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School Desegregation, School Choice and Changes in Residential Location Patterns by Race

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1. Introduction

A literature going back to Tiebout (1956) examines the impact of local public goods on the equilibrium allocation of people across space and jurisdictions in metropolitan areas. A number of recent papers on the topic, including Nechyba (1997), Epple & Sieg (1999), Hoxby (2000), and Rothstein (2006), leverage multi-community sorting models inspired by Tiebout's hypothesis to investigate topics including local taxation policies, how the spatial configuration of local jurisdictions generates variation in the quality of local public goods, and the willingness to pay for local public goods. However, there exists little direct quasi-experimental empirical evidence on the extent to which the residential location equilibrium in a metropolitan area changes with an exogenous shock to the quality of a local public good in one jurisdiction.[1]

In this paper, we use the experience of school desegregation in central city school districts to examine, among other things, the response of the residential location equilibrium to a shock to school quality in the central jurisdiction. Variation across metropolitan areas in the timing of court-ordered school desegregation facilitates our empirical evaluation of the importance of Tiebout sorting for generating residential location patterns by race, both between central school districts and suburbs and over space within central school districts. We examine how the sharp decline in white public school enrollment in central districts caused by desegregation manifested itself as relocation to suburban public school districts versus enrollment in private schools. We perform a similar decomposition of the black enrollment increase in central districts that we find was caused by school desegregation. Our construction of a unique data set on the evolution over time of population and enrollment counts by race, school type and detailed spatial location is an essential input into our analysis.

In addition to facilitating an empirical evaluation of Tiebout sorting theory, the empirical estimates presented in this paper also inform the debate on the causes of urban decentralization. Population decentralization within urban areas has been a stark feature of the landscape in the United States since World War Two. Baum-Snow (2007) documents that between 1950 and 1990 the aggregate population living in the 139 largest

[1] Banzhaf and Walsh (2008), who examine the impact of air quality on residential location choices within a metropolitan area, is a recent exception.

central cities declined by 17 percent despite large gains in overall population. Boustan (2008), Collins & Margo (2007) and others document that whites in particular make up a disproportionate fraction of this aggregate decline. Indeed, among the 93 large urban school districts examined in this paper, the aggregate white population fell by 14 percent between 1960 and 1990 while the aggregate black population grew by 53 percent over the same period. Mieszkowski & Mills (1993) cite reductions in the quality of local public goods in central cities relative to suburbs as a potentially important explanation for suburbanization. However, other than Cullen & Levitt (1999) and this paper, there is little empirical evidence on the extent to which changes in local public goods in central cities have generated population decentralization in urban areas.

Our analysis also informs the current debate on the efficacy of school district integration policies. With the 2007 Supreme Court decision striking down public school desegregation policies in Seattle, WA and Louisville, KY, understanding the effects of school resegregation has considerable contemporary policy relevance. Indeed, Orfield & Eaton (1996), Clotfelter et al. (2006) and Lutz (2005) demonstrate that the release of school districts from court supervision that started in the early 1990s has led to resegregation in many cases. Furthermore, Weinstein (2008) demonstrates that recent redistricting in the Charlotte-Mecklenburg, North Carolina public school district following the end of court-ordered desegregation induced sizable responses in residential location choices. Understanding the mechanisms by which the original orders of the 1960s and 1970s led to declines in white public school enrollment and increases in black enrollment may be invaluable in understanding the effects of changes in school assignment policies currently under consideration.

Our analysis of central district enrollment and population data generates a host of new empirical results. We find that the 10 to 15 percent decline in white public school enrollment due to desegregation, also documented using a different data set by Reber (2005), primarily manifested itself as migration to suburban districts in the South. Outside of the South, the decline occurred primarily through increased rates of private school attendance. Moreover, consistent with Guryan (2004), Lutz (2005) and Reber's (2007a, 2007b) evidence that desegregation improved public school quality for black students, we demonstrate that black public enrollment significantly increased by 20 percent outside the South and that the private school enrollment of black central district residents declined by almost 60 percent in the South as a result of desegregation. To the best of our knowledge, our estimates are the first of the causal connection between court-ordered school desegregation and total central district population flows by race and private school enrollment by race produced using a national sample.[2]

To help understand the mechanisms behind our estimates, we formulate a model of residential location and private school choice that has predictions about the spatial distribution of the treatment effects of central district school desegregation. Using census tract data, we demonstrate that the spatial distribution of responses by race to desegregation orders match those predicted by the model. In particular, we demonstrate that most of the population shifts produced by desegregation occurred in the outer portions of central districts while shifts in private school enrollment primarily occurred in the inner regions of central districts, both as predicted by the model. Taken together, our results indicate that while the magnitudes of population shifts due to desegregation are not sufficiently large to be responsible for a large fraction of aggregate population decentralization, they are essential for understanding observed changes in the spatial distribution of the population by race, especially in outer regions of central districts.

This paper proceeds as follows. Section 2 presents some descriptive facts about the evolution of the spatial distribution of the population by race and income. Section 3 presents relevant background information on school desegregation and describes the data. Section 4 decomposes the effect of school desegregation on central district public enrollment by race into private enrollment and migration responses. Section 5 presents a spatial model that can be used to evaluate the mechanisms more precisely. Section 6 tests the model by empirically examining the spatial distribution of responses to school desegregation. Finally, Section 7 concludes.

[2] Numerous previous studies have examined the impact of desegregation on public school enrollment by race using a national sample, e.g. Welch and Light (1987), Rossell and Armor (1996) and Reber (2005).

2. Historical Patterns in the Data

Table 1 presents data showing the extent of urban population decentralization by race that occurred between 1960 and 1990. Panel A presents population counts by race in central areas, suburbs and the entire United States while Panel B shows analogous counts of enrolled pupils in public and private elementary and high schools. In order to be consistent with the analysis to come, we present statistics using central city school districts, henceforth "central districts", from 1970 to represent central urban areas and areas within the central districts' metropolitan areas, but located outside of central districts, to represent suburbs. We only include the 93 metropolitan areas with central districts that experienced major school desegregation orders between 1960 and 1990.

One broad trend seen in Table 1 has not received much attention in the literature and is thus of particular note. The higher U.S. population growth rate of blacks shows up dramatically as increases in both city and suburban black populations. While the aggregate central district black population in our sample increased by 3.8 million between 1960 and 1990, it grew by 3.7 million in suburban areas, representing a much larger percentage increase for the suburbs. In fact, though white central district population declined, the magnitude of this decline relative to suburban white population growth was far less than the analogous difference in the black population growth rate between central districts and suburbs. The difference between suburban and central city white population growth from 1960 to 1990 was 74 percent (column (4) minus column (1), last row of Panel A) while the analogous number for blacks was 102 percent (column (5) minus column (2)). Indeed, by this measure, blacks were suburbanizing faster than whites during this period.[3] The data on enrollment counts in Panel B show a similar though less dramatic pattern. Relative central district white enrollment fell by 25 percent between 1970 and 1990 while that for blacks fell by 63 percent. In sum, the patterns in Table 1 imply that most of the slower population growth rate in cities relative to suburbs can be explained by race-neutral factors. Indeed, one important result demonstrated below is that while central district school desegregation did produce white flight, as well

[3] Similar data from a more complete sample of 165 metropolitan areas reveals a similar pattern. In this sample, aggregate central district white population declined by 18 percent between 1960 and 1990 while white suburban population grew by 59 percent over this period. Central district black populations grew by 55 percent while suburban black population grew by 150 percent.

as black in-migration, the magnitudes are only large enough to have driven about one-ninth of the gap between central district population growth and metropolitan area population growth between 1960 and 1990.

Figure 1 shows the evolution of the ratio of whites to whites plus blacks by residential location between 1960 and 1990. In order to compare areas of different sizes, we index space to be between 0 and 1 in central districts and 1 and 2 in suburbs. Our central district location index is the cumulative distribution function of population with respect to distance to the central business district built using census tract data from 1990. We assign index values in previous years using the 1990 cumulative distribution function expressed as a step function. Therefore, 0 represents the tract closest to the central business district and 1 represents the tract furthest from the central business district in each year. The suburban index is built the same way except that it runs from 1 to 2 instead of 0 to 1. The sample only includes census tracts from the 70 metropolitan areas for which we have census tract data for both central districts and suburbs in all census years 1960-1990. Each point on the graph weights each metropolitan area equally.

While race-neutral factors are probably the most important determinants of population decentralization in U.S. metropolitan areas since 1960, inspection of the spatially disaggregated data in Table 1 reveals that race-specific factors likely did play a role in influencing shifting residential location patterns. Fraction white is increasing in distance from the central business district (CBD) within central districts in all years, but is relatively flat in the suburbs. The fraction white declined monotonically over time at all locations in central districts and suburbs located near central district borders, with this decline much more rapid in central districts. The data in Figure 1 imply a rough "difference-in-difference" relationship between the decline in the fraction white in central districts relative to the decline in the inner suburbs of about 10 percentage points. In Section 6, we show that the racial compositions of neighborhoods near central district-suburban borders would have been very different had school desegregation not occurred.

Evidence from Figure 1 indicates that over time racial sorting over the borders between central districts and suburban districts strengthened. This increased sorting may reflect changes in location incentives for blacks and whites because of race or some other variable correlated with race. To evaluate whether this increased racial sorting could be generated by socio-economic background instead, Figure 2 depicts average income levels by residential location for each race in each census year 1960 to 1990. Panel A shows results for whites while Panel B shows results for blacks. Because of data limitations, we use family income in 1960 and per-capita income for those over 14 or 15 in later years. Unlike Figure 1, there are no large discontinuities at the border in Figure 2.[4] Furthermore, the income profiles for whites and blacks are remarkably similar in shape and evolve in a similar manner over time. Thus, the patterns in Figure 1 are unlikely to have been generated by differences in socio-economic background correlated with race. Of additional note in Figure 2 is that within central districts, average incomes conditional on race are roughly upward sloping. This fact will be important for the model developed in Section 5.

3. Historical Context and Data

3.1 School Desegregation

In 1954, the Supreme Court's ruling in *Brown vs. Board of Education of Topeka* (347 US 483) stated that segregated schools were unconstitutional. However, the ruling did not impose a mechanism for desegregating the nation's schools and only limited integration occurred in the 1950s. Many smaller school districts, particularly in the South, desegregated in the 1960s after the Federal government threatened to withhold Title I financial assistance to districts that continued to discriminate by race (Cascio et al., 2007). However, large school districts, including those located in central cities, were much slower to desegregate. Most large districts did not desegregate until forced to do so by separate federal court orders. Heterogeneity across districts in when desegregation court cases were first filed and in the length of time it took these cases to proceed through the judicial system represents plausibly exogenous variation in the timing of school desegregation. It is this variation that we employ to examine the effects of desegregation on residential location patterns.

Although the assumption that the timing of desegregation is exogenous for small windows of time is quite plausible, it is important to consider the implications for our

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[4] There is a small discontinuity at the border in 1990 for whites and a slightly larger discontinuity for blacks. Because this discontinuity is apparent only in 1990 and because it emerges simultaneously for both blacks and whites, it is unlikely to explain the patterns visible in Figure 1.

empirical work of potential endogeneity over our full thirty year sample period. Indeed, following the Brown decision, the NAACP pursued a legal strategy of filing cases where they were most likely to succeed in order to build up a set of legal precedents favorable to desegregation (Greenberg, 1994). The fact that desegregation litigation occurred first in districts with the highest probability of success represents a potential threat to identification. In particular, if more institutionally segregated areas had different trends in location patterns by race, perhaps due to changing attitudes or housing market discrimination, we would spuriously attribute declining white populations to desegregation when it was in fact due to some unobserved factor. To account for such fixed factors that differ across metropolitan areas and may be associated with the timing of school desegregation, we control for metropolitan area fixed effects in all empirical work performed in this paper. In addition, we provide robustness checks in which we control for MSA-specific linear trends and pre-desegregation MSA attributes.

Another important aspect of the timing of desegregation which we are careful to address in our empirical work is regional clustering produced by the evolution of legal doctrine. The 1968 *Green* decision (*Green vs. New Kent County, Virginia*, 391 U.S. 430, 1968), which established specific factors with which to judge a district's compliance with the *Brown* decision, produced a surge of litigation activity in the South. The Keyes decision (*Keyes v. Denver School District*, 413 U.S. 189), issued in 1973, stated that court-ordered desegregation could proceed in areas which had not practiced du jure segregation. As a result, desegregation began on a large scale outside the South, where segregation largely arose from residential housing patterns, not legal mandate. Figure 3 shows the regional clustering in the timing of desegregation in our sample of central city school districts produced by the two decisions; southern districts were more likely to desegregate early in the sample period, whereas non-southern districts were more likely to desegregate later in the period.

Table 2 demonstrates that court-ordered desegregation was effective at achieving racial integration. Column (1) presents regressions of the dissimilarity index on MSA fixed effects, year fixed effects interacted with a South fixed effect and an indicator for whether a district was desegregated at each point in time using our sample of central districts in 1970, 1980 and 1990. The dissimilarity index ranges from 0 to 1, with 1 denoting complete segregation. The index can be interpreted as the fraction of black students who would need to be reassigned to a different school for perfect integration to be achieved given a district's overall racial composition.[5] An increase in racial integration causes a decrease in the dissimilarity index. Similar to Reber (2005), we find that desegregation reduced the dissimilarity index an average of 14 points, equal to about 20 percent of the index's mean 1970 value. Table 2 Column (2) shows analogous results using the white-black exposure index as an alternative outcome. The exposure index gives the percent of black students in the average white student's school and is thus a measure of interracial contact.[6] Desegregation increased the exposure of whites to blacks by around .05, equal to around 50 percent of the 1970 mean exposure.

3.2 Data

Our empirical analysis benefits from a unique data set that includes information from the decennial Censuses of Population 1960-1990. The data set includes information on school enrollment by school type and additional demographic information by race for those living in central school districts and remainders of metropolitan areas. Our sample is comprised of 93 metropolitan areas with central school districts identified by Welch and Light (1987) as having experienced a major court-ordered desegregation plan between 1960 and 1990. We define central districts as those school districts that included the central business districts of the largest census defined central city as of 1960 in each metropolitan area nationwide. The sample includes all 56 districts of over 50,000 students with minority enrollment between 20 and 80 percent in 1968 other than New

[5] The dissimilarity index is defined as:

$$D_t = \frac{1}{2} * \sum_{i=1}^{n} \left| \frac{b_{it}}{B_t} - \frac{w_{it}}{W_t} \right|,$$

where b_{it} and w_{it} refer to the number of black and white students at school *i* at time *t* and B_t and W_t refer to the total number of black and white students in the school district.

[6] The exposure index is defined as:

$$E_t = \frac{1}{W_t} \sum_{i=1}^{n} w_{it} * \frac{b_{it}}{t_{it}},$$

where t_{it} is the total number of students in school *i*. For a given district, it ranges from 0 to the percent of black students in the district as a whole.

York City, which did not have a major desegregation order. The remaining 37 districts, which had enrollment over 15,000 and were between 10 and 90 percent minority in 1968, were randomly sampled with enrollment and region sampling weights. Appendix Table A1 lists all of the districts in our sample.[7]

In order to limit the possibility that school district boundaries were drawn in response to pressure for desegregation, we utilize 1970 school district geographies.[8] The "69-70 School District Geographic Reference File" (Bureau of Census, 1970) relates census tract and school district geographies. For each census tract in the country, it provides the fraction of the population that is in each school district. Using this information, we build district geographies using Geographic Information Systems (GIS) software. Because spatial data on regions smaller than census tracts are not available for 1970, we assign tracts split across school districts to the district that made up the largest fraction of the tract by population. As such, our constructed geographies do suffer from some measurement error. For this reason, we also undertake the same empirical analysis using exact 2000 school district geographies as a robustness check and find that our results are little changed by using the alternative boundaries. 1970 is the only year before 2000 that the Census Bureau released such detailed geographic information on school districts.

We use census tract and county tabulations from 1960 to 1990 to build constant geography central district and metropolitan area demographic data over time. We use the census summary tape files 4a and 4c in 1970, 1980 and 1990 and the census bureau's internal release of tract data for 1960. In addition, we employ census county and city aggregate data to fill out the data set with several districts for which census tract data were not available in 1960 and 1970. As such, we only observe spatially disaggregated data for 78 districts in 1960 and 90 districts in 1970. The spatially disaggregated tract level geography allows us to analyze the extent to which effects of desegregation differ

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[7] Table A1 has census enrollment counts for 1970 definition districts. Welch and Light (1987) use school district reported enrollments as of 1968 to determine their sample. In cases where school districts merged with other districts after 1968, they use the larger, post-1968 school district definitions.

[8] In practice, the majority of changes to school districts between 1970 and 2000 have been minor. The *Milliken v. Bradley, 418 U.S. 717 (1974)* Supreme Court decision ended the possibility that school districts could be forced to merge in order to achieve racial integration. In this case, the Court ruled that suburban districts surrounding Detroit could not be forced to merge with the Detroit school district.

across space within central districts. We use metropolitan area definitions from 1999. Summary statistics are in Appendix Table A2.

4. Central District Level Results

In this section, we present regression results using central district level data. We demonstrate that the central district white public enrollment losses resulting from desegregation are primarily driven by migration out of central cities in the South, and by increased rates of private school attendance in other regions. We also show that desegregation increased black central district public enrollment as the result of both migration and reductions in private school enrollment.

Our base regression specification is

(1) $$y_{jt} = \alpha_j + \beta_{rt} + cD_{jt} + \varepsilon_{jt}$$

where *j* indexes metropolitan area, *t* indexes time and *r* indexes region. D_{jt} is an indicator for the central school district being desegregated at time t, and y_{jt} is the outcome of interest. We examine the effects of desegregation on public school enrollment by race, private school enrollment by race and population by race in central districts. As discussed in Section 3, we include metropolitan area fixed effects, α_j, to account for the possibility that fixed differences across metropolitan areas may have influenced the timing of desegregation orders.

Our sample is restricted to urban areas which experienced desegregation. As a result, identification of the parameter of interest, *c*, requires only that the timing of desegregation be uncorrelated with trends in the outcome variable not related to school desegregation. (If the sample included districts which were not desegregated, the identifying assumption would be more restrictive and require that both when and if an area was desegregated be uncorrelated with trends in the outcome variable.) It is possible that southern and non-southern urban areas decentralized at different times or at different paces in a way that was correlated with the timing of desegregation orders. Underlying predictors of decentralization potentially correlated with region include the size of central district geography, the availability of outside options including private schools and suburban districts, income levels, and the extent of housing market discrimination and residential segregation. As such, we allow the year effects in equation (1), β_{rt}, to differ for the South census region.

4.1 White Results

Specification (1) of Table 3, Panel A, presents our estimates of the effects of desegregation on white public school enrollment in central districts. Consistent with Reber's (2005) results using district reported enrollment data, we find that desegregation orders decreased white enrollment by 16 percent on average in central districts. Specifications (2) and (3) show that this result is robust to inclusion of MSA-specific time trends and a set of metropolitan area characteristics measured in 1960 interacted with year effects.[9] We include these interactions to control for the possibility that white enrollment trends may be driven by initial factors such as percent black enrollment or central district size. Given that the coefficient of interest is robust to their inclusion, they appear to be uncorrelated with the timing of desegregation orders.

Specification (4) allows the effect of desegregation to vary by the length of time a district has been desegregated. The point estimates suggest that the long-run impact of desegregation, defined as exposure to desegregation for at least five years, is a bit smaller than the short-run impact, although the two estimates are not statistically distinguishable. (The two coefficients are jointly significant at the 1% level.) Results in Appendix Table A3 indicate that this conclusion is robust to alternate specification of the distributed lag.

Specification (5) presents a falsification exercise. A placebo treatment variable is added to the model which equals one when a district is one or two years away from being desegregated. If school desegregation was implemented in areas where white flight was already occurring, rather than being causally related to white out-migration, the coefficient on the placebo variable should be negative. Instead, the estimated placebo coefficient is positive, small in magnitude and imprecisely estimated. Moreover, the estimated parameter of interest hardly changes.

Panel B presents estimates of the impact of desegregation on total white central district population. The estimate from our base specification, column (1), suggests that desegregation induced 10 percent of the white population to exit central districts on

[9] See the notes to Table 3 for a complete list of included MSA characteristics.

average. Panel C presents estimates of the effect of desegregation on central city white private school enrollment. The estimates are very small in magnitude and imprecise. Viewed jointly, the three panels of Table 3 indicate that white flight from desegregated central district public schools manifested itself primarily as migration to suburban school districts.

In Table 4, we allow the effects of desegregation to vary by region. The results indicate important regional heterogeneity in the response to desegregation. While desegregation led to a loss of white enrollment in central school districts in all regions, column (1) indicates that the magnitude of the loss is estimated to be about twice as large in the South as outside the South. The manner in which whites exited desegregated schools also differs by region. In the South, white flight largely took the form of migration to the suburbs, as seen in column (2), while column (3) shows that outside the South desegregation caused an estimated 15 percent increase in private school attendance, though this estimate is only significant at the 10 percent level. These estimates provide no evidence that desegregation caused a loss in white population in desegregated cities outside the South, whereas southern cities experienced a significant reduction in their white population.

To the best of our knowledge, the private school estimates in Tables 3 and 4 are the first of the causal connection between court-ordered desegregation and white private school attendance produced using a national sample.[10] It seems likely that the lack of nationwide data on private school enrollment by race at the district level has prevented a systematic exploration of the link between court-ordered desegregation and white private school attendance up to this point. Our unique data set allows us to fill this gap in the literature.

The desegregation literature has generally concluded that private schools represented an important outlet for southern whites wishing to avoid desegregated schools. This conclusion is based on several facts (Clotfelter 2004a). First, white private school enrollment has increased in the South since 1960, while it has fallen in the rest of

[10] Many papers, including Fairlie and Resch (2002), Reardon and Yun (2002), Lankford, Lee and Wyckoff (1995), and Clotfelter (1976) document a strong correlation between the percent black (or non-white) in public schools and the propensity of whites to attend private school.

the country.[11] Desegregation is often cited as an explanation for this regional divergence because it produced a much greater change in public school racial composition in the South than it did elsewhere. Second, there are several well documented cases of white flight to private school in response to desegregation in the South, for instance Mississippi's "segregation academies" and Virginia's "massive resistance". Finally, the large average size of southern school districts meant that migration to alternative public school districts was usually costly, making private schools a relatively more attractive option.

While the results of this paper lend no support to the hypothesis that whites used private schools to avoid court-ordered desegregation in the South, they do not necessarily invalidate the hypothesis either. The sample used here is comprised of large urban centers. White flight to private school may have been more prevalent in non-urban areas of the South because the large, generally county-wide, school districts in the non-metropolitan South make avoiding desegregation through residential relocation difficult. Indeed, Clotfelter (2004a, 2004b) demonstrates that the contribution of private schools to overall school segregation is substantially greater in the non-metropolitan areas of the South than in the South's urban areas. Finally, our point estimate for the South is sufficiently imprecise that we cannot reject a moderate positive response of white private enrollment to desegregation in central districts. (At the 5% confidence level, the upper bound of our white private school enrollment estimate is a 16 percent increase.)

In the next section we present a residential location model detailing how district size, racial composition, the number of alternative districts and income by race can influence desegregation treatment effects. Table 5 explores the impacts of each of these factors, measured as of 1960, on our estimated desegregation treatment effect for whites. Column (1) displays the estimates for white public enrollment in the central city. Most of the coefficients are imprecisely estimated, making it difficult to draw firm conclusions. There is evidence, however, that the number of districts in an MSA and the size of the

[11] Seven percent of white elementary school students were enrolled in private schools in the South in 1960, rising to 10 percent by 1980. By contrast, white elementary private school enrollment fell from 18 percent to 13 percent between 1960 and 1980 outside the South.

MSA influence the extent of white exit from desegregated schools.[12] As expected, the more alternative public school districts available to whites, the greater the extent of white flight. Similarly, the larger is the MSA, the less white flight occurs. Holding the number of alternative districts and the size of the central district fixed, a larger MSA implies fewer suburban district options within a given commuting distance. The size of the MSA also has a significant influence on the form that white departure from the desegregated district takes. In particular, column (3) shows that larger MSAs promoted more exit to central city private schools. Finally, the South census region-desegregation interaction coefficient is imprecisely estimated in all specifications and, contrary to estimates in Table 4, mitigates the estimated effect of desegregation on white enrollment and population. This suggests that the regional heterogeneity in the desegregation treatment effects documented in Table 4 can largely be explained by underlying MSA characteristics.

4.2 Black Results

Guryan (2005) and Lutz (2005) present evidence that school desegregation reduced dropout rates for blacks, suggesting that desegregation generated an improvement in school quality experienced by blacks. Moreover, Reber (2007a) documents that desegregation increased the educational resources provided to black students. The natural implication is that blacks should seek to attend newly integrated school systems. Table 6, Panel A, provides evidence to this effect. Although there is no evidence of black public enrollment increases due to desegregation when desegregation is coded as a single indicator variable equaling one in any year in which public schools were desegregated, we do find evidence of a 9 to 14 percent increase in black enrollment in the long-run, defined as 5 or more years after implementation of desegregation (columns (2) and (3)). This result is robust both to inclusion of MSA-specific linear trends (column (4)) and 1960 MSA characteristic–year interactions (column (5)). Appendix Table A4 documents that this result is robust to alternative specification of the distributed lag.

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[12] Reber (2005) also finds a positive relationship between the number of districts in an MSA and the magnitude of white public school enrollment loss associated with desegregation.

Table 6, Panel B, presents evidence that desegregation increased the total black population of central districts by up to 8 percent, although not all estimates are precise. Panel C documents that desegregation reduced private school enrollment of blacks living in central public school districts by 21 to 44 percent. This response appears to have occurred immediately following the announcement of desegregation orders. While these are very large responses, they come off a relatively small base of black private school students. The possibility that blacks exited private schools in order to attend desegregated public schools, while quite plausible given the documented increase in public school quality caused by desegregation, has received little consideration in the literature.

Black responses to desegregation display even more evidence of regional heterogeneity than white responses. Table 7, column (1), shows that the increase in black enrollment in desegregated schools is almost entirely a non-southern phenomenon. The non-southern coefficient indicates a 20 percent increase in black central district public enrollment as a result of desegregation, and is very precisely estimated. The southern point estimate, in contrast, is small and imprecise. Consistent with these results, column (2) documents that the increase in black central city population due to desegregation, estimated to be 11 percent, occurred only outside of the South. Column (3) suggests, however, that the decrease in private school attendance was much larger in the South than elsewhere. Interacting the treatment variable with MSA characteristics (analogous to the estimates for white outcomes on Table 5) generates imprecise estimates that display no clear patterns across the three outcome variables. These results are available from the authors upon request.

4.2 Results by Age Group

The underlying process that we postulate generates the observed relationship between school desegregation, white flight and black inflows from and to central districts operates through public school quality. Therefore, we should see that the response is greater for school age children and their parents than for other age groups.[13] We

[13] Other age groups may also respond through a tipping mechanism in which households care directly about the race of their neighbors.

investigate this possibility by estimating the effects of school desegregation on population by age, using the same specification as in column (1) of Table 3 for whites and column (3) of Table 6 for blacks.

Figure 4 depicts the impact of desegregation on central district population by age and race. Panel A shows that white flight was most pronounced among those aged 0-24, roughly the age of children in school, and 35-49, roughly the age of parents with children in school. The black estimates shown in Panel B indicate in-migration in response to desegregation was greatest for those aged 0-14, 25-49 and 55-74, although the estimates for this last group are somewhat noisy. The response of older blacks may reflect the prevalence of grandparents as primary caregivers in many African-American families. Of particular note is that desegregation had zero estimated effect on the black population 75 and older.

5. Theory

In this section, we theoretically explore potential mechanisms behind the causal links between school desegregation and outcomes established in the previous section. We specify a spatial model that generates equilibrium location patterns that can be empirically evaluated using census tract level data. Results from the model indicate the spatial distribution of responses to school desegregation that we should expect to see in the data. In the next section, we demonstrate that the data support the predictions of the model remarkably well. We view this empirical support for the model as further evidence that our estimates from the previous section reflect causal responses to school desegregation. Our empirical verification of the model's predictions also supports the claim that a Tiebout sorting and land use framework reasonably captures the data generating process underlying the effects of changes in local public goods on location patterns by race.

Existing models that generate patterns in urban residential location choice can be grouped into two broad categories: those stemming from the classical urban land use model of Alonso (1964), Mills (1967) and Muth (1969) and those stemming from Tiebout's (1956) conjecture that individuals sort across local jurisdictions as a function of their demands for different bundles of local public goods. The model presented here combines these two features and has some elements of that proposed by de Bartolomé & Ross (2007) and Hanushek & Yilmaz (2007). We introduce public schooling as a local public good, the quality of which is determined endogenously by the composition of the public school population in each community. In addition, we give parents the opportunity to send their children to private schools, which provide a fixed known quality of the same good for a given price.

Before continuing, we provide support for potentially the most controversial assumption in the model. A longstanding puzzle is that while classical residential land use theory with fixed lot size predicts that the rich outbid the poor to live near city centers, we generally observe the opposite ordering in the data. Figure 2 (discussed in detail earlier) shows that this widely documented increasing income profile in distance from the central business district (CBD) is not the result of changing racial composition with distance. Indeed, in each year in our data set, family or per-capita incomes of individuals is roughly increasing in CBD distance for each race separately within central districts.

A host of theories have been proposed to explain similar patterns observed in other contexts. Leroy & Sonstelie (1983) and Glaeser, Kahn & Rappaport (2008) propose heterogeneity in commuting modes to explain this pattern. Brueckner & Rosenthal (2009) propose a filtering model of the housing market to fit this fact. Brueckner, Thisse & Zenou (1999) propose a model that generates this ordering essentially by assuming public goods are normal and increasing in CBD distance. In this paper we remain agnostic about the reasons for this pattern but we need a model that generates equilibria matching it. Therefore, we somewhat arbitrarily assume that an exogenous public good (like air quality) is normal and increasing in CBD distance. While this assumption is ad-hoc, it serves the purpose of generating observed orderings of whites and blacks by income within school district jurisdictions. In order for the model to generate empirically relevant predictions, we require that the process that generates increasing income profiles as a function of CBD distance is not correlated with the timing of school desegregation orders. The evidence in Figures 1 and 2 indicate that this statement should not be controversial.

5.1 Environment

Each metropolitan area is independent and features exogenous masses of white and black households and a set of school district jurisdictions. Each household of type $i \in \{W, B\}$ contains one parent and one child and must rent one unit of space. The parent commutes to work while the child attends public or private school. If the parent chooses public school, the child must attend school in her jurisdiction j. Otherwise, if the household lives in the central district the parent can send the child to a private school at tuition cost T, which is an i.i.d. draw from a distribution with finite support. Random tuition represents price discrimination by private schools to achieve diversity and attract high ability students. Parents have income y. For simplicity, we assume that there are only two income groups in the population and that the fraction of blacks that are high income is less than the fraction of whites who are high income.[14]

Households have preferences u(z,g,x) over a composite consumption good z, the quality of the child's schooling g and an exogenous local amenity x. Utility is increasing and concave in all arguments. In addition we assume that $u_{zg} > 0$ and $u_{zx} > 0$, or that the marginal utilities of school quality and the local amenity are increasing in income. These assumptions are akin to the standard "single-crossing" condition used in the Tiebout literature. In addition, we assume $u_{gx} \leq 0$, or that the two public goods are weak substitutes.

Parents choose the community j in which to live and if they choose the central school district (j=0), they also choose the distance r from the central business district at which to live and whether to send their children to public or private school. The local amenity is fixed at $\bar{x}$ in all suburban districts and varies continuously as a function of location r in the central district such that x'(r)>0. Each central district resident lives at a distance $r \in [0, r_f]$ from the CBD and incurs commuting cost tr. We assume that all suburban jurisdictions have the same commuting distance $\bar{r} > r_f$.[15]

[14] We assume only two income levels for simplicity of exposition and location equilibrium configurations only. There is nothing that precludes solving the model with continuous income distributions.

[15] The assumption of identical commuting distances and local amenities in suburban communities is stronger than necessary. Introducing such heterogeneity makes the analysis unnecessarily complicated for the purposes of this paper.

Public school quality in each community is an increasing function of the average income of the students' peers in school y_{kj}, where *i* indexes own race, and *k* indexes peer group in school.

(3) $$g_{ij} = g(y_{kj}), i \in \{B, W\}, k \in \{Black, White, All\}$$

Given our assumptions on the income distributions of whites and blacks, absent changes in public enrollment by race integration thus weakly reduces public school quality for whites and improves it for blacks through peer effects. $\bar{g}$ denotes the quality of private schools which only exist in the central district. We assume that private school quality is higher than that of the best possible public school. The taxes paid to provide public schools are assumed to be fixed and thus can be normalized to 0.[16] Allowing cities to choose their local property tax rates through majority vote would only reinforce the positive relationship derived below between public school quality and community household income.

Given this environment, parents choose how much of the composite good z to consume, residential location and whether to send their children to a private school. An equilibrium allocation of individuals across space, communities and schools consists of an allocation in which 1) every household is maximizing subject to its resource constraint and 2) no household can improve its welfare by moving or changing school type given its endowments y and T. To understand equilibrium residential location and school choice in the metropolitan area, we first establish how households sort between the central and suburban districts. Then we consider analytical properties of the residential location equilibrium within the central district. Finally, we consider the implications of different school assignment policies in the central district for equilibrium school choice and residential location inside the central district.

5.2 Location Choice Between Communities

The suburban equilibrium can be characterized by a set of land rental rates R_j that equilibriate the housing market. As in Fernandez & Rogerson (1996) and Epple & Sieg (1999), there is a stable perfect sorting equilibrium in which each community attracts some portion of the income distribution. To see this, define the set of income cutoffs y_j

[16] This is equivalent to renormalizing the opportunity rental rate of land in each district.

for households indifferent between living in communities j and j-1, j>0. For these people,

$$(2) \quad u(y_j - R_j - t\bar{r}, g_j, \bar{x}) = u(y_j - R_{j-1} - t\bar{r}, g_{j-1}, \bar{x})$$

If, without loss of generality, $R_j > R_{j-1}$ then it must be that $g_j > g_{j-1}$ to compensate. Therefore, community j is richer on average than community j-1. In addition, since $u_{zg}>0$, any household with $y < y_j$ is strictly better off living in community j-1 than in community j. Similarly, any household with $y > y_j$ is strictly better off in community j. Therefore, this environment implies perfect sorting in the suburbs. This perfect sorting may manifest itself in different equilibrium configurations as a function of the environment, including several rich districts with high quality schools, several mixed income districts with medium quality schools and several poor districts with low quality schools, or rich and poor districts only.

The key force that pins down the central district versus suburban location choice is that any group split between central and suburban districts and attending public schools must be on the same indifference curve in each location. Further, no group limited to either the city or suburbs can improve its welfare by moving. Therefore, all mixed income suburban districts must be identical and have the same fraction of rich and poor as those in the city public schools. This occurs because the single-crossing assumption assures a unique combination of g and other goods that makes both high and low income households indifferent between mixed and homogenous districts and city and suburban districts.

To analyze the effects of school desegregation on the between district sorting equilibrium, we select a location equilibrium in the segregated central school district environment consistent with the properties derived above and that can generate the treatment effects documented in Section 4 when desegregation is implemented in the central district. We do not provide a full solution to the between district sorting equilibrium because, as is discussed in the next section, it cannot be reliably evaluated empirically given our limited suburban data. Instead, we provide an example in order to establish the environment for our theoretical discussion in the following two subsections about the spatial distribution of responses in the central district to school desegregation.

Specifically, we select a segregated equilibrium in which the central district includes rich whites, poor whites and poor blacks but no rich blacks in public schools. Rich whites, poor blacks and rich blacks but no poor whites attend private schools in the central district. Suburbs house rich whites, rich blacks and poor whites but no poor blacks.[17] Therefore, all rich households have the same utility while poor whites (who only attend city public schools) are better off than poor blacks (who attend city and suburban schools). With free mobility it would be impossible for poor blacks and whites with different utility levels living in the suburbs to be supported as an equilibrium.

To establish some intuition about how this equilibrium changes with desegregation, Figure 5 presents indifference curves and consumption bundles of individuals of various types in segregated and desegregated central district public school environments. Solid lines show indifference curves when the central district is segregated while dashed lines depict indifference curves under central district desegregation. Those attending private schools are on the same or higher indifference curve than their public school counterparts. We depict the private school households' equilibrium points as solid regions along the $\bar{g}$ line at the right of Figure 5. We assume that no poor whites in the segregated environment find it optimal to choose private schools.

The implementation of desegregation shifts the equilibrium to be on the two dashed indifference curves, one for rich and one for poor. While poor blacks' welfare is improved by desegregation, everyone else is worse off in this example because central district school quality declines for them and suburban rents are bid up as the suburbs become richer on average. Once desegregation is achieved, it is possible for there to be rich, middle income and poor suburbs with rents adjusting to make both income groups indifferent between living in the central district and both of their suburban options.

In this example, the implementation of desegregation in the central district public schools leads to the following shifts. Some poor and rich whites move to the suburbs while others enter private school. Some poor and rich blacks in the city shift from private to public schools. Finally, some poor and rich blacks from the suburbs move into the city

[17] We assume that poor suburbs are all black in order to make the point that desegregation can cause blacks of all income levels to migrate to the city. It would not change the analytics much to instead assume that poor suburbs are all white.

to take advantage of the better quality public schools. These responses are all consistent with the empirical evidence presented in the previous section.

5.3 Properties of the Central District Location Equilibrium

Conditional on living in the central district, each parent's choice problem can be characterized by the following expression:

$$
(3) \qquad \begin{aligned} &\max_{z,r,g\in\{g_{i0},\bar{g})} [u(z,g,x(r)] \\ &s.t. y - tr = z + R(r) + TV \end{aligned}
$$

where R(r) is the equilibrium rental rate of a unit of land at CBD distance r and V is an indicator for the child attending private school.

As in the large body of research on urban land use questions, we use conditional bid-rent functions to analyze equilibrium residential location patterns. We define the function $\psi^{ygT}(r,u)$ as the most a household of income y sending its child to a school of quality g with the option of private school tuition T and utility u is willing to pay for a unit of space at commuting distance r from work. Taking the income distribution in the central district as given, it is then straightforward to derive the spatial distribution of income and school choice through comparison of these conditional bid-rents. The following properties of the equilibrium rent function are useful aids in analyzing the spatial equilibrium.

Property 1: The equilibrium rent function in the city is made up of the upper envelope of individual conditional bid-rent functions at equilibrium utility levels.

Property 2: The equilibrium rent function is continuous over all space in the central district. This can be seen by noticing that any discontinuity implies that the household on the high rent side of the discontinuity can move an infinitesimal distance dr and receive a finite rent decrease thereby making it better off, violating equilibrium condition 2.

Property 3: Of two households with the same bid-rent for a location, the household with the steeper bid-rent function as a function of r always outbids that with the flatter bid-rent function to live nearer to the CBD.

Together, these 3 properties imply that sufficient to understand much about the spatial equilibrium in the central district is to understand the ordering of bid-rent slopes with respect to r at crossing points. This observation is extensively explained in Fujita (1989). Differentiating (3) yields

$$(4) \qquad \psi_r^{ygT}(r, u^{ygT}) = -t + \frac{u_x}{u_z} x'(r)$$

where subscripts denote partial derivatives. This expression indicates how commuting cost and the value of the local amenity are capitalized into rents. At greater CBD distances, willingness to pay for a unit of space declines because of higher commuting costs but increases because of the higher quality local amenity. Henceforth, we assume that all bid-rent functions are negatively sloped.[18]

Given our single-crossing assumptions, it is straightforward to verify the following three inequalities:

$$\psi^{ygT}{}_{ry} > 0$$

$$(5) \qquad \psi^{ygT}{}_{rg} < 0$$

$$\psi^{ygT}{}_{rT} < 0$$

The first condition indicates that conditional on school type and tuition offer, the rich outbid the poor to live in higher amenity areas. The complementarity of consumption and the local amenity generates this result. The second condition, that higher school quality pushes households towards the CBD, comes from the complementarity of consumption and school quality along with the substitutability of the amenity and school quality. The final condition indicates that those faced with a higher tuition burden compensate with their greater willingness to pay to live in a neighborhood with a lower amenity value but a higher income net of commuting cost and rent.

Each group has an endogenous tuition cutoff τ below which they attend private school. This cutoff is a function of location, their income and public school quality. Since all households with children attending public schools of quality g have the same

[18] In addition, it is straightforward to show that under mild regularity conditions $\psi_{rr} > 0$.

utility (call it u^g), the household indifferent between public and private school determines the level of τ according to the following equation:

$$u(y - tr - R(r) - \tau, \overline{g}, x(r)) = u^g$$

It is straightforward to see that conditional on income and location τ is decreasing in g whereas conditional on g and r, τ is increasing in y. Finally, τ is decreasing in r conditional on y and g in private school attendance regions. Because g and y are not functions of r, these results indicate that conditional on income, the private school households with the lower quality public schools have a greater tuition cutoff and some of them thus outbid other groups to live at shorter commuting distances than private school households whose public school option is of higher quality.

The inequalities in (5) and the logic of private school choice indicate that conditional on income, the residential location ordering from the CBD outwards must be private school attendees in decreasing order of tuition paid followed by public school attendees in decreasing order of school quality. Parents of private school attendees live closer to work than those of public school attendees because their school quality is higher and they are effectively poorer because of their tuition payments. In addition, conditional on school quality, higher income households live further from the CBD.

Put together, these results paint a fairly complete picture of how households are allocated across space in the central district. At location 0 are the poor households paying the most for private school and with the lowest quality public schools. Beyond them are other poor private school households in increasing order of tuition paid followed by poor public school households in declining order of school quality. Assuming no suburban districts are available, the rich households attending the lowest quality public schools reside at the edge of the central district. They live outside of rich households with higher quality public schools and private school households in order of tuition paid from lowest to highest respectively.

While this model has precise implications about spatial orderings within income groups and between income groups for a given school quality level, further restrictions are required to determine the exact ordering of incomes in regions other then near the

CBD and at the periphery.[19] As such, although income levels can fluctuate a bit at any distance, mean income is generally increasing in r. In addition, the private school attendance rate is pushed up nearer to the CBD by the fact that conditional on income, private school households live nearer to the CBD, whereas it is pushed down by the fact that higher income people who live further out are more likely to send their kids to private school. Henceforth, we will assume that parameter values are such that all poor households live closer to the CBD than all rich households.

5.4 Changes in Central District Equilibrium Residential Location Patterns

In this subsection, we derive predictions about the spatial patterns of responses by central district residents to school desegregation. These predictions will be empirically evaluated in the next section. The model implies that the largest shifts in population should occur between suburbs and regions of the central district further from the CBD than regions in which the private school margin is important. Figure 6 depicts two potential equilibrium sets of bid-rent functions for the central district. Panel A depicts a potential segregated public school equilibrium while Panel B shows a potential integrated central district equilibrium. The depicted equilibria satisfy all of the analytical inequalities derived above: $\psi_{ry} > 0, \psi_r^{y\bar{g}T} < \psi_r^{yg}$ and $\psi_{rg} < 0$. The upper envelope of these bid-rent functions determines the type of household that lives at each location in equilibrium.

While the model analytically generates a partial ordering of types as a function of location within the central district, as discussed in Section 5.3, this ordering is not analytically unique. Figure 6 Panels A and B should thus best be viewed as the bid-rent functions generated by simulating the model using parameter values in which income inequality is large. In this case, rich private school households live further from the CBD than poor households with children attending the lowest quality public schools. While the exact residential location equilibrium before and after desegregation depends on parameter values, we can make some general predictions about the relative locations in which different effects of school desegregation take place.

[19] For example, rich private school students living beyond poor students in low quality public schools requires the income gap between rich and poor to be sufficiently greater than the highest tuition charge.

Figure 6 Panel C shows theoretical treatment effects of school desegregation on our six outcomes of interest as functions of residential location in the central district. For the purposes of this illustration, we assume that before desegregation occurs there are 20 rich whites, 10 poor whites, 5 rich blacks and 15 poor blacks living in the central district. After desegregation, we assume (consistent with theory and empirical evidence above) that population shifts between the central district and suburbs implies 12 poor whites, 8 rich whites, 10 rich blacks and 20 poor blacks in the central district result. Therefore, of the 50 residential locations in the central district, 10 turn over from white to black.

Moving from left to right, we first see turnover from black private school households to white private school households among the poor. We then see switches from white public to black public school households. In this example, the inner part of the middle ring of the central district is a stable poor black public school neighborhood. The rich neighborhoods start at position 26 before desegregation and 29 after desegregation due to a greater number of rich whites leaving than rich blacks arriving. In this middle region we see a movement from black private school households to white private school households. Beyond this, we see movement from white public to black public households. At the outer edge of the central district, we see no change in the composition of the population.

This example highlights several things worth noting for the empirical work in the next section. While white public enrollment may fall and black public enrollment may rise anywhere except adjacent to the CBD, the preponderance will occur near but potentially not at the periphery of the central district. Furthermore, the responses of private school enrollment will occur to the left of the public school responses. These are empirically testable implications of the model that we demonstrate are evident in the data in the next section.

It is worth noting that the magnitudes of these effects are functions of underlying exogenous variables describing the environment. Indeed, the nature of the residential equilibrium depends crucially on the relative wages of blacks and whites, the number of blacks and whites living in the metropolitan area and the spatial size of the central district. The model predicts that central districts with few blacks or large geographic areas will exhibit relatively small behavioral responses by whites in reaction to desegregation orders. This implies caution in evaluating the external validity of empirical results gleaned from examining a group of heterogeneously structured metropolitan areas.

6. The Spatial Distribution of Responses to Desegregation

In this section, we investigate how central district school desegregation has affected the residential location choices and school choices of blacks and whites as a function of location. We present evidence, largely consistent with the model, that virtually the full effect of desegregation on white enrollment documented in Section 4 came from the outer half of central districts. In addition, patterns of total population loss and gain by race closely match those for public enrollment to a scale. Finally, also as predicted by theory, spatial patterns in private enrollment effects by race appear closer to CBDs than do population effects by race.

6.1 Empirical Model

To study the spatial distribution of the impacts of desegregation, we specify an empirical model analogous to that estimated in Section 4 that flexibly captures the causal response as a function of location. We index central district location to be between 0 and 1 in order to make metropolitan areas of different structures and sizes comparable. As in Figures 1 and 2, location 0 indicates central business districts and location 1 indicates the furthest census tracts from CBDs. The index represents the point in the cumulative distribution function of 1990 black plus white population with tracts ordered by CBD distance. Additional explanation is in Section 2. We use census tract data from 1960, 1970, 1980 and 1990 to estimate parameters of this model. The census tract data set we use includes all but 18 of the MSA-year combinations used for the analysis in Section 4. Appendix Table A2 presents summary statistics of this tract data set.

Although our spatial data would permit analyzing some suburbs, we restrict our attention to central districts. Attempts to estimate suburban responses to desegregation resulted in estimates that were sensitive to minor changes in the specification or indexing scheme. Thin data in 1960 and 1970 and measurement error in tract assignment to suburban districts likely accounts for these unstable estimates. Furthermore, it is not clear what the most appropriate suburban tract indexing scheme would be.

Our empirical model is perfectly analogous to that estimated in Section 4 with the addition of a full interaction with segmented location to capture spatial profiles. Because many census tracts contained 0 counts of some outcomes of interest, we utilize a fixed effects Poisson model.[20] This allows coefficients to be interpreted as partial elasticities, commensurate with the analysis in Section 4. Experimentation with specification reveals that splitting the data into four location segments of width 0.25 allows us to efficiently capture the spatial distribution of treatment effects while maintaining power.[21] For each of four location segments s in South and Non-South regions r separately, we estimate relevant parameters of the equation

(10) $$\ln E(y_{ijt}{}^{s}) = a_j{}^{s} + b_{rt}{}^{s} + \gamma_r{}^{s} D_{jt} + \varepsilon_{ijt}{}^{s}$$

where i indexes census tract in MSA j at time t. The 8 key treatment parameters of interest for each outcome are $\gamma_r{}^{s}$. When white outcomes are used D_{jt} equals one if the central district has been desegregated at time t. Consistent with the evidence on Table 6, D_{jt} equals one if the district has been desegregated for five or more years when either black public school enrollment or black total population is the dependent variable and equals one if the district has been desegregated for any number of years when black private school enrollment is the outcome variable. We weight by the inverse of the number of observations in each MSA in order to give equal weight to each MSA and make these estimates comparable to those from Section 4. To handle potential spatial correlation in the error term, we bootstrap standard errors using 500 replications sampling MSA clusters with replacement.

6.2 Location Specific Results

Figure 7 presents estimated impacts of school desegregation on white and black public school enrollment as functions of location. It graphs the estimated effects of

[20] We use the Hausman, Hall and Griliches (1984) procedure to eliminate the MSA fixed effects. The model is then estimated by quasi-maximum likelihood, a procedure characterized by strong consistency properties (Wooldridge 1999).

[21] More flexible polynomial distance specifications produce qualitatively similar though somewhat wilder results.

desegregation in the South and other regions separately. Bolded portions of the plots indicate statistical significance at the 10 percent level.[22] Panel A shows that desegregation caused white enrollment in the outer fourth of central districts to fall significantly by about 25 percent in all regions and in the third segment of central districts in the South by an estimated 36 percent. Estimated enrollment effects of desegregation are not statistically significant in other region-location combinations. These results are consistent with the estimates reported in Table 3 indicating a 16 percent decline in total central district white enrollment as a result of desegregation. They also suggest that the larger enrollment decline in the South reported in Table 4 was produced by the fact that the enrollment response extended closer to the CDB in the South than it did elsewhere.

Estimated effects for blacks in the South, shown in Panel B, are largely a mirror image of those for southern whites shown in Panel A. Black public school enrollment increased by a significant 55 percent as a result of desegregation in the third segment with estimates in other segments smaller and not significantly different from zero. As shown in Figure 1, the population in the third segment of central districts was overwhelming white in 1960 and 1970. The large percentage increase in black enrollment in this region is not, therefore, inconsistent with the estimates in Table 6 indicating essentially no black enrollment response to desegregation in southern central districts as a whole. Outside of the South, the black enrollment response was relatively constant at about 20 percent in all central district locations, although the estimate is not precise in the outermost region. These spatially disaggregated estimates of the black public enrollment effects are of the same magnitude as the estimates using aggregated central city data displayed in Table 6.

Figure 8 shows analogous results for total white and black populations. Perhaps not surprisingly, the patterns are similar to those in Figure 7. While white population significantly declines as a result of desegregation in all South central district locations, estimates are greatest in absolute value in the third and fourth segments at -.32 and -.25 respectively. Though as with public enrollment, the greatest white population response to

[22] The block bootstrap generates overly large standard errors as it assumes an arbitrary error covariance structure within MSA groups.

desegregation outside the South is in the outer segment at minus 12 percent, it is not statistically significant. Consistent with estimated responses in black public enrollment, black population responses to desegregation are largest and statistically significant only in the third segment at 50 percent in the South and 15 percent in other regions.

The results in Figures 7 and 8 are largely consistent with predictions of the model. The model predicts that the largest public enrollment and population responses should occur in the outer portion of central districts where rich people live. This prediction is evident in the estimates. The model additionally predicts that population responses to desegregation should happen in roughly the same regions as public enrollment responses, though to a smaller extent since some public school leavers go to private schools. While not all estimates in Figures 7 and 8 are statistically different from 0, they do follow patterns consistent with this prediction of the model. Of the sixteen race-region-segment combinations, none have estimated public enrollment declines as a result of school desegregation that are statistically different from their estimated white population declines. Indeed, the magnitudes of point estimates for the two outcomes are remarkably similar.

Figure 9 shows the spatial results for white and black private school enrollment. It shows that desegregation led to a statistically significant increase of 12 percent in white private school enrollment in the second segment of Non-Southern central districts. No other white private enrollment estimates are statistically significant. Panel B shows that black private enrollment declined by 27 and 41 percent in the first and second segments of southern cities respectively as results of desegregation, with no remaining statistically significant estimates. Consistent with the model, our results indicate that private enrollment increases for whites and declines for blacks as results of desegregation indeed occurred in regions closer to CBDs than did population responses.

7. Conclusions

This paper provides new evidence on the mechanisms by which school desegregation in large urban districts led to public enrollment declines for whites and increases for blacks. We demonstrate that white enrollment declines in southern central districts were primarily the product of out-migration while enrollment declines in districts outside the South were primarily the product of increases in private school attendance. Enrollment increases for blacks as a result of desegregation did not occur for several years, primarily occurred outside of the South, and came primarily in the form of residential relocation into central districts.

Overall, our estimates indicate that while it caused sizable shifts of whites out of the outer regions of central districts to be replaced largely by blacks, school desegregation was not one of the main forces driving urban population decentralization. Table 8 reports numbers analogous to those in Table 1 assuming that school desegregation had never occurred in any of the metropolitan areas in our sample. To build the numbers in this table, we take estimates from Table 4 and add back the number of white residents and public school students estimated to be lost from central districts in the South and other regions due to school desegregation. Similarly, we take estimates from Table 7 to subtract off the blacks that we estimate moved to central districts because of desegregation.

Even without court-ordered desegregation, our calculations indicate that aggregate central district white population would have fallen by 6 percent between 1960 and 1990 rather than the decline of 14 percent actually observed. These changes should be viewed relative to the 26 percent increase in white population nationwide during this period. Our estimates also indicate that aggregate central district black population would have increased by 44 percent rather than the 53 percent increase actually experienced in central districts. Overall, this implies a counterfactual increase in central district population of 15 percent relative to the 11 percent increase actually experienced. It is clear from these numbers that school desegregation was not a particularly important force in generating observed changes in urban residential location patterns over the past 50 years.

We emphasize, however, that school desegregation was an important force in generating changes in the racial composition of outlying central district neighborhoods and patterns of private school attendance in neighborhoods close the central business districts. Particularly in the South, these neighborhoods saw large turnover rates of white residents for black residents because of school desegregation.

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Table 1: Trends in Metropolitan Area Residential Location Patterns by Race

Year	1970 Geography of Central School Districts			Metropolitan Area Remainders			Entire United States		
	White	Black	All	White	Black	All	White	Black	All
	1	2	3	4	5	6	7	8	9
Panel A: Population Totals									
1960	30.5	7.2	38.1	41.6	2.4	44.1	158.8	18.9	179.3
1970	29.4	9.1	39.1	51.8	2.9	55.2	173.1	21.7	197.2
1980	26.9	10.6	40.4	59.4	4.4	66.6	189.0	26.5	226.2
1990	26.3	11.0	42.2	66.6	6.0	78.4	199.8	29.9	248.7
60-90 Change	-4.2	3.8	4.1	25.0	3.7	34.3	41.0	11.1	69.4
60-90 % Change	-0.14	0.53	0.11	0.60	1.55	0.78	0.26	0.59	0.39
Panel B: Children Enrolled in School									
1960	5.7	1.6	7.4	NA	NA	NA	38.3	5.0	43.8
1970	6.0	2.6	8.7	13.0	0.9	14.0	40.7	6.4	47.7
1980	3.8	2.5	7.2	11.8	1.2	13.4	34.9	6.5	44.0
1990	3.4	2.4	6.9	10.7	1.3	13.3	31.5	6.6	42.6
60-90 Change	-2.3	0.8	-0.5	NA	NA	NA	-6.8	1.6	-1.2
60-90 % Change	-0.41	0.49	-0.07	NA	NA	NA	-0.18	0.33	-0.03

Note. Population counts are in millions. Numbers are constructed by the authors based on counts reported in decennial censuses. The sample in columns 1-6 includes the 93 metropolitan areas with central districts that had major school desegregation orders between 1960 and 1990. Metropolitan area definitions are from 1999. Enrollment data by race is not available for suburban areas in 1960.

Table 2: Impact of School Desegregation on School Segregation

	Dissimilarity Index	White-Black Exposure Index
	1	**2**
Desegregated	-0.137	0.056
	(0.054)***	(0.032)*
1970 Mean	0.713	0.099
1970 Standard Deviation	0.170	0.060
Number of Observations	263	263
MSA Fixed Effects	X	X
Year-South Region Fixed Effects	X	X

Note. The unit of observation is the central school district. The sample only includes central districts that had major school desegregation orders between 1960 and 1990 and for which enrollment counts by race could be constructed using census data and district enrollment data. See text for definitions of the dependent variables.

Table 3: Impacts of School Desegregation on Outcomes for Whites

	1	2	3	4	5
Panel A: ln(white public enrollment in central district)					
Desegregated	-0.16	-0.13	-0.09		-0.14
	(0.06)***	(0.05)**	(0.04)**		(0.08)*
Desegregated (1 - 4)				-0.17	
				(0.06)***	
Desegregated (5+)				-0.11	
				(0.07)	
Placebo Desegregated					0.05
					(0.08)
Number of Observations	372	372	372	372	372
Panel B: ln(white population of central district)					
Desegregated	-0.10	-0.08	-0.04		-0.07
	(0.05)**	(0.05)*	(0.03)		(0.06)
Desegregated (1 - 4)				-0.11	
				(0.05)**	
Desegregated (5+)				-0.04	
				(0.05)	
Placebo Desegregated					0.05
					(0.07)
Number of Observations	372	372	372	372	372
Panel C: ln(white private enrollment in central district)					
Desegregated	-0.01	0.03	0.03		0.04
	(0.08)	(0.08)	(0.09)		(0.10)
Desegregated (1 - 4)				-0.01	
				(0.08)	
Desegregated (5+)				0.02	
				(0.11)	
Placebo Desegregated					0.09
					(0.10)
Number of Observations	372	372	372	372	372
MSA Fixed Effects	X	X	X	X	X
Year-South Region Fixed Effects	X	X	X	X	X
MSA Specific Linear Trends		X			
MSA Characteristics * Year Effects			X		

Note. The unit of observation is the central school district. The sample includes the 93 central districts identified in Welch and Light (1987) as having had a major school desegregation order between 1960 and 1990. Dependent variables are given in each panel heading. Desegregated is an indicator variable equaling one in years in which the district is under a court-ordered desegregation plan. Placebo Desegregated is an indicator variable equaling one if the district was to be desegregated in one or two years. Desegregated (1 - 4) is an indicator variable equaling one in years in which the district has been under a court-ordered desegregation plan for 1 to 4 years. Desegregated (5+) is an indicator variable equaling one in years in which the district has been under a court-ordered desegregation plan for 5 or more years. MSA characteristics, measured as of 1960, are: percent black enrollment in the central district, log central district area, log MSA area, number of districts in the MSA, log median black income in the central district and log median white income in the central district. * significant at 10%; ** significant at 5%; ***significant at 1%

Table 4: Impacts of School Desegregation on Outcomes for Whites by Region

	ln(white public enrollment in central district)	ln(white population of central district)	ln(white private enrollment in central district)
	1	**2**	**3**
Deseg. * South Census Region	-0.20	-0.18	-0.10
	(0.10)**	(0.08)**	(0.13)
Deseg. * Non-South Census Region	-0.09	0.03	0.15
	(0.05)*	(0.05)	(0.09)*
Number of Observations	372	372	372
MSA Fixed Effects	X	X	X
Year-South Region Fixed Effects	X	X	X

Note. See note to Table 3 for an explanation of the sample and variables.

Table 5: Interacted Impacts of Desegregation on Outcomes for Whites

	ln(white public enrollment in central district)	ln(white population of central district)	ln(white private enrollment in central district)
	1	2	3
Desegregated	-4.90	-5.80	2.82
	(4.58)	(4.23)	(10.01)
Deseg. * % Black Enrollment	-0.18	-0.34	0.00
	(0.40)	(0.28)	(0.85)
Deseg. * log(Central District Area)	-0.70	-0.74	-0.40
	(0.46)	(0.44)	(0.65)
Deseg. * log(MSA Area)	0.17	0.08	0.37
	(0.08)**	(0.07)	(0.15)**
Deseg. * # of Districts in MSA	-3.77	0.52	-3.18
	(2.19)*	(1.53)	(3.99)
Deseg. * South Census Region	0.18	0.17	-0.37
	(0.18)	(0.16)	(0.47)
Deseg. * log(white income)	0.33	0.66	0.25
	(0.60)	(0.54)	(1.22)
Deseg. * log(black income)	0.23	0.01	-0.60
	(0.35)	(0.30)	(0.48)
Number of Observations	372	372	372
MSA Fixed Effects	X	X	X
Year-South Region Fixed Effects	X	X	X
MSA Characteristics * Year Effects	X	X	X

Note. See notes to Table 3 for an explanation of the sample. All MSA characteristics and desegregation dummy interactions are from 1960.

Table 6: Impacts of School Desegregation on Outcomes for Blacks

	1	2	3	4	5
Panel A: ln(black public enrollment in central district)					
Desegregated	-0.02				
	(0.05)				
Desegregated (1 - 4)		-0.05			
		-(0.05)			
Desegregated (5+)		0.10	0.14	0.09	0.12
		(0.05)*	(0.03)***	(0.03)**	(0.03)***
Number of Observations	372	372	372	372	372
Panel B: ln(black population of central district)					
Desegregated	-0.04				
	(0.04)				
Desegregated (1 - 4)		-0.06			
		(0.05)			
Desegregated (5+)		0.03	0.08	0.04	0.05
		(0.04)	(0.03)***	(0.02)	(0.03)*
Number of Observations	372	372	372	372	372
Panel C: ln(black private enrollment in central district)					
Desegregated	-0.33		NA	-0.38	-0.21
	(0.15)**			(0.17)**	(0.15)
Desegregated (1 - 4)		-0.30			
		(0.15)**			
Desegregated (5+)		-0.44			
		(0.18)**			
Number of Observations	372	372	372	372	372
MSA Fixed Effects	X	X	X	X	X
Year-South Region Fixed Effects	X	X	X	X	X
MSA Specific Linear Trends				X	
MSA Characteristics * Year Effects					X

Note. See note to Table 3 for an explanation of the sample and variables.

Table 7: Impacts of School Desegregation on Outcomes for Blacks by Region

	ln(black public enrollment in central district)	ln(black population of central district)	ln(black private enrollment in central district)
	1	2	3
deseg.(5+)* South Census Region	0.01	0.00	
	(0.05)	(0.06)	
deseg.(5+)* Non-South Census Reg.	0.20	0.11	
	(0.05)***	(0.04)***	
deseg.* South Census Region			-0.58
			(0.22)***
deseg.* Non-South Census Reg.			0.10
			(0.22)
Number of Observations	372	372	372
MSA Fixed Effects	X	X	X
Year-South Region Fixed Effects	X	X	X

Note. See note to Table 3 for an explanation of the sample and variables.

Table 8: Counterfactual Trends in Central District Population by Race

Year	1970 Geography of Central School Districts		
	White	Black	All
	Panel A: Population Totals		
1960	30.5	7.2	38.1
1970	30.3	9.0	39.9
1980	29.1	10.3	42.4
1990	28.6	10.4	43.8
60-90 Change	-1.9	3.2	5.7
60-90 % Change	-0.06	0.44	0.15
	Panel B: Children Enrolled in School		
1960	5.7	1.6	7.4
1970	6.2	2.6	8.9
1980	4.2	2.4	7.5
1990	3.7	2.2	7.1
60-90 Change	-2.0	0.6	-0.4
60-90 % Change	-0.35	0.36	-0.05

Note. All counts are in millions. All numbers are constructed by the authors by taking data used to build the numbers in Table 1 and adding back or subtracting off white and black population and public and private enrollment using coefficients in Tables 4 and 7 that are significant at the 10 percent level.

Table A1: MSAs in Sample and Year of Desegregation

MSA	State of Central School District	1970 MSA Population (,000)	1970 Central District Enrollment (,000)	1970 Central School District % Black	Desegre-gation Date
Panel A: Large Central School Districts in Sample					
Birmingham	AL	738	65	52%	1970
Mobile	AL	377	72	42%	1971
Tucson	AZ	352	53	4%	1978
Fresno	CA	455	57	9%	1978
Los Angeles	CA	7,036	614	23%	1978
Oakland	CA	1,632	60	56%	1966
Sacramento	CA	753	48	12%	1976
San Diego	CA	1,358	122	12%	1977
San Francisco	CA	1,478	84	26%	1971
Denver	CO	1,104	89	14%	1974
Wilmington	DE	439	14	73%	1978
Fort Lauderdale	FL	620	109	21%	1970
Jacksonville	FL	612	120	28%	1971
Lakeland	FL	227	20	16%	1969
Miami	FL	1,268	233	23%	1970
Orlando	FL	523	79	18%	1972
Tampa	FL	1,106	102	18%	1971
Palm Bay-Melbourne-Titusville	FL	230	59	11%	1969
West Palm Beach	FL	349	64	27%	1970
Atlanta	GA	1,764	88	64%	1973
Chicago	IL	7,099	542	54%	1982
Castleton	IN	1,248	98	35%	1973
Wichita	KS	417	61	13%	1971
Louisville	KY	905	50	45%	1975
Baton Rouge	LA	376	65	34%	1970
New Orleans	LA	1,144	105	66%	1961
Shreveport	LA	334	53	45%	1969
Baltimore	MD	2,089	178	65%	1974
Boston	MA	4,153	85	30%	1974
Detroit	MI	4,491	265	63%	1975
Minneapolis	MN	2,027	63	8%	1974
Kansas City	MO	1,383	65	47%	1977
St Louis	MO	2,456	106	64%	1980
Omaha	NE	572	58	18%	1976
Las Vegas	NV	305	61	12%	1972
Newark	NJ	2,008	78	71%	1961
Buffalo	NY	1,349	69	37%	1976
Charlotte	NC	840	82	29%	1970
Akron	OH	679	54	26%	1977
Cincinnati	OH	1,440	77	43%	1973
Cleveland	OH	2,419	138	56%	1979
Columbus	OH	1,126	96	27%	1979
Dayton	OH	972	54	36%	1976

Toledo	OH	607	57	26%	1980
Oklahoma City	OK	718	69	21%	1972
Tulsa	OK	528	73	13%	1971
Portland	OR	1,078	70	8%	1974
Philadelphia	PA	4,878	265	60%	1978
Pittsburgh	PA	2,684	70	39%	1980
Charleston	SC	336	56	45%	1970
Greenville	SC	615	55	21%	1970
Berry Hill	TN	699	93	23%	1971
Memphis	TN	857	148	49%	1973
Austin	TX	399	55	15%	1980
Dallas	TX	1,630	164	32%	1971
El Paso	TX	359	60	3%	1978
Fort Worth	TX	802	83	26%	1973
Houston	TX	1,903	235	32%	1971
San Antonio	TX	901	73	15%	1969
Norfolk	VA	1,091	55	41%	1970
Seattle	WA	1,449	82	12%	1978
Milwaukee	WI	1,404	120	25%	1976

Panel B: Large Central School Districts Not in Sample

Washington	DC	3,204	135	93%	None
Albuquerque	NM	374	80	3%	None
New York City	NY	9,076	1,088	35%	None
Salt Lake City	UT	684	33	2%	None
Charleston	WV	257	52	6%	None

Panel C: Medium Sized Central School Districts in Sample

Little Rock	AR	381	26	38%	1971
San Bernardino	CA	1,140	36	14%	1978
San Jose	CA	1,065	35	2%	1986
Vallejo	CA	249	13	25%	1975
Hartford	CT	1,035	26	46%	1966
Fort Myers	FL	105	19	18%	1969
Daytona Beach	FL	174	30	22%	1969
Albany	GA	97	22	40%	1980
Columbus	GA	250	39	31%	1971
Rockford	IL	315	38	11%	1973
Fort Wayne	IN	420	39	14%	1971
South Bend	IN	245	34	16%	1981
Lexington-Fayette	KY	309	34	16%	1972
Houma	LA	145	20	17%	1969
Alexandria	LA	118	28	32%	1969
Lake Charles	LA	145	38	25%	1969
Springfield	MA	583	28	20%	1974
Grand Rapids	MI	763	33	21%	1968
Lansing	MI	378	29	12%	1972
Jersey City	NJ	609	35	41%	1976
Rochester	NY	1,020	41	33%	1970
Fayetteville	NC	212	9	36%	1969

Wilmington	NC	107	18	29%	1969
Lawton	OK	108	20	14%	1973
Columbia	SC	323	40	43%	1970
Amarillo	TX	144	28	6%	1972
Lubbock	TX	179	33	11%	1978
Odessa	TX	157	24	6%	1982
Waco	TX	148	18	21%	1973
Roanoke	VA	200	18	26%	1970
Tacoma	WA	411	35	9%	1968

Note. Large central school districts are those districts which had enrollment exceeding 50,000 in 1968 (as measured in Welch and Light (1987)) and included the central business districts of their MSAs in 1960. Medium central school districts are districts which were included in the Welch and Light (1987) sample, had enrollment between 15,000 and 50,000 in 1968 (as measured in Welch and Light (1987)) and included the central business districts of their MSAs in 1960. See Welch and Light (1987) and the text for more information.

Table A2: Summary Statistics

		1960	1970	1980	1990
Panel A: Central Districts (means with standard deviations in parentheses)					
Log (White Public Enrollment)		10.47	10.56	10.05	9.90
		(0.73)	(0.74)	(0.78)	(0.85)
Log (White Private Enrollment)		8.59	8.62	8.57	8.42
		(1.45)	(1.34)	(1.07)	(1.01)
Log (Black Public Enrollment)		8.98	9.50	9.50	9.56
		(1.20)	(1.17)	(1.10)	(1.03)
Log (Black Private Enrollment)		6.21	6.01	6.36	6.44
		(1.56)	(1.59)	(1.55)	(1.45)
Log(Total White Population)		12.30	12.31	12.26	12.21
		(0.84)	(0.80)	(0.77)	(0.81)
Log(Total Black Population)		10.54	10.75	10.99	11.10
		(1.19)	(1.19)	(1.12)	(1.06)
Desegregated Districts		0	29	89	93
Desegregated Districts (5+)		0	4	70	93
Panel B: Census Tract Aggregate Counts by Location Index (millions)					
Total White Population	0 to 0.25	9.5	8.1	6.5	5.6
	0.25 to 0.5	7.9	7.6	6.7	6.2
	0.5 to 0.75	6.4	7.0	6.9	7.0
	0.75 to 1	5.2	6.5	6.8	7.5
Total Black Population	0 to 0.25	4.3	4.3	3.9	3.5
	0.25 to 0.5	1.5	2.5	3.0	3.1
	0.5 to 0.75	0.7	1.3	2.0	2.4
	0.75 to 1	0.4	0.9	1.6	2.0
Total Tracts		7,976	9,466	10,242	10,554
Desegregated Tracts		0	1,789	9,278	10,554
Desegregated Tracts (5+)		0	411	6,503	10,554
Central Districts With Tract Data		78	90	93	93
Desegregated Central Districts		0	26	89	93
Desegregated Central Districts (5+)		0	4	70	93

Note. Panel A shows summary statistics of the data set used to generate Tables 1-8 and A3-A4 while Panel B shows summary statistics of the data set used to generate Figures 7-9. Figures 1-2 are generated using a subset of the sample described in Panel B.

Table A3: Impacts of School Desegregation on Outcomes for Whites: Treatment Effect Timing

	ln(white public enrollment in central district)	ln(white population of central district)	ln(white private enrollment in central district)
	1	2	3
deseg.(1)	-0.10	-0.06	0.02
	(0.06)	(0.05)	(0.08)
deseg.(2+)	-0.19	-0.12	-0.02
	(0.07)***	(0.06)**	(0.10)
deseg.(1-2)	-0.19	-0.14	-0.03
	(0.07)***	(0.06)**	(0.09)
deseg.(3+)	-0.10	-0.02	0.04
	(0.06)	(0.04)	(0.11)
deseg.(1-3)	-0.17	-0.12	-0.01
	(0.06)***	(0.05)**	(0.08)
deseg.(4+)	-0.12	-0.03	0.03
	(0.07)*	(0.05)	(0.11)
deseg.(1-4)	-0.17	-0.11	-0.01
	(0.06)***	(0.05)**	(0.08)
deseg.(5+)	-0.11	-0.04	0.02
	(0.07)	(0.05)	(0.11)
deseg.(1-5)	-0.16	-0.10	0.00
	(0.06)***	(0.05)**	(0.08)
deseg.(6+)	-0.14	-0.06	-0.02
	(0.09)	(0.06)	(0.13)
deseg.(1-6)	-0.16	-0.10	-0.01
	(0.06)***	(0.05)**	(0.08)
deseg.(7+)	-0.10	-0.04	0.01
	(0.09)	(0.06)	(0.13)

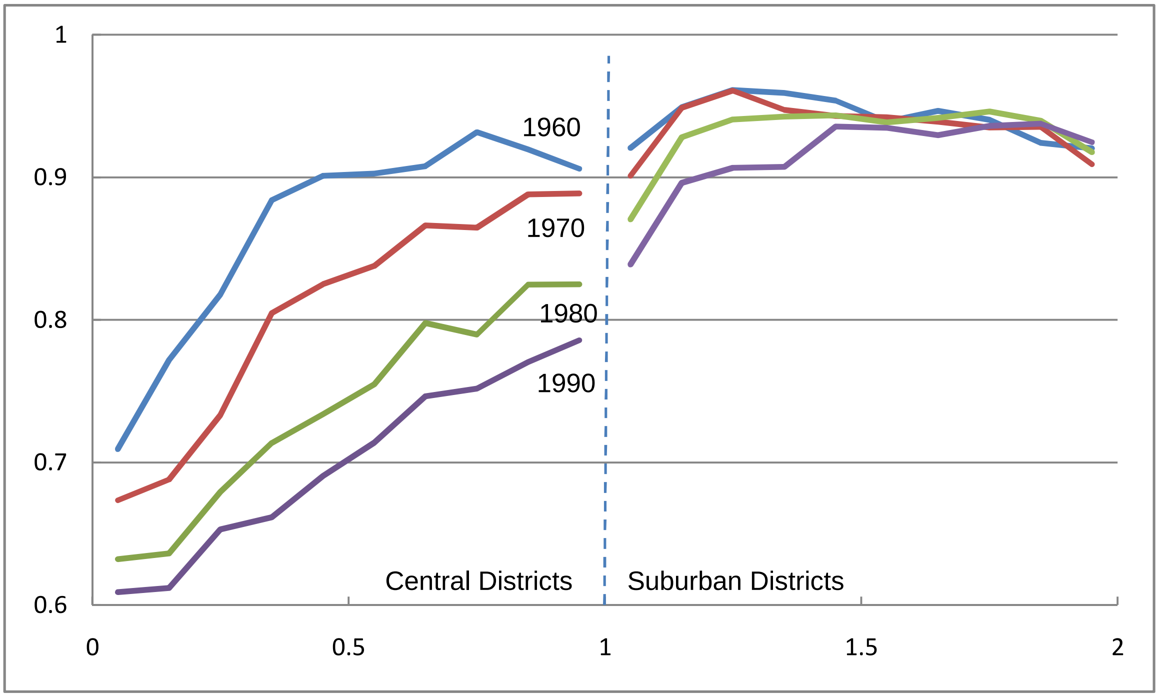
Note. This table shows regression results from specifications analogous to those in Table 3 Specification 4 with the only difference being the specification of the distributed lags.

Table A4: Impacts of School Desegregation on Outcomes for Blacks: Treatment Effect Timing

	ln(black public enrollment in central district)	ln(black population of central district)	ln(black private enrollment in central district)
	1	**2**	**3**
deseg.(1)	-0.05	-0.06	-0.27
	(0.04)	(0.03)	(0.15)*
deseg.(2+)	-0.01	-0.04	-0.36
	(0.06)	(0.06)	(0.17)**
deseg.(1-2)	-0.09	-0.09	-0.38
	(0.06)	(0.05)	(0.15)***
deseg.(3+)	0.10	0.04	-0.23
	(0.04)***	(0.04)	(0.19)
deseg.(1-3)	-0.05	-0.06	-0.30
	(0.05)	(0.05)	(0.15)**
deseg.(4+)	0.09	0.03	-0.42
	(0.05)*	(0.04)	(0.18)**
deseg.(1-4)	-0.05	-0.06	-0.30
	(0.05)	(0.05)	(0.15)**
deseg.(5+)	0.10	0.03	-0.44
	(0.05)*	(0.04)	(0.18)**
deseg.(1-5)	-0.03	-0.05	-0.31
	(0.05)	(0.04)	(0.15)**
deseg.(6+)	0.07	0.00	-0.53
	(0.06)	(0.06)	(0.22)**
deseg.(1-6)	-0.03	-0.05	-0.32
	(0.05)	(0.04)	(0.15)**
deseg.(7+)	0.08	0.01	-0.51
	(0.06)	(0.06)	(0.22)**

Note. This table shows regression results from specifications analogous to those in Table 6 Specification 2 with the only difference being the specification of the distributed lags.

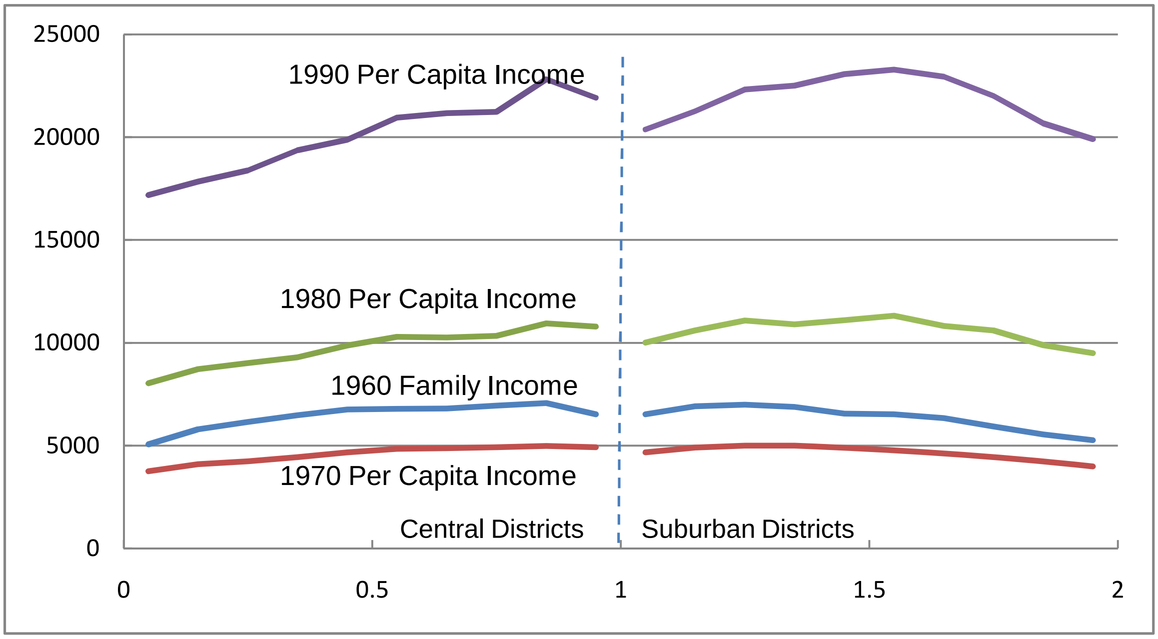
Figure 1: Fraction White by Residential Location



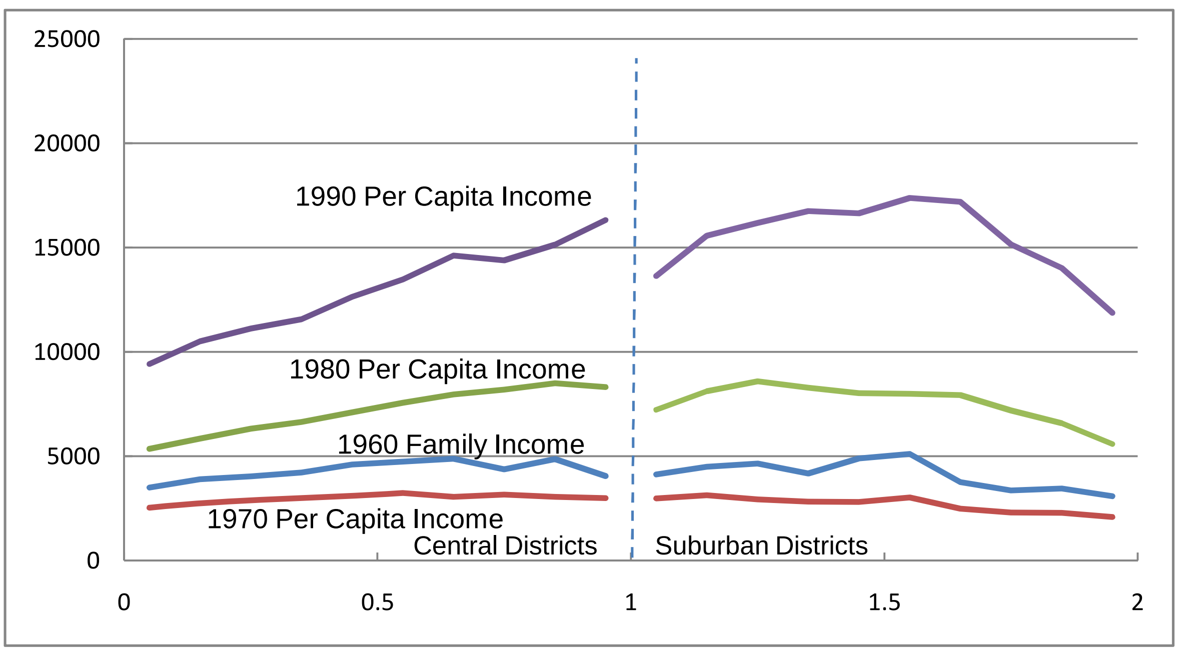
Note: Graph shows the average ratio of residential white to white plus black population as a function of CBD distance across metropolitan areas in our sample for which census tract data are available. The sample includes the 70 metropolitan areas with central districts that were tracted in 1960 and experienced major desegregation orders. Central districts without at least 6 suburban tracts in all years are excluded. Each metropolitan area is weighted equally at all locations on the graph. The horizontal axis shows locations indexed as the cumulative distribution functions of 1990 population with respect to CBD distance inside and outside of central districts.

Figure 2: Income by Race and Residential Location

Panel A: Whites

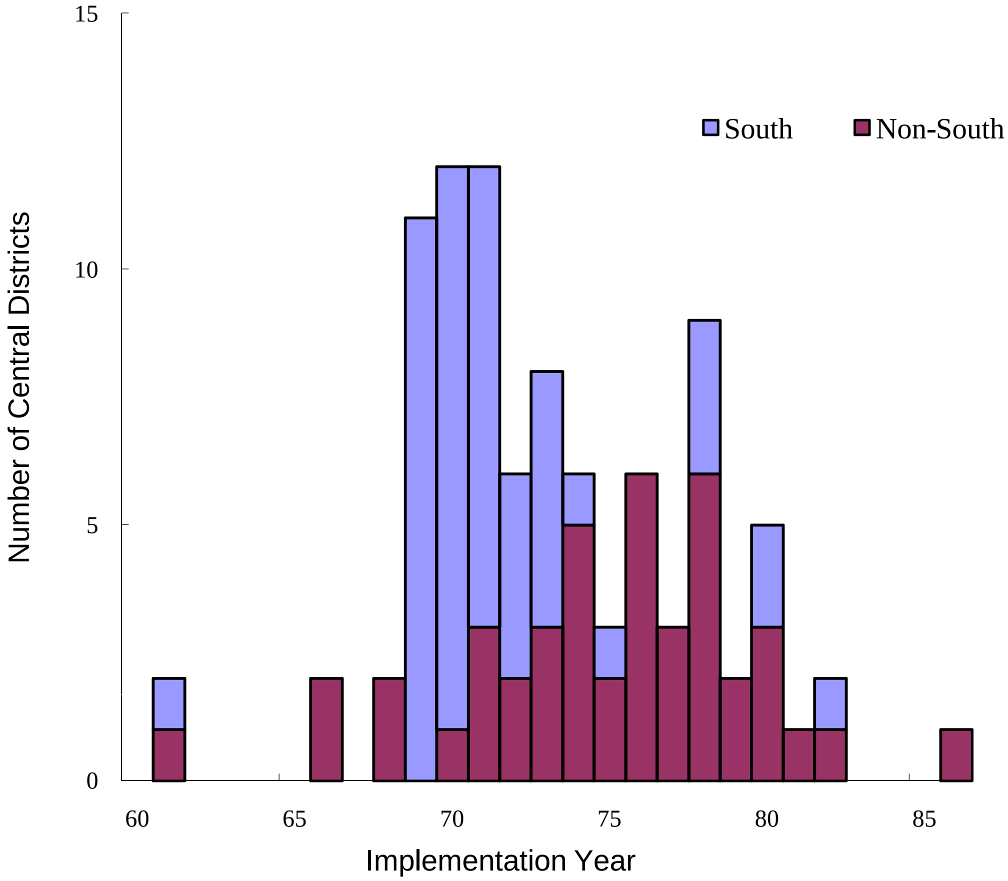


Panel B: Blacks



Notes: Graphs show average family or per capita income by race as a function of CBD distance across metropolitan areas. See the notes to Figure 1 for explanations of the sample, distance metric and weighting.

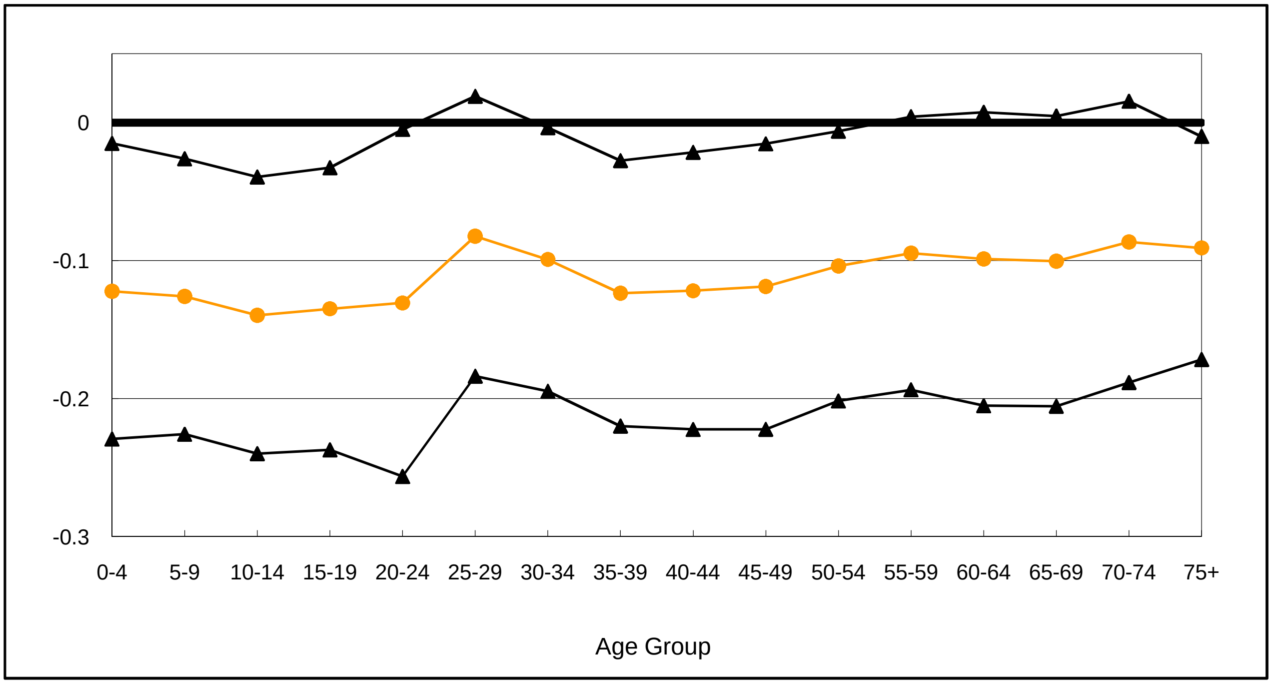
Figure 3: Timing of School Desegregation



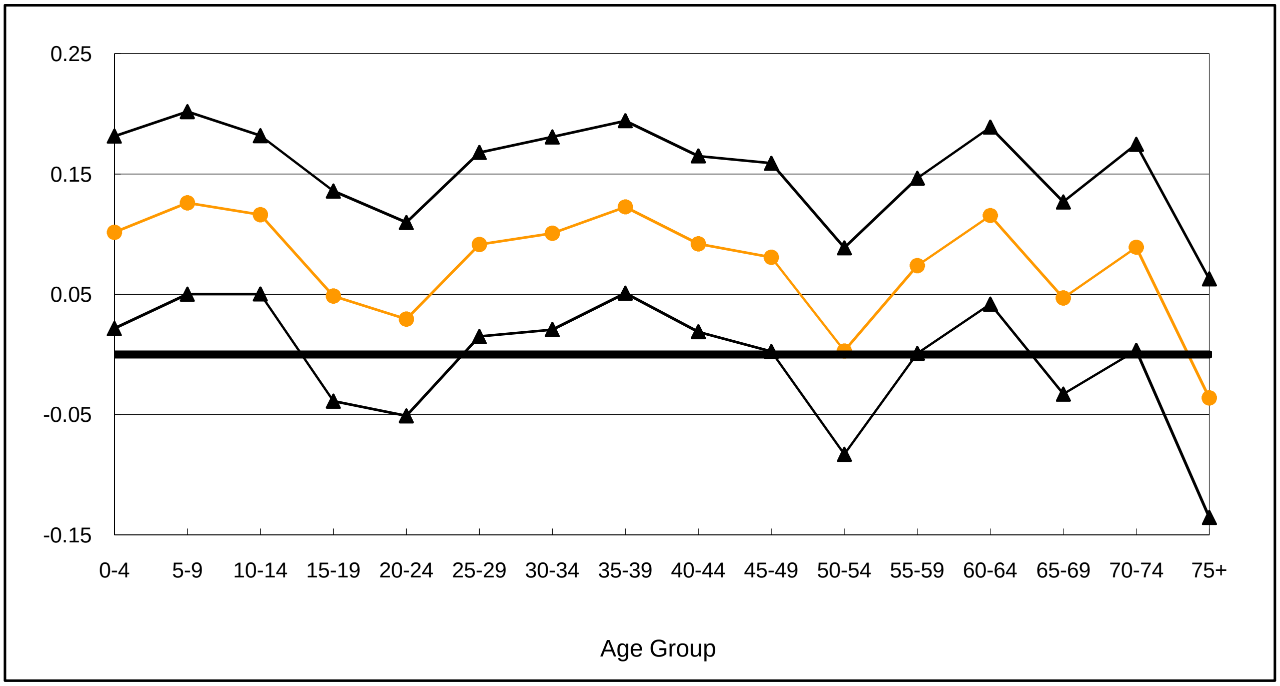
Note. The sample includes the 93 central school districts from the Welch and Light (1987) study that experienced major court-ordered desegregation between 1960 and 1990.

Figure 4: Impacts of School Desegregation on Total Population by Age Group

Panel A: White Population

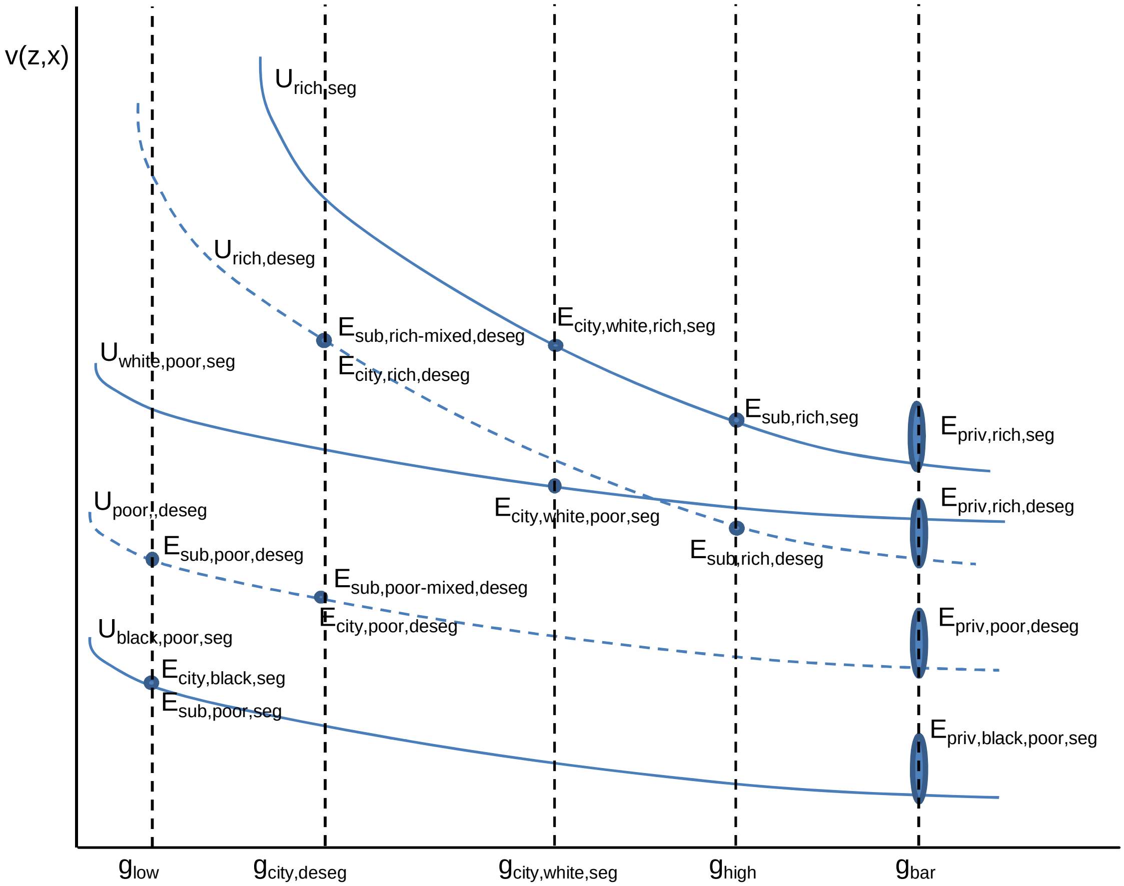


Panel B: Black Population



Note. Graphs show 95% confidence intervals around point estimates of the effects of desegregation on population by race and age in central districts. Each point estimate is the coefficient on desegregation dummy variables from separate regressions of population by race and age groups listed on the x-axis on

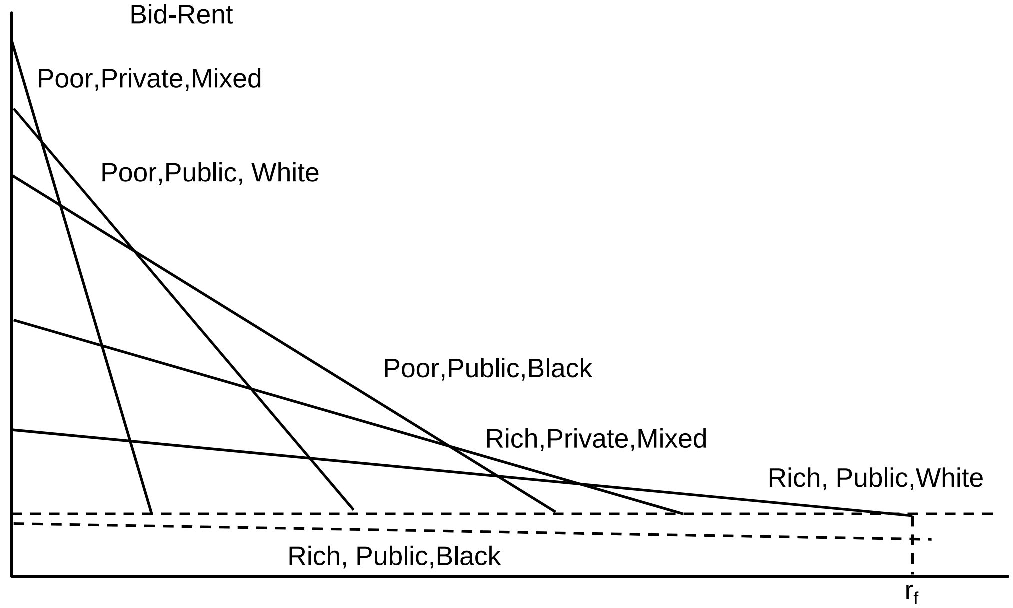
Figure 5: Consumption and School Quality Before and After Desegregation



Note: This figure shows an example of how equilibrium public school quality can differ for rich and poor in central and suburban districts and segregated and desegregated environments. Homogenous poor public schools have quality g_{low} while homogenous rich public schools have quality g_{high}. For the purposes of this figure, we express preferences as U(v(z,x),g). Each line in the figure is an indifference curve between v(z,x) and g for a group of individuals attending public schools. Solid lines represent indifference curves in an environment in which the central district schools are segregated and dashed lines represent indifference curves in a desegregated environment. All potential equilibrium points are indicated with an E. Utilities of households with students in private school are in all cases equal or greater to those associated with indifference curves on the graph.

Figure 6: Theoretical Effects of Desegregation on Central District Land Use Patterns

Panel A: Segregated Environment



Panel B: Desegregated Environment

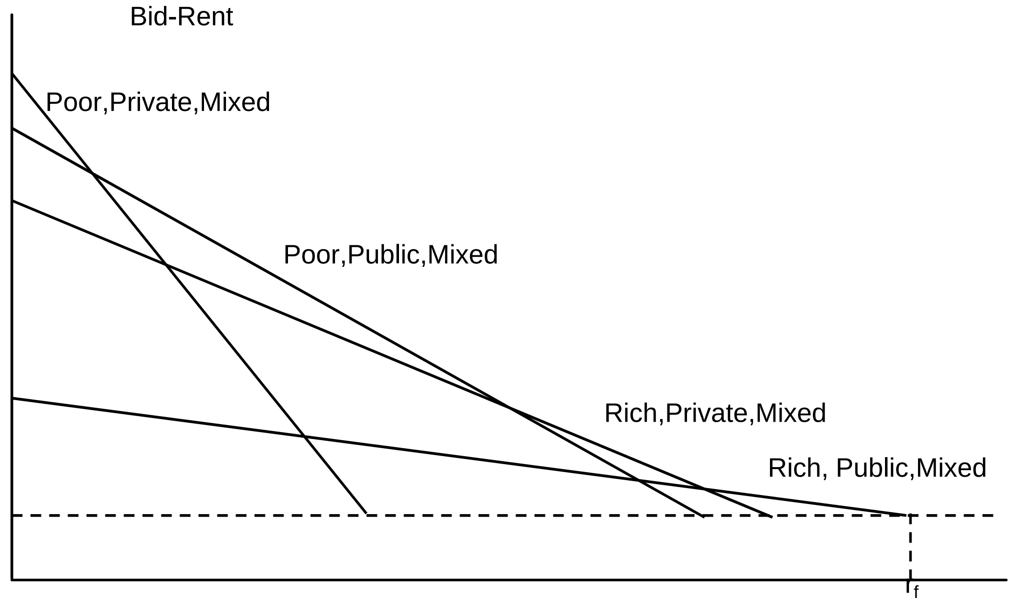


Figure 6 (cont.): Theoretical Effects of Desegregation on Central District Land Use Patterns

Panel C: Theoretical Treatment Effects of Central District Desegregation Based on Example

- = decrease, 0 = no effect, + = increase

Location	**00000000011111111112222222222333333333344444444445** **12345678901234567890123456789012345678901234567890**
White Public Enrollment	000000-0-0-0---00000000000000000--------------0000
Black Public Enrollment	000000+0+0+0+++0000000000+++0000000000++++++++0000
White Private Enrollment	++++0000000000000000000000000000++++++000000000000
Black Private Enrollment	----000000000000000000000---0000000000000000000000
White Population	++++00-0-0-0---00000000000000000000000--------0000
Black Population	----00+0+0+0+++00000000000000000000000++++++++0000

Pre-desegregation poor-rich border

Post-desegregation poor-rich border

Notes: This figure shows how land use patterns can change with school desegregation in the central district. In the initial segregated environment, we assume that 10 poor whites, 20 rich whites, 15 poor blacks and 5 rich black live in the central district. With desegregation, we assume that the resulting populations are 8, 12, 20 and 10 respectively. Panel C shows the theoretical changes in each of the outcome measures as a function of location. Location patterns in racially mixed regions are chosen so as to minimize the number of residential moves. Regions marked in Panel A as "mixed private" have an equilibrium location pattern implied by the model in which blacks must live at the left end of the mixed region. This pattern is maintained for the purpose of constructing Panel C. All columns in Panel C add to 0.

Figure 7: Impacts of School Desegregation on Public School Enrollment

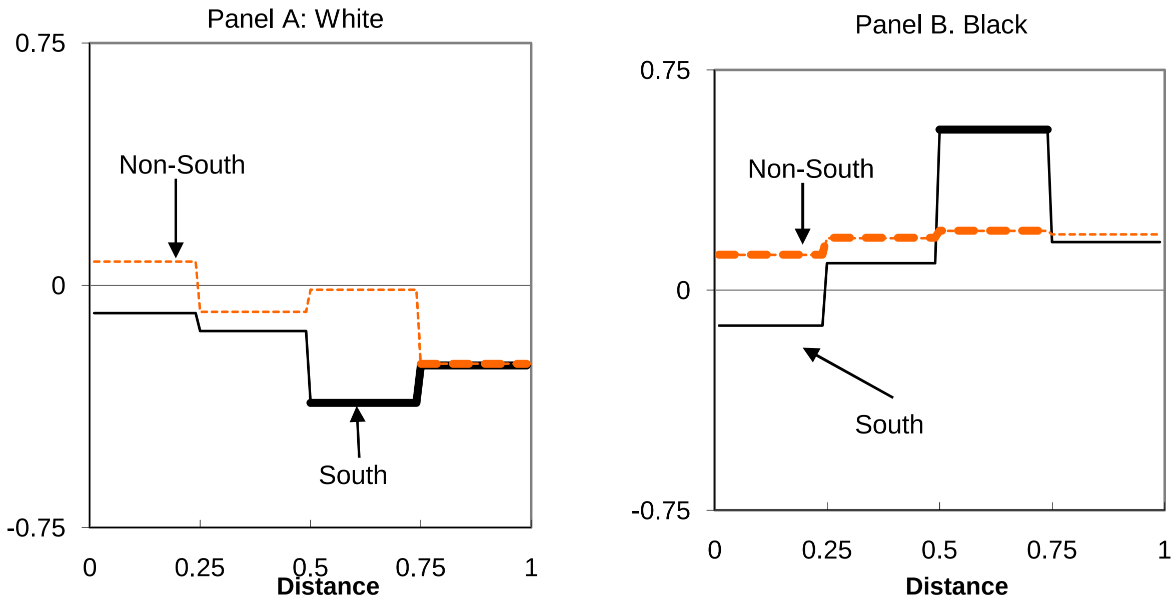
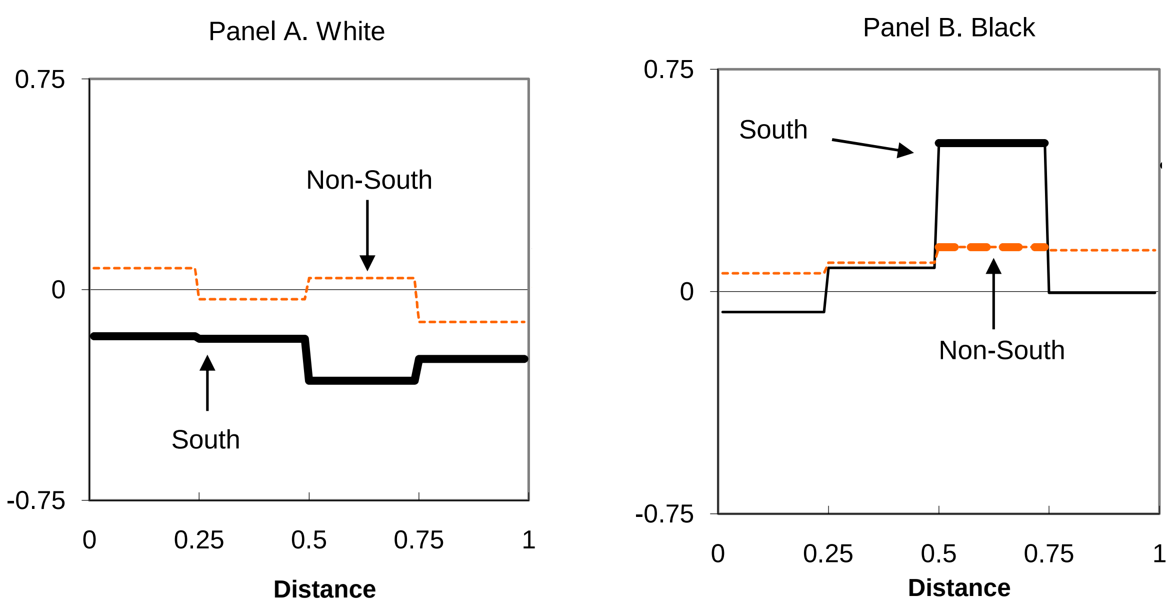
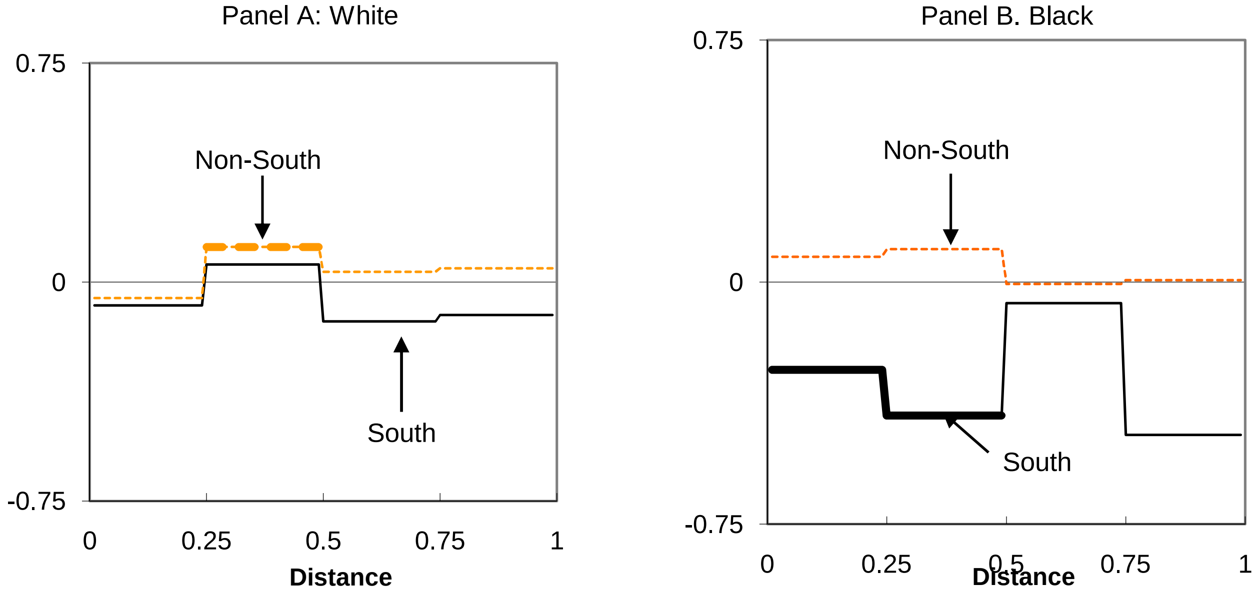


Figure 8: Impacts of School Desegregation on Total Population



Note. Each graphed line segment is a coefficient from a separate Poisson regression described in Equation 10 in the text. Samples include only the census tracts from 1960-1990 that fall within indicated distance intervals. The horizontal axis gives location within central districts using the same metric as that used for Figures 1 and 2. Thick portions of the lines show statistically significant results at the 10% level based on 500 bootstrap replications sampling using MSA clusters with replacement. Table A1 Panel B presents summary statistics of the census tract data.

Figure 9: Impacts of School Desegregation on Private School Enrollment



Note: See the notes to Figures 7 and 8 for an explanation of the distance metric, sample and estimation method.