial composition of a neighborhood against the racial composition of the elementary school within the neighborhood. Each point represents one school and neighborhood pair. N=69

Figure 2 b. School vs. Neighborhood Composition (% Black) By Year ¹¹



IV b. Quintile Analysis: Influence of the Default on Different Types of Neighborhoods

The district level analysis provides only a partial picture of the effects of the policy default on student assignments. It is important to delve deeper and isolate key differences in how the default policy affects assignments for students living in different types of neighborhoods, namely highly segregated and mixed. In the following section, I split the 69 neighborhoods into quintiles based on percentage Black composition¹². Percent Black composition was chosen because African Americans are historically the most residentially segregated racial group in Mecklenburg County.

Given the desegregation goals of 2001-2002, I expect the racial composition of diverse, racially mixed neighborhoods to most closely resemble that of their local schools. Students living in diverse neighborhoods should logically receive assignments to the local school instead of being bussed elsewhere to balance out a school located in a racially homogenous neighborhood. I also predict that the neighborhoods at each extreme, meaning either entirely black or entirely white, will show little to no correlation between local school and neighborhood composition. The district would have bussed students either in or out of the most racially polar neighborhoods in order to achieve racial balance,

¹² The first quintile consists of neighborhoods with the lowest % black composition and the fifth quintile contains neighborhoods with the highest % percent black composition

resulting in schools that do not mimic the composition of their immediate neighborhoods. The data supports all three predictions for 2001-2002. The most segregated neighborhoods represented by quartiles 1 and 5, had correlation coefficients near zero, or 0.11 and -0.15 respectively. This pattern suggests that the default assignment for students living in the most homogeneous neighborhoods was more diverse than their residential experience. As predicted, the middle quartiles show the strongest positive correlation of 0.88 between school and neighborhood composition. Interestingly, the more a neighborhood diverges from the racially balanced quartile (3rd), the less likely the school mirrors the neighborhood. This pattern is consistent with the type of default assignment policy.

The 2004-2005 policy of home school defaults with formal choice corresponds to a complete reversal of correlation patterns for both diverse and highly segregated neighborhoods. The most heavily Black neighborhoods show the strongest positive correlation of 0.70 to the neighborhood school. The strength of the relationship is not surprising given previous discussions of the barriers low income, often minority, families face in opting out of a disadvantageous default assignment. The most heavily white neighborhoods now exhibit a strong positive correlation coefficient, given that they are automatically assigned to an advantageous default by virtue of residence and thus have no incentive to opt-out. Though the correlation coefficients of 0.42 and 0.44 for the first and second quartiles indicate a clear positive relationship, it is surprising to note that the relationship between school and neighborhood composition is not stronger. The effect is likely due to Black students opting out of their default assignments and exercising choice to attend high performing schools in heavily white neighborhoods. Middle income families can more easily exercise choice and opt-out of their default assignments, however their default assignments are marginally better than those of low income families. Thus, it is difficult to predict or interpret the effect of the home school default on school assignments for students in racially balanced, middle class neighborhoods because the direction is primarily dependent on parental preferences.

The correlation patterns under the mandatory, home school default assignment policy of 2010-2011 indicate that the default most strongly determines assignment for students living in highly segregated neighborhoods. For both the first and last quintiles, the correlation coefficients were 0.82 and 0.88 respectively. These values are extremely high and indicate a very strong positive relationship between neighborhood and school composition. Under the behavioral economics default framework, the correlation patterns suggest that families in homogenous white neighborhoods benefit from a quality default school and thus accept it. On the other hand, families in highly segregated Black neighborhoods are assigned to underperforming neighborhood schools due to the home school default. Unlike the 2004-2005 policy, these families lack formal avenues to exercise choice and opt-out of their default assignments, leading to a high correlation coefficient with the neighborhood school. A comparison of the 2004 and 2010 data lends support to the assertion that lack of choice in assignment policies contributed to the increase in correlation coefficients in the most segregated neighborhoods. The substantial differences in the coefficients of the first quintile, 0.82 in 2010 relative to 0.42 in 2004, indicate that black families were not able to exercise choice and attend schools in wealthy white neighborhoods.

Table 3: Percent Black Neighborhood Quintiles: School to Neighborhood Correlation Analysis¹³

<i>r</i>	2001-2002	2004-2005	2010-2011
1st	0.11	0.42	0.82
2nd	0.53	0.44	0.43
3rd	0.88	0.07	0.01
4th	0.32	0.42	0.14
5th	-0.15	0.70	0.88

¹³ Table 3 is populated by sorting the 69 neighborhoods into quintiles based on % Black composition. The % Black composition increases by quintile, meaning the fifth quintile consists of neighborhoods with the highest % Black compositions. The correlation coefficients are then calculated separately for each quintile of neighborhoods, N=14 for each quintile.

III b. School Level Racial Isolation & District Level Racial Imbalance:

I now turn to an analysis of the extent to which the increased correlation between the demographic mix of schools and their proximal neighborhoods translates into an increase in segregation and racial imbalance across the district as a whole. When neighborhoods are racially segregated, the issue of schools mirroring their local neighborhoods provides legitimate cause for concern because it leads to racially polarized schools, and thus a segregated district. I hypothesize that the increased school-to-neighborhood correlation also translates to greater segregation in schools and the district overall. I test the hypothesis in the following section by analyzing measures of racial isolation and segregation.

Measures of Racial Isolation: Analysis and Discussion

Across all three measures of isolation, the data suggest that the average minority student in the CMS district grew increasingly isolated from non-minorities between 2001 and 2011. The isolation index used in this analysis measures the concentration of Black and Hispanic students with students like themselves. Black and Hispanic students are specifically chosen because they represent traditionally disadvantaged minorities, as opposed to traditionally advantaged minorities such as Asians. By isolating Blacks and Hispanics, the links between assignment policies and isolation can be measured for disadvantaged racial groups. In 2001, the average black or Hispanic student attended a school where 65% of students had the same background. As predicted, the isolation of disadvantaged minorities increased to 73% in 2004 and 83% in 2010. Between 2001 and 2010, the isolation index for disadvantaged minorities increased by almost 20 percentage points.

A limitation of the isolation index as a tool is that it varies with the underlying demographics of the district, meaning it does not control for changes in the underlying population. As a result, changes in

isolation across different years cannot be interpreted without considering changes in the composition of elementary school children enrolled in the CMS district. In 2001, Black and Hispanic students comprised 49% of CMS elementary students, growing slightly to 54% in 2004 and then 62% in 2010 (see Appendix). This increase reflects the influx of Hispanic families in greater Charlotte. In all three years, the increase in isolation is greater than the increase in the percent of Black and Hispanic students in the district. The numbers suggest that the isolation of disadvantaged minorities in schools is increasing at a faster rate than the increase in their share of the district’s elementary students.

Table 4. Percent of Elementary Schools Overwhelmingly Comprised of Disadvantaged Minorities¹⁴

% of Schools	≥ 70%	≥ 90%
2001-2002	36%	7%
2004-2005	43%	16%
2010-2011	62%	19%

A simpler measure of minority isolation is the number of schools in the district comprised of $\geq 70\%$ and $\geq 90\%$ disadvantaged minorities. Disadvantaged minorities are defined as Black and Hispanic students. As summarized in Table 4, the proportion of schools with over 70% and 90% minority enrollment grew by almost 72% and 160% respectively between 2001 and 2011. The largest increase occurred between 2002 and 2005 during the shift to home school defaults with parental choice. Approximately 62 % of schools included in the sample fell into the category of $>70\%$ in 2010, the year after the CMS district began to rely exclusively on home school defaults and mandatory assignments. These raw numbers alone suggest that the increased probability of default assignment being the neighborhood school corresponds to the increased concentration of minorities in certain schools.

¹⁴ Table 4 shows the proportion of district elementary schools that were composed of $\geq 70\%$ and $\geq 90\%$ historically disadvantaged minorities, namely Black and Hispanic students. N=69

Measures of Racial Imbalance: Analysis & Discussion

An analysis of measures of district-wide racial imbalance also supports the hypothesis that the district would grow increasingly segregated as the default became more closely linked to the neighborhood school. Unlike measures of racial isolation, each measure of racial imbalance controls for changes in the composition of the school district, allowing for a clear comparison between segregation levels in different years. Both the Gap-Based Segregation Index and Theil’s Entropy Index measure the deviation of each school’s actual racial composition from the “ideal” composition, given district-wide elementary student enrollment. The Gap-Based Segregation Index measured 0.07 in 2001, indicating the district was close to perfectly integrated. However, the Gap-Base Segregation Index recorded a major jump in imbalance to 0.35 in 2004 and to 0.40 in 2010 (See Table 3). Thus, district-wide imbalance measures increased by 0.28 percentage points from 2002 to 2005 when the likelihood of the default being the neighborhood school most increased. The Entropy Index shows a similar trend with segregation levels increasing the most from 2002 to 2005 and again from 2005 to 2011. The Dissimilarity Index lends further support to these trends. The increases in the Dissimilarity Index were of a smaller magnitude but followed the same pattern, as imbalance grew from 0.41 to 0.55 to 0.65.¹⁵

Table 5. CMS: Trends in Racial Imbalance & Isolation¹⁶

Index Type	Gap-Based Segregation	Entropy	Dissimilarity	Isolation
2001-2002	0.07	0.20	0.41	0.65
2004-2005	0.35	0.31	0.55	0.73
2010-2011	0.40	0.39	0.65	0.83

¹⁵ Dissimilarity Index calculated for Blacks and Hispanic, representing disadvantaged minorities

¹⁶ Table 5 aggregates and presents the results of the analysis of each individual measure of racial imbalance. A detailed explanation of each index can be found within the Empirical Analysis section of the paper in subsection II.a .

In sum, each measure of racial imbalance or isolation conforms to the same general pattern: the increasing weight of the neighborhood school as the default option translates to higher levels of school segregation. Given the absence of major changes to residential patterns and because I use measures that control for changes to district enrollment demographics, I can reasonably conclude that the district's decision to more closely link the default assignment to the neighborhood school contributes to higher levels of racial imbalance and segregation. Each measure of segregation shows that racial imbalance increased the most in magnitude between 2002 and 2005 rather than between 2005 and 2011. However, I cannot draw any meaningful conclusions about the relative influence of home school defaults versus formal choice without more periods of observation.

Although these trends in racial balance contribute to a broader understanding of segregation in the CMS district, they do not definitively establish causal links between school assignment policies and levels of segregation. A decrease in the emphasis of residence in school assignments does not automatically imply a subsequent reduction in district-wide racial imbalance. This analysis highlights the importance of examining segregation across schools in light of changes in residence-based assignment policies in districts with relatively homogenous neighborhoods.

VII. Conclusion

I applied a behavioral economics framework to the school assignment environment to examine the influence of policy defaults on the racial distribution of students. The analysis presented in this paper supports the hypotheses that as the policy default assignment becomes more linked to a student's neighborhood school, the similarities between the racial compositions of schools and their proximate

neighborhoods will increase at the district-level, with the most pronounced effects on the most segregated neighborhoods, and that district-wide racial imbalance and isolation will increase. In the Charlotte-Mecklenburg School District, the progression towards a system in which assignments are entirely determined by neighborhood school has clear negative implications for racial balance at the district level ,and likely for equal access to quality schools at the individual level. Taking a step back from the district-specific analysis, the broad implication of this paper is that more attention needs to be paid to the design of the default within an assignment policy because defaults ultimately influence assignment outcomes , which impact educational equity. Areas for further research include analyzing assignment outcomes under different policy defaults using student-specific data, expanding the analysis to other districts, and looking into more equitable alternatives to residence-based defaults.

VIII. Appendix

District Aggregate Elementary School Enrollment

	2001-2002	2004-2005	2010-2011
% White	46%	41%	29%
% Black	42%	42%	40%
% Hispanic	7%	12%	22%
% Other	5%	5%	10%

Magnet School Enrollment

	2001-2002	2004-2005	2010-2011
% White	41%	35%	23%
% Black	47%	50%	50%
% Hispanic	7%	10%	17%
% Other	5%	5%	10%

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