The Impact of School Racial Compositions on Neighborhood Racial Compositions: Evidence from School Redistricting*

Jeffrey Weinstein†
Department of Economics, Syracuse University

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Abstract

I use data surrounding public school redistricting to study how school racial compositions affect neighborhood racial compositions. This redistricting followed from the end of court-ordered busing for racial desegregation, significantly changing the racial composition of the assigned school for many neighborhoods. Over a five-year period, I find that the impact of an increase in the percent black of the assigned elementary school on the percent black of the neighborhood was positive. The effects increased over time, consistent with predictions from a simple model of short-run neighborhood racial dynamics. These results have implications for the potential effects of school racial desegregation policy changes on neighborhood racial compositions.

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1 Introduction

The United States Supreme Court's 1954 *Brown v. Board of Education of Topeka* decision and subsequent decisions ended the "separate but equal" doctrine applied to public schools and led to implementation of court-ordered racial desegregation plans for school districts across the country.[1] Various desegregation techniques have been used, including public school choice, the creation of magnet schools, and busing of students in one part of the district to a school located in another (Rivkin and Welch (2006)).

The 1991 *Board of Education of Oklahoma City v. Dowell* decision stipulated how a school district could be declared unitary, managing a single educational system for students of all races (as opposed to a dual system), after it has "taken all 'practicable' steps to eliminate the legacy of segregation" (Rivkin

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†Address: Center for Policy Research, 426 Eggers Hall, Syracuse, NY 13244-1020; Phone: (315) 443-9046; Fax: (315) 443-1081; E-mail address: jmwein04@maxwell.syr.edu

[1]See Table 1 of Rivkin and Welch (2006) for a summary of landmark school desegregation Supreme Court cases.

and Welch (2006), p. 1023). Once a district has achieved unitary status, it is no longer subject to court-ordered racial desegregation and cannot use race as a factor in assigning students to schools, even if the new, race-neutral student assignment plan causes an increase in school racial segregation. This and consequent Supreme Court decisions have made it easier for school districts to be released from court-ordered racial desegregation. As a result of the dismissal, a student may be reassigned to a school closer to residence with possibly very different characteristics than the school previously attended.

I investigate short-run neighborhood racial sorting in response to changes in school assignments that resulted from the termination of court-ordered racial desegregation in a large, urban public school district. Tiebout (1956) motivated neighborhood sorting with the idea that households "vote with their feet" by choosing residential locations with the most desired package of local public goods (e.g., public schools). Subsequent theoretical work developed general equilibrium models of public goods provision, taxation, voting, and residential location decisions to study the relationship between public goods provision, household sorting, and housing market equilibrium.[2]

I use rich administrative data surrounding extensive school redistricting in Charlotte-Mecklenburg Schools (CMS) to examine the impact of large changes in school racial characteristics on neighborhood racial characteristics. CMS is one of the largest school districts in North Carolina, serving all of Mecklenburg County, which includes the city of Charlotte and six neighboring suburbs. In Fall 2001, CMS was ordered to dismantle the race-based student assignment plan that had been in effect for 30 years. Under this plan, school assignment zones were typically drawn to capture non-contiguous areas with vastly different racial compositions to achieve racial balance in schools. A district-wide public school choice plan was approved for the 2002-2003 school year, with school assignment zones dramatically redrawn to give each student a guaranteed seat at a school close to her residence, typically the closest (students could gain admission to other schools in the district through a lottery process). Approximately half of families were reassigned to different schools, causing large changes in school racial compositions across the district. These extensive shocks to school racial compositions make CMS an ideal place for identifying the impact of school racial compositions on neighborhood racial compositions.

Several related studies have used data surrounding school desegregation programs to examine the effect of school racial compositions or school desegregation on neighborhood racial sorting or housing prices. Findings include a negative relationship between the percent black of the assigned school and housing prices (Clotfelter (1975)), slower increases in housing prices in cities expected to undergo school

[2] Examples include Epple, Filimon, and Romer (1984), Fernandez and Rogerson (1996), and Nechyba (1997).

desegregation relative to their neighboring suburbs (Gill (1983)), decreases in housing prices in neighborhoods subject to redistricting but mixed evidence that school racial compositions affected housing values (Bogart and Cromwell (2000)), less capitalization of school performance into housing prices for neighborhoods subject to redistricting (Zahirovic-Herbert and Turnbull (2008)), and increases in black populations mostly in non-southern central city school districts and declines in white populations mostly in southern central city school districts due to school desegregation (Baum-Snow and Lutz (2011)).

Kane, Staiger, and Riegg (2005) explored the relationship between school compositions and housing prices with data on multiple smaller-scale episodes of redistricting in CMS from 1994 to 2001, which were needed under busing to maintain racial balance in schools. They found that housing prices responded gradually to changes in school racial compositions, suggesting that part of the effect was due to neighborhood racial sorting as a result of the school reassignments. Examining changes in block group racial compositions over the 1990s using Decennial Census data, the authors found more direct evidence of sorting: a 10 percentage point increase in the percent black of the assigned school was associated with a two to four percentage point increase in the percent black of the block group over the 1990s.

My paper looks more closely at neighborhood racial sorting in response to a much larger episode of redistricting in CMS, focusing on annual changes versus a 10-year change in neighborhood racial compositions to better understand the adjustment process over time. Moreover, I have exact residential locations for all CMS students in each year, and I use annual averages of these *student-level* data by neighborhood to construct neighborhood characteristics. I thus measure residential sorting for the population most affected by the changes in school compositions, since many of the students directly experienced the change in school assignment by having attended the school with the changed composition. This direct effect is in contrast to a likely smaller, more indirect effect of changes in school racial compositions on rents or housing values that might have led to residential mobility for households with and without children in CMS.[3] Demographic data for the entire population at an annual, disaggregated level are not available; however, the geographic specificity of my data more than offsets this potential limitation.

I use instrumental variables (IV) to identify the effect of school racial compositions on neighborhood racial compositions (i.e., the geographic distribution of public school students). My research design exploits variation in elementary school racial compositions generated solely by the Summer 2002 redistricting, comparing neighborhoods in close geographic proximity but exposed to different shocks to the racial composition of the assigned elementary school. Over the five-year period 2001 to 2006, the effect of

[3]Lending support to this idea is Barrow's (2002) finding that white families with children were more likely to locate in an area with higher test scores than white families without children.

an increase in the percent black of the assigned elementary school on the percent black of the neighborhood was positive and statistically significant. A 10 percentage point increase in the percent black of the assigned elementary school led to a 1.37 percentage point increase, relative to a mean of 53.6 percent, in the percent black of the neighborhood five years after the dismissal of busing. The impacts rose over time, consistent with predictions from a simple model of short-run neighborhood racial dynamics. I provide evidence that differential trends in neighborhood racial compositions prior to the dismissal of busing are unlikely to explain these results.

I then examine student-level attrition from and decisions to change residences within CMS to shed light on the mechanism by which school racial compositions affected neighborhood racial compositions. I find that the positive estimated effects on neighborhood racial compositions for the longer time horizons are consistent with non-black residents' moving from neighborhoods with increases in the percent black of the assigned elementary school to neighborhoods with decreases in the percent black of the assigned elementary school, while black residents did not move in response to the reassignments.

The analysis of short-run neighborhood dynamics is important for policy because many districts only recently have ended their racial desegregation plans. My findings are useful for understanding the potential short-run effects of school racial desegregation policy changes on neighborhood racial compositions.

2 School Redistricting in CMS

The 1971 United States Supreme Court decision *Swann v. Charlotte-Mecklenburg Board of Education* required CMS to create racially integrated schools by redrawing school boundaries and employing race-based busing (Kane, Staiger, and Riegg (2005)). As a result, school assignment zones were typically drawn to capture non-contiguous areas with very different racial compositions to achieve racial balance in schools. A 1980 court order mandated that CMS make reasonable attempts at keeping each school's percent black within 15 percentage points of the district-wide percent black, so CMS needed to redraw assignment boundaries at various times to have schools remain desegregated. Students could also apply to magnet programs, with admission determined by lottery. Each student was required to attend the (non-magnet) school assigned to her residence if she did not gain admission to a magnet program.

In September 1997, CMS was sued for its magnet assignment policy, leading to the reactivation of the *Swann* ruling to determine if CMS had achieved unitary status. In September 2001, the United States Fourth Circuit Court of Appeals declared CMS to be unitary and ordered the district to end race-based student assignment. In December 2001, the school board voted to approve a race-neutral, district-wide public school choice plan beginning in the 2002-2003 school year. In Spring 2002 and in each spring thereafter, parents were asked to submit three choices of school programs for each of their children for the upcoming school year. Each student was assigned a home school, typically her closest school, and was guaranteed a seat at this school. Admission of students to non-home choices was limited by grade-specific capacities set by the district, with lotteries used to determine admission to over-subscribed schools.[4] As most of the data I use was compiled near the beginning of a school year, I characterize a school year by the calendar year in which it starts; for example, the 2001-2002 school year (last year of busing) is denoted as 2001, and the 2002-2003 school year (first year of choice plan) is denoted as 2002.

The end of court-ordered busing led to a large redistricting of home school assignments in 2002. Before 2002, many school assignment zones were satellite zones: a school located in an area with a large percentage of students from one race drew students from this area, as well as students from another area (possibly located many miles from the school) where a large percentage were of another race.[5] Beginning in 2002, all school assignment zones were connected areas. In addition, due to population growth in CMS, four new elementary, one new middle, and one new high school opened in 2002.

Forty-five percent of student residences were reassigned to different elementary schools due to the redistricting. This number was 53 percent and 39 percent at the middle and high school levels, respectively. Nineteen percent were reassigned at all three school levels, 25 percent were reassigned at exactly two levels, 30 percent were reassigned at exactly one level, and 26 percent were not reassigned at all. Reflecting the primary goal of the redistricting, students were, on average, reassigned to schools closer to their residences: the mean driving distance from a student's residence to her assigned school was 4.04 miles in 2001, declining by 27 percent to 2.96 miles in 2002. The percent decrease in driving distance was much larger for black versus non-black students: 41 percent for black students (4.52 miles in 2001 to 2.67 miles in 2002) versus 13 percent for non-black students (3.67 miles in 2001 to 3.19 miles in 2002). This is due to the fact that busing typically assigned students living in areas with higher concentrations of black students to schools in areas with higher concentrations of non-black students.[6]

After 2002, there were additional changes in school assignment zones as new schools opened due to

[4] In Spring 2002, CMS required each parent to submit a choice form, even if she chose her home school first, and the district achieved 95 percent compliance. From Spring 2003 onwards, only parents of students in rising grades (kindergarten, sixth, and ninth), new CMS students, students affected by the opening of new schools, and parents who wished to change their children's schools were required to submit choice forms. See Hastings and Weinstein (2008) for more information.

[5] See Kane, Staiger, and Riegg (2005) for a discussion of other racial desegregation strategies used in CMS.

[6] Relatedly, the percentage of students assigned to their closest schools rose from 2001 to 2002, with a much larger increase for black versus non-black students.

continued population growth in CMS. Relative to the district-wide changes in school assignments in 2002, episodes of redistricting after 2002 affected far fewer students.[7] Moreover, reassigned students after 2002 were transferred from nearby schools to other nearby schools (within areas of similar demographics), while reassigned students in 2002 were possibly moved from schools distant from residence to schools close to residence (areas with different demographics). As a result, I focus on how neighborhood compositions changed due to the 2002 redistricting, ignoring subsequent smaller-scale redistricting.

3 Data and Empirical Strategy

3.1 Data

My main analysis uses secured annual administrative records from CMS for 2001 to 2006. The primary sources of demographic and geographic data are 20^{th} day student censuses, collected around the end of September of each year to determine official enrollment figures for funding purposes. These data include the exact residential location, the school attended, ethnicity, free- or reduced-lunch status, and gender for each student enrolled in CMS. I also use end-of-year data on the number of absences and suspensions and, for students in grades three through nine, scores on North Carolina standardized tests. In addition, I know the exact location of every school and school assignment zone.

Table 1 gives the racial/ethnic distributions for students in CMS for 2001 to 2006, as well as the Mecklenburg County racial/ethnic distributions from the United States Census Bureau Population Estimates Program (July 1 reference date). In each year, the school district had a higher percent black and a lower percent white than the county as a whole. This was likely due to higher private school enrollment for whites versus blacks: in the 2000 Decennial Census, four percent of black students in the county were enrolled in private schools, versus 22 percent of white students (the overall rate was 14 percent). Percent black remained roughly constant in both CMS and in the county over time, while there was a decline in percent white in both CMS and in the county (the decrease was a couple of percentage points larger in CMS). Percent Hispanic increased in both CMS and in the county, with a larger increase in CMS.

3.1.1 Definition of Neighborhoods

I define a neighborhood at the level of the intersection of 2001 (pre-dismissal) and 2002 (post-dismissal) elementary school assignment zones. This implies that the entire neighborhood was assigned to exactly one

[7] Three percent of student residences were reassigned to different elementary schools from 2002 to 2003, one half of one percent from 2003 to 2004, two percent from 2004 to 2005, and five percent from 2005 to 2006.

elementary school in 2001 and exactly one elementary school in 2002. These elementary schools might or might not have been the same, but even neighborhoods assigned to the same elementary school in both years might have experienced changes in elementary school racial characteristics due to reassignment elsewhere. Constructing neighborhoods in this way implies that the "shock" to school assignment was constant within a neighborhood (ignoring changes in middle and high school assignments).

I use elementary school assignment zones because they were, on average, much smaller and thus more numerous than middle or high school assignment zones. There were 68 elementary versus 21 middle and 14 high school assignment zones in 2001, implying a far larger sample of neighborhoods when using elementary school assignment zones.[8]

Figure 1 is a visual representation of neighborhood construction from a hypothetical 2001 elementary school assignment zone. Notice that this assignment zone consisted of two unconnected areas, Triangles I and II. This was typical, as many elementary school assignment zones were satellite zones in 2001, whereby a school located in an area with a large percentage of students from one race drew students from this area, as well as students from another area where a large percentage were of another race. In what follows, I call each of these unconnected areas a polygon, implying that a 2001 elementary school assignment zone possibly consisted of two or more polygons. By contrast, every elementary school assignment zone in 2002 was a single connected area because there was no busing, so that the three rectangles in Figure 1 were precisely the assignment zones for three different elementary schools in 2002. Given how I define neighborhoods, a polygon assigned to n different elementary schools in 2002 consisted of n neighborhoods, and each of these n neighborhoods was fully contained in the polygon.

The final sample is 249 neighborhoods.[9] Each neighborhood had, on average, 427 students in 2001 (standard deviation of 449) and 538 students in 2006 (standard deviation of 636). These neighborhoods are in 102 polygons, so each polygon has, on average, 2.44 neighborhoods (standard deviation of 1.20).[10]

3.1.2 Neighborhood and School Racial Characteristics

I focus on neighborhood sorting for the black versus non-black (white, Asian, multiracial, Hispanic, and Native American) populations. I define the groups in this way for the following reasons. As court-ordered

[8] Constructing neighborhoods from elementary school assignment zones gives 249 neighborhoods (see below), while constructing neighborhoods from middle or high school assignment zones gives only 104 or 69 neighborhoods, respectively.

[9] Each neighborhood in the sample had at least 10 students in each year analyzed: 2001 to 2006, inclusive. Neighborhoods with fewer than 10 students were dropped because they were almost always tiny areas created when a 2001 assignment zone only slightly overlapped a 2002 assignment zone, as a result of boundaries common to both years that did not match perfectly.

[10] Twenty-eight of the 102 polygons contained exactly one neighborhood; that is, everybody living in the polygon was assigned to the same elementary school in 2002 (e.g., Triangle II in Figure 1).

busing in CMS focused on black versus non-black enrollment, it is interesting to look at the dynamics in neighborhood black compositions separately from other racial/ethnic groups typically considered minority groups (e.g., Hispanics or Asians). In addition, the growth rates of the black and Hispanic populations in CMS from 2001 to 2006 were very different, as shown in Table 1: the percentage of the student population that was black remained about the same at 43 percent, while the percentage of the student population that was Hispanic went from 7.1 percent in 2001 to 14.1 percent in 2006, accounting for 45.1 percent of the overall district growth over the period. Section 4.4 examines whether there were different patterns of neighborhood racial sorting in response to the school reassignments for the non-white versus white populations, as compared to the black versus non-black populations.

Table 2 gives summary statistics for $bneigh^j_{2001+k}$, the percent of enrolled CMS students in neighborhood j who are black in the year $2001 + k$, where k is the number of years since the dismissal of busing in 2001 ($k = 0, ..., 5$). Each row is for a different year ($N = 249$). The first two columns contain sample means and standard deviations, and the remaining columns contain percentiles of the distributions: minimum, fifth percentile, first decile to ninth decile, 95^{th} percentile, and maximum.

Table 3 gives summary statistics for the percent black of the assigned elementary school for 2001 and 2002, as well as its change from 2001 to 2002, across neighborhoods ($N = 249$). For 2001, I compute percent black using school assignments observed in the 2001 20^{th} day student census, $bschl\_obs^j_{2001}$. For 2002, I compute percent black in two ways. The first measure, $bschl\_obs^j_{2002}$, uses school assignments observed in the 2002 20^{th} day student census. This measure captures variation in school racial compositions due not only to the 2002 redistricting but also to factors endogenous to neighborhood racial compositions, such as the outcome of the first year of the school choice lottery (winning or losing lotteries to attend non-home schools) and residential sorting between Fall 2001 and Fall 2002. The second measure, $bschl\_shock^j_{2002}$, uses student locations in the *2001* 20^{th} day student census to determine which elementary school each elementary school student would have been assigned to in 2002 and then averages the student characteristics over these 2002 assignment zones. This "shock" measure isolates variation in school racial compositions due solely to the redistricting because it is calculated close to when the 2002 school boundaries were announced using pre-redistricting student locations, thus not capturing sorting by families into more-preferred schools between Fall 2001 and Fall 2002.

The two measures of 2002 percent black imply two measures of the change in the percent black of the assigned elementary school: the observed change, $\Delta bschl\_obs^j = bschl\_obs^j_{2002} - bschl\_obs^j_{2001}$, and the change due solely to the redistricting, $\Delta bschl\_shock^j = bschl\_shock^j_{2002} - bschl\_obs^j_{2001}$. I define two measures because I identify the effect of observed changes in school racial compositions on neighborhood racial compositions by exploiting changes in school racial compositions due solely to the redistricting.

The sample means in the first three rows of Table 3 show that neighborhoods were assigned to elementary schools that were, on average, 44 percent black in 2001 and 51 percent black in 2002. The standard deviations indicate that assigned elementary school percent black was more dispersed in 2002 versus 2001. This makes sense because CMS was generally required to maintain school racial compositions within certain bands while under the busing system, within 15 percentage points of the district-wide percent black, but assigned each student to a school close to residence once busing was terminated.[11] The percentiles in the remaining columns indicate that far fewer neighborhoods were assigned to elementary schools within 15 percentage points of the district-wide percent black in 2002 versus 2001.[12]

The last row confirms that the redistricting generated large and varied changes in the racial composition of the assigned elementary school: approximately half of the neighborhoods experienced an increase in assigned elementary school percent black, while the other half experienced a decrease. About half of the neighborhoods had an increase or decrease of more than 20 percentage points. Moreover, the numbers in the last two rows are very similar, implying that the redistricting explained much of the variation in the observed change in the percent black of the assigned elementary school.

3.2 Empirical Strategy

3.2.1 Estimating Equations

Section 4.2 presents IV estimates of the following neighborhood-level equations ($k = 1, ..., 5$):

$$bneigh^j_{2001+k} - bneigh^j_{2001} = \alpha_{FE} + \beta \Delta bschl\_obs^j + \delta' X^j_{2001} + \varepsilon^j_{2001+k} \tag{3.1}$$

$$\Delta bschl\_obs^j = \alpha_{FE} + \mu \Delta bschl\_shock^j + \eta' X^j_{2001} + \nu^j_{2001+k}. \tag{3.2}$$

The dependent variable in second-stage equation (3.1) is the change in the percent black of neighborhood j from 2001 to the year $2001 + k$, where k is the number of years since the dismissal of busing in 2001. The coefficient of interest is β: the impact (in percentage points) of a one percentage point increase in the percent black of the assigned elementary school on the percent black of the neighborhood one

[11] Some schools, typically in more remote areas, did not have racial compositions within this band in 2001, likely because very long bus rides would have been required for some students (Kane, Staiger, and Riegg (2005)).

[12] Table 3 also shows that $bschl\_shock^j_{2002}$ is more dispersed than $bschl\_obs^j_{2002}$. This is consistent with families' sorting across schools between Fall 2001 and Fall 2002 (changing residences or gaining admission to non-home schools through the lottery) in response to large changes in school racial compositions.

to five years after the dismissal of busing. Because the observed change in the percent black of the assigned elementary school contains variation in school racial compositions caused by factors endogenous to neighborhood racial compositions, ordinary least squares (OLS) estimation of equation (3.1) leads to biased estimates of β. To eliminate the bias, I instrument $\Delta bschl\_obs^j$ with $\Delta bschl\_shock^j$, exploiting changes in school racial compositions generated solely by the redistricting (first-stage equation (3.2)). The similarity between the last two rows of Table 3 suggests that $\Delta bschl\_shock^j$ is a strong predictor of $\Delta bschl\_obs^j$; Section 4.2 shows this formally.

Control variables include 2001 elementary school polygon fixed effects, α_{FE}, and a vector of baseline neighborhood characteristics constructed using the 2001-2002 school year administrative data, X^j_{2001}: percent black, percent Hispanic, percent receiving lunch subsidies, percent female, average test score, average number of absences, and average number of suspensions.[13] The polygon fixed effects ensure that I compare changes in neighborhood racial compositions across neighborhoods within the same polygon (within the same geographic area) but exposed to different shocks to school racial compositions. The baseline neighborhood characteristics capture observable, pre-existing differences in the characteristics of neighborhoods within the same polygon. Section 3.3 provides more formal justification for the instrument and the control variables. ε^j_{2001+k} is a random error term that allows for clustering at the polygon level.

3.2.2 Threats to Identification

I focus on the role of neighborhood school assignment in explaining neighborhood racial sorting, as my empirical strategy uses policy-driven changes in school assignments through redistricting to identify the impact of school racial compositions on neighborhood racial compositions. After the redistricting, parents could enter the lottery to send their children to magnet programs or to regular, non-magnet programs at non-home schools (there were also magnet options prior to the redistricting). If parents not happy with their home schools gained admission to non-home schools through the lottery, instead of relocating to the assignment zones of more-preferred schools, there would be less residential sorting as a result of the changed school assignments (all else equal), thus working against finding an impact of changes in assigned school racial characteristics on neighborhood racial characteristics.[14]

However, the changes in school assignments are still meaningful under the choice plan. Since admission

[13] Average test score is the mean score on Spring 2002 North Carolina reading and math exams, averaged across students residing in the neighborhood. Each student's test score was first standardized by the district mean and standard deviation within each grade. Students in grades three through nine take these exams (ninth graders take only an English exam).

[14] Lending support to this idea is Walden's (1990) finding that test scores and racial compositions had smaller impacts on housing prices when magnet programs were more widely implemented.

to a non-home school was not guaranteed if the school was oversubscribed, a parent might have decided to locate in the neighborhood of a more-preferred school to be guaranteed admission, leading to neighborhood sorting. Furthermore, in the first year of the choice plan, CMS expanded capacities at popular schools in an effort to give each parent one of her three choices (Hastings and Weinstein (2008)). After the first year, the district did not further expand capacities at high-demand schools, so students were less likely to attend non-home schools in these years.[15] As a result, attendance at a given school became more tied to residence over time, suggesting an increase in neighborhood sorting over time.

Another potential threat to identification is the four-year gap between the time that CMS was first sued for its magnet admissions policy (September 1997) and the actual dismissal of busing (September 2001). It is possible that a parent forecasted that school assignments were going to change and acted accordingly by, say, immediately changing her residential location if she was not satisfied with the characteristics of what she thought was going to be her new assigned school. However, this forecasting is unlikely since the legal process went through numerous appeals before the actual dismissal. A September 1999 ruling said that race could not be used to determine school assignments; later that month the school board voted to appeal the decision. A November 2000 ruling declared that CMS was not unitary in all areas, followed by a full court review of this ruling, and in September 2001 CMS was declared unitary. A group even tried to appeal the decision in December 2001 after parents had already received their choice forms, but the United States Supreme Court said in April 2002 that it would not hear the appeal (CMS (2013)).

3.3 Baseline Characteristics

To further motivate the instrument and the control variables in equations (3.1) and (3.2), Table 4 compares mean baseline characteristics across neighborhoods reassigned and not reassigned to different elementary schools due to the redistricting. If baseline characteristics differed across reassigned and non-reassigned neighborhoods, then estimates of the effect of school racial compositions on neighborhood racial compositions could be spurious: pre-existing differences between reassigned and non-reassigned neighborhoods might have implied different patterns of sorting regardless of the change in school assignments.

Columns (1) and (2) give mean baseline characteristics for reassigned and non-reassigned neighborhoods, respectively, for the seven baseline characteristics included in equations (3.1) and (3.2). Column

[15] Thirty-six percent of students attended non-home schools in 2002, with the percentage decreasing monotonically to 29 percent in 2006. Excluding magnet students, 24 percent attended non-home schools in 2002, with the percentage decreasing monotonically to 17 percent in 2006.

(3) gives mean differences in baseline characteristics obtained from separate OLS regressions of the form:

$$y^j = \alpha + \beta R^j + \varepsilon^j, \tag{3.3}$$

where y^j is the baseline characteristic of interest for neighborhood j, R^j is an indicator for whether neighborhood j was reassigned to a different elementary school, and ε^j is a random error term that allows for clustering at the polygon level. Each row reports $\widehat{\beta}$: the mean difference in the baseline characteristic of interest across reassigned and non-reassigned neighborhoods. Since the busing plan typically assigned areas with large percentages of black students to schools located in areas with large percentages of non-black students, reassigned neighborhoods had higher percentages black, higher percentages receiving lunch subsidies, lower average test scores, higher average absences, and higher average suspensions.

Column (4) gives polygon-adjusted mean differences in baseline characteristics, obtained by adding polygon fixed effects to equation (3.3). The reported estimates of β are then the within-polygon (within small geographic area) mean difference in the baseline characteristic of interest across reassigned and non-reassigned neighborhoods. After controlling for polygon fixed effects, all of the mean differences are much smaller in magnitude and generally not significantly different from zero. In particular, the mean difference in neighborhood percent black is no longer statistically significant. This is important because initial neighborhood percent black is a strong predictor of future changes in neighborhood percent black. There is still a significant difference in neighborhood average number of absences and a marginally significant difference in neighborhood average number of suspensions; however, each difference is less than half of the magnitude of the corresponding difference in column (3).

Overall, the polygon fixed effects absorb most of the differences in observable baseline characteristics across reassigned and non-reassigned neighborhoods, justifying their inclusion in equations (3.1) and (3.2). I also control for the seven baseline neighborhood characteristics to capture additional observable, pre-existing differences in the characteristics of neighborhoods within the same polygon.

4 Empirical Results for Neighborhood Racial Dynamics

4.1 Theoretical Predictions

In Appendix A, I present a simple model of short-run neighborhood racial dynamics, extending the theoretical framework used by Card, Mas, and Rothstein (2006) in their study of neighborhood tipping, to generate testable predictions for how neighborhood racial compositions respond to changes in assigned school racial compositions. According to Schelling (1971), tipping occurs "when a recognizable new minority enters a neighborhood in sufficient numbers to cause the earlier residents to begin evacuating," and the tipping point is the neighborhood minority share where the above process begins. Card, Mas, and Rothstein (2006) analyzed a simple model of neighborhood racial dynamics to generate testable implications of the long-run behavior of the neighborhood minority share around a tipping point.[16] I incorporate school racial compositions into this framework, modeling the change in the racial composition of a neighborhood as a function of lagged neighborhood and school racial compositions, and use it to trace out the short-run impact of a change in school assignments on neighborhood racial compositions.

Two intuitive predictions emerge from the model. The first prediction says that an increase in the percent black of the assigned school leads to an increase in the percent black of the neighborhood one or more years after the dismissal of busing. This prediction of a positive effect of school racial compositions on neighborhood racial compositions is consistent with $\widehat{\beta} > 0$ for all k in equation (3.1). The second prediction says that, for a given increase in the percent black of the assigned school, the increase in the percent black of the neighborhood is larger for longer time horizons. This prediction of larger responses over time is consistent with larger values of $\widehat{\beta}$ for larger k.

4.2 Main Results

Table 5 gives OLS estimates of first-stage equation (3.2), showing that $\Delta bschl\_shock^j$ is a strong predictor of $\Delta bschl\_obs^j$. A 10 percentage point increase in $\Delta bschl\_shock^j$ led to a 7.45 percentage point increase in $\Delta bschl\_obs^j$, with the F-statistic on $\Delta bschl\_shock^j$ equal to 226.44. The prediction is not perfect, as the estimated effect does not equal one. This is due to residential sorting between Fall 2001 and Fall 2002, as well as the fact that some students gained admission to non-home schools through the lottery.

Table 6 presents IV estimates of equation (3.1), with estimates of β in the first row.[17] Column (1) gives the estimated impact of the change in the percent black of the assigned elementary school on the percent black of the neighborhood one year after the end of busing. It is negative, inconsistent with the first model prediction, but very small and statistically insignificant. A 10 percentage point increase in the

[16] Using Decennial Census data, the authors found evidence of tipping behavior in most cities, with the average estimated tipping point around 0.13 fraction minority.

[17] Appendix Table B.1 shows reduced-form estimates of equation (3.1), giving the impact of the shock change in assigned elementary school percent black on neighborhood percent black. Since the first-stage coefficient on $\Delta bschl\_shock^j$ from Table 5 is 0.745, the reduced-form and IV estimates tell a similar story about the relationship between assigned elementary school percent black and neighborhood percent black. The former estimates, however, may be more informative for understanding potential effects of school racial desegregation policy changes on neighborhood racial sorting, as these estimates directly reflect the impact of the court-induced changes in school racial compositions on neighborhood racial compositions.

percent black of the assigned elementary school led to a 0.30 percentage point decrease in neighborhood percent black one year after dismissal, a 0.56 percent decline in neighborhood percent black at its mean of 53.6 percent in 2001 (Table 2).

The remaining columns give the estimated impacts of the change in the percent black of the assigned elementary school on the percent black of the neighborhood two to five years after the dismissal of busing. Each coefficient is positive, in line with the first model prediction, and the magnitudes increase over time, consistent with the second model prediction. The marginally significant four-year estimate says that a 10 percentage point increase in the percent black of the assigned elementary school led to a 1.17 percentage point increase in the percent black of the neighborhood four years after dismissal, a 2.18 percent increase in neighborhood percent black at its mean. The five-year estimate, statistically significant and 17 percent larger than the four-year estimate, shows that a 10 percentage point increase in the percent black of the assigned elementary school led to a 1.37 percentage point increase in the percent black of the neighborhood five years after dismissal, a 2.56 percent increase in neighborhood percent black at its mean.

Overall, the empirical findings in Table 6 show evidence of neighborhood racial sorting in response to changes in the percent black of the assigned elementary school, with larger effects over time, and are broadly consistent with predictions from the simple model of short-run neighborhood racial dynamics. They are also in line with the finding from Kane, Staiger, and Riegg (2005) of a positive relationship between school racial compositions and neighborhood racial compositions over a longer time horizon.[18]

Moreover, my results imply that neighborhood school assignment is still important under the choice plan, as the impacts of the reassignments on neighborhood racial compositions were bigger for longer time horizons when students were less likely to gain admission to non-home schools through the lottery. Hastings, Kane, and Staiger (2009) estimated preferences for school characteristics using parental choices from the first year of school choice in CMS. They found that parents, on average, preferred schools where the majority of the school population was of their own race. This suggests that more neighborhood racial sorting would have occurred in earlier years, when students were more frequently admitted to chosen schools by lottery, had the choice plan not been implemented.[19]

[18] It is difficult to directly compare the estimated impacts across the studies. I analyze one- to five-year changes in neighborhood compositions, while Kane, Staiger, and Riegg (2005) studied a 10-year change. I focus on the population most affected by the change in school compositions, whereas Kane, Staiger, and Riegg (2005) used Decennial Census data.

[19] Other studies of urban school choice have also found evidence of same-race preferences, including Lankford and Wyckoff (1992, 2006), Glazerman (1998), Saporito and Lareau (1999), Weiher and Tedin (2002), and Saporito (2003).

4.3 Falsification Test

The findings in columns (3) and (4) of Table 4 suggest that controlling for polygon fixed effects and the observable baseline neighborhood characteristics in equations (3.1) and (3.2) account for much of the pre-existing differences between reassigned and non-reassigned neighborhoods in the estimation of the impact of school racial compositions on neighborhood racial compositions. In this section, I perform a falsification test as a check for differential, pre-existing trends in neighborhood racial compositions. Table 7 presents IV estimates of equation (3.1), where the dependent variable is now the change in the percent black of the neighborhood one to five years *prior* to the dismissal of busing in 2001, $bneigh^j_{2001} - bneigh^j_{2001-k}$ for $k = 1, ..., 5$.[20] I continue to assign to each neighborhood the change in the percent black of its assigned elementary school as a result of the redistricting in 2001.

The coefficient estimates in the first row of Table 7 show a negative relationship between the change in the percent black of the assigned elementary school and the five pre-redistricting changes in neighborhood percent black. However, the estimates are not monotonic over time (as they were in Table 6), nor are they statistically significant, except for the marginally significant impact three years prior to the reassignments.[21] In particular, the estimates in columns (4) and (5) of Table 7 are smaller in magnitude and noisier than the estimate in column (3), unlike the pattern in Table 6. This suggests that differential, pre-existing trends in neighborhood racial compositions are unlikely to explain the results in Table 6.

4.4 Alternative Definition of Racial Groups

To see if there were different patterns of neighborhood sorting in response to changes in the racial composition of the assigned school across two racial group definitions, I compare the results in Table 6 with results that examine the non-white versus white populations. Table 8 presents IV estimates of equation (3.1), where the dependent variable is now the change in the percent non-white of the neighborhood one to five years after the dismissal of busing in 2001, and the explanatory variable of interest (instrument) is now the observed (shock) change in the percent non-white of the assigned elementary school.[22] The mean neighborhood percent non-white in 2001 was 66.2 percent.

The estimated effects of the change in the percent non-white of the assigned elementary school on

[20] The sample for this analysis consists of 241 neighborhoods, the subset of the original 249 neighborhoods that had at least 10 students for the years 1996 to 2006, inclusive.

[21] The non-monotonic pattern of coefficient estimates can potentially be explained by the smaller-scale redistricting prior to 2001: approximately 10 percent of households were reassigned to different elementary schools in 1996, 15 percent in 1998, and five percent in 1999 (Kane, Staiger, and Riegg (2005)).

[22] I use the same control variables as in equation (3.1); estimates of β are almost identical when 2001 neighborhood percent non-white is used as a control variable instead of 2001 neighborhood percent black and percent Hispanic.

the percent non-white of the neighborhood in the first row of Table 8 are negative except for the five-year impact, statistically insignificant except for the marginally significant one-year impact, and much smaller in magnitude than the corresponding estimates in Table 6 for the three-year and longer horizons. Overall, as compared to the estimates in Table 6, the estimates in Table 8 do not provide clear evidence of neighborhood racial sorting in response to changes in the percent non-white of the assigned elementary school. This could be explained by the different population growth rates across the racial/ethnic groups that comprise the non-white population, as shown in Table 1, implying that the racial/ethnic mix of the non-white population changed a lot over time. It could also be due to different interactions both within and across the groups in terms of the coordination of residential location decisions.[23]

5 Student-Level Attrition and Moving

5.1 Motivation and Empirical Strategy

The results from Table 6 show evidence of neighborhood racial sorting in response to changes in the percent black of the assigned elementary school. However, by themselves, these findings cannot determine whether the increase (decrease) in the percent black of a given neighborhood was caused by black families' moving into (out of) the neighborhood, non-black families' moving out of (into) the neighborhood, or a combination of both. In other words, it remains unclear if the residential location decisions of black families or non-black families were more responsive to changes in elementary school racial compositions.

In this section, I study individual decisions to leave CMS (attrition) and to switch residences conditional on not having left CMS, both as a result of changes in the percent black of the assigned elementary school. I analyze attrition first because I do not observe a student's residential location upon her leaving the public school district; for instance, a student who left CMS might have changed her residential location or remained in the same residence but transferred to a non-CMS school (e.g., a private school).

My approach is as follows. I begin with the universe of students in the 2001 20^{th} day CMS student census, dropping students with special academic needs (including preschoolers), students with missing baseline characteristics or addresses, and students not in one of the 249 neighborhoods used in the analysis (293 students). I count a student as not enrolled in CMS in a given year (2002 to 2006, inclusive) if and only if she did not appear in the 20^{th} day student census for that year. Due to graduation in Spring

[23] Card, Mas, and Rothstein (2008) explored three different definitions of the minority population (non-white plus white Hispanic, black plus Hispanic, and black only), finding that estimated tipping behavior was similar across the three definitions during the 1980s and 1990s but was more a function of the neighborhood fraction black during the 1970s.

2002, almost all 12^{th} grade students in 2001 did not appear in the 2002 20^{th} day student census; those that did appear were retained and hence were not representative of 12^{th} graders. I thus further drop all 12^{th} grade students when exploring attrition in 2002. Likewise, I further drop 11^{th} grade students when studying 2003 attrition, 10^{th} grade students when considering 2004 attrition, ninth grade students when analyzing 2005 attrition, and eighth grade students when investigating 2006 attrition.

The top panel of Table 9 presents summary statistics for the probability of attrition: overall, for black students, and for non-black students. In each year, the probability was significantly different across the two racial groups (p-value = 0.0000) and larger for non-black students. However, this finding of differential rates of attrition does not necessarily imply that non-black students were more likely than black students to leave CMS in response to changes in the percent black of the assigned elementary school.

Section 5.2 provides IV estimates of the following student-level linear probability models, estimated separately for black and non-black students ($k = 1, ..., 5$):

$$A^j_{2001+k} = \alpha_{FE} + \beta \Delta bschl\_obs^j + \delta' X^j_{2001} + \varepsilon^j_{2001+k} \tag{5.1}$$

$$\Delta bschl\_obs^j = \alpha_{FE} + \mu \Delta bschl\_shock^j + \eta' X^j_{2001} + \nu^j_{2001+k}. \tag{5.2}$$

The dependent variable in second-stage equation (5.1) is an indicator for whether student j was *not* enrolled in CMS in year $2001 + k$, where k is the number of years since the dismissal of busing in 2001. The coefficient of interest is β: the impact of a one percentage point increase in the percent black of the assigned elementary school on the probability of non-enrollment in CMS one to five years after the dismissal of busing. I again instrument $\Delta bschl\_obs^j$ with $\Delta bschl\_shock^j$ (first-stage equation (5.2)). Control variables include polygon fixed effects, α_{FE}, and a vector of baseline student characteristics, X^j_{2001}: indicator if female, indicator if lunch subsidy recipient, indicator if enrolled in magnet program, number of absences, number of suspensions, and grade-level indicators.[24] ε^j_{2001+k} is a random error term that allows for clustering at the polygon level.

I then look at decisions to change residences within CMS for students who had not left CMS. The estimation sample for each year is the same as the estimation sample used in the corresponding attrition regression, excluding the students no longer in CMS at the beginning of that year. I count a student as living in a different residence in a given year (2002 to 2006, inclusive) if and only if her residence that year was located in a different neighborhood than her residence in 2001. I do not treat a within-neighborhood

[24] I do not control for baseline test score because these data are only available for students in grades three through nine.

move as changing residence because my analysis focuses on racial sorting across neighborhoods, and the explanatory variable of interest and its instrument vary only at the neighborhood level.

The bottom panel of Table 9 shows summary statistics for the probability of moving within CMS conditional on not having left CMS. In each year, the probability was significantly different across the two racial groups (p-value = 0.0000) and larger for black students. However, this finding of differential rates of moving does not necessarily imply that black students were more likely than non-black students to move in response to changes in the percent black of the assigned elementary school.

Section 5.2 gives IV estimates of equation (5.1), estimated separately for black and non-black students, where I replace A^j_{2001+k} with M^j_{2001+k}, an indicator for whether student j's residence in year $2001+k$ differed from her residence in 2001. In this case, β measures the impact of a one percentage point increase in the percent black of the assigned elementary school on the probability of moving within CMS one to five years after the dismissal of busing. The estimated effects on attrition and moving provide insight into the mechanism by which assigned elementary school percent black affected neighborhood percent black.

5.2 Empirical Results

The top panel of Table 10 presents IV estimates for the effect of school racial compositions on attrition for black students. In each year, there was a negative and statistically significant impact of the change in the percent black of the assigned elementary school on attrition. A 10 percentage point increase in the percent black of the assigned elementary school implied a five to seven percent decrease in the probability of attrition at its mean (comparing the coefficient estimate to the attrition rate for each year). The bottom panel contains the IV estimates for non-black students. None of the estimates is statistically significant, except in 2002, when there was a positive effect of the change in the percent black of the assigned elementary school on attrition. In each year, the magnitude of the implied percent change in the probability of attrition at its mean is less than the corresponding magnitude for black students. Overall, there is evidence that the reassignments affected the composition of CMS, in that a black student was less likely to leave CMS when she experienced an increase in the percent black of her assigned elementary school, and a non-black student was more likely to leave immediately following the reassignments.

The top panel of Table 11 gives IV estimates for the effect of school racial compositions on moving for black students. None of the estimates is statistically significant, suggesting that changes in the percent black of the assigned elementary school did not affect moving decisions for black students that remained enrolled in CMS. A 10 percentage point increase in the percent black of the assigned elementary school implied a less than one percent increase in the probability of moving at its mean for black students.[25] The bottom panel shows the IV estimates for non-black students. In each year, there was a positive and statistically significant impact of the change in the percent black of the assigned elementary school on moving. A 10 percentage point increase in the percent black of the assigned elementary school implied a 17 to 19 percent increase in the probability of moving at its mean, far larger than the implied percent changes in moving for black students and more than twice the magnitudes of the implied percent changes in attrition for both black and non-black students. The changes in neighborhood racial compositions appear to have been driven much more by moving decisions than by attrition decisions.

Taken together, the findings from the attrition and moving analyses put forward an explanation for the positive estimated impacts on neighborhood racial compositions from Table 6 for the longer time horizons: non-black residents moved from neighborhoods with increases in the percent black of the assigned elementary school to neighborhoods with declines in the percent black of the assigned elementary school, while black residents did not change residential locations in response to the school reassignments.[26]

6 Conclusions, Policy Implications, and Future Research

This paper provided empirical evidence on how changes in school racial compositions affect neighborhood racial compositions. I used a natural experiment in CMS: school redistricting that coincided with the end of court-ordered busing for desegregation in 2001. Approximately 50 percent of families were reassigned to different schools, leading to large changes in school racial compositions across the district. I found that a 10 percentage point increase in the percent black of the assigned elementary school led to a 1.37 percentage point increase, relative to a mean of 53.6 percent, in the percent black of the neighborhood five years after the end of busing. The effects grew over time, consistent with predictions from a simple model of short-run neighborhood racial dynamics. Moreover, the estimated responses of neighborhood racial compositions to changes in assigned school racial compositions for the longer time horizons were consistent with non-black residents' moving from neighborhoods with increases in the percent black of

[25] Priority in the school choice lottery has generally been given to lower-income and lower-performing students who choose higher-income and higher-performing schools (Hastings and Weinstein (2008)). Because black students have, on average, lower baseline achievement and income than non-black students, lottery priority can potentially explain why the reassignments did not affect moving decisions for black students. However, it is unlikely that lottery priority is the only explanation because the probability of attending a non-home school was smaller in later years for both black and non-black students and because there is substantial heterogeneity in preferences for school characteristics (Hastings, Kane, and Staiger (2009)).

[26] In the urban school choice context, Glazerman (1998), Weiher and Tedin (2002), and Hastings, Kane, and Staiger (2009) found that both white and minority parents showed own-race preferences when choosing schools, while Lankford and Wyckoff (1992, 2006), Saporito and Lareau (1999), and Saporito (2003) found that such preferences were specific to white parents.

the assigned elementary school to neighborhoods with decreases in the percent black of the assigned elementary school, while black residents did not move in response to the reassignments.

My findings have implications for the potential short-run impacts of changes in school racial desegregation policies on neighborhood racial compositions. The 1991 *Board of Education of Oklahoma City v. Dowell* decision described how a school district could be declared unitary and thus no longer subject to a racial desegregation order. Since that time, many school districts have been released from racial desegregation; for instance, a recent Supreme Court ruling declared that race-based student assignment plans in Seattle, Washington and Louisville, Kentucky were unlawful.[27] These and other school districts are then faced with designing school assignment systems not based on race. Possible alternatives to racial busing include school choice, local residential neighborhood assignment, or "social integration" programs where students are assigned to schools based on other factors, such as income or prior academic achievement.[28] There is empirical evidence that school racial segregation has increased as a result of dismissal from court-ordered racial desegregation (Orfield and Eaton (1996), Clotfelter, Ladd, and Vigdor (2006), and Lutz (2011)). These findings, together with my results, support the idea that short-run neighborhood racial sorting may occur if school racial compositions change after the termination of racial desegregation.

My work has found short-run evidence of neighborhood racial sorting in response to changes in school racial compositions. Longer-term impacts on neighborhood racial compositions due to these school reassignments and, more broadly, the end of court-ordered racial desegregation remain to be seen, as many districts only recently have ended their racial desegregation programs. In addition, my results cannot address how changes in school racial characteristics affect neighborhood sorting for households without children in CMS. Comparing patterns of sorting across households with and without children in the public school system would provide a more complete understanding of the importance of school racial compositions in determining location decisions, that is, the extent to which school racial compositions directly influence location decisions (through having a child attend the assigned school) or more indirectly affect these decisions (through rents or housing values). Finally, the estimated changes in neighborhood racial compositions can be linked to panel data on individual economic outcomes, such as educational achievement, labor market activity, or health, to better understand how neighborhood effects operate and to hopefully separate the impacts of schools from the impacts of neighborhoods on these outcomes.[29]

[27] High court rejects school integration plans. (2007, June 27). *The Seattle Times*.

[28] See Kahlenberg (2007) and Wake Education Partnership (2008) for a listing of school districts that use socioeconomic status as a factor in assigning students to schools and the history of school desegregation for some of these districts.

[29] Borjas (1995), O'Regan and Quigley (1996), Cutler and Glaeser (1997), O'Regan and Quigley (1998), Weinberg (2000), Clark and Drinkwater (2002), Durlauf (2004), Card and Rothstein (2007), and Ananat (2011) found effects of neighborhood

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Table 1: Racial/Ethnic Distribution of CMS Versus Mecklenburg County

	% Black, Not Hispanic	% White, Not Hispanic	% Hispanic	% Other Ethnicities	Number of Students/ Residents
	(1)	(2)	(3)	(4)	(5)
CMS: 2001	43.0	43.7	7.1	6.1	110,434
CMS: 2002	43.0	42.4	8.1	6.4	113,954
CMS: 2003	43.1	40.7	9.4	6.7	118,623
CMS: 2004	43.3	38.8	11.0	6.9	123,707
CMS: 2005	43.3	36.7	12.6	7.4	129,340
CMS: 2006	42.7	35.3	14.1	7.9	135,367
County: 2001	28.0	60.4	7.1	4.5	719,552
County: 2002	28.4	59.3	7.6	4.6	735,194
County: 2003	28.6	58.5	8.1	4.8	752,227
County: 2004	28.8	57.5	8.6	5.0	770,638
County: 2005	29.2	56.5	9.2	5.1	796,369
County: 2006	29.5	55.4	9.8	5.3	827,445

Notes: The CMS distributions were taken from student censuses. The county distributions were taken from the United States Census Bureau Population Estimates Program (July 1 reference date). The "% Other Ethnicities" category includes Asian, Native American, and Multiracial.

Table 2: Summary Statistics for Neighborhood Percent Black

			Percentiles												
	μ	σ	Min	5	10	20	30	40	50	60	70	80	90	95	Max
2001	53.6	32.9	0	4.2	6.3	15.2	28.7	43.2	54.8	69.8	80.9	89.9	96.1	97.6	100
2002	53.7	32.2	0	4.3	6.7	16.9	30.9	44.4	54.8	67.8	81.4	88.9	95.1	97.4	100
2003	54.0	31.7	0	4.8	7.5	18.2	30.8	46.3	55.8	67.2	77.7	89.2	94.3	97.3	100
2004	54.2	31.3	0	4.8	8.7	17.8	35.1	46.7	56.9	65.9	77.0	89.1	95.1	97.7	100
2005	54.3	30.7	0	5.0	8.4	18.6	34.5	47.2	56.4	67.2	76.1	87.6	94.2	97.0	100
2006	53.9	30.5	0	4.3	7.7	22.1	35.3	46.1	56.8	65.0	76.2	86.3	93.4	96.7	100

Note: These statistics were constructed using neighborhood-level data.

Table 3: Summary Statistics for Assigned Elementary School Percent Black

			Percentiles												
	μ	σ	Min	5	10	20	30	40	50	60	70	80	90	95	Max
2001 (observed)	44.3	16.5	3.2	7.0	25.3	33.3	37.3	40.9	44.4	46.1	51.1	59.2	66.3	72.3	82.8
2002 (observed)	51.0	26.1	3.7	7.4	13.8	25.0	32.7	44.0	50.8	59.9	67.5	73.5	90.8	91.8	96.3
2002 (shock)	51.2	28.9	3.0	6.7	8.1	20.4	31.8	40.2	53.1	62.8	70.1	84.1	90.7	95.4	97.5
Change (observed)	6.7	24.3	-54.0	-29.4	-21.2	-12.9	-6.0	-1.8	1.8	8.8	17.2	27.6	45.1	54.7	63.9
Change (shock)	6.9	27.0	-50.2	-32.1	-25.6	-16.2	-8.8	-2.7	1.0	8.7	22.0	33.6	48.8	57.3	64.8

Note: These statistics were constructed using neighborhood-level data.

Table 4: Mean Baseline Characteristics for Reassigned and Non-Reassigned Neighborhoods

Baseline Characteristic	Mean for Reassigned Neighborhoods	Mean for Non-Reassigned Neighborhoods	Mean Difference (1)-(2)	Within-Polygon Mean Difference
	(1)	(2)	(3)	(4)
% Black	59.166	35.775	23.392***	4.743
			(4.109)	(3.763)
% Hispanic	6.562	7.795	-1.233	-0.418
			(1.054)	(1.111)
% Lunch	54.218	35.228	18.991***	3.962
			(3.500)	(2.672)
% Female	48.507	48.896	-0.389	-0.243
			(0.476)	(0.711)
Average Test Score	-0.250	0.083	-0.332***	-0.085
			(0.060)	(0.052)
Average Number of Absences	9.983	8.358	1.625***	0.601**
			(0.274)	(0.248)
Average Number of Suspensions	1.210	0.679	0.530***	0.133*
			(0.090)	(0.072)
Observations	190	59	249	249

Notes: Columns (3) and (4) report the coefficient on whether the neighborhood was reassigned to a different elementary school from separate OLS regressions with each baseline characteristic as the dependent variable. Column (3) does not include polygon fixed effects, whereas column (4) does. Standard errors, clustered at the polygon level, are in parentheses. Asterisks indicate significance (*=.10, **=.05, ***=.01).

Table 5: First-Stage (OLS) Estimates of Impact of Shock Change in Assigned Elementary School Percent Black on Observed Change in Assigned Elementary School Percent Black

	Observed Δ% Black in Assigned Elem. School from 2001 to 2002
Shock Δ% Black in Assigned Elem. School from 2001 to 2002	0.745***
	(0.050)
2001 Neighborhood % Black	-0.124*
	(0.072)
2001 Neighborhood % Hispanic	-0.149
	(0.125)
2001 Neighborhood % Lunch	0.097
	(0.088)
2001 Neighborhood % Female	-0.057
	(0.147)
2001 Neighborhood Average Test Score	-2.878
	(5.673)
2001 Neighborhood Average Number of Absences	0.252
	(0.585)
2001 Neighborhood Average Number of Suspensions	0.007
	(1.974)
F-Statistic on Excluded Instrument	226.44***
Observations	221

Notes: The regression includes polygon fixed effects. Singleton groups (i.e., polygons with exactly one neighborhood, like Triangle II in Figure 1) were dropped in the estimation, reducing the sample size to 221 neighborhoods. Standard errors, clustered at the polygon level, are in parentheses. Asterisks indicate significance (*=.10, **=.05, ***=.01).

Table 6: IV Estimates of Impact of Observed Change in Assigned Elementary School Percent Black on Neighborhood Percent Black

	Δ% Black in Neigh. from 2001 to 2002	Δ% Black in Neigh. from 2001 to 2003	Δ% Black in Neigh. from 2001 to 2004	Δ% Black in Neigh. from 2001 to 2005	Δ% Black in Neigh. from 2001 to 2006
	(1)	(2)	(3)	(4)	(5)
Observed Δ% Black in Assigned	-0.030	0.026	0.074	0.117*	0.137**
Elem. School from 2001 to 2002	(0.056)	(0.060)	(0.069)	(0.068)	(0.064)
2001 Neighborhood % Black	-0.059	-0.163***	-0.229***	-0.301***	-0.289***
	(0.049)	(0.059)	(0.065)	(0.068)	(0.091)
2001 Neighborhood % Hispanic	0.073	-0.123	-0.071	0.003	0.088
	(0.114)	(0.126)	(0.147)	(0.147)	(0.161)
2001 Neighborhood % Lunch	0.025	0.166	0.092	0.111	0.042
	(0.070)	(0.111)	(0.121)	(0.106)	(0.121)
2001 Neighborhood % Female	-0.017	-0.109	0.050	0.108	0.057
	(0.116)	(0.123)	(0.140)	(0.164)	(0.189)
2001 Neighborhood Average	0.907	5.124	3.036	3.930	6.240
Test Score	(4.365)	(5.517)	(6.320)	(7.071)	(5.823)
2001 Neighborhood Average	-0.533	0.042	-0.377	-0.393	0.023
Number of Absences	(0.583)	(0.612)	(0.732)	(0.645)	(0.783)
2001 Neighborhood Average	1.751	-0.648	2.432	3.049	3.238
Number of Suspensions	(1.912)	(1.710)	(1.673)	(1.904)	(2.529)
Observations	221	221	221	221	221

Notes: Each regression includes polygon fixed effects. Singleton groups (i.e., polygons with exactly one neighborhood, like Triangle II in Figure 1) were dropped in the estimation, reducing the sample size to 221 neighborhoods. Standard errors, clustered at the polygon level, are in parentheses. Asterisks indicate significance (*=.10, **=.05, ***=.01).

Table 7: IV Estimates of Impact of Observed Change in Assigned Elementary School Percent Black on Neighborhood Percent Black (Falsification Test)

	Δ% Black in Neigh. from 2000 to 2001	Δ% Black in Neigh. from 1999 to 2001	Δ% Black in Neigh. from 1998 to 2001	Δ% Black in Neigh. from 1997 to 2001	Δ% Black in Neigh. from 1996 to 2001
	(1)	(2)	(3)	(4)	(5)
Observed Δ% Black in Assigned Elem. School from 2001 to 2002	-0.077	-0.087	-0.117*	-0.088	-0.109
	(0.058)	(0.064)	(0.067)	(0.063)	(0.071)
2001 Neighborhood % Black	0.046	0.038	0.095	0.088	0.147
	(0.061)	(0.065)	(0.074)	(0.090)	(0.094)
2001 Neighborhood % Hispanic	-0.038	-0.171	-0.242	-0.232	-0.277*
	(0.133)	(0.167)	(0.160)	(0.167)	(0.167)
2001 Neighborhood % Lunch	-0.048	-0.113	-0.177*	-0.263**	-0.355***
	(0.092)	(0.096)	(0.103)	(0.114)	(0.122)
2001 Neighborhood % Female	0.215	-0.063	-0.202	-0.362**	-0.384**
	(0.142)	(0.156)	(0.181)	(0.161)	(0.178)
2001 Neighborhood Average Test Score	-0.691	-3.599	-4.676	-9.583	-10.519
	(5.516)	(6.178)	(6.618)	(6.232)	(7.603)
2001 Neighborhood Average Number of Absences	-0.004	-0.001	0.004	0.006	0.012
	(0.007)	(0.007)	(0.007)	(0.008)	(0.009)
2001 Neighborhood Average Number of Suspensions	0.024*	0.004	-0.018	-0.034	-0.044
	(0.013)	(0.015)	(0.021)	(0.024)	(0.030)
Observations	211	211	211	211	211

Notes: Each regression includes polygon fixed effects. Singleton groups (i.e., polygons with exactly one neighborhood, like Triangle II in Figure 1) were dropped in the estimation, reducing the sample size to 211 neighborhoods. Standard errors, clustered at the polygon level, are in parentheses. Asterisks indicate significance (*=.10, **=.05, ***=.01).

Table 8: IV Estimates of Impact of Observed Change in Assigned Elementary School Percent Non-White on Neighborhood Percent Non-White

	Δ% Non-White in Neigh. from 2001 to 2002	Δ% Non-White in Neigh. from 2001 to 2003	Δ% Non-White in Neigh. from 2001 to 2004	Δ% Non-White in Neigh. from 2001 to 2005	Δ% Non-White in Neigh. from 2001 to 2006
	(1)	(2)	(3)	(4)	(5)
Observed Δ% Non-White in Assigned Elem. School from 2001 to 2002	-0.060*	-0.034	-0.034	-0.031	0.049
	(0.036)	(0.053)	(0.051)	(0.048)	(0.054)
2001 Neighborhood % Black	-0.086*	-0.123**	-0.192***	-0.226***	-0.314***
	(0.047)	(0.059)	(0.071)	(0.058)	(0.066)
2001 Neighborhood % Hispanic	-0.019	-0.118	-0.221*	-0.170	-0.229**
	(0.088)	(0.119)	(0.130)	(0.125)	(0.116)
2001 Neighborhood % Lunch	0.062	0.083	0.076	0.020	-0.029
	(0.084)	(0.148)	(0.149)	(0.127)	(0.117)
2001 Neighborhood % Female	-0.067	-0.175	-0.079	-0.110	-0.088
	(0.106)	(0.152)	(0.153)	(0.148)	(0.165)
2001 Neighborhood Average Test Score	-0.815	2.912	3.484	1.204	-3.599
	(3.615)	(6.109)	(5.425)	(5.150)	(5.495)
2001 Neighborhood Average Number of Absences	-0.174	0.432	1.050	1.661**	1.146
	(0.555)	(0.663)	(0.803)	(0.794)	(0.726)
2001 Neighborhood Average Number of Suspensions	0.821	-0.339	0.217	-1.595	-2.329
	(1.741)	(1.834)	(1.783)	(1.521)	(1.434)
Observations	221	221	221	221	221

Notes: Each regression includes polygon fixed effects. Singleton groups (i.e., polygons with exactly one neighborhood, like Triangle II in Figure 1) were dropped in the estimation, reducing the sample size to 221 neighborhoods. Standard errors, clustered at the polygon level, are in parentheses. Asterisks indicate significance (*=.10, **=.05, ***=.01).

Table 9: Probability of Attrition and Moving by Race

		All Students	Black Students	Non-Black Students
Panel 1: Attrition				
2002	Probability of Attrition	0.063	0.054	0.070
	Observations	83,382	34,635	48,747
2003	Probability of Attrition	0.135	0.114	0.150
	Observations	78,228	32,821	45,407
2004	Probability of Attrition	0.183	0.149	0.208
	Observations	71,813	30,342	41,471
2005	Probability of Attrition	0.219	0.161	0.260
	Observations	64,096	26,943	37,153
2006	Probability of Attrition	0.261	0.198	0.306
	Observations	57,116	23,940	33,176
Panel 2: Moving				
2002	Probability of Moving	0.146	0.231	0.084
	Observations	78,120	32,774	45,346
2003	Probability of Moving	0.237	0.369	0.138
	Observations	67,680	29,087	38,593
2004	Probability of Moving	0.304	0.456	0.184
	Observations	58,648	25,816	32,832
2005	Probability of Moving	0.360	0.524	0.226
	Observations	50,090	22,598	27,492
2006	Probability of Moving	0.400	0.569	0.259
	Observations	42,228	19,207	23,021

Table 10: IV Estimates of Impact of Observed Change in Assigned Elementary School Percent Black on Attrition

	Not Enrolled in CMS in 2002	Not Enrolled in CMS in 2003	Not Enrolled in CMS in 2004	Not Enrolled in CMS in 2005	Not Enrolled in CMS in 2006
	(1)	(2)	(3)	(4)	(5)
Panel 1: Black Students					
Observed Δ% Black in Assigned	-0.0004***	-0.0007***	-0.0011***	-0.0011***	-0.0010***
Elem. School from 2001 to 2002	(0.0001)	(0.0003)	(0.0004)	(0.0004)	(0.0004)
Dependent Variable Mean	0.054	0.114	0.149	0.161	0.198
Observations	34,635	32,821	30,342	26,943	23,940
Panel 2: Non-Black Students					
Observed Δ% Black in Assigned	0.0004**	0.0005	0.0007	-0.00004	0.0010
Elem. School from 2001 to 2002	(0.0002)	(0.0004)	(0.0006)	(0.0006)	(0.0007)
Dependent Variable Mean	0.070	0.150	0.208	0.260	0.306
Observations	48,746	45,406	41,470	37,152	33,175

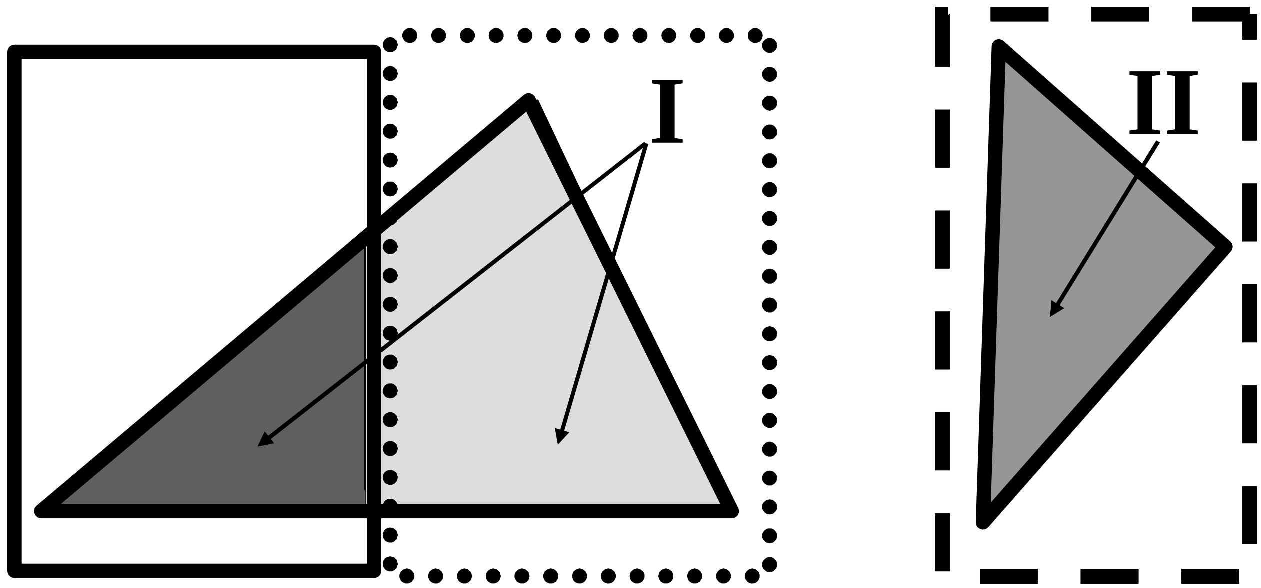
Notes: Each regression includes polygon fixed effects and the following baseline student characteristics: female, lunch, magnet program, number of absences, number of suspensions, and grade dummies. Singleton groups (i.e., polygons with exactly one student) were dropped in the estimation, slightly reducing some of the sample sizes from those in Table 9. Standard errors, clustered at the polygon level, are in parentheses. Asterisks indicate significance (*=.10, **=.05, ***=.01).

Table 11: IV Estimates of Impact of Observed Change in Assigned Elementary School Percent Black on Moving

	Different Residence in 2002	Different Residence in 2003	Different Residence in 2004	Different Residence in 2005	Different Residence in 2006
	(1)	(2)	(3)	(4)	(5)
Panel 1: Black Students					
Observed Δ% Black in Assigned	0.0002	0.00002	0.0004	0.0004	0.0003
Elem. School from 2001 to 2002	(0.0004)	(0.0006)	(0.0007)	(0.0008)	(0.0008)
Dependent Variable Mean	0.231	0.369	0.456	0.524	0.569
Observations	32,774	29,087	25,816	22,598	19,207
Panel 2: Non-Black Students					
Observed Δ% Black in Assigned	0.0015***	0.0026***	0.0034***	0.0039***	0.0046***
Elem. School from 2001 to 2002	(0.0006)	(0.0007)	(0.0007)	(0.0008)	(0.0008)
Dependent Variable Mean	0.084	0.138	0.184	0.226	0.259
Observations	45,345	38,592	32,830	27,490	23,019

Notes: Each regression includes polygon fixed effects and the following baseline student characteristics: female, lunch, magnet program, number of absences, number of suspensions, and grade dummies. Singleton groups (i.e., polygons with exactly one student) were dropped in the estimation, slightly reducing some of the sample sizes from those in Table 9. Standard errors, clustered at the polygon level, are in parentheses. Asterisks indicate significance (*=.10, **=.05, ***=.01).

Figure 1: Construction of Neighborhoods



1) Triangles I and II are two unconnected areas that were assigned to the same elementary school under busing in 2001.

2) Call each of the two triangles a polygon.

3) School redistricting due to the dismissal of busing in 2002 created new elementary school assignment zones. Three of the new assignment zones, each of which is a separate rectangle, overlapped triangles I and II.

4) The three overlapping regions are separate neighborhoods, each of which is given a different shading.

Appendices

A Simple Model of Short-Run Neighborhood Racial Dynamics

A.1 Assumptions

These assumptions are in line with the construction of neighborhoods in Section 3. There are two race categories: black and non-black. A school district consists of neighborhoods defined in such a way that each neighborhood was assigned to exactly one school before redistricting and exactly one school after redistricting. Note that while each neighborhood was assigned to exactly one school, that school was typically populated by multiple neighborhoods. Each student attended the public school assigned to her neighborhood both before and after the redistricting; there were no public school choice options or private schools. I also abstract away from different school levels (elementary, middle, and high).[30]

Following Card, Mas, and Rothstein (2006), I assume that the law of motion for the neighborhood black population is

$$\Delta b_t^j \equiv b_t^j - b_{t-1}^j = f\left(b_{t-1}^j, sch_{t-1}^j\right) \equiv \gamma_0 + \gamma_1 b_{t-1}^j + \gamma_2 sch_{t-1}^j, \tag{A.1}$$

where b_t^j is the percent black of neighborhood j in year t, and sch_{t-1}^j is the percent black of the school assigned to neighborhood j in year $t-1$. Equation (A.1) says that the one-year change in the percent black of a neighborhood (Δb_t^j) depends linearly on the initial percent black of the neighborhood (b_{t-1}^j) and on the initial percent black of the assigned school (sch_{t-1}^j).[31] γ_0, γ_1, and γ_2 are known parameters that govern the law of motion for b_t^j, and along the same lines as Card, Mas, and Rothstein (2006), I assume $\gamma_0 < 0$, $\gamma_1 > 0$, and $\gamma_2 > 0$. These assumptions mean that a larger neighborhood percent black in year $t-1$ is associated with a larger increase in neighborhood percent black from year $t-1$ to year t, and a larger percent black at the assigned school in year $t-1$ is associated with a larger increase in neighborhood percent black from year $t-1$ to year t.[32] As in Card, Mas, and Rothstein (2006), this sign pattern generates an unstable equilibrium percent black for neighborhood j.

[30] The framework presented below is less useful for examining long-run neighborhood racial dynamics because it predicts that all neighborhoods will become completely segregated in the long run, an unlikely outcome.

[31] The equation for the law of motion for the neighborhood black (minority) population in Card, Mas, and Rothstein (2006) is equation (A.1) without the term $\gamma_2 sch_{t-1}^j$.

[32] I ignore the fact that b_t^j cannot be less than 0 or greater than 100 for all j and for all t.

Given how neighborhoods were defined above, the following accounting identity for sch^j_{t-1} holds:

$$sch^j_{t-1} \equiv f^j_{t-1} b^j_{t-1} + \left(1 - f^j_{t-1}\right) b^{-j}_{t-1}, \tag{A.2}$$

where f^j_{t-1} is the fraction of students attending the school assigned to neighborhood j who live in neighborhood j in year $t-1$, and b^{-j}_{t-1} is the percent black of students attending the school assigned to neighborhood j but who do not live in neighborhood j in year $t-1$. Equation (A.2) expresses the percent black of the school assigned to neighborhood j in year $t-1$ as a weighted average of the percent black from neighborhoods that send students to this school. For simplicity, from the standpoint of neighborhood j, I assume f^j_{t-1} and b^{-j}_{t-1} are taken as given and constant and let $f^j_{t-1} \equiv f^j$ and $b^{-j}_{t-1} \equiv b^{-j}$. Hence, plugging equation (A.2) into equation (A.1), I have

$$\Delta b^j_t = \gamma_0 + \gamma_1 b^j_{t-1} + \gamma_2 \left(f^j b^j_{t-1} + \left(1 - f^j\right) b^{-j} \right). \tag{A.3}$$

A.2 Equilibrium

An equilibrium neighborhood percent black requires that $\Delta b^j_t = 0$ and $b^j_t \equiv b^j_*$ for all t. If the percent black of neighborhood j is in equilibrium, then the percent black of the assigned school is also in equilibrium (i.e., $sch^j_* = f^j b^j_* + \left(1 - f^j\right) b^{-j}$). Under the assumptions that $\gamma_0 < 0$, $\gamma_1 > 0$, and $\gamma_2 > 0$, b^j_* is an unstable equilibrium percent black for neighborhood j: $b^j_{t-1} > b^j_* \Leftrightarrow \Delta b^j_t > 0$. In addition, $\left|\Delta b^j_t\right|$ is larger when b^j_{t-1} is further away from b^j_*.

A.3 Short-Run Impact of School Redistricting

I trace out the short-run impact on b^j_t resulting from a shock to the racial composition of the school assigned to neighborhood j in year t (i.e., sch^j_t). This shock is the result of the 2002 school redistricting. I assume that, before this shock to school compositions, b^j_t was in equilibrium as described above, so that $b^j_t = b^j_*$ and $sch^j_* = f^j b^j_* + \left(1 - f^j\right) b^{-j}$. While this implies that neighborhoods were in unstable equilibria prior to the termination of busing, one of the requirements of the desegregation order in CMS provides some support for it. Recall that there were smaller-scale episodes of redistricting under busing for the district to maintain, as best as it could, school racial compositions within required bands. These episodes of redistricting might have helped to prevent neighborhood compositions from changing too much, as a neighborhood that had started to experience large changes in its percent black would have caused the assigned school to deviate too much from the court-ordered mandate. Changing school assignment zones would have been necessary to prevent schools from drifting further and further outside of the required bands. Without this assumption, it is more difficult to derive implications of changes in school racial compositions on neighborhood racial compositions because neighborhood racial compositions would have been evolving independently of the discrete change in school compositions at the time that the discrete change occurred (based on equation (A.1)), thus making it harder to disentangle the two effects.

The shock to the racial composition of the school assigned to neighborhood j in year t is a shock to f^j and b^{-j}. Suppose the post-shock values of f^j and b^{-j} are $f^{j\prime}$ and $b^{-j\prime}$, respectively. Thus,

$$sch_t^j = f^{j\prime} b_*^j + \left(1 - f^{j\prime}\right) b^{-j\prime}. \tag{A.4}$$

I obtain two qualitative predictions from this simple framework. Proposition 1 says that, under an assumption on the magnitude of γ_2, an increase in the percent black of the assigned school leads to an increase in the percent black of the neighborhood one or more years after the dismissal of busing. Proposition 2 says that, under the same assumption, for a given increase in the percent black of the assigned school, the increase in the percent black of the neighborhood is larger for longer time horizons.

Proposition 1 *Under the assumption that* $(\gamma_2)^2$ *is negligible,* $\left(b_{t+k}^j - b_*^j\right)$ *is an increasing function of* $\left(sch_t^j - sch_*^j\right)$ *for* $k \geq 1$.

Proposition 2 *Under the assumption that* $(\gamma_2)^2$ *is negligible, for a given increase in* $\left(sch_t^j - sch_*^j\right)$*, the increase in* $\left(b_{t+k}^j - b_*^j\right)$ *is larger for larger* k.

Proof. The one-year change in neighborhood percent black, $\left(b_{t+1}^j - b_*^j\right)$, is derived as follows:

$$\begin{aligned}
b_{t+1}^j &\equiv b_t^j + \gamma_0 + \gamma_1 b_t^j + \gamma_2 sch_t^j \qquad \text{by (A.1)} \\
&= b_*^j + \gamma_0 + \gamma_1 b_*^j + \gamma_2 \left(f^{j\prime} b_*^j + \left(1 - f^{j\prime}\right) b^{-j\prime}\right) \qquad \text{since } b_t^j = b_*^j.
\end{aligned}$$

$$\begin{aligned}
\Rightarrow \Delta b_{t+1}^j &= b_{t+1}^j - b_*^j \\
&= \left(b_*^j + \gamma_0 + \gamma_1 b_*^j + \gamma_2 \left(f^{j\prime} b_*^j + \left(1 - f^{j\prime}\right) b^{-j\prime}\right)\right) \\
&\quad - \left(b_*^j + \gamma_0 + \gamma_1 b_*^j + \gamma_2 \left(f^j b_*^j + \left(1 - f^j\right) b^{-j}\right)\right) \\
&= \gamma_2 \left(\left(f^{j\prime} b_*^j + \left(1 - f^{j\prime}\right) b^{-j\prime}\right) - \left(f^j b_*^j + \left(1 - f^j\right) b^{-j}\right)\right) \\
&= \gamma_2 \left(sch_t^j - sch_*^j\right).
\end{aligned}$$

The two-year change in neighborhood percent black, $\left(b_{t+2}^j - b_*^j\right)$, is derived as follows:

$$\begin{aligned}
b_{t+2}^j &\equiv b_{t+1}^j + \gamma_0 + \gamma_1 b_{t+1}^j + \gamma_2 sch_{t+1}^j \\
&= b_{t+1}^j + \gamma_0 + \gamma_1 b_{t+1}^j + \gamma_2 \left(f^{j\prime} b_{t+1}^j + \left(1 - f^{j\prime}\right) b^{-j\prime} \right).
\end{aligned}$$

$$\begin{aligned}
\Rightarrow \Delta b_{t+2}^j &= b_{t+2}^j - b_{t+1}^j \\
&= \left(b_{t+1}^j + \gamma_0 + \gamma_1 b_{t+1}^j + \gamma_2 \left(f^{j\prime} b_{t+1}^j + \left(1 - f^{j\prime}\right) b^{-j\prime} \right)\right) \\
&\quad - \left(b_*^j + \gamma_0 + \gamma_1 b_*^j + \gamma_2 \left(f^{j\prime} b_*^j + \left(1 - f^{j\prime}\right) b^{-j\prime} \right)\right) \\
&= \left(\left(b_{t+1}^j - b_*^j \right) + \gamma_1 \left(b_{t+1}^j - b_*^j \right) + \gamma_2 f^{j\prime} \left(b_{t+1}^j - b_*^j \right) \right) \\
&= \left(1 + \gamma_1 + \gamma_2 f^{j\prime}\right) \Delta b_{t+1}^j.
\end{aligned}$$

$$\begin{aligned}
\Rightarrow b_{t+2}^j - b_*^j &= \Delta b_{t+1}^j + \Delta b_{t+2}^j \\
&= \Delta b_{t+1}^j + \left(1 + \gamma_1 + \gamma_2 f^{j\prime}\right) \Delta b_{t+1}^j \\
&= \gamma_2 \left(1 + \left(1 + \gamma_1 + \gamma_2 f^{j\prime}\right)\right) \left(sch_t^j - sch_*^j \right).
\end{aligned}$$

The three-year change in neighborhood percent black, $\left(b_{t+3}^j - b_*^j\right)$, is derived as follows:

$$\begin{aligned}
b_{t+3}^j &\equiv b_{t+2}^j + \gamma_0 + \gamma_1 b_{t+2}^j + \gamma_2 sch_{t+2}^j \\
&= b_{t+2}^j + \gamma_0 + \gamma_1 b_{t+2}^j + \gamma_2 \left(f^{j\prime} b_{t+2}^j + \left(1 - f^{j\prime}\right) b^{-j\prime} \right).
\end{aligned}$$

$$\begin{aligned}
\Rightarrow \Delta b_{t+3}^j &= b_{t+3}^j - b_{t+2}^j \\
&= \left(b_{t+2}^j + \gamma_0 + \gamma_1 b_{t+2}^j + \gamma_2 \left(f^{j\prime} b_{t+2}^j + \left(1 - f^{j\prime}\right) b^{-j\prime} \right)\right) \\
&\quad - \left(b_{t+1}^j + \gamma_0 + \gamma_1 b_{t+1}^j + \gamma_2 \left(f^{j\prime} b_{t+1}^j + \left(1 - f^{j\prime}\right) b^{-j\prime} \right)\right) \\
&= \left(\left(b_{t+2}^j - b_{t+1}^j \right) + \gamma_1 \left(b_{t+2}^j - b_{t+1}^j \right) + \gamma_2 f^{j\prime} \left(b_{t+2}^j - b_{t+1}^j \right) \right) \\
&= \left(1 + \gamma_1 + \gamma_2 f^{j\prime}\right) \Delta b_{t+2}^j \\
&= \left(1 + \gamma_1 + \gamma_2 f^{j\prime}\right)^2 \Delta b_{t+1}^j.
\end{aligned}$$

$$
\begin{aligned}
\Rightarrow b^j_{t+3} - b^j_* &= \Delta b^j_{t+1} + \Delta b^j_{t+2} + \Delta b^j_{t+3} \\
&= \Delta b^j_{t+1} + \left(1 + \gamma_1 + \gamma_2 f^{j\prime}\right) \Delta b^j_{t+1} + \left(1 + \gamma_1 + \gamma_2 f^{j\prime}\right)^2 \Delta b^j_{t+1} \\
&= \gamma_2 \left(1 + \left(1 + \gamma_1 + \gamma_2 f^{j\prime}\right) + \left(1 + \gamma_1 + \gamma_2 f^{j\prime}\right)^2\right) \left(sch^j_t - sch^j_*\right),
\end{aligned}
$$

and so on. Thus, the k-year change in neighborhood percent black, $\left(b^j_{t+k} - b^j_*\right)$, is

$$
b^j_{t+k} - b^j_* = \gamma_2 \left(\sum_{i=0}^{k-1} \left(1 + \gamma_1 + \gamma_2 f^{j\prime}\right)^i\right) \left(sch^j_t - sch^j_*\right) \qquad \text{for } k \geq 1. \tag{A.5}
$$

As long as $(\gamma_2)^2$ is negligible, the terms involving $f^{j\prime}$ in equation (A.5) become negligible, proving Propositions 1 and 2. ■

When $k \geq 2$, the term that multiplies $\left(sch^j_t - sch^j_*\right)$ in equation (A.5) depends on $f^{j\prime}$, the post-shock fraction of students attending the school assigned to neighborhood j who live in neighborhood j. Thus, without making the assumption that $(\gamma_2)^2$ is negligible, the predictions for the impact of the shock to school racial compositions on neighborhood racial compositions more than one year after the dismissal of busing are not straightforward. This is because school racial compositions after the shock depend on both $f^{j\prime}$ and $b^{-j\prime}$ (equation (A.4)), and the mapping of $f^{j\prime}$ and $b^{-j\prime}$ to sch^j_t is not one-to-one. For example, a neighborhood with a high concentration of blacks can be reassigned to a school with a higher black concentration by either becoming a larger share of the new school and being paired with a sufficiently small neighborhood with a lower concentration of blacks than before, or it can become a smaller share of the new school but be paired with a sufficiently large neighborhood with a higher concentration of blacks than before. By making the assumption that $(\gamma_2)^2$ is negligible, the terms involving $f^{j\prime}$ in equation (A.5) for $k \geq 2$ become negligible, and so the predictions become straightforward. This assumption is consistent with the existence of a sufficiently small one-year change in neighborhood percent black for a given initial assigned school percent black. My main empirical results in Table 6 indicate that the estimated impact of the change in the percent black of the assigned elementary school on the one-year change in the percent black of the neighborhood is very small and insignificant.

B Reduced-Form Estimates

Table B.1: Reduced-Form (OLS) Estimates of Impact of Shock Change in Assigned Elementary School Percent Black on Neighborhood Percent Black

	Δ% Black in Neigh. from 2001 to 2002	Δ% Black in Neigh. from 2001 to 2003	Δ% Black in Neigh. from 2001 to 2004	Δ% Black in Neigh. from 2001 to 2005	Δ% Black in Neigh. from 2001 to 2006
	(1)	(2)	(3)	(4)	(5)
Shock Δ% Black in Assigned	-0.023	0.019	0.055	0.087*	0.102**
Elem. School from 2001 to 2002	(0.042)	(0.045)	(0.050)	(0.050)	(0.048)
2001 Neighborhood % Black	-0.056	-0.166***	-0.238***	-0.316***	-0.306***
	(0.052)	(0.061)	(0.066)	(0.072)	(0.096)
2001 Neighborhood % Hispanic	0.078	-0.126	-0.082	-0.014	0.068
	(0.115)	(0.126)	(0.147)	(0.147)	(0.159)
2001 Neighborhood % Lunch	0.022	0.168	0.099	0.122	0.055
	(0.067)	(0.110)	(0.120)	(0.107)	(0.120)
2001 Neighborhood % Female	-0.015	-0.111	0.046	0.101	0.049
	(0.116)	(0.122)	(0.138)	(0.163)	(0.190)
2001 Neighborhood Average	0.995	5.050	2.823	3.595	5.844
Test Score	(4.438)	(5.497)	(6.283)	(6.982)	(5.707)
2001 Neighborhood Average	-0.540	0.048	-0.358	-0.363	0.058
Number of Absences	(0.587)	(0.612)	(0.724)	(0.629)	(0.772)
2001 Neighborhood Average	1.751	-0.648	2.432	3.050	3.239
Number of Suspensions	(1.919)	(1.709)	(1.675)	(1.914)	(2.535)
R^2	0.07	0.12	0.16	0.23	0.27
Observations	221	221	221	221	221

Notes: Each regression includes polygon fixed effects. Singleton groups (i.e., polygons with exactly one neighborhood, like Triangle II in Figure 1) were dropped in the estimation, reducing the sample size to 221 neighborhoods. Standard errors, clustered at the polygon level, are in parentheses. Asterisks indicate significance (*=.10, **=.05, ***=.01).