School Desegregation, School Choice and Urban Population Decentralization*

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1. Introduction

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 central cities declined by 17 percent despite large gains in overall population. Boustan (2006), Collins & Margo (2007) and others document that whites in particular make up a disproportionate fraction of this aggregate decline. Indeed, among the 90 central urban areas examined in this paper the aggregate white population fell by 12 percent between 1970 and 1990 while the aggregate black population grew by 21 percent over the same period.

This paper examines the role of school desegregation in shaping these changing location patterns by race. School desegregation orders represent a unique source of plausibly exogenous variation in the quality of race-specific local public goods. This variation facilitates our empirical evaluation of the importance of Tiebout (1956) sorting for generating observed historical patterns in residential location by race, both between central school districts and suburbs and over space within central school districts. We examine how the sharp white public school enrollment decline caused by court-ordered school desegregation demonstrated elsewhere manifested itself as relocation to suburban public school districts versus enrollment in private schools. We perform a similar decomposition of the black enrollment increases in central districts that we find were caused by school desegregation. We demonstrate that regional differences are important for understanding the effects. Further, we show that the sizable spatial variation in responses within districts provides a vivid picture of how school desegregation in central districts changed the residential location equilibrium and patterns of private school choice in metropolitan areas. Our construction of a unique data set on the evolution over time of population and enrollment counts by race, 1970 definition public school district, type of school and detailed spatial location is an essential input into our analysis.

In addition to being an empirical evaluation of the importance of Tiebout sorting for generating changes in the spatial distribution of urban populations by race, our analysis also informs the current debate on the efficacy of school district integration policies. With the recent Supreme Court decision striking down integration plans in

Seattle, WA and Louisville, KY, understanding the effects of school resegregation has considerable contemporary policy relevance. Indeed, Lutz (2005), Orfield (1996), and Clotfelter et al. (2005) demonstrate that the releases of school districts from court supervision that occurred starting 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 induced sizable responses in residential location choices. Understanding the mechanisms by which the original orders of the 1960s and 1970s led to declines in central district public school white enrollment and increases in black enrollment may be invaluable in helping to understand the effects of changes in school assignment policies currently under consideration.

Our examination of census data confirms Reber's (2005) results using district enrollment data that desegregation orders caused a 10 to 15 percent decline in white enrollment in central districts. While in the South most of these white students ended up enrolled in suburban public schools, private schools represented a key outlet in other regions. Moreover, consistent with Guryan (2004), Lutz (2005) and Reber's (2007a) evidence that desegregation improved school quality for black students, we demonstrate that black enrollment significantly increased outside the South as a result of desegregation and that private school enrollment of black central district residents significantly declined. These public school enrollment increases are reflected in overall population changes by race in central city district areas. This paper presents the first estimates of the causal connection between court-ordered desegregation and private school attendance produced using a national sample.

Our observed changes in spatial location patterns by race in response to desegregation orders match those predicted by a model developed below that incorporates both commuting and Tiebout sorting. In particular, we demonstrate that most of the population shifts as a result of desegregation occurred near the borders between central districts and suburbs, as is predicted by the model. Further, we show that shifts in private school enrollment primarily occurred in the inner to middle regions of central districts and poor inner suburbs, also as predicted by the model. While the magnitudes of the population shifts are not sufficiently large to have generated a large fraction of aggregate population decentralization, they are essential for understanding observed changes in the spatial distribution of the population by race in outer regions of central districts and inner suburbs.

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

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 and suburbs 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 from 1970 to represent central urban areas and metropolitan area remainders to represent suburbs.

One broad trend seen in Table 1 has not received much attention in the literature and is thus of particular note. The great black migration from rural areas of the South to urban areas shows up dramatically as increases in both city and suburban black populations. While the aggregate black population of the 90 central school district areas in our sample increased by 1.9 million between 1970 and 1990, it grew by an impressive 3.2 million in suburban areas, representing a much larger percentage increase for the suburbs. In fact, though white central area population declined on aggregate, its decline relative to suburban white population was far less than that of central area black population relative to suburban black population. Aggregate white population decline between 1970 and 1990 in central areas relative to suburban areas was 41 percent while the analogous number for blacks was 91 percent. Indeed, by this measure, blacks were suburbanizing much faster than whites during this period.[1] The data on enrollment counts in Panel B show a similar though less dramatic pattern. Relative central white enrollment fell by 26 percent while that for blacks fell by 62 percent.

Taking into account the very different metropolitan area population growth rates by race appears important for understanding reasons behind urban decentralization. In particular, the patterns in Table 1 indicate that most of the slower population growth rate in cities relative to suburbs can be explained by race-neutral factors. One important result from this paper is that while central district school desegregation did generate some white flight, the magnitudes are not large enough to have driven an important share of urban population decentralization.

Figure 2 shows the evolution of the fraction of the population that is white by residential location between 1960 and 1990. Panel A shows data from outside the South while Panel B shows data from the South. In order to compare central school districts of different sizes, we index space to be between 0.1 and 1 in the central district, where 0.1 represents the central business district (CBD) and 1 is the distance of the furthest census tract within the central public school districts.[2] We report data from census tracts within distance 2 in each metropolitan area with a major desegregation order and in school districts for which census tract data are available for 1970 and beyond. In all descriptive and statistical analysis in this paper, we weight each metropolitan area equally.

Figure 2 shows that fraction white is increasing in CBD distance in both samples within central districts but is relatively flat outside of central districts. White fraction declined much faster in central school districts than in suburban ones between 1960 and 1990. In the North, fraction white declined by about 0.2 on average in central districts and by 0.1 in suburban districts. In the South, the declines were about 0.15 and 0.05 respectively over the same period. Data from both regions thus imply a rough

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[1] Similar data from a larger sample of 149 1960 geography central cities and metropolitan areas reveals an even more pronounced pattern. In this sample, aggregate central city white population declined by 20 percent between 1970 and 1990 while white suburban population grew by 28 percent over this period. City black populations grew by 17 percent while suburban black populations more than doubled. The larger magnitudes for this alternative sample likely reflect the fact that city geographies are more spatially constricted than central school district geographies.

[2] Because the maximum distances within central districts encompass a small amount of land area due to irregularities in central district shapes, we combine all locations with index values greater than 1 to be at 1. Even with this aggregation near central district edges, the outer of 10 distance bins of width 0.1 has the smallest population.

"difference in difference" relationship of about 10 percent. Inspection of data from 1970 and 1980 reveals that all declines in white fraction were monotonic over time. 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. Descriptive data in Table A1 Panel B confirms that the areas near central district borders are where the black population increased fastest relative to the white population.

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 local federal court orders. Heterogeneity across districts in the time it took for court cases challenging segregation to proceed through the judicial system represents plausibly exogenous variation in the timing of implementation of school desegregation for many large districts. It is this variation that we employ in this paper to examine the effects of desegregation on residential location patterns.

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, states 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 desegregation largely arose from residential housing patterns, not legal mandate. Figure 2 shows that these two court decisions are correlated with regional variation in the timing of desegregation in our sample of central city school districts. In particular, southern districts were more likely to have been desegregated early in our sample period and non-southern districts were more likely to have been placed under a court-order later in the period.

While there is considerable evidence that for small windows of time, the year in which desegregation orders occurred can be taken as exogenous, it is important to consider the implications for our empirical work of potential endogeneity of the dates of desegregation orders 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. 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 pre-desegregation MSA attributes.

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.[3] An increase in racial

[3] The dissimilarity index is defined as:

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

integration causes a decrease in the dissimilarity index. Similar to Reber (2005), we find that desegregation reduced the dissimilarity index an average of 12 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.[4] Desegregation increased the exposure of whites to blacks by around .05, equal to 25 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 only includes the 90 metropolitan areas with central school districts that experienced major court ordered desegregation between 1960 and 1990. Limitations to data availability further restrict our sample to 87 districts in 1960 and 1980. We define central districts as those school districts that included the central business districts of the largest central city as of 1960 in each metropolitan area nationwide.

In order to limit the possibility that school district boundaries were drawn in response to pressure for desegregation, we utilize 1970 school district geographies.[5] The "69-70 School District Geographic Reference File" (Bureau of Census, 1970) relates

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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.

[4] 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*. It is interpreted as the percent of white students in the average black student's school. For a given district, it ranges from 0 to the percent of black students in the district as a whole.

[5] 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.

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. 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 1970 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 data to fill out the data set with several county-level districts for which census tract data were not available in some years. As such, we only observe spatially disaggregated data for 78 districts in 1960, 88 districts in 1970 and 83 districts in 1980. The spatially disaggregated tract level geography allows us to analyze the extent to which effects of desegregation have differed across space within central districts and suburbs. We use metropolitan area definitions from 1999. Summary statistics are in Appendix Table 1.

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 rather than choice of private schools, although the private school margin was important outside of the South. We also show that desegregation increased black central district public enrollment as the result of both migration and reductions in private school enrollment.

We estimate the base specification

(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 enrollment by race, private enrollment by race and population by race in central districts.

It is possible that due to different environments, southern and non-southern urban areas may have 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, extents of housing market discrimination, residential segregation, and income levels. Given that the timing of desegregation is strongly associated with region, this possibility is problematic because identification of the parameter of interest, c, requires that the timing of desegregation is uncorrelated with trends in the outcome variable not related to school desegregation. In order to address this concern, we allow the year effects in equation (1), β_{rt}, to vary by region, where region is defined as the south and non-south (based on census regions). As discussed in Section 2, we include metropolitan area fixed effects in order to account for the possibility that fixed differences across metropolitan areas may have influenced the timing of desegregation orders.

4.1 White Results

Table 3 Panel A, presents our census data based 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 14 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 metro area characteristics, measured in 1960, interacted with year effects. We include these interactions to control for the possibility that white enrollment trends may be driven by initial factors such as black enrollment or city size. Given that the coefficient of interest changes little with 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 (where the long-run is defined as five or more years of desegregation) is a bit smaller than the short-run impact, although the two estimates are not statistically distinguishable.

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 flight, 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, analogous to those on Panel A, of the effect of desegregation on central city white private school enrollment. The estimates are very small in magnitude and imprecise. Panel C presents estimates of the impact of desegregation on the total white central city population. The estimate from our base specification, column (1), suggests that desegregation induced 7 percent of the white population to exit central cities on average. Viewed jointly, the three panels of Table 3 suggest that white flight from desegregated central city public schools manifested itself primarily as migration to suburban school districts.

Table 4 allows the effect of desegregation to vary by region. The results suggest important regional heterogeneity in the white response to desegregation. While desegregated central city school districts in the South and Non-South both experienced a loss of white enrollment, the magnitude of the loss is estimated to have been almost twice as large in the South as outside the South. The manner in which whites exited desegregated schools also differed by region. In the South, white flight largely took the form of migration to the suburbs, while in the Non-South desegregation caused an estimated 15 percent increase in private school attendance, though this estimate is only marginally significant. These estimates provide no evidence that desegregation caused a loss in white population in desegregated non-southern cities, whereas southern cities experienced a significant reduction in their white population.

To the best of our knowledge, the private school estimates on 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. The existing literature on public school segregation and white private school attendance has generally pursued one of two approaches. First, many papers document a strong correlation between the percent black of public school enrollment and the propensity of whites to attend private school (e.g. Fairlie and Resch (2002), Reardon and Young (2002), Lankford, Lee and Wyckoff (1995), and Clotfleter (1976)). Second, some papers document specific instances of school desegregation producing increased white private school attendance (e.g. Clotfelter's (1976) examination of the desegregation of Mississipi's schools). It seems likely that lack of nationwide data on private school enrollment by race has prevented a systematic exploration of the link between court-ordered desegregation and white private school attendance. Our unique dataset overcomes this difficulty.

In the absence of results produced from a national sample, the desegregation literature has generally assumed that private school attendance was an important element of white flight in the South. This assumption is based on several facts. First, white private school attendance has increased in the south since 1960, while it has fallen in the rest of the country. Desegregation produced a much greater change in public school racial composition in the South than it did elsewhere. Desegregation is therefore often cited as an explanation for the divergence in white private school attendance patterns by region. 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 was costly, making private schools a relatively more attractive option (Clotfelter 2004a).

While the results of this paper lend no support to the hypothesis that whites used private schools to avoid 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 prevalent in non-urban areas of the south. Indeed, the highest rates of white private school attendance in the south are in non-metropolitan counties and the contribution of private schools to overall school segregation is greatest in the nonmetropolitan areas of the south (Clotfelter 2004a, 2004b).

In the next section we present a residential location model detailing how district size, racial composition, number of alternative districts and income by race can influence this treatment effect. Table 5 explores the impact 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 an MSA influence the extent of white exit from desegregated schools.[6] As expected, the more alternative public school districts available to whites, the greater the extent of white flight. The size of the MSA has the opposite influence – the larger the MSA, the less white flight occurs. Holding the number of alternative districts fixed, a larger MSA implies higher commuting costs to live in the attendance areas of the alternative districts.

The size of the MSA also has a significant influence on the form that white departure from the desegregated district takes. The larger the MSA, the more exit to central city private schools occurs (columns (2)). Large MSAs exhibit less overall white population loss, however (column (3)). This reflects both the lower exit rate from the desegregated school and a higher propensity for exit to take the form of private school attendance, which involves continued residence in the central city.

The southern MSAs in our sample are considerably smaller, on average, than the non-southern MSAs. This difference appears to be a partial explanation for the regional divergence in the manner in which white flight manifests itself. The larger non-southern MSAs promote exit to private schools, while the smaller southern MSAs promote exit to suburban schools. The south census region coefficient is imprecisely estimated in all specifications on Table 5, suggesting that the regional heterogeneity in the desegregation treatment effects documented on Table 4 can be explained by underlying MSA characteristics.

[6] 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. She does not estimate the impact of MSA size.

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. 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.

While 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 about a 10 percent increase in black enrollment in the long-run, defined as 5 or more years after implementation of desegregation (column (2)). This result is robust both to inclusion of MSA-specific linear trends and the set of 1960 MSA characteristic–year interactions. Table A3 documents that the result is also robust to alternative codings of the desegregation treatment variables.

Panel B documents that desegregation reduced private school enrollment of blacks living in central public school districts by 20 to 30 percent. While these are very large changes, 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 precious little consideration in the past literature. Panel C presents evidence that desegregation increased the total black population of central districts by around 5 percent, although not all of these estimates are precise.

The black response to desegregation displays even more evidence of regional heterogeneity than the white response. 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 is small and imprecise. Column (2) suggests, however, that the decrease in private school attendance was larger in the south than in the non-south.

Consistent with the desegregated school enrollment results, column (3) documents that the increase in black central city population was mostly a non-southern phenomenon.

Table 8 presents the results of interacting the treatment variable with MSA characteristics, analogous to the white results presented on Table 5. Unfortunately, across the three columns, only a single variable is precisely estimated, making it difficult to make any conclusions about how MSA characteristics influenced the black response to desegregation.

5. Theory

In this section, we theoretically explore potential mechanisms behind the causal links between school desegregation and changes in white and black public enrollment 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 as further evidence that our estimates from the previous section are not spurious.

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), Muth (1968) and Mills (1969) and those stemming from Tiebout's (1956) conjecture that individuals sort across local jurisdictions as a function of their demands for different levels of public goods. The model presented here combines these two features and has some features of that proposed by de Bartolomé and Ross (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 the potentially most controversial assumption in the model. A longstanding puzzle in urban land use theory is that while classical residential land use theory with fixed lot size predicts that the rich will outbid the poor to live near city centers, we generally observe the opposite ordering. Figure 3 shows that this widely documented increasing income profile in CBD distance 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 over 14 are 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 (2007) propose heterogeneity in commuting modes to explain this pattern. Brueckner & Rosenthal (2005) propose a filtering model of the housing market to fit this fact. Finally, 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 need a model that matches 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 rather 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 need that the forces generating increasing income profiles and fraction white as a function of CBD distance apply both in environments with integrated schools and segregated schools. The evidence in Figures 2 and 3 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 the school in her jurisdiction j. Otherwise, the parent can send the child to a private school at tuition cost T, which is an i.i.d. draw from the distribution G with support $(0, \overline{T})$. This random tuition represents price discrimination by private schools to achieve diversity and attract high ability students. Parents have income y with distribution functions $F_W(y)$ for whites and $F_B(y)$ for blacks, where $F_B(y) \geq F_W(y)$ for all y. Parents 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.[7] Utility is increasing and concave in all arguments. In addition we assume that $u_{13} > 0$ and $u_{12} > 0$, 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 $u_{23} \leq 0$.

Parents choose their residential community j based on income net of commuting costs, rent, school quality to them g_{ij} and the exogenous quality of the amenity in each community x_j. Community j = 0 is the "central district" where the local amenity varies continuously as a function of location r such that x'(r)>0. Each central district resident lives at a distance $r \in [0, r_0]$ from the central business district (CBD) and incurs commuting cost tr. We assume that all suburban jurisdictions have the same commuting distance $\bar{r} > r_0$ and local amenity value $\bar{x} > x(r_0)$[8].

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

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

If white parents earn higher wages and individuals are not allowed to move, integration thus weakly reduces public school quality for whites and improves it for blacks through peer effects. $\bar{g}$ denotes the quality of local private schools. We assume for simplicity 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.[9] 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.

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[7] We assume that individuals are indifferent about the race of their neighbors. The addition of racial preferences and 2-dimensional space would generate residential segregation and imply no change in the relevant analytical implications of the model.

[8] The assumption of identical commuting distances and local amenities in suburban communities is stronger than necessary. To derive analytical results for this model, one could have heterogeneity in one of these dimensions. However, introducing such heterogeneity makes the analysis unnecessarily complicated. In principle, one could allow for both types of heterogeneity and simulate sorting equilibria using data from metropolitan areas.

[9] This is equivalent to normalizing the opportunity rental rate of land.

Given this environment, parents choose how much of the composite good z to consume, residential location and whether to send their kid 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, it is convenient first to consider that in the central district and suburban districts in turn. Then we establish how households sort between the central and suburban districts and consider the implications of different school assignment policies in the central district for equilibrium school choice and residential location.

5.2 Central District Location Equilibrium

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

$$(2) \qquad \begin{aligned} &\max_{z,r,g\in\{g_{i0},\bar{g})} [u(z,g,x(r)] \\ &s.t.\, y - tr = z + R(r) + T1(g=\bar{g}) \end{aligned}$$

where R(r) is the equilibrium rental rate of a unit of land at CBD distance r.

As in a large body of research on urban land use questions, it is convenient to use bid-rent functions to analyze equilibrium residential location patterns. We define the function $\psi^{yMT}(r,u)$ as the most a household of income y choosing school type M = {Public,priVate} with the option of private school tuition T and utility u is willing to pay for a unit of space at distance r from the CBD. 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 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 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 end can move an infinitesimal distance dr and yet receive a finite rent decrease thereby making it better off, violating equilibrium condition 2.

Property 3: The household with the steeper bid-rent function at a given distance 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 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 made in Fujita (1989). Differentiating (2) yields

$$\psi_r^{yMT}(r, u^{yMT}) = -t + \frac{u_3}{u_1} x'(r)$$

where the subscript denotes a partial derivative. This expression indicates how commuting cost and the value of the local amenity are capitalized into rents.[10] 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.

Given the single-crossing assumption, it is straightforward to verify that $\psi^{yMT}{}_{ry} > 0$ and that for those sending their kids to private school, $\psi^{yVT}{}_{rT} < 0$. The first condition indicates that conditional on school type and tuition offer, the rich outbid the poor to live in higher amenity areas and the second condition indicates that those faced with a higher tuition burden compensate by moving to a neighborhood with a lower amenity value but a higher income net of commuting cost and rent.

We now examine school choice and location for a given income level y. A parent sends his child to private school if T is sufficiently low. An examination of relative bid-rent slopes reveals that unless x and g are very strong complements, private school households outbid others to live closer to the CBD conditional on income.[11] That is, households are willing to trade off school quality for consumption and the local amenity. Assuming the tuition draw is orthogonal to income, it is straightforward to see that the probability of attending private school is increasing in income conditional on location.

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

[11] In mathematical terms, $\psi_{rg} < 0$.

This result also implies that with segregation, those attending the higher quality public schools live closer to the CBD conditional on income.

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 poorest households with kids attending private school. The richest households in the central district reside at its edge, location r_0.[12] It is evident that though income levels can fluctuate a bit at any distance, mean income between the CBD and r is 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.

5.3 Location Choice Across 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 unique stable perfect sorting equilibrium in which each community attracts some portion of the income distribution. To see this, define the set of incomes y_j as those who are indifferent between living in communities j and j-1, j>0. For these people,

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

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 $u_{12}>0$, 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.[13]

The final piece is to understand how households sort between city and suburban jurisdictions. In principle, there could be two types of equilibria: one in which there is perfect sorting on income for households sending kids to public school, and one in which

[12] Residents at r_0 are either the richest public school households in the central district or an isolated set of richer households who send their kids to private school.

[13] In a similar model, Fernandez & Rogerson (1996) point out that there also exists an unstable integrated equilibrium.

households of the same type live both in the central district and a suburban district. Given this setup of the model, it is clear that the second case is not possible unless a middle income group is large enough to monopolize one suburban jurisdiction. Otherwise, the uniform rent net of commuting cost in suburban jurisdictions cannot satisfy indifference for more than one income level. The lack of possibility for this type of equilibrium comes, of course, by assumption of different location and local amenity profiles in the central district and suburbs and could be relaxed in future work. However, spatial data on income presented above indicate that there is a high level of sorting on income between central and suburban jurisdictions even before school desegregation. As such, we will focus on the case in which public school households perfectly sort on income.

In the perfect sorting case, the indifferent income group sending kids to public schools is that at or near the edge of the central district.[14] This household is indifferent between the city and suburb J with the lowest quality public schools. Some income mixing is achieved by the fact that those attending private schools live closer to the CBD in equilibrium. Thus, we may find that the low tuition draw segment of the lowest income groups who send their children to public schools in the suburbs may find it optimal to live in the central district and send their kids to private schools. Additionally, we may find that the lowest rent suburb has many households with kids in private school who are close to the margin for sending their kids to public schools in the central district. Based on empirical evidence, we do not consider the potential equilibrium in which any but the poorest public school households live in the central district.[15]

5.4 Equilibrium Residential Location Patterns

In this subsection, we demonstrate how school desegregation generates white flight and black migration to central cities through the model. In addition, we show that school desegregation causes some whites that remain in the central city to send their children to private schools and that some blacks to move their kids from private to public

[14] There could be a very high income private school household located at r_0.

[15] An equilibrium with the rich living in the central district would require a relatively weak single crossing condition on the local amenity and/or only a small amenity premium for living in the suburbs. Otherwise, the poor suburban households would prefer to save on commuting costs and would outbid the rich to live in the central district.

schools. Based on the spatial structure of these different equilibria, we argue that one way to evaluate the mechanism behind which school desegregation orders cause whites to flee central city school districts is to examine their impacts on the profiles of public versus private school choice and residential location patterns by race across space within central districts and in relatively poor suburban districts. The model implies that the largest shifts in population should occur between poor suburbs and the outer region of the central school district, as this is the area with the most white households sending children to public schools for whom a suburban district represents a close substitute.

It is perhaps easiest to see how school desegregation impacts equilibrium location patterns through a diagram. Figure 4 presents the case in which there are two income types (rich and poor), with a greater fraction of the black than white population that is poor. 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: $\psi_{ry} > 0, \psi_r^{yV} < \psi_r^{yP}$ and $\psi_{rg} < 0$.

In the segregated case, the income levels at which blacks and whites are indifferent between living in the city and a suburb are different. In particular, since school quality for whites is greater, the white income cutoff exceeds that for blacks in the central district, with the bid-rent by rich blacks below equilibrium rent at all points in the central district. With integration, the central district loses some rich white public schoolgoers with the decline in their school quality. Some of these whites move toward the center and attend private schools while others decamp for suburban public schools. At the same time, some rich blacks leave the private schools for the public schools while others come into the system from suburban school districts. In the integrated environment, incentives are identical for blacks and whites of the same income. The key driving force behind racial differences in responses is that blacks are on average poorer than whites.

Table 9 summarizes the relevant analytical implications of the model. The key points are that desegregation causes public enrollment changes and population flows to occur between the edge of the central districts and the poorest suburbs. The richest central district whites and the poorest suburban blacks are the marginal residents of their jurisdictions. Private enrollment changes are predicted to occur primarily between the

CBD and the central areas of central districts. This is because the middle and higher income central district whites are the ones most likely to find it optimal to pay their tuition draw and stay in the central district in the face of declining public school quality. To help pay for private school, they move toward the CBD and save on commuting cost. The improvement in central district school quality for blacks induces some to leave private schools in the district. These will primarily be the poorer private school students who live between the CBD and the middle of the central district. Finally, some blacks attending private schools in the poorest suburb will move into the central district to take advantage of its improved public school quality.

It is clear 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. In particular, 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 third of the central district, with a commensurate increase in black public enrollment in the same region. Patterns of total population loss and gain by race closely match those for public enrollment to a scale. Finally, spatial patterns in private enrollment effects by race also largely match those predicted by theory.

6.1 Empirical Model

To study the spatial distribution of desegregation impacts, we specify an empirical model analogous to that estimated in Section 4 that flexibly captures the causal response as a function of location. 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 15 MSA-year observations used for the analysis in Section 4. These data points were built using county or central place data and were not tracted or did not have the stf4a tabulations available. We index central district location the same as in Figures 1 and 3 in order to make metropolitan areas of different structures and sizes comparable. Suburban district location is indexed between 1 and 2 by ordering all suburban tracts first by mean 1970 personal income in the suburb and then by CBD distance.

Our empirical model is perfectly analogous to that estimated in Section 3 with the addition of a full interaction with a flexible functional form to capture spatial profiles. We allow the spatial profile of the outcomes to vary with distance interacted with time fixed effects and include MSA fixed effects. Finally, because many census tracts contained 0 counts of some outcomes of interest, we utilize a fixed effects Poisson model. This allows coefficients to be interpreted as partial elasticities, commensurate with the analysis in Section 4. We estimate relevant parameters of the equation

$$\ln E(y_{ijt}) = a_j + b_t + f(d_{ijt}; Q_1) + b_t f(d_{ijt}; Q_2) + D_{jt} f(d_{ijt}; Q_3) \tag{10}$$

where i indexes census tract in MSA j at time-region t. We specify f as a step function in distance d with coefficient vectors given by Q.[16] The distance function is interacted with year fixed effects. Standard errors are bootstrapped using 500 replications sampling MSA clusters with replacement. The key treatment parameters of interest are the elements of the vector Q_3. Tract mean counts by location are in Table A1.

6.2 Location Specific Results

Figure 5 presents estimated impacts of school desegregation on white and black enrollments as a function of location. It graphs the estimated effect of desegregation in the South and other regions. Bolded portions of the plots indicate statistical significance

[16] We use the Hausman, Hall and Griliches (1984) procedure to eliminate the inconsistently estimated MSA fixed effects. We also tried estimating more flexible polynomial distance specifications. They produce similar though somewhat wilder results.

at the 5 percent level. Panel A shows that, as is predicted by the model, white enrollment in the outer third of central districts fell significantly as a result of school desegregation. The estimated effect is 20 percent outside the South and 26 percent in the South. Estimated effects of desegregation are not statistically significant at other locations. These results are consistent with results reported in Section 4 indicating a 17 percent decline in total central district white enrollment as a result of desegregation. The right portion of Figure 5 Panel A presents estimates for suburban districts. These estimates are not statistically different from 0 at any location.

Estimated gaps for blacks shown in Figure 5 Panel B are largely a mirror image of those for whites shown in Panel A. While white public enrollment declined near the edges of central districts, black public school enrollment increases caused by desegregation documented in Section 4 appear to have disproportionately occurred in the outer third of central districts. In this region, we find that desegregation caused a significant increase of 52 percent outside of the South and an imprecisely measured increase of 11 percent in Southern districts. We estimate a 40 percent decline in black public suburban enrollment in poor and close suburbs outside the South as a result of desegregation. These results are consistent with the district level estimate of a twenty percent increase in black enrollment due to desegregation presented above.

Figure 6 shows analogous results for total white and black populations. Perhaps not surprisingly, it shows patterns that are consistent with those in Figure 5 and discussed in Section 4. Panel A shows that in the South, there were statistically significant declines of 27 percent in the white population due to school desegregation. This is consistent with an estimated statistically significant 11 percent decline in average incomes for whites in the same area, a result that is not reported on this graph. Panel B shows that outside the South, there was a large shift in the black population from poor inner suburbs to central districts as a result of school desegregation. In the outer third of central districts, desegregation caused an estimated 44 percent increases in the black population, closely matching an estimated 37 percent decline in the inner suburban black population.

Figure 7 shows analogous results for white and black private school enrollment. Commensurate with predictions of the model, it shows that desegregation led to increases of 16 percent in white private school enrollment in the middle region of Non-Southern central districts. Inconsistent with the model, it shows an estimated 39 percent decline in white non-Southern central district private school enrollment for those living near CBDs. Panel B shows results for blacks that are perfectly consistent with the model. Black private enrollment declined by a statistically significant 35 percent in regions of central districts between the CBD and the middle as a result of desegregation. While not precisely estimated, point estimates indicate that black private enrollment declined to an even greater extent as a result of central district desegregation in the poorest inner non-Southern suburbs. While we cannot measure where these students went, we suspect their families moved to the outer portions of the central district to take advantage of the newly available higher public school quality.

6.3 Counterfactuals

In this subsection, we explore the extent to which school desegregation could have driven observed patterns in decentralization by race documented in Table 1 and Figure 1. Overall, our estimates indicate that while it caused sizable shifts of whites out of certain central areas to be replaced largely by blacks, school desegregation was not one of the main forces driving urban population decentralization.

Table 10 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 due to school desegregation. Similarly, we take estimates from Table7 to subtract off the blacks that we estimate moved to central districts because of desegregation.

Table 10 shows that even without desegregation, white central city population would have fallen by 8 percent between 1970 and 1990 rather than the decline of 12 percent actually observed. Similarly, our estimates indicate that central district white school enrollment would have fallen by 40 percent rather than 44 percent absent desegregation in this period. 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. However, school desegregation was an important force in generating changes in the racial composition of outlying neighborhoods.

7. Conclusions

In the early 1990s, the Supreme Court issued three decisions that allowed lower courts to declare districts under desegregation orders to be “unitary”, or beyond continued court oversight. This led to a series of rulings releasing districts from legal requirements to remain desegregated. The lifting of court ordered desegregation has left many cities with considerable freedom in choosing new schemes by which students are assigned to schools. Estimates in this paper indicate that the resegregation of central school districts will draw some white students back into these districts and push some black students out of these districts. However, it will have a small though measurable impact on overall population shifts by race.

While changes in the quality of local public goods in general and school desegregation in particular are often proposed as an important determinant of observed patterns of urban decentralization by race, our estimates indicate that desegregation simply has not been an important force generating the sea change in urban residential location patterns that have occurred in the U.S. over the past 40 years. However, the increase in the number of blacks and the decline in the number of whites seen on the fringes of central school districts can in large part be attributed to desegregation. This result is consistent with predictions of a standard Tiebout sorting and land use model.

This paper provides new evidence on the mechanisms by which school desegregation led to enrollment declines for whites and enrollment increases for blacks. We demonstrate that white enrollment declines in Southern central districts primarily led to migration while enrollment declines in Northern districts also led to 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 come primarily in the form of residential relocation from poorer inner suburbs.

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

Year	1970 Geography of Central City School Districts			Metropolitan Area Remainders			Obs.
	White	Black	All	White	Black	All	
Panel A: Population Totals							
1960	30.0	7.1	37.4	41.4	2.3	44.0	87/80
1970	29.1	9.0	38.7	51.7	2.8	55.0	90
1980	25.6	10.3	38.8	58.0	4.3	65.0	87
1990	25.6	10.9	41.3	66.4	6.0	78.3	90
70-90 Change	-3.5	1.9	2.6	14.7	3.2	23.3	
70-90 % Change	-0.12	0.21	0.07	0.28	1.13	0.42	
Panel B: Children Enrolled in School							
1960	5.6	1.6	7.3	NA	NA	NA	87/0
1970	5.9	2.6	8.6	13.0	0.8	14.0	90
1980	3.6	2.4	6.9	11.5	1.2	13.1	87
1990	3.3	2.4	6.8	10.6	1.3	13.3	90
70-90 Change	-2.6	-0.2	-1.8	-2.4	0.5	-0.6	
70-90 % Change	-0.44	-0.08	-0.21	-0.18	0.54	-0.05	

Notes: Population counts are in millions. Numbers are constructed by the authors based on counts reported in decennial censuses. The sample only includes metropolitan areas with central city districts that had major school desegregation orders between 1960 and 1990.

Table 2: Impact of School Desegregation on School Segregation

	Dissimilarity Index	White-Black Exposure Index
	1	**2**
Desegregated	-0.120	0.047
	(0.045)***	(0.026)*
1970 Mean	0.537	0.203
1970 Standard Deviation	0.231	0.141
Number of Observations	251	251
MSA Fixed Effects	X	X
Year-South Region Fixed Effects	X	X

Notes. The unit of observation is the central city school district. The sample only includes central city 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.

Table 3: Impact of School Desegregation on White Population

	1	2	3	4	5
Panel A: ln(white enrollment in central city public school district)					
Desegregated	-0.14	-0.13	-0.10		-0.11
	(0.05)***	(0.04)***	(0.04)**		(0.07)
Desegregated (1 - 4)				-0.15	
				(0.05)***	
Desegregated (5+)				-0.10	
				(0.07)	
Placebo Desegregated					0.05
					(0.08)
Number of Observations	355	355	349	355	355
Panel B: ln(white enrollment in central city private schools)					
Desegregated	-0.02	-0.02	0.00		0.03
	(0.08)	(0.08)	(0.08)		(0.10)
Desegregated (1 - 4)				-0.03	
				(0.08)	
Desegregated (5+)				0.01	
				(0.11)	
Placebo Desegregated					0.09
					(0.10)
Number of Observations	355	355	349	355	355
Panel C: ln(white population of central city school district)					
Desegregated	-0.07	-0.07	-0.04		-0.05
	(0.04)*	(0.04)*	(0.03)		(0.06)
Desegregated (1 - 4)				-0.09	
				(0.04)**	
Desegregated (5+)				-0.02	
				(0.05)	
Placebo Desegregated					0.05
					(0.07)
Number of Observations	355	355	349	355	355
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 city school district. The sample only includes central city districts that had major school desegregation orders between 1960 and 1990 and for which enrollment counts by race could be constructec using census data. The dependent variable is given in the panel heading. Desegregated is an indicator variable equaling one in years in which the district is under a court-ordered desegregation place. Placebo Desegregated is an indicator variable equaling one if the district *will be* desegregated in one or two years time. 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 time. 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 time. MSA characteristics, measured as of 1960, are: percent black enrollment in the central city, school district area, MSA area, number of districts in the MSA, median black income in the central city school district and median white income in the central city school district.

Table 4: Impact of School Desegregation on White Population by Region

	ln(white enrollment in central city public school district)	ln(white enrollment in central city private schools)	ln(white population of central public school district)
	1	2	3
Deseg. * South Census Region	-0.16	-0.13	-0.14
	(0.09)*	(0.13)	(0.06)**
Deseg. * Non-South Census Region	-0.09	0.15	0.03
	(0.05)*	(0.09)*	(0.05)
Number of Observations	355	355	355
MSA Fixed Effects	X	X	X
Year-South Region Fixed Effects	X	X	X

Note. The unit of observation is the central city school district. The sample only includes central city districts that had major school desegregation orders between 1960 and 1990 and for which enrollment counts by race could be constructed using census data. The dependent variable is given in the panel heading. Deseg. is an indicator variable equaling one in years in which the district is under a court-ordered desegregation place.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Impact of School Desegregation on White Population

	ln(white enrollment in central city public school district)	ln(white enrollment in central city private schools)	ln(white population of central public school district)
	1	2	3
Desegregated	-2.02	5.86	-3.05
	(4.12)	(9.35)	(3.90)
Deseg. * % Black Enrollment	0.10	0.59	-0.17
	(0.38)	(0.71)	(0.26)
Deseg. * log(District Area)	-0.34	-0.16	-0.31
	(0.28)	(0.63)	(0.28)
Deseg. * log(MSA Area)	0.21	0.42	0.10
	(0.06)***	(0.13)***	(0.06)*
Deseg. * # of Districts in MSA	-4.86	-5.61	0.01
	(2.01)**	(3.55)	(1.37)
Deseg. * South Census Region	0.05	-0.61	0.10
	(0.17)	(0.39)	(0.15)
Deseg. * log(white income)	-0.21	-0.24	0.12
	(0.51)	(1.11)	(0.46)
Deseg. * log(black income)	0.45	-0.46	0.24
	(0.32)	(0.46)	(0.23)
Number of Observations	349	349	349
MSA Fixed Effects	X	X	X
Year-South Region Fixed Effects	X	X	X
MSA Characteristics * Year Effects	X	X	X

Note. The unit of observation is the central city school district. The sample only includes central city districts that had major school desegregation orders between 1960 and 1990 and for which enrollment counts by race could be constructed using census data. The dependent variable is given in the panel heading. Desegregated is an indicator variable equaling one in years in which the district is under a court-ordered desegregation place. MSA characteristics, measured as of 1960, are: percent black enrollment in the central city, school district area, MSA area, number of districts in the MSA, median black income in the central city school district and median white income in the central city school district.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: Impact of School Desegregation on Black Population

	1	2	3	4	5
Panel A: ln(Black enrollment in central city public school district)					
Desegregated	0.00				
	(0.04)				
Desegregated (1 - 4)		-0.02			
		(0.03)			
Desegregated (5+)		0.12	0.13	0.09	0.12
		(0.05)**	(0.04)***	(0.03)**	(0.03)***
Number of Observations	355	355	355	355	349
Panel B: ln(Black enrollment in central city private schools)					
Desegregated	-0.19				
	(0.14)				
Desegregated (1 - 4)		-0.15			
		(0.13)			
Desegregated (5+)		-0.34	-0.22	-0.24	-0.27
		(0.18)*	(0.11)**	(0.10)**	(0.11)**
Number of Observations	355	355	355	355	349
Panel C: ln(Black population of central city school district)					
Desegregated	-0.01				
	(0.03)				
Desegregated (1 - 4)		-0.02			
		(0.03)			
Desegregated (5+)		0.05	0.07	0.03	0.05
		(0.04)	(0.03)**	(0.02)	(0.03)*
Number of Observations	355	355	355	355	349
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 city school district. The sample only includes central city districts that had major school desegregation orders between 1960 and 1990 and for which enrollment counts by race could be constructed using census data. The dependent variable is given in the panel heading. Desegregated is an indicator variable equaling one in years in which the district is under a court-ordered desegregation place. 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 city, school district area, MSA area, number of districts in the MSA, median black income in the central city school district and median white income in the central city school district.
* significant at 10%; ** significant at 5%; ***significant at 1%

Table 7: Impact of School Desegregation on Black Population by Region

	ln(black enrollment in central city public school district)	ln(black enrollment in central city private schools)	ln(black population of central public school district)
	1	**2**	**3**
deseg.(5+)* South Census Region	0.00	-0.48	-0.01
	(0.05)	(0.28)*	(0.06)
deseg.(5+)* Non-South Census Reg.	0.20	-0.09	0.11
	(0.05)***	(0.12)	(0.04)***
Number of Observations	355	355	355
MSA Fixed Effects	X	X	X
Year-South Region Fixed Effects	X	X	X

Note. The unit of observation is the central city school district. The sample only includes central city districts that had major school desegregation orders between 1960 and 1990 and for which enrollment counts by race could be constructed using census data. The dependent variable is given in the panel heading. Deseg. (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.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 8: Impact of School Desegregation on Black Population

	ln(black enrollment in central city public school district)	ln(black enrollment in central city private schools)	ln(black population of central public school district)
	1	2	3
Desegregated (5+)	4.13	-3.76	-3.62
	(3.91)	(14.10)	(4.83)
deseg.(5+)* % Black Enrollment	-0.34	0.81	-0.13
	(0.28)	(0.93)	(0.21)
deseg.(5+)* log(District Area)	0.59	0.97	0.29
	(0.28)**	(0.90)	(0.24)
deseg.(5+)* log(MSA Area)	0.01	-0.06	-0.01
	(0.03)	(0.10)	(0.02)
deseg.(5+)* # of Districts in MSA	1.45	-0.86	1.94
	(1.39)	(4.22)	(1.20)
deseg.(5+)* South Census Region	-0.09	-0.33	-0.02
	(0.12)	(0.44)	(0.12)
deseg.(5+) * log(white income)	0.32	0.45	-0.19
	(0.28)	(1.23)	(0.28)
deseg.(5+) * log(black income)	-0.77	-0.03	0.59
	(0.48)	(2.16)	(0.69)
Number of Observations	349	349	349
MSA Fixed Effects	X	X	X
Year-South Region Fixed Effects	X	X	X
MSA Characteristics * Year Effects	X	X	X

Note. The unit of observation is the central city school district. The sample only includes central city districts that had major school desegregation orders between 1960 and 1990 and for which enrollment counts by race could be constructed using census data. The dependent variable is given in the panel heading. 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 city, school district area, MSA area, number of districts in the MSA, median black income in the central city school district and median white income in the central city school district.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 9: Theoretical Impacts of Central District Public School Desegregation

Outcome	Whites	Blacks	Affected Location
Public Enrollment, Central District	-	+	Suburban Edge
Population, Central District	-	+	Suburban Edge
Private Enrollment, Central District	+	-	Near CBD\Middle
Public Enrollment, Suburban Districts	+	-	Poorest Suburbs
Population, Suburban Districts	+	-	Poorest Suburbs
Private Enrollment, Suburban Districts	0	-	Poorest Suburbs

Table 10: Counterfactual Trends in Central District Population by Race

Year	1970 Geography of Central City School Districts White	Black	All
Panel A: Population Totals			
1960	30.0	7.1	37.4
1970	29.7	9.0	39.3
1980	27.3	9.8	39.9
1990	27.3	10.3	42.4
70-90 Change	-2.4	1.3	3.0
70-90 % Change	-0.08	0.14	0.08
Panel B: Children Enrolled in School			
1960	5.6	1.6	7.3
1970	6.0	2.6	8.6
1980	4.0	2.2	7.1
1990	3.6	2.2	6.9
70-90 Change	-2.4	-0.4	-1.8
70-90 % Change	-0.40	-0.16	-0.20

Notes: 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 enrollment using coefficients in Tables 4 and 7.

Table A1: Summary Statistics

	1960	1970	1980	1990	Pct Chg. 60-90
Panel A: Central Districts (means with standard deviations in parentheses)					
Log (White Public Enrollment)	10.52	10.58	10.05	9.89	
	(0.71)	(0.74)	(0.79)	(0.86)	
Log (White Private Enrollment)	8.72	8.66	8.59	8.43	
	(1.39)	(1.34)	(1.09)	(1.03)	
Log (Black Public Enrollment)	9.05	9.54	9.53	9.58	
	(1.19)	(1.17)	(1.13)	(1.04)	
Log (Black Private Enrollment)	6.25	6.17	6.44	6.48	
	(1.57)	(1.50)	(1.56)	(1.45)	
Log(Total White Population)	12.37	12.34	12.27	12.21	
	(0.81)	(0.79)	(0.78)	(0.81)	
Log(Total Black Population)	10.62	10.79	11.02	11.13	
	(1.18)	(1.19)	(1.14)	(1.06)	
Observed Districts	87	90	87	90	
Desegregated Districts	0	26	83	90	
Desegregated Districts (5+)	0	4	64	90	

Panel B: Census Tract Aggregate Counts (millions)

		1960	1970	1980	1990	Pct Chg. 60-90
Total Population	<.33	11.2	9.6	8.4	8.7	-0.22
	0.33-0.66	17.1	17.3	16.3	17.3	0.01
	0.66-1	7.7	11.5	12.9	15.2	0.97
	1-1.33	8.6	11.1	12.1	14.2	0.66
	1.33-1.66	8.1	11.8	13.2	15.8	0.96
	1.66-2	8.4	12.3	14.0	16.7	0.99
Total White Population	<.33	7.8	6.3	4.6	4.5	-0.43
	0.33-0.66	13.9	12.7	10.4	10.2	-0.27
	0.66-1	7.1	9.8	9.7	10.9	0.53
	1-1.33	7.9	10.1	10.0	10.9	0.37
	1.33-1.66	7.8	11.2	11.8	13.3	0.71
	1.66-2	8.1	11.8	12.8	14.3	0.76
Total Black Population	<.33	3.3	3.1	2.7	2.7	-0.17
	0.33-0.66	3.0	4.3	4.8	5.1	0.69
	0.66-1	0.6	1.6	2.5	3.1	4.63
	1-1.33	0.6	1.0	1.2	1.6	1.83
	1.33-1.66	0.3	0.4	0.8	1.2	3.96
	1.66-2	0.2	0.4	0.6	1.1	4.02
Total Tracts		12,937	16,886	17,899	20,291	
Desegregated Tracts		0	2,797	16,306	20,291	
Desegregated Tracts (5+)		0	930	10,613	20,291	
Observed Metropolitan Areas		78	88	83	90	
Desegregated Central Districts		0	24	79	90	
Desegregated Central Districts (5+)		0	4	60	90	

Table A2: Impact of School Desegregation on White Population: Treatment Effect Timing

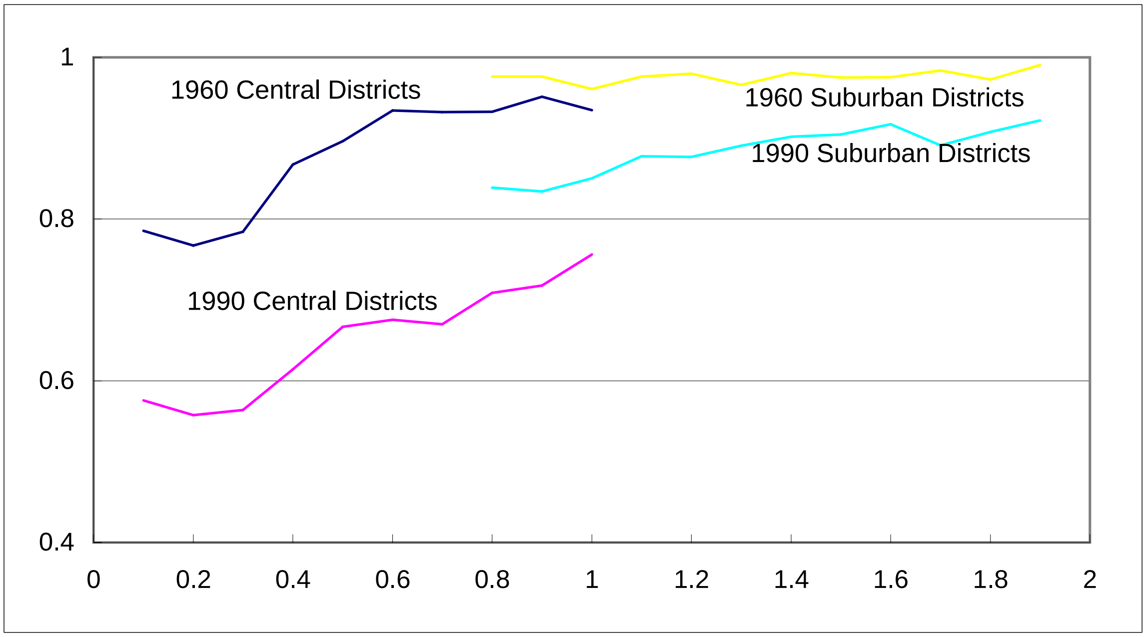
	ln(White enrollment in central city public school district)	ln(White enrollment in central city private schools)	ln(White population of central city school district)
	1	2	3
deseg.(1)	-0.10	0.00	-0.06
	(0.06)	(0.08)	(0.05)
deseg.(2+)	-0.16	-0.03	-0.08
	(0.06)***	(0.10)	(0.04)*
deseg.(1-2)	-0.16	-0.05	-0.11
	(0.06)***	(0.09)	(0.05)**
deseg.(3+)	-0.09	0.04	-0.01
	(0.06)	(0.11)	(0.04)
deseg.(1-3)	-0.14	-0.03	-0.09
	(0.05)***	(0.08)	(0.04)**
deseg.(4+)	-0.10	0.02	-0.02
	(0.07)	(0.11)	(0.04)
deseg.(1-4)	-0.15	-0.03	-0.09
	(0.05)***	(0.08)	(0.04)**
deseg.(5+)	-0.10	0.01	-0.02
	(0.07)	(0.11)	(0.05)
deseg.(1-5)	-0.14	-0.02	-0.08
	(0.05)***	(0.08)	(0.04)**
deseg.(6+)	-0.11	-0.02	-0.03
	(0.09)	(0.13)	(0.06)
deseg.(1-6)	-0.14	-0.02	-0.08
	(0.05)***	(0.08)	(0.04)**
deseg.(7+)	-0.07	0.00	-0.01
	(0.09)	(0.13)	(0.06)

Table A3: Impact of School Desegregation on Black Population: Treatment Effect Timing

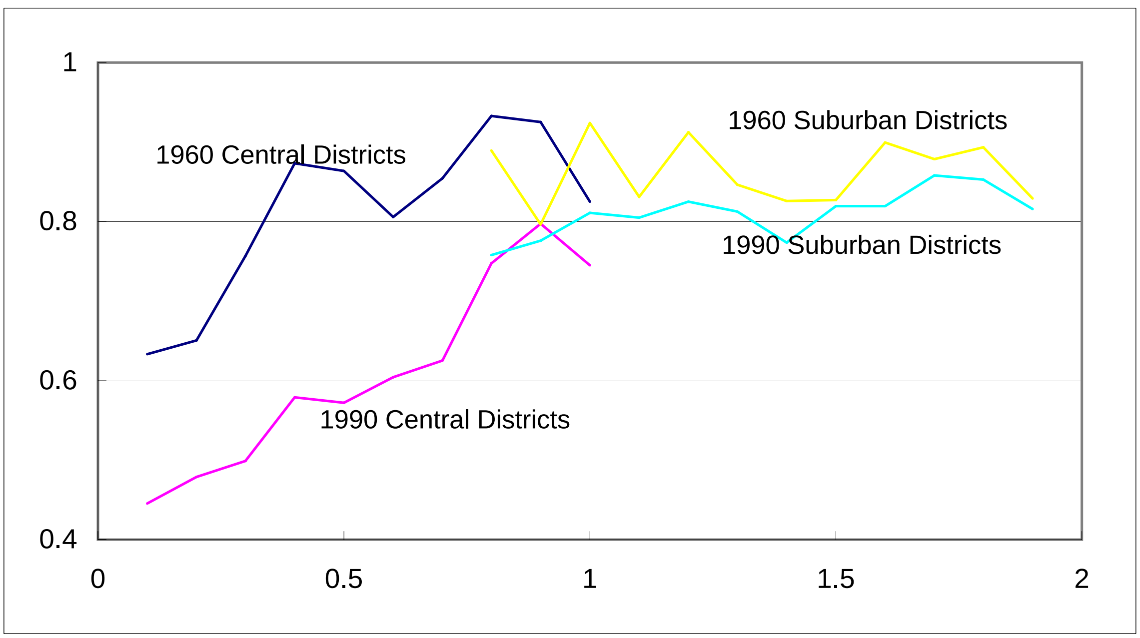
	ln(Black enrollment in central city public school district)	ln(Black enrollment in central city private schools)	ln(Black population of central city school district)
	1	2	3
deseg.(1)	-0.05	-0.15	-0.05
	(0.04)	(0.15)	(0.04)
deseg.(2+)	0.04	-0.21	0.02
	(0.04)	(0.16)	(0.03)
deseg.(1-2)	-0.06	-0.19	-0.05
	(0.04)*	(0.14)	(0.03)
deseg.(3+)	0.12	-0.18	0.06
	(0.04)***	(0.19)	(0.04)
deseg.(1-3)	-0.03	-0.15	-0.03
	(0.03)	(0.13)	(0.03)
deseg.(4+)	0.11	-0.32	0.05
	(0.05)**	(0.18)*	(0.04)
deseg.(1-4)	-0.02	-0.15	-0.02
	(0.03)	(0.13)	(0.03)
deseg.(5+)	0.12	-0.34	0.05
	(0.05)***	(0.18)*	(0.04)
deseg.(1-5)	0.00	-0.17	-0.01
	(0.03)	(0.14)	(0.03)
deseg.(6+)	0.09	-0.45	0.02
	(0.05)*	(0.22)**	(0.05)
deseg.(1-6)	0.00	-0.18	-0.01
	(0.03)	(0.14)	(0.03)
deseg.(7+)	0.10	-0.41	0.03
	(0.05)*	(0.22)*	(0.05)

Figure 1: Fraction White by Location

Panel A: Metropolitan Areas Outside the South

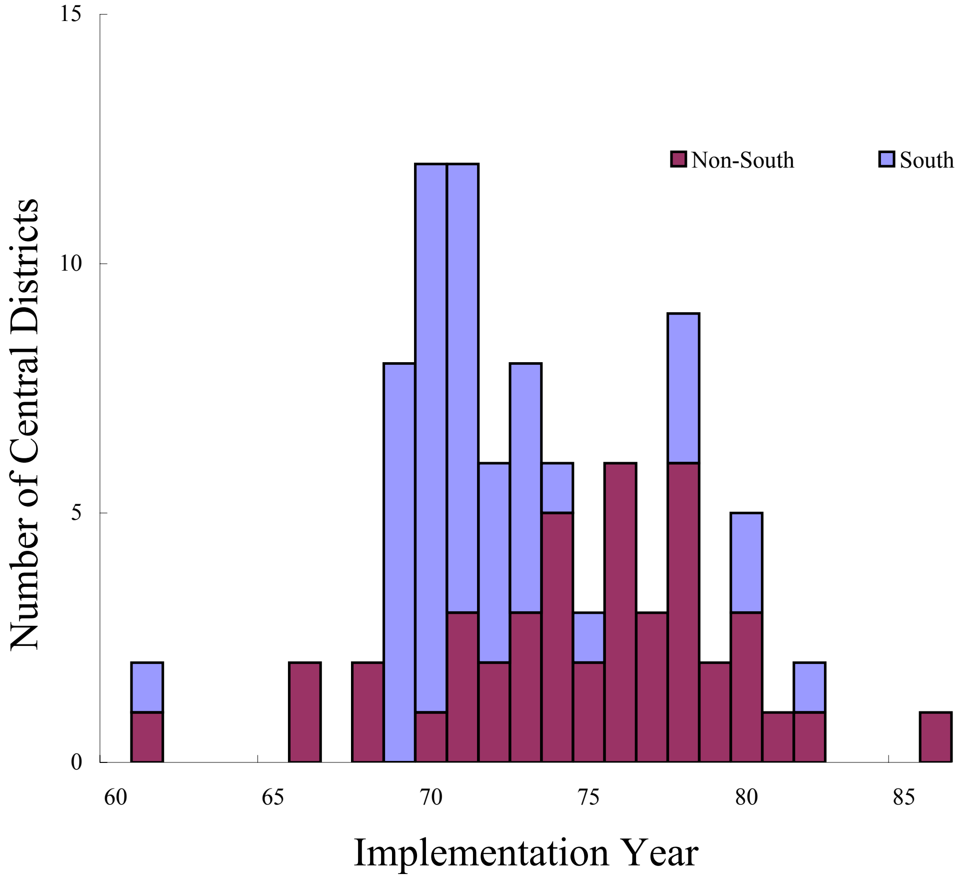


Panel B: Metropolitan Areas in the South



Notes: Graphs show the average residential fraction white as a function of CBD distance across metropolitan areas in our sample for which census tract data are available. Each metropolitan area is weighted equally for the purpose of these calculations. Distance is normalized such that 1 represents the maximum CBD distance within the central school district in each metropolitan area.

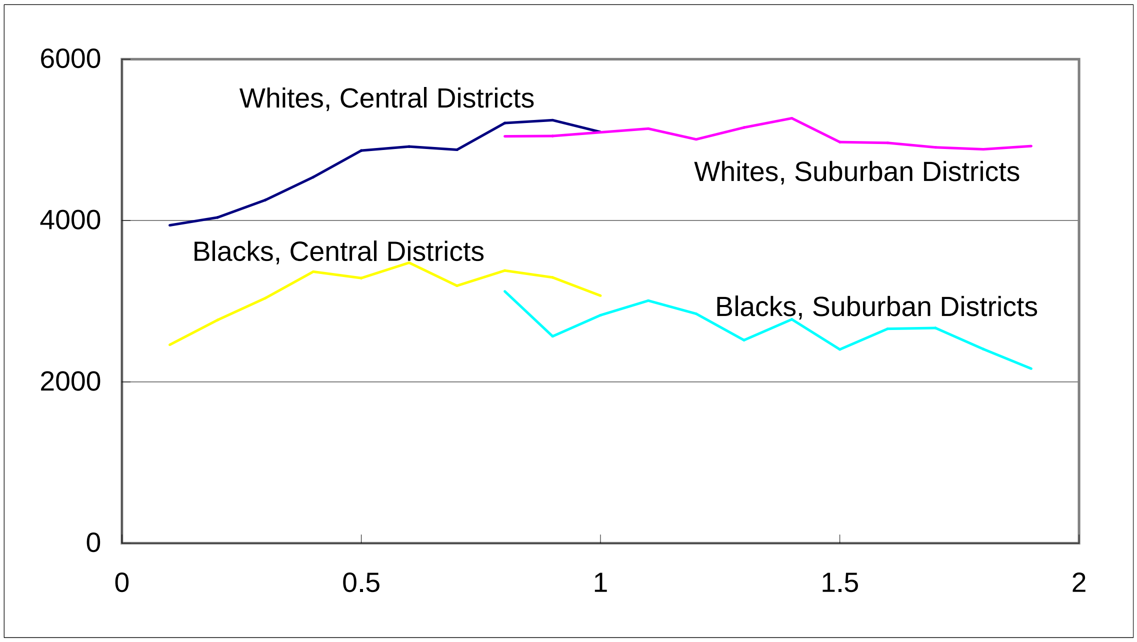
Figure 2: Timing of School Desegregation



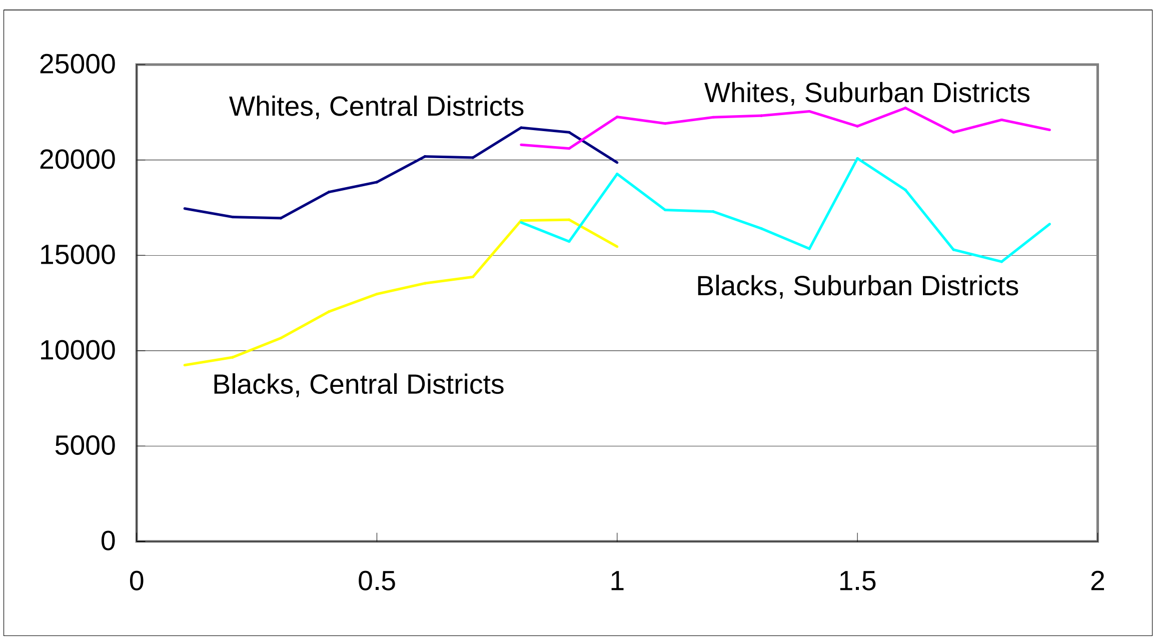
Note. The sample includes the 90 central school districts from the Welch and Light (1987) study that experienced major court-ordered desegregation between 1960 and 1990.

Figure 3: Mean Per Capita Income by Race and Location

Panel A: 1970



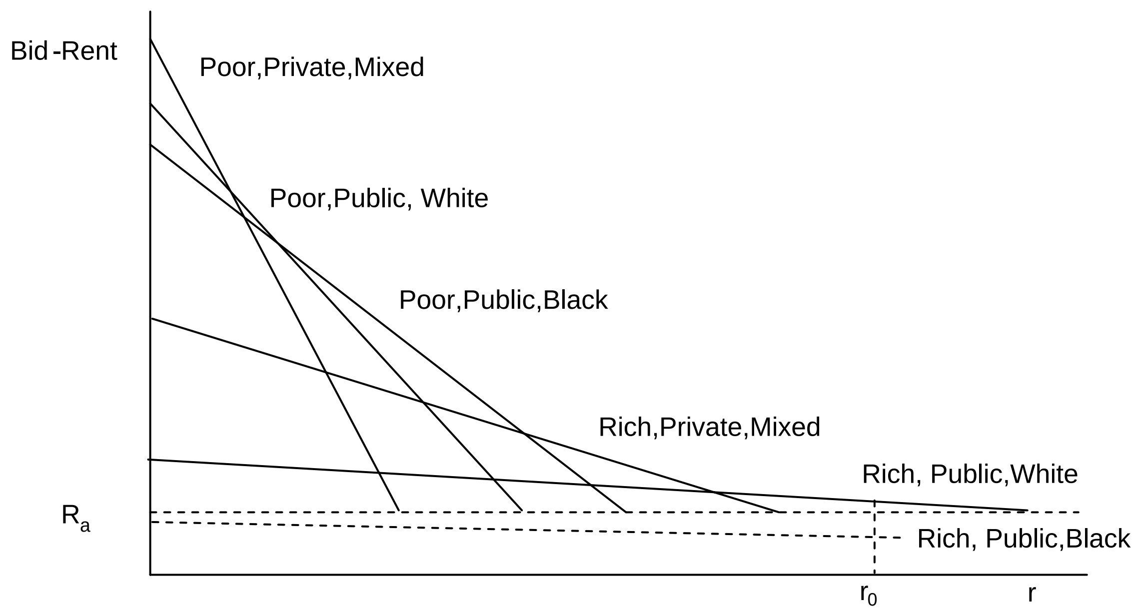
Panel B: 1990



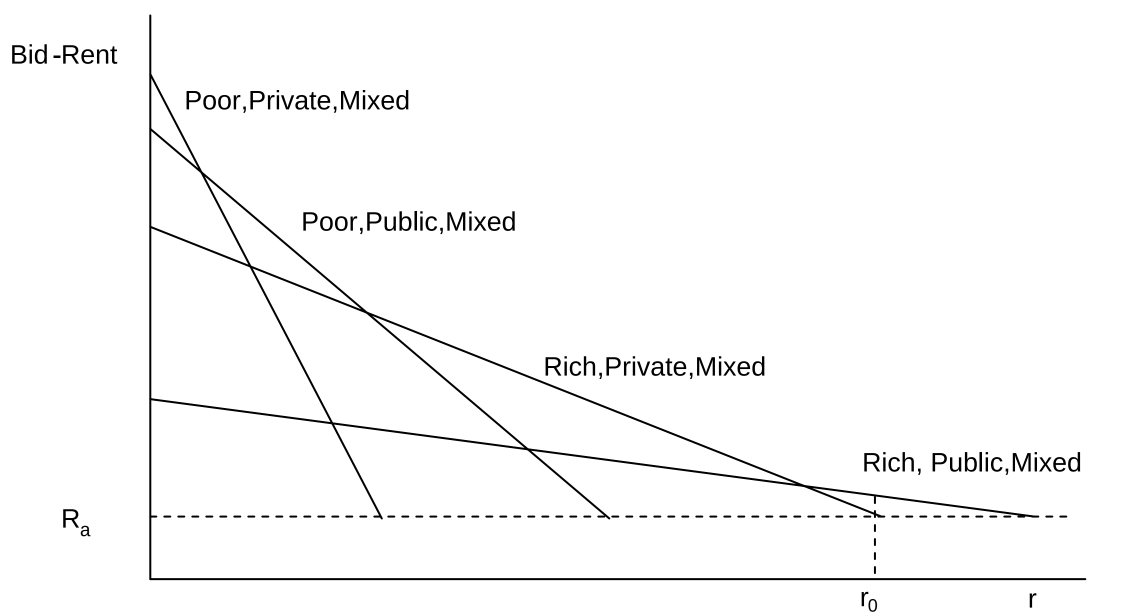
Notes: Graphs show average per capita income by race as a function of CBD distance across metropolitan areas in our sample for which census tract data are available. Each metropolitan area is weighted equally for the purpose of these calculations. Distance is normalized such that 1 represents the maximum CBD distance within the central school district in each metropolitan area.

Figure 4: Model Equilibrium Graphs
Example With Two Income Groups

Panel A: Potential Equilibrium With Segregated Schools



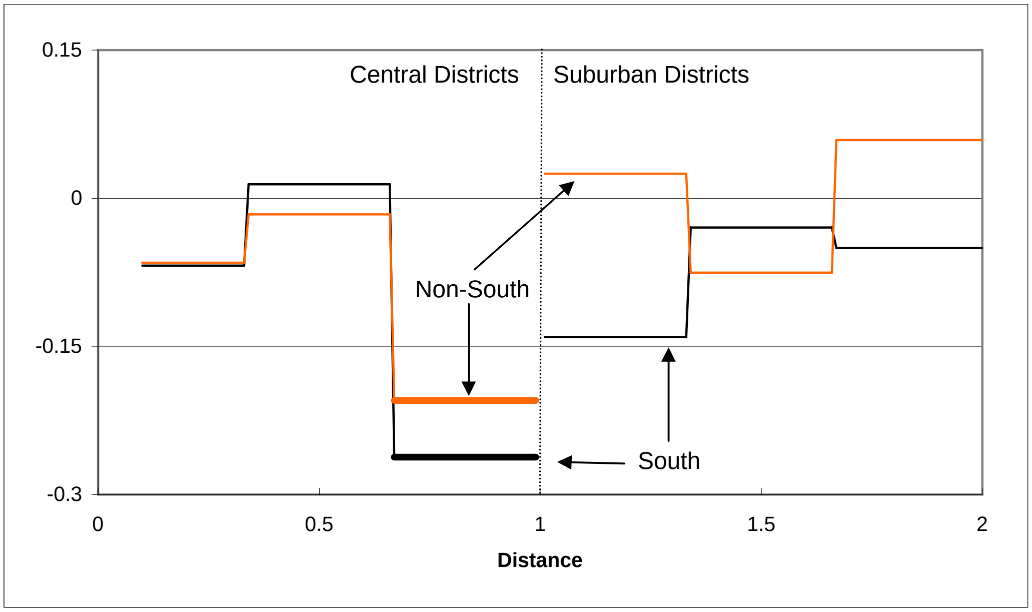
Panel B: Potential Equilibrium With Integrated Schools



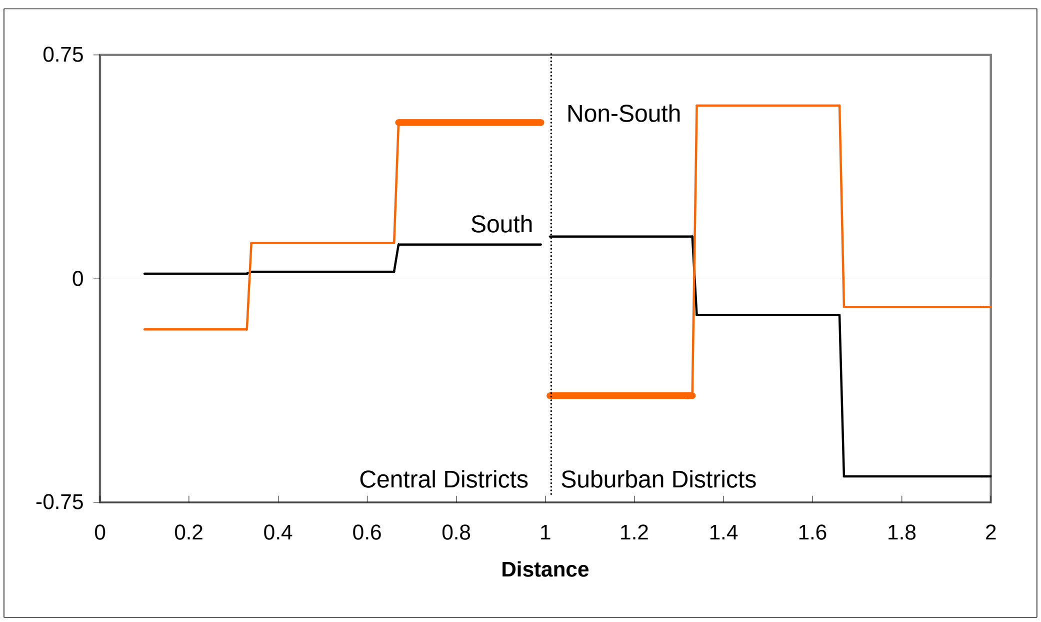
Notes: Both segregated and integrated environments include several (potentially mixed) rich suburban communities. Convexity to the origin of bid-rent functions is not depicted for clarity. The equilibrium rent function for areas of private school attending children is formed through the upper envelope of multiple bid-rent functions. Other regions have one bid-rent function only.

Figure 5: Impact of School Desegregation on Public School Enrollment

Panel A: White Public School Enrollment



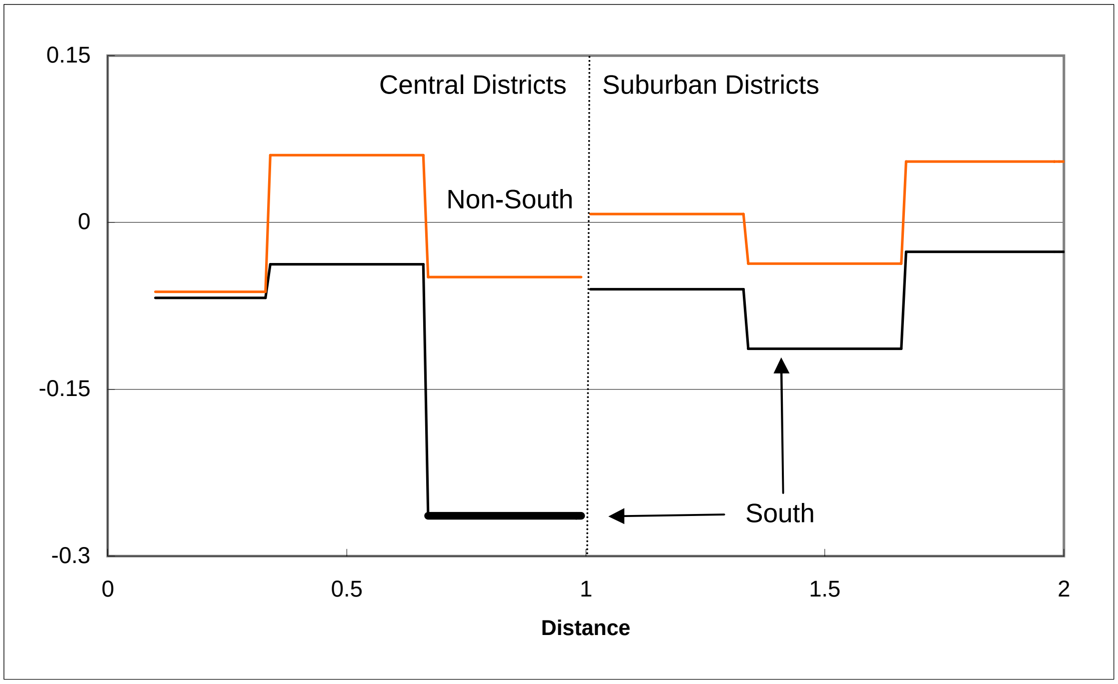
Panel B: Black Public School Enrollment



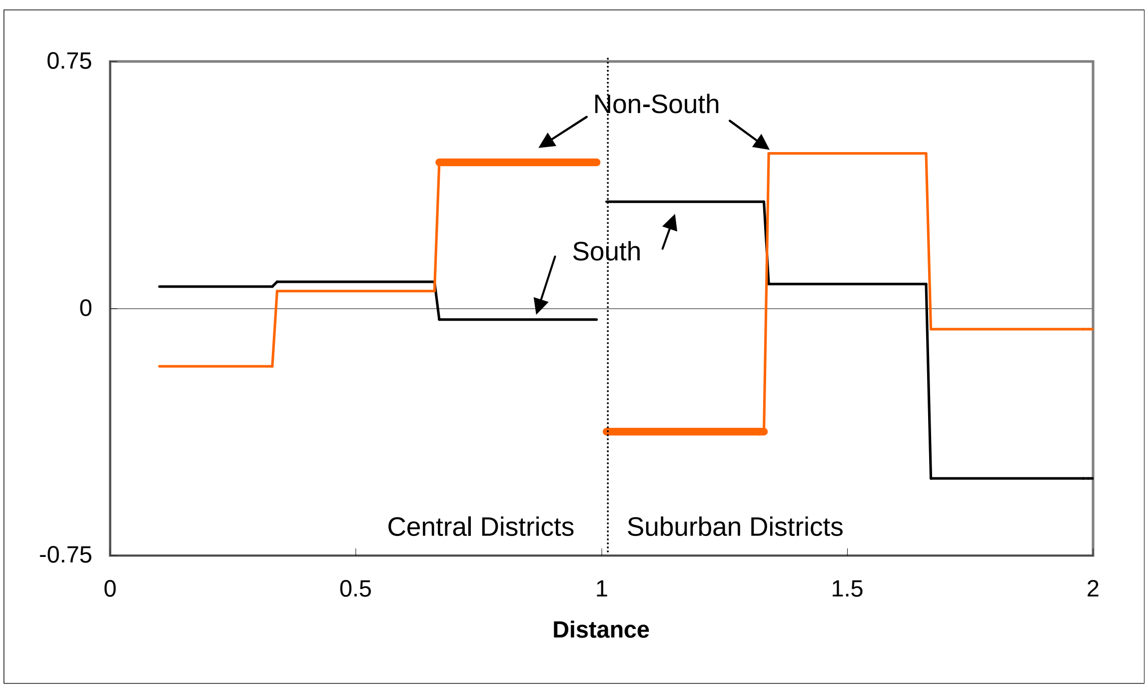
The horizontal axis gives location within the central school district (0-1) and outside the central school district (1-2) as a function of distance to the central business district located in the central school district. The suburban distance index is calculated by ordering all suburban districts within twice the distance from the CBD to central district border by income and then ordering by CBD distance within district. Each figure is generated from differencing predicted public enrollment with and without desegregated central district schools based on parameter estimates of Equation 10 in the text. Negative numbers indicate a decline in enrollment because of desegregation. Thick portions of the lines show statistically significant results at the 5% level based on 500 bootstrap replications sampling using MSA clusters with replacement.

Figure 6: Impact of School Desegregation on Total Population

Panel A: White Population



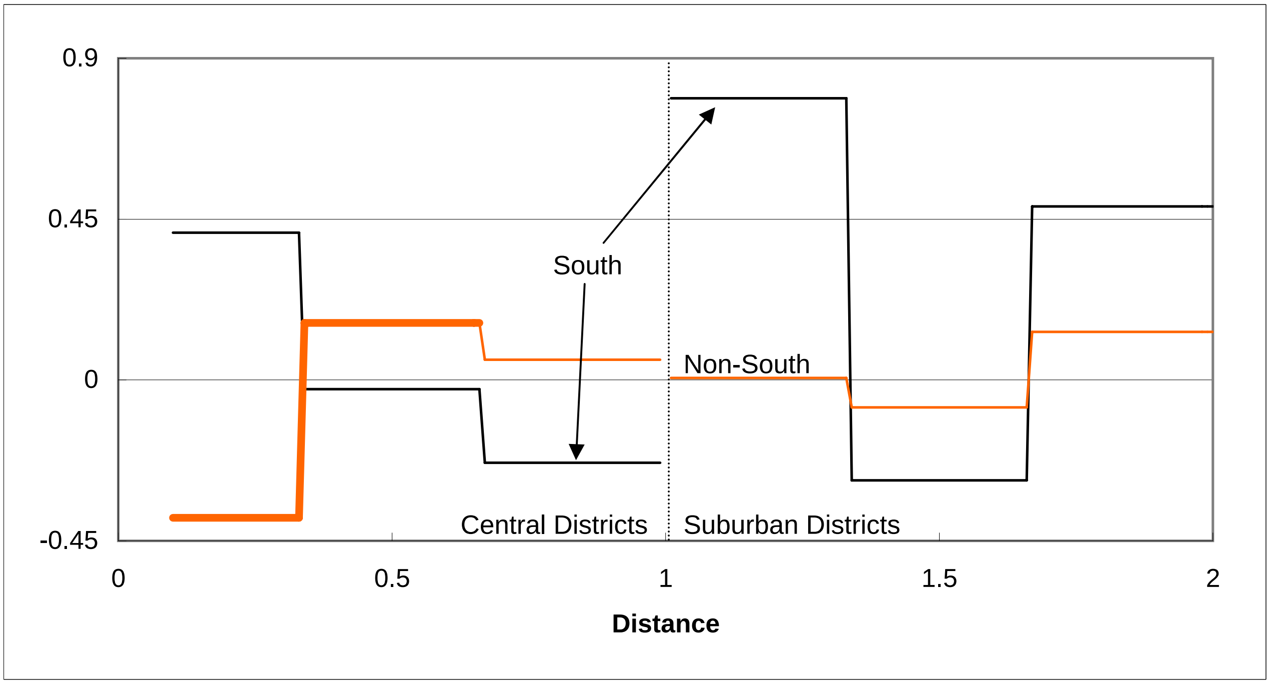
Panel B: Black Population



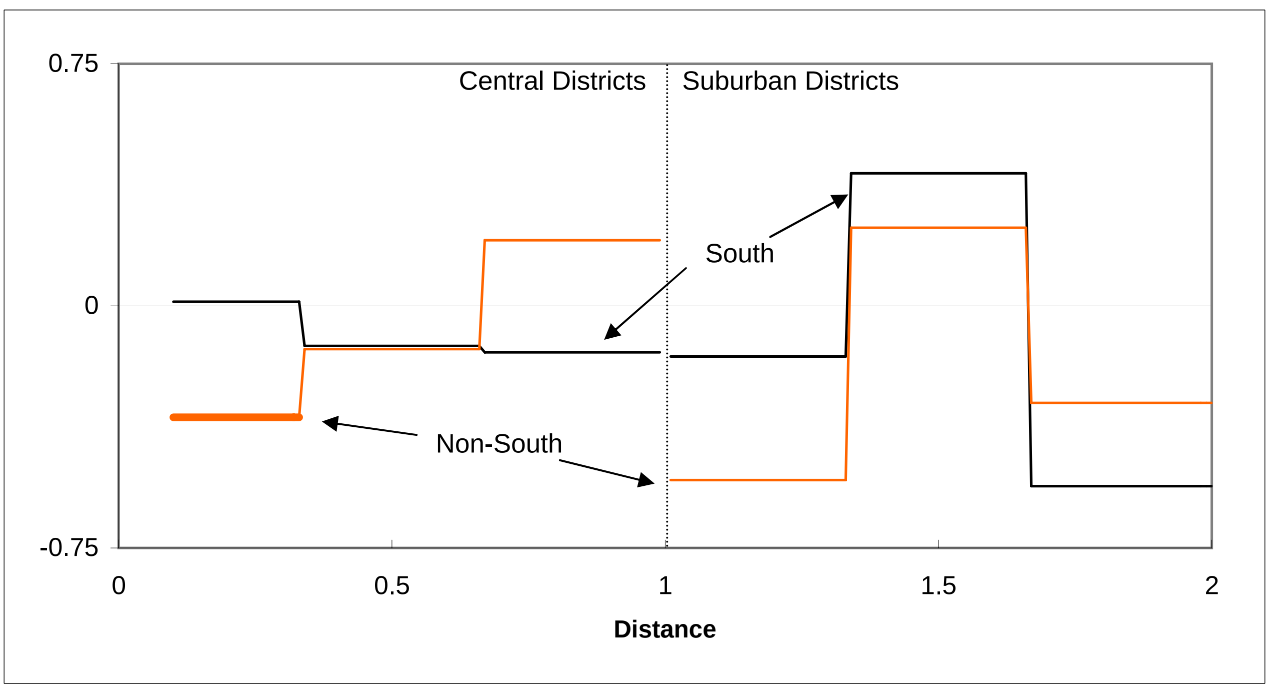
See the notes to Figure 5 for an explanation.

Figure 7: Impact of School Desegregation on Private School Enrollment

Panel A: White Private School Enrollment



Panel B: Black Private School Enrollment



See the notes to Figure 5 for an explanation.