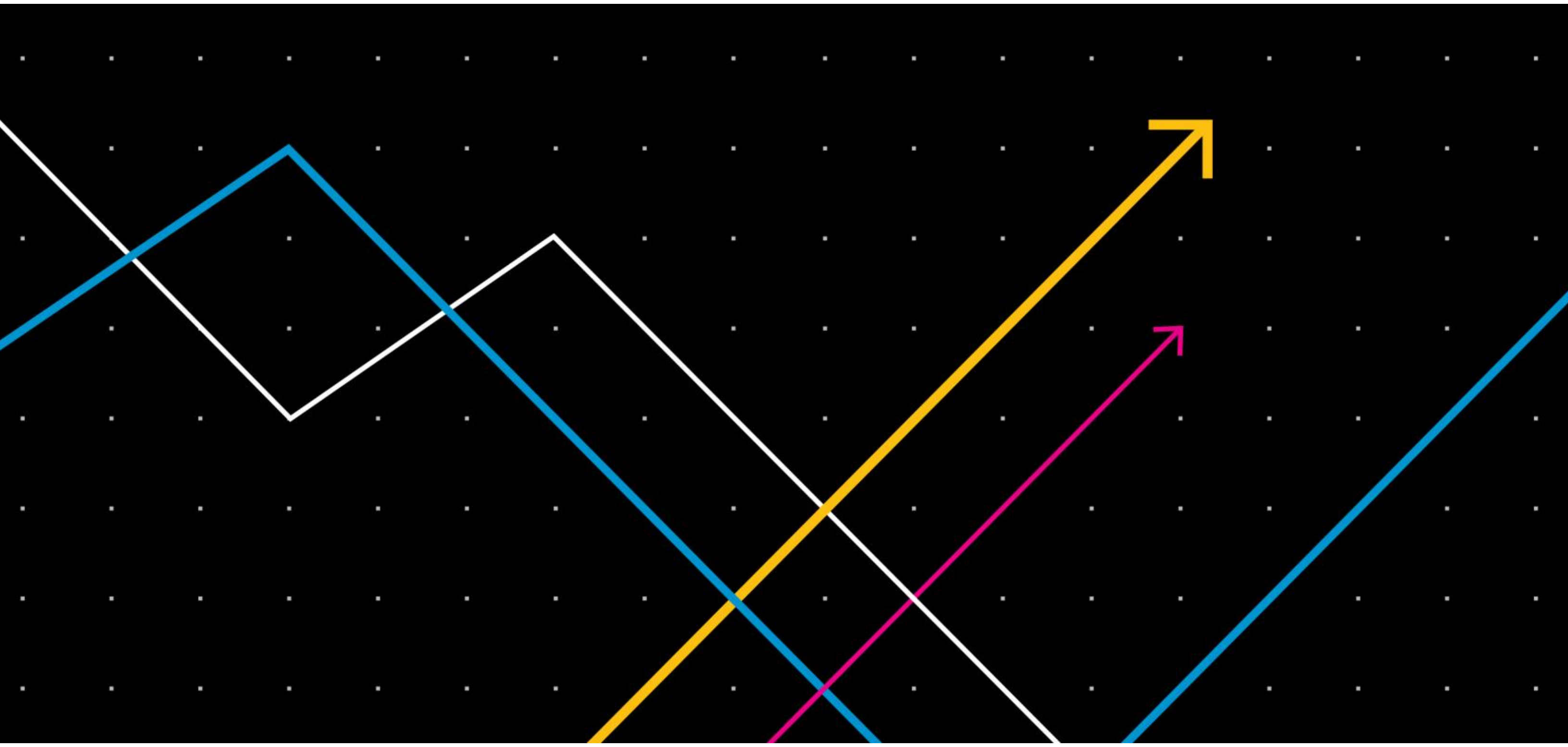
CENTER ON EDUCATION DATA AND POLICY



RESEARCH REPORT

Education Borders in Atlanta

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Education Boundaries in Atlanta

Segregation on the basis of race or ethnicity is one of the most enduring and pervasive inequities in US public education. Public school segregation has its roots in government-backed racist policies of the early 20th century. The landmark 1954 Supreme Court decision in *Brown v. Board of Education of Topeka* ruled that school segregation was unconstitutional, but over the following decades, action at every level of government directly or indirectly ensured that schools stayed segregated. Because of this resistance to integration, the average instructional experience that Black and Hispanic children face in public schools today is vastly different from that of white children. Decades of social science research has established that public school segregation reinforces differences in socioeconomic outcomes, from student test scores and high school graduation rates to income and wealth in adulthood and even life expectancy (Johnson 2019; reardon and Owens 2014; Welch 1987).

In this report, we preview a body of work aimed at rigorously characterizing the role of **school boundaries** in perpetuating school segregation. To be comprehensive, we define "school boundaries" broadly as any geographic delineation of access to public education. We study both school attendance boundaries administered by local school districts and the jurisdictional boundaries that divide school districts themselves. Doing so enables us to provide a full taxonomy of the lines that drive school segregation in US metropolitan areas. We discuss how policy implications differ for different types of boundaries.

Our work is centered around a novel geographic information system (GIS) dataset and a measurement methodology to dig into the microgeography of school segregation. Our goal is to pinpoint the worst dividing lines in public education access across the country, highlighting the many racial and ethnic borders that perpetuate school segregation. Policymakers invested in improving integration in schools should look at the examples we highlight in this work. We hope that elevating these inequities can facilitate further research and discussion toward developing a sustainable solution to racial and ethnic inequality in public education.

What Causes School Segregation?

School segregation has several causes. Many of them are linked, complicating the process of developing policy solutions. Economists have long espoused a simplistic theory of "de facto" school segregation to understand the problem and its potential solutions. This idea proposes that segregation is largely the

result of families' free choices regarding where to live and where to send their children to school (Bayer, Ferreira, and McMillan 2007; Bewley 1981; Tiebout 1956). This theory naturally lends itself to the conclusion that if people sort themselves in a way that generates segregation and this is the equilibrium outcome of an efficient housing or education market, there is limited basis for policy to intervene in an effort to desegregate schools (Hoxby 2000).

What is missing from the de facto segregation theory is the government's role in setting the stage for sorting to take place. Segregation is caused not only by individual choices but by government agencies that set the rules for allocating public goods (Rothstein 2017). School segregation is also linked to neighborhood segregation, both exerting influence on each other (Card and Rothstein 2007; Frankenberg 2013). And neighborhoods have their own impact on children's outcomes (Chetty and Hendren 2018; Chetty, Hendren, and Katz 2016). Evidence shows that the government policies that created and perpetuated racial and ethnic segregation have also contributed to today's racial and ethnic wealth gap and persisting housing discrimination (Avenancio-Leon and Howard 2020; Akbar et al. 2019).

From the view of school districts, there is little power to remedy residential segregation, and school segregation needs to be addressed by taking neighborhood disparities as an immutable fixture of an urban area (Clotfelter 2004). Neighborhood segregation need not be perfectly replicated in public schools because districts have policy levers to push toward integrated schools. School districts have the administrative authority to set student assignment policy, which determines which children get to attend which public schools in the local system. This means district officials have full discretion for setting "default" public school assignments in the community. Default assignments could be set to promote equity in education access, compensating for structural racism. Districts can also restructure grade levels across schools to bring diverse communities together (Orfield and Frankenberg 2013). Most school systems feature administrative mechanisms by which families can opt out of default school assignments, but student assignment policy is the key lever available to district officials to tilt the scale toward racially and ethnically balanced public school enrollment.

Virtually every school district in the country bases its student assignment rules on **school attendance boundary (SAB)** systems (or "catchment areas").[1] Although districts vary in how much school choice alters the relevance of SABs, the ubiquity of SABs in particular can be useful. Updated boundaries could change patterns of segregation across the country. Districts would not have to introduce a new integration program or develop a complicated plan. They would not have to do anything except change their boundaries.

Previous research has demonstrated that, on the aggregate, most school districts have SAB maps that replicate patterns of neighborhood segregation in schools (Richards 2014).[2] This represents a lost opportunity. But our work has shown that multiple districts in 2013 had SABs that, on the aggregate, ameliorate the impact of neighborhood segregation on school segregation (Monarrez 2019). Indeed, it is more common to find SAB systems that ameliorate, rather than exacerbate, the impact of neighborhood segregation on school segregation. We also found that the waning number of districts under court-ordered desegregation plans use SABs to encourage integration in their jurisdictions. Evidence supports the notion that attendance boundary policy is a promising lever available to school districts to promote integration in public schools.

Although school districts have broad discretion in setting student assignments, attendance boundary maps are a prominent feature of the organization of most local school systems, and the politics associated with changing SABs are complicated. There are many notable anecdotes of the protracted community debates regarding SAB reform. Parents often show furious opposition to proposed boundary changes.[3] There is ample evidence that some families purchase homes in particular neighborhoods because of the reputation of the school they are linked to, and many families pay a large premium for it (Black 1999; Bayer, Ferreira, and McMillan 2007). It is also clear that in some contexts, high-income (typically white) families have leveraged the SAB system to capture desirable public schools (Siegel-Hawley 2013). In some of the more egregious cases, politically connected families have secured massive public investments from the state and local government for their neighborhood school, while enforcing strict "in-boundary" enrollment rules that leave out historically underserved communities (DeRoche 2020).

Our analysis is foundational to developing a solution to school boundary inequality. We develop tools to combine school boundary and census data in a way that captures the extent to which certain boundary lines are unequal. This allows us to provide some of the first quantitative data describing instances in which lines create racial and ethnic inequality in the school system. We believe that a thorough descriptive analysis of the scope and nature of the problem of inequitable school boundaries can help spur better research and discussion of optimal solutions.

Segregation between School Districts

Attendance boundaries are only the beginning of the story when it comes to the geographic fragmentation of access to public education. Most US cities are composed of several independent local school districts, each with its own elected leaders, instructional practices, and independent funding

flows. The lion's share of the historic inequality between public schools is caused by stark differences between school districts, both in terms of total funding for schools and racial and ethnic segregation (Lafortune, Rothstein, and Schanzenbach 2018; Monarrez, Kisida, and Chingos 2020). There is therefore great interest in understanding how redressing between-district disparities could affect aggregate inequality in public education.

The scope for inequality is greater when a city has many school districts. This was made clear during the era of judicial intervention and court-mandated desegregation orders. White families that opposed integration could move to other districts in the same metropolitan area, often in the suburbs. District fragmentation set the stage for decades of "white flight" between school districts in a city (Baum-Snow and Lutz 2011). Across the country, there is large variation in the extent of district fragmentation and in the prevalence of school district secessions (i.e., new district creation). Research shows that patterns of residential segregation vary across cities with varying levels of district fragmentation (Clotfelter 2004; Hoxby 2000) and that new district creation can increase racial and ethnic inequality (Frankenberg, Siegel-Hawley, and Diem 2017).

The Supreme Court helped perpetuate between-district segregation in its 1974 *Milliken v. Bradley* decision, holding that the unconstitutionality of school segregation did not apply to between-district disparities and thus that no remedy was necessary to address segregation between school districts. To the benefit of intolerant white families willing to move to suburban districts to avoid desegregation, this decision left education officials with few tools to address segregation between school districts. This, along with other decisions aimed against desegregation efforts, led to a loss of the school integration gains made during the late 1960s and 1970s (Billings, Deming, and Rockoff 2014; Lutz 2011; reardon et al. 2012).

Any attempt to comprehend the role of geographic boundaries in perpetuating school segregation would thus fall short without an explicit look into school district boundaries. There is research documenting that many adjacent school districts have vastly different socioeconomic compositions.[4] Our work builds and improves on this work by adding an analysis of school attendance boundaries and by focusing our measurement at the microgeographic level. We highlight socioeconomic differences near a boundary, showing that in many cases, it would take only a small boundary change to decrease racial and ethnic inequality (we describe our measurement framework below).

In terms of the tools we have developed to find inequitable boundaries, there is little difference between a divisive SAB line or an inequitable jurisdictional boundary between school districts. We believe it is useful to analyze these together to provide a full portrait of the education borders that

perpetuate segregation. But the implications for potential policy solutions are different between the two. SABs are an administrative policy set by school district leaders at their discretion. But the creation of school district jurisdictions is state policy. In some states, communities can vote to secede to form new districts or to dismantle district jurisdictions altogether. Tennessee state law prohibited district secession, but suburbanites lobbied to change that law (Frankenberg, Siegel-Hawley, and Diem 2017). Districts can merge either by bilateral agreement or by mandate of the state education agency. They can also be shut down by state authorities. In some states, all changes to district jurisdictions need to be reviewed by the state legislature, while in others, there is only local control. Taken together, state policies governing changes to jurisdictional boundaries can have a profound impact on districts' ability to splinter into more segregated entities on the one hand or to merge into more integrated ones on the other. As such, acting based on the information we provide will involve different players in each state.

Data

The scope and nature of solutions to the problem may vary for different types of school boundaries, but the first step is to describe and understand how much school boundaries drive segregation in a given city. Our goal is to produce fine-grained geographic data and descriptive statistics on the residential composition of the area delineated by school boundaries and the resulting composition of school enrollments. We use GIS data on school attendance boundary maps from the data services firm Precisely. We focus our descriptive analysis on elementary schools and provide estimates for middle and high schools in the appendix.[5]

The data include information on more than 65,000 SABs, covering most metropolitan areas in the country and including data for most school districts. Prominent real estate and school rating websites such as Zillow, Redfin, and GreatSchools use Precisely's data to show families the link between prospective home addresses and area public schools. The attendance boundary data correspond to the 2019–20 school year. We supplement the SAB data with information on public school enrollment demographics and school geographic locations from the National Center for Education Statistics (NCES) Common Core of Data (2018–19 school year), accessed via the Urban Institute's Education Data Portal. Additionally, we collect information on student test scores at the school level from the Stanford Education Data Archive, which provides information on student proficiency in mathematics and reading by race and ethnicity. These data enable us to assess whether differences in students' test scores by race or ethnicity are linked to SAB inequities (see our analysis in the appendix).

To bring school district jurisdictional boundaries into the analysis, we use publicly available shapefiles from the NCES Education Demographic and Geographic Estimates. These files are maintained by the US Census Bureau for estimating district population and poverty estimates and are used to index federal education funds. To paint a complete portrait of school district jurisdictional boundaries on public education access, we study school segregation at the metropolitan area level, providing a case study for the Atlanta metropolitan area. By "stacking" school district jurisdictional maps over each district's SAB map, we obtain a partition of the geography of a metropolitan area into many smaller geographic areas. The Atlanta area is partitioned into 609 elementary school SABs and 36 school districts (appendix figure A.1).

We use GIS tools to link the SAB files to 2010 Decennial Census data on demographics at the most granular geography available, census blocks, allowing us to observe the racial and ethnic breakdowns of the population residing within any given SAB.[6] Because the census data are about a decade old, we verify our results using data from the US Census Bureau's Longitudinal Employer-Household Dynamics Origin-Destination Employment Statistics (LODES). These tabulations provide census block–level data and racial and ethnic breakdowns of the formally employed population by residential location for the year 2017. Because this is a selected population, we do not use the LODES files for our main estimates, keeping them instead to confirm that the 2010 Census patterns are not fatally outdated.

Measurement Framework

We are interested in identifying individual school boundaries that support segregated public schools. This task is complicated by the sheer number of SABs and school districts in a given city and the difficulty of handling the GIS data to assess the demographic characteristics of each SAB. To do so, we propose a novel dataset structured at the "school pair" level, which generates a rigorous definition of a school boundary. School pairs are defined as schools whose attendance boundaries are adjacent to each other. The Atlanta metropolitan area has 1,826 elementary school boundary pairs, 470 of which are district jurisdictional boundaries. Because school pairs are geographically adjacent, it is easy to envision a student assignment reform that would make hyperlocal (almost surgical) equity-improving changes to the attendance boundary between the schools. Because it would be so localized, such a change to the SAB map would not cause a large disruption in student commuting patterns or to the overall structure of the student assignment system, but it could significantly increase school integration.[7] For the sake of keeping this measurement exercise as straightforward as possible, we ignore considerations of white

flight and real estate impacts when thinking of these policy counterfactuals and simply focus on locating segregating lines.

We measure how much the attendance boundary dividing two schools affects segregation using an analogy to regression discontinuity research design in econometrics (Lee and Lemieux 2010). Regression discontinuity methods are used to estimate the impact of a program whose access is indexed by a running variable crossing a threshold. In our case, the units are census blocks, the attendance boundary between two schools is the threshold, and the running variable is the distance from a block to the boundary. The key insight in regression discontinuity methods is that units near the threshold are similar along several dimensions (e.g., neighborhood amenities or access to transportation), justifying comparisons between units that are near the threshold. We make comparisons between the average demographics of residences within 500 meters of the attendance boundary. Finding a large discontinuity in demographics between residences on each side of a boundary amounts to finding a sharp dividing line in public school access between racial and ethnic groups, one that cannot be easily justified by such concerns as daily commuting burdens.

Figure 1 shows our measurement approach for the Ashford Park Elementary and John R. Lewis Elementary school pair in the Atlanta suburbs, part of the DeKalb County public school district. The left panel presents a scatterplot of census blocks' demographic composition, the share of residents that are Black or Hispanic, against their distance to the boundary, divvying up the right to attend either of these schools. The right panel presents a map of the Ashford Park and John R. Lewis attendance boundaries against the backdrop of the city. The blue blocks correspond to the dots in the scatterplot, those within 500 meters of the school pair boundary line, with darker colors denoting a higher Black or Hispanic share of the population.

The patterns in figure 1 make it clear that the boundary between Ashford Park and John R. Lewis constitutes a border that reinforces racial and ethnic segregation in the DeKalb County district schools and in the Atlanta metropolitan area in general. This is visualized by the yellow lines in the scatterplot, which denote the average racial and ethnic composition of blocks on each side of the boundary. The left side of the plot shows that blocks assigned to John R. Lewis are blocks where 80 percent of the population is Black or Hispanic. In sharp contrast, blocks on the other side of the road, which are assigned to Ashford Park, are blocks where only about 10 percent of the population is Black or Hispanic, and many of these blocks are almost 100 percent white. There are exceptions on both sides (e.g., not all blocks on the John R. Lewis side are more than 80 percent Black or Hispanic, and not all blocks on the Ashford Park side are less than 10 percent Black or Hispanic), but the overall pattern is clear. The boundary between these schools closely delineates a racial and ethnic border between the two schools.

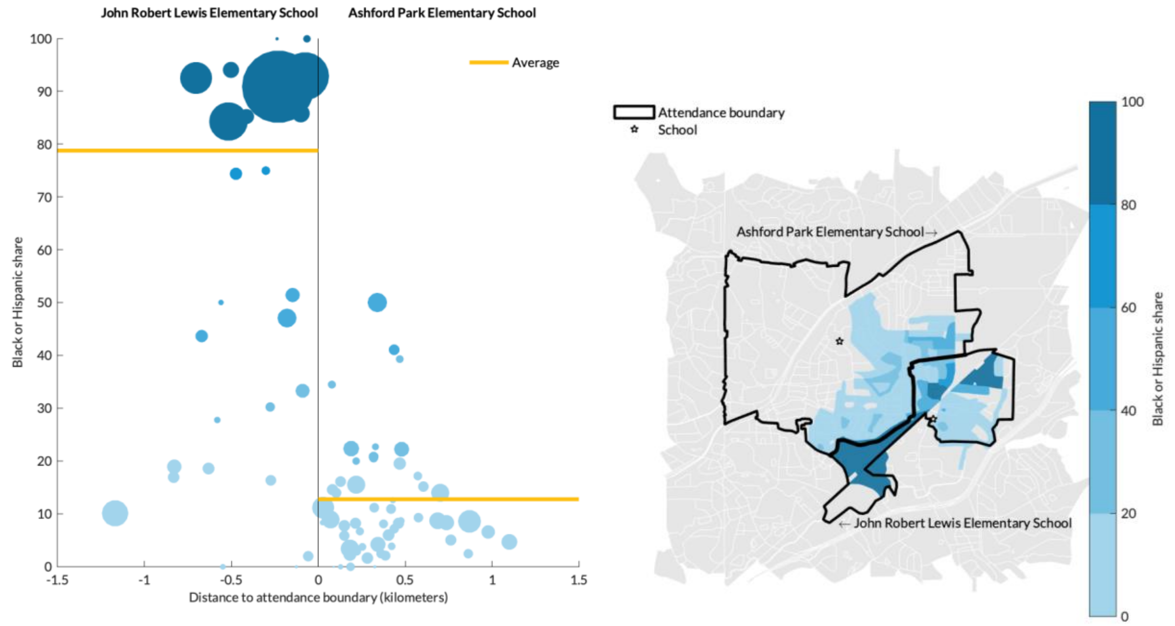
If the boundary ran from north to south, instead of from east to west, the default composition of these schools would be more racially and ethnically balanced.

Our main contribution is to estimate boundary discontinuities like figure 1 for every adjacent school attendance boundary pair in the country. To sift through this large amount of data, we develop an index of school boundary inequality based on mean absolute differences between blocks near the boundary. For the example in figure 1, the absolute gap in the Black or Hispanic share is approximately 70 percentage points. Because gaps in demographic composition near the boundary are not unequivocally indicative of demographic differences between schools, the unequal boundary index is defined as the product of three absolute gaps: (1) the demographic gap between blocks near the boundary (i.e., the boundary regression discontinuity estimate described above), (2) the gap in total demographics between the two SABs (including blocks far from the boundary), and (3) the gap in enrollment composition between the schools, according to 2018 NCES records. By taking the product of these three absolute gaps, the index ensures that only schools that have large disparities along these three dimensions are highlighted in our data. Finally, the index weights by total population near the boundary, giving more importance to school pairs for which the boundary divides larger populations. (See the appendix for a detailed discussion of our measurement framework.)

By ranking school boundaries based on the unequal boundary index, we obtain a list of the worst dividing lines in US public education. Our hope is that this dataset will enable policymakers and researchers to easily find the myriad of microgeographic lines that help maintain segregation in school systems at a hyperlocal level.

FIGURE 1

Measuring Racial and Ethnic Inequality in School Boundaries



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Sources: US Census Bureau and Precisely.

Notes: Observations are census blocks, and the scatterplot is weighted by total population. The yellow line denotes the average Black or Hispanic share in blocks on each side of the boundary. Grayed-out blocks are those outside these schools' attendance zones or those not within 500 meters of the shared boundary between the schools.

Case Study: Atlanta Metropolitan Area

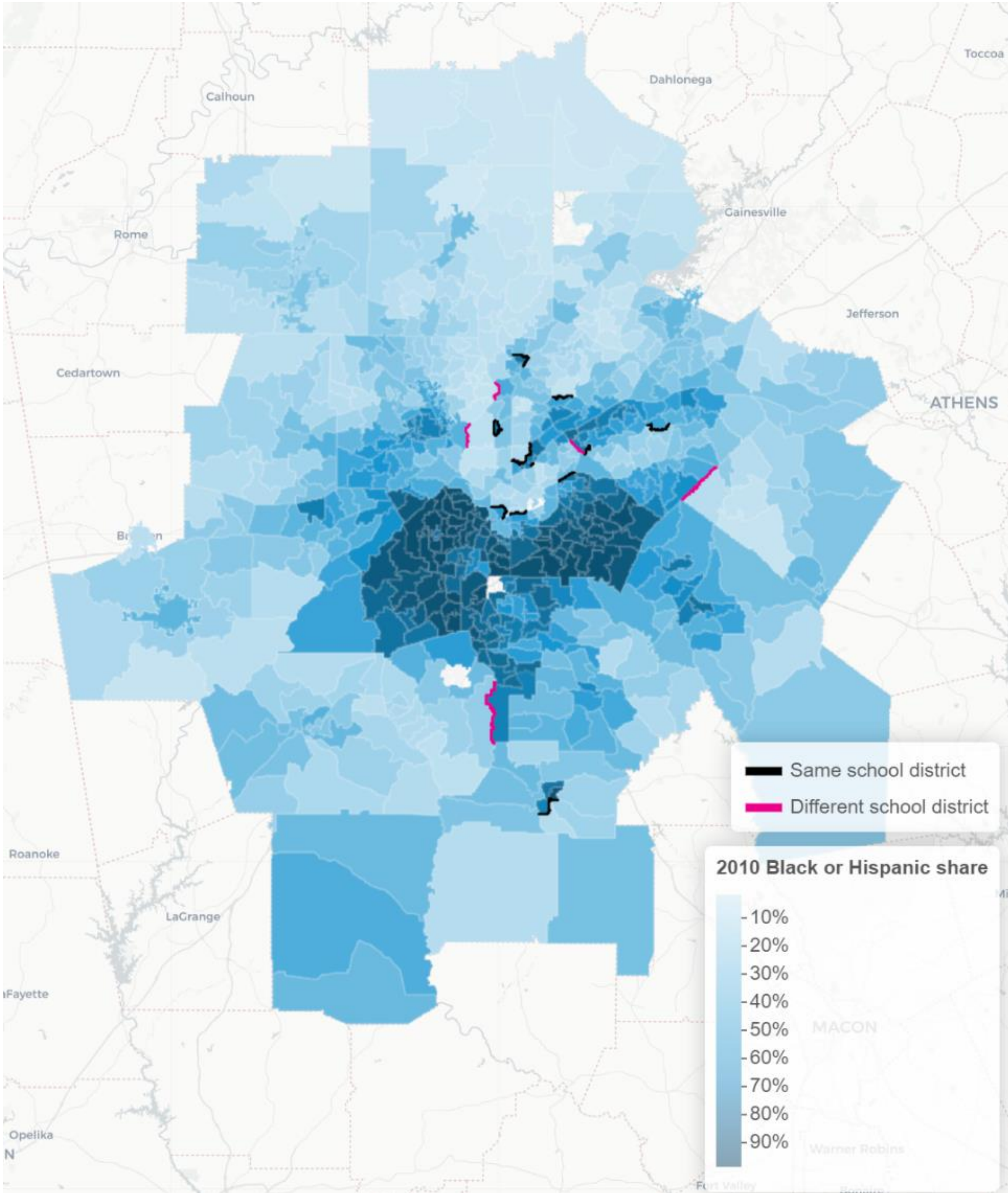
We showcase the potential use of these data with a case study of the most racially and ethnically unequal elementary school boundaries in the Atlanta metropolitan area. Atlanta is an ideal city to examine these disparities. The metropolitan area is fragmented into 36 school districts and 609 elementary school attendance boundaries (appendix figure A.1). Atlanta, historically, has been the nucleus of a great deal of racial conscience and the fight for racial equity. There is a long history of Black leadership in Atlanta, especially during the civil rights movement of the 1960s. Atlanta has seen both the inspirational side of the fight for racial equality and the dark and furious reaction of white communities when faced with the prospect of an equitable redressing of the legacy of chattel slavery (Kruse 2005). There are ongoing efforts led by affluent white communities to secede from Atlanta to form a new wealthy suburban district.[8] Atlanta is the birthplace of Martin Luther King Jr. and has been the scene of some the most egregious acts of racist violence. Given its history of race relations, Atlanta is an ideal place to dive into the microgeography of inequality in access to public education.

We begin with some descriptive patterns of racial and ethnic segregation and inequality in Atlanta's school boundaries. The map in figure 2 shows the 2010 Census share of the total population who identify as Black or Hispanic[9] in the Atlanta metropolitan area. The data represent census blocks aggregated to the SAB level. Notably, many of the SABs toward the center of Atlanta are 90 to 100 percent Black or Hispanic, while many of the suburban SABs in the outskirts of the metropolitan area are often less than 10 percent Black or Hispanic. Still, even in the presence of severe urban-suburban segregation, a closer analysis of the map shows that there are plenty of adjacent boundaries that are of starkly different compositions. The map overlays a highlight of our estimated 25 most-unequal school boundaries in the metropolitan area, shown in bold black lines.[10] Although difficult to discern at this scale, the lines often correspond with roads and other types of "natural division."

The racial and ethnic demographics of Atlanta, particularly in the suburbs, are rapidly changing. An analysis of 2018 census population estimates found that 7 of the 10 US counties with the fastest-growing Black populations were near Atlanta.[11] Residential segregation has decreased,[12] but both residential and school segregation persist at alarming levels. In appendix figure A.2, we present additional maps of the Atlanta metropolitan area, showing the 2017 distribution of Atlanta's Black and Hispanic population (restricting to the residing workforce because of data constraints), as well as a map of the 2000–10 census change in the composition of SABs (appendix figure A.3). These maps confirm that even though Atlanta is an evolving metropolis, the patterns we present using 2010 Census data are as relevant today as ever.

FIGURE 2

Racial and Ethnic Segregation and Atlanta's Most-Unequal School Boundaries



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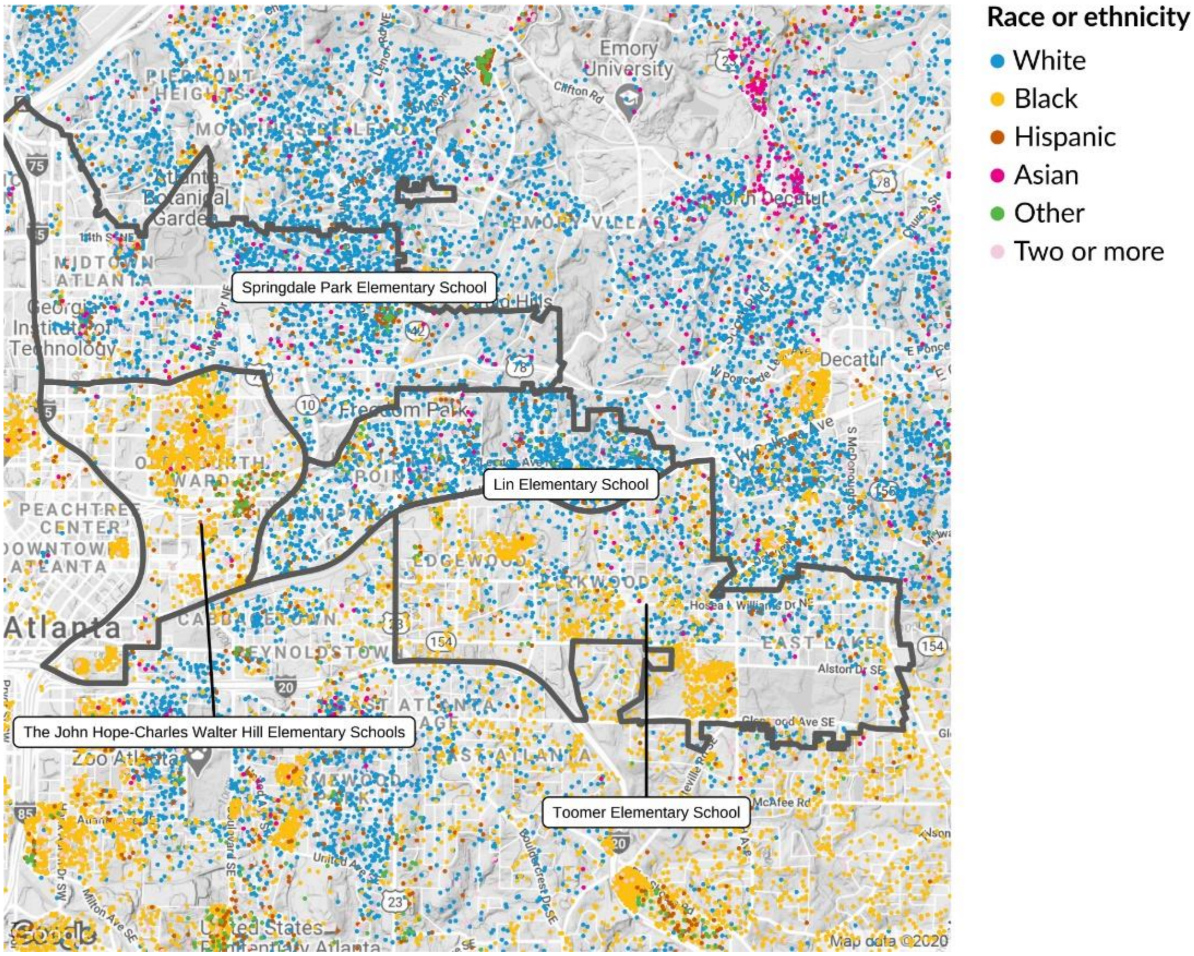
Source: Urban Institute analysis of 2010 Census data and Precisely school attendance boundaries.

Notes: Bold line segments in black and pink denote the 25 most-unequal school boundaries in the Atlanta metropolitan area, identified using the methodology outlined in the appendix. Black lines are school attendance boundaries within a school district. Pink lines are school attendance boundaries that coincide with school district jurisdictional boundaries.

Figure 3 zooms in on one of the dividing lines shown in the map above, near the heart of downtown Atlanta. All four elementary schools shown here are a part of the Atlanta Public Schools (APS) district: Springdale Park Elementary School, the John Hope-Charles Walter Hill Elementary School, Mary Lin Elementary School, and Toomer Elementary School. Student assignment in APS is based entirely on this attendance boundary map, as one can easily verify by navigating the district's enrollment website.[13] One dot in figure 3 represents one child younger than 9, and the dot's color corresponds to a race or ethnicity. The difference in racial and ethnic composition is stark between the four schools, despite the proximity of the zones and schools and the diversity of the local community. Springdale Park is only 17 percent Black and Hispanic, but just across its border, John Hope-Charles Walter Hill is 63.2 percent Black and Hispanic. Mary Lin, which also shares a border with John Hope-Charles Walter Hill is only 11.5 percent Black and Hispanic, and Toomer, which shares a border with Mary Lin, is 61.2 percent Black and Hispanic. Despite the potential for diversity in each of these four schools, we instead see extremes in racial and ethnic composition and a clear division in schools that either have a high share of Black and Hispanic students or a very low share of Black and Hispanic students.

FIGURE 3

Unequal School Attendance Boundaries within the Atlanta Public Schools District



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Source: Urban Institute analysis of Precisely school boundaries and US Census Bureau data.

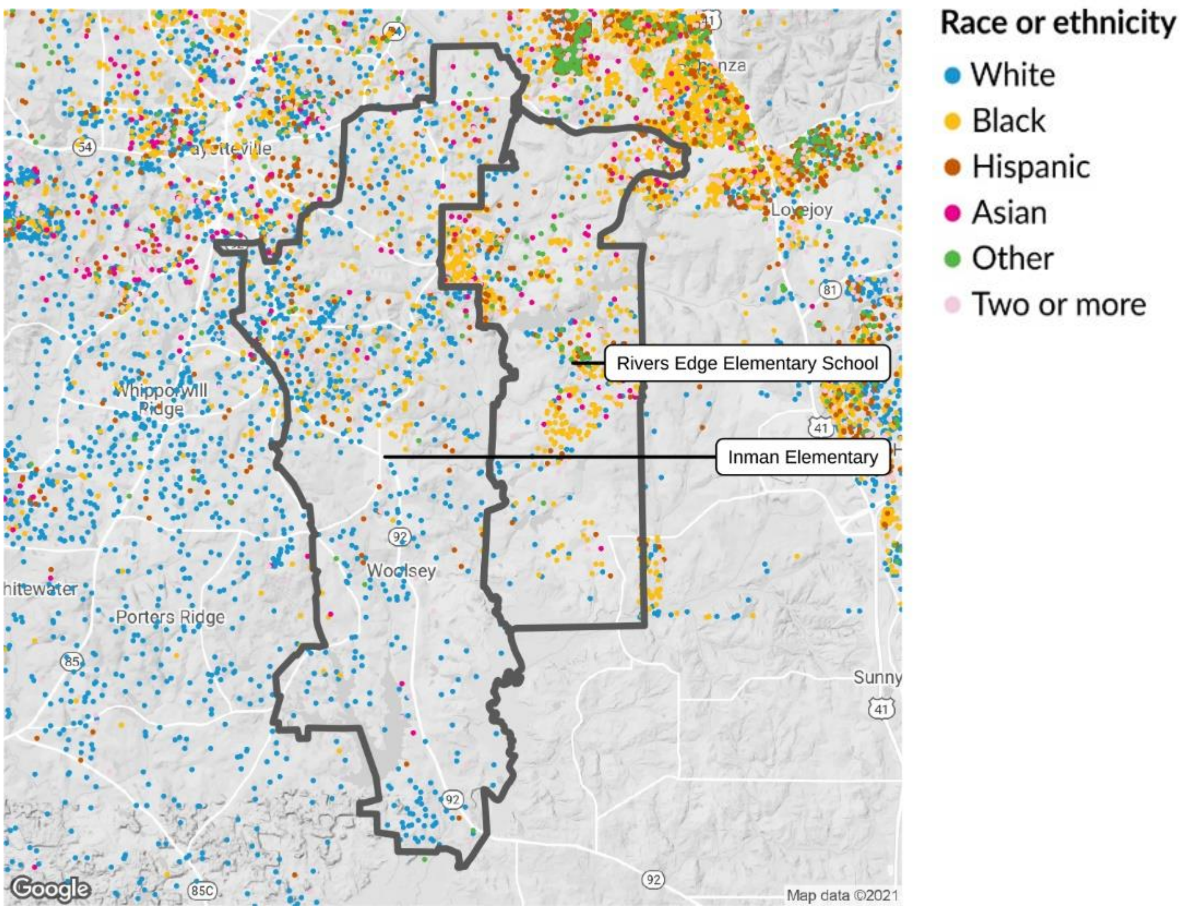
While figure 3 shows the racial and ethnic inequality between schools in the same school district, figure 4 demonstrates that the same type of racial and ethnic disparity manifests across school district borders. Figure 4 shows two elementary schools, Inman and Rivers Edge, that belong to different school districts (Fayette County and Clayton County, respectively) and that have vastly different shares of Black and Hispanic students: Inman is 22.4 percent Black and Hispanic, and Rivers Edge is 73.7 percent Black and Hispanic. These two examples show that the root of racial and ethnic inequality driven by school boundaries is multifaceted and complex. For the unequal lines in figure 3, the school board of APS could simply vote to redraw these in ways that promotes racial equity. Although this may be easier said than done given local politics, the solution is easy to outline—APS should reform its attendance boundaries. But for the segregating boundary patterns shown in figure 4, the task lies at the level of the

state's authority over school district jurisdictions and the willingness of these districts to redress structural inequality. Despite the visual similarities between the gaps shown in figures 3 and 4, the distinction reminds us that structural barriers to equity in public education exist at varying levels of government and geographic scale.

FIGURE 4

Unequal School District Jurisdictional Boundaries in the Atlanta Metropolitan Area

Fayette County School District and Clayton County School District



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Source: Urban Institute analysis of Precisely school boundaries and US Census Bureau data.

The examples above provide visual intuition for the framework we have developed to identify school boundaries that support a segregated public education system. We now provide a list of the most unequal school boundaries in the Atlanta metropolitan area. Table 1 shows the 25 most-unequal elementary school boundaries in the area. In appendix tables A.1 and A.2, we provide lists of the most-unequal middle school and high school boundaries. The tables provide demographic breakdowns of residences near boundaries, with overall rankings based on the unequal boundary index. The list shows

pairs of schools that have (1) large differences in the composition of residents living near the boundary, (2) large differences in overall composition (the two SABs are different overall), and (3) the enrollment inside these schools is also of vastly different composition. Finally, the index gives more weight to boundaries with larger populations living nearby.

Further, the tables indicate whether the boundary coincides with a residential road, a highway, or a different type of geography.[14] This information is useful for developing solutions because there are claims that the key racial and ethnic boundaries in US cities are demarcated by interstate highways and railroads (Anant 2011; Baum-Snow 2007). Finally, the tables report whether the attendance boundary separating schools is also a district jurisdictional boundary. Unlike attendance boundaries within jurisdictions, there are fewer administrative avenues for remedying inequality between jurisdictional boundaries. One possibility would be for states to review unequal school district boundaries and strategically merge jurisdictions. Although solution considerations vary for each type of line, we find it important to quantify every geographic barrier to equality in public education, despite the complexity of the solution.

The most unequal elementary school attendance boundary in the Atlanta metropolitan area lies between Ashford Park Elementary School and John R. Lewis Elementary School in Dekalb County School District (figure 1). The Dekalb district is no stranger the ills of segregation. It was placed under a court-ordered desegregation plan in 1969 and was plaintiff of a 1992 Supreme Court case that ruled it "unitary," even as the court admitted that there remained racially identifiable schools and deep racial and ethnic disparities in school resources.[15] In the 2019 school attendance map, on the north side of Drew Valley Road, a residential road that divides these schools' attendance zones, children are predominantly white and affluent (80 percent of residences on the Ashford Park side of the boundary are white) and they attend Ashford Park, one the "top" elementary schools in the district according to popular school ratings websites.[16] If one lives south of Drew Valley Road, the assigned school is John R. Lewis. The attendance boundary of this school appears gerrymandered to capture the high-density residential blocks located in the southwestern area of the neighborhood, where 70 percent of residents are Hispanic and 9 percent are Black. The John R. Lewis boundary seems to explicitly avoid the inclusion of the large homes with big lawns to the north, which are assigned to Ashford Park.

Table 1 contains 25 stories of racial and ethnic inequity in access to public schools. It is not easy to figure out a solution to a problem so deeply imbedded in historic and structural inequity, but we hope these data help changemakers in Atlanta find each instance in which two adjacent school boundaries have starkly different compositions, which is almost always a red flag indicating exclusion and perpetuation of racial and ethnic inequality. The value-add of our work is thus to elevate places and

lines that are severely inefficient from the perspective of a social planner interested in improving the racial and ethnic balance between schools without severely disrupting the student assignment system. Without intimate knowledge of a locality, it would be difficult for a researcher or other observers to detect such inequities using data on school demographics alone. There are simply too many lines to look at in the aggregate. Our measurement tools enable us to sift through these data effectively, highlighting where the inequities lie with a high degree of geographic accuracy.

Discussion

The story of two vastly unequal schools with adjacent attendance boundaries is repeated many times in the Atlanta metropolitan area and thousands of times in the country as a whole. To an outside observer, it may appear baffling that even after decades of Supreme Court decisions and local efforts to end the racial and ethnic segregation of schools, our local governments are still willing to sustain these borders in the administrative service maps they use for student assignment. To a seasoned advocate for racial equity in the US, this may be all too familiar, perhaps even obvious. We believe that a large part of the problem is that these inequities happen at a microgeographic level, making them easy to hide. Therefore, it is necessary to employ quantitative tools to elevate the thousands of invisible lines that create racial and ethnic borders in our cities. States could do this, especially ones that have racial-imbalance laws that require district reports on public school demographics and racial and ethnic enrollment balance (e.g., Connecticut's Sec. 10-226e-1).

For many of these unequal boundaries, it would take a simple redrawing of the line to remedy much of the inequality between the schools. Redrawing the line separating adjacent schools would not lead to much of a change in households' commuting patterns, and it would not disrupt the rest of the school system, but it could significantly decrease segregation between the two schools. In turn, redressing a multiplicity of these unequal boundaries in a given city could help dismantle segregation in the entire public school system.

Politics are a significant factor impeding local action on racialized school boundaries. High-income groups have been known to leverage their political influence to ensure that school boundaries remain inequitable (DeRoche 2020). It is obviously not a coincidence that high-quality public schools often serve areas populated exclusively by affluent white residents. School districts and states have the power to break down these barriers, but the specter of unintended consequences always hovers over discussions of equitable student assignment reform. The fear is that a brusque readjustment of housing values would follow a school redistricting reform, resulting from a wholesale exodus of affluent families,

also known as “white flight.” In some cases, these fears are substantiated by past experience, but in many others, it is less clear what the full consequences of reform would be, and the uncertainty can result in limited buy-in from the community and district leadership.

A generalized claim that severe market readjustment would completely undo the benefits of school redistricting reform drives much of the anxiety over school boundary reform. But the evidence of real estate depreciation and white exodus for localized school redistricting in recent decades is scant (Monarrez 2019; Monarrez and Schonholzer 2021). Instead, anxiety over reform is typically based on a dim view of the history of court-ordered desegregation and shock at the documented instances of white flight following the implementation of integration plans more than 40 years ago (Lutz 2011). Social and economic dynamics are much different today. Today, there is a greater impetus for racial and ethnic equity and redressing the harm of structural racism. Once school boundaries change, they are typically accepted by the community, so with enough support, some districts could see sustainable improvements to integration via school boundary reform. This is a key area in which we believe more rigorous research could quell the anxiety associated with a policy agenda aimed at redressing the legacy of structural racism in public education.

TABLE 1

The Most-Unequal Elementary School Boundaries in Atlanta

Racial and ethnic breakdown of neighboring attendance boundaries

Rank	School name	Black (%)	White (%)	Hispanic (%)	Asian (%)	School name	Black (%)	White (%)	Hispanic (%)	Asian (%)	Bndy. type	District bndy.
1	John R. Lewis ES	9.3	16.5	69.5	3.1	Ashford Park ES	4.5	80.8	8.2	4.0	Res.	No
2	Springdale Park ES	17.7	69.4	4.7	5.2	Hope-Hill ES	47.2	40.6	4.5	4.0	Hwy.	No
3	Lake Forest ES	9.5	31.7	54.1	2.6	Heards Ferry ES	3.8	72.1	18.5	4.1	Res.	No
4	Mary Lin ES	6.8	84.3	3.2	2.4	Toomer ES	53.4	39.3	2.8	2.0	Res.	No
5	Hope-Hill ES	49.5	36.3	8.0	2.4	Mary Lin ES	10.2	79.7	4.6	3.1	Res.	No
6	Ashford Park ES	7.8	79.4	5.5	4.8	Woodward ES	7.9	43.3	40.5	6.8	Res.	No
7	Nesbit ES	34.0	15.6	42.1	5.9	Livsey ES	18.4	58.9	11.7	8.2	Other	Yes
8	Northwood ES	16.6	46.3	24.7	9.6	Mimosa ES	26.0	12.5	56.9	1.5	Hwy.	No
9	Oak Grove ES	3.1	78.9	4.1	9.8	Montclair ES	44.2	29.0	15.2	9.8	Hwy.	No
10	Crescent Road ES	16.2	78.9	2.4	1.1	Anne Street ES	66.2	25.7	5.9	0.4	Res.	No
11	Peachtree ES	27.3	50.8	13.5	6.4	Simpson ES	3.0	81.8	2.7	11.0	Res.	No
12	Lake Forest ES	16.9	25.1	53.6	2.7	High Point ES	16.6	63.3	13.0	4.4	Res.	No
13	Inman ES	21.6	66.6	6.7	2.3	Eddie White MS	69.3	22.1	4.1	2.0	Other	Yes
14	Sharon ES	6.6	82.1	8.4	1.5	Rosebud ES	53.2	35.6	7.3	1.0	Other	Yes
15	Inman ES	21.6	66.6	6.7	2.3	Rivers Edge ES	69.3	22.1	4.1	2.0	Other	Yes
16	Arcado ES	22.3	29.9	12.9	31.3	Nesbit ES	40.2	11.1	41.0	5.1	Other	No
17	Idlewood ES	76.7	10.1	4.6	5.8	Brockett ES	23.2	60.5	5.3	8.1	Hwy.	No
18	Futral Road ES	27.9	68.1	1.2	0.1	Moore ES	90.8	5.3	2.5	0.1	Res.	No
19	Ashford Park ES	5.2	71.4	14.5	6.2	Dresden ES	17.3	19.0	60.6	2.4	Res.	No
20	Heards Ferry ES	3.9	92.1	2.0	1.1	Brumby ES	27.5	52.5	5.8	10.7	Other	Yes
21	Cedar Hill ES	31.9	34.2	19.1	12.2	Craig ES	12.4	67.5	9.2	8.2	Other	No
22	Hembree Springs ES	14.6	59.5	15.3	7.1	Mimosa ES	24.5	20.0	49.1	3.5	Res.	No
23	Crescent Road ES	25.7	72.6	0.0	0.0	Moore ES	90.5	3.3	3.5	0.1	Res.	No
24	Ison Springs ES	32.3	51.4	9.5	1.7	Mount Bethel ES	2.0	86.5	0.6	8.5	Other	Yes
25	Sharon ES	0.9	96.0	3.1	0.0	Magill ES	35.9	47.7	10.7	2.2	Other	Yes

Source: Urban Institute analysis of 2019–20 Precisely elementary school attendance boundaries and 2010 US Census Bureau data.

Notes: bndy. = boundary; ES = elementary school; Hwy. = highway; MS = middle school; Res. = residential. "Other" boundary types are those that do not coincide with roads. Rankings are based on an analysis of 2,624 school boundary pairs in the Atlanta metropolitan area, using geographic information system analysis and using an unequal boundary index capturing absolute differences in the (1) demographics of blocks near the schools' shared boundaries, (2) demographics of all blocks in the schools' attendance boundaries, and (3) demographics in the schools' enrollment, according to the 2018–19 National Center for Education Statistics Common Core of Data.

Appendix

The following describes the procedure we use to build our novel dataset measuring disparities between adjacent school attendance boundary pairs.

We begin by loading and linking GIS data on school boundaries (SABs and school districts) from Precisely and NCES Education Demographic and Geographic Estimates. Next, we link these data to US Census Bureau TIGER/Line shapefiles of 2010 census blocks (in urban areas, these delineate city blocks) using standard centroid GIS matching procedures (these procedures test whether the average coordinates of a census block lie within the polygon that makes up the school boundary). This merge allows us to assign census blocks to school boundaries that we can then aggregate up to obtain SAB area demographics. This method is flawed because about a quarter of unique census blocks overlap with multiple school attendance boundaries. But among these, 68 percent are more than 90 percent overlapping with their best match, and 56 percent are more than 96 percent overlapping. We opt for the centroid matching procedure rather than a procedure based on percentage area overlap because it allows for most blocks to be cleanly sorted into a single school boundary and avoids duplicating or losing data from blocks spread over multiple boundaries. We collect racial and ethnic composition data both for the entire population and for the population of children ages 5 to 9. Because the 2010 Census data are 10 years old, we employ census block estimates of the residential composition of the employed population from LODES in 2017 to assess whether our analysis is sensitive to recent changes in neighborhood demographics.

A complication with the SAB data is that, unlike school district jurisdictions, SABs can overlap, meaning that a given block may be assigned to more than one school serving the same grades. This precludes our ability to simply structure the data as a long crosswalk between census block IDs and assigned school IDs. We build a nested data structure that can handle this complexity by allowing block observations to be repeated across overlapping SABs. As such, it is possible, though uncommon, that a block could be assigned to a predominantly Black school and a predominantly white school simultaneously.

There are also complications with census data measured at the block level. Because blocks tend to be small geographic units of observation, privacy protection considerations sometimes need to be enforced before the Census Bureau makes the data publicly available. For example, if only one person lives in a given census block, reporting that person's race or ethnicity would violate privacy protections. The Census Bureau solves this problem by introducing random noise into the data. For the example

provided, the Census Bureau protects privacy by randomly swapping the identity of the person living in the block, meaning that the person's reported race or ethnicity in the data could be wrong. This noise problem is a smaller issue when population sizes are larger. Hence, when estimating the boundary discontinuities, we focus on the total block population (as opposed to the school-age population), which minimizes any inaccuracies driven by random noise at this fine-grained geographic level of observation.[17]

Once we have the link between the SAB map data and census blocks, the next step in our data building procedure is to generate the school-pair structure needed for the regression discontinuity samples we use to identify unequal boundaries. To do this, we create small buffers around all SABs and intersect these to tell whether SABs are adjacent to each other. Once we find a pair of adjacent SABs, we link blocks located around a one-kilometer buffer of the shared boundary using intersection (as opposed to centroid) matching. This creates the regression discontinuity sample of blocks near the attendance boundary, grabbing blocks approximately 500 meters on each side. Next, we compute the perpendicular distance between the regression discontinuity sample of block centroids and the attendance boundary. Finally, we arbitrarily assign one side of the boundary to have negative distance to the boundary, generating the running variable for our regression discontinuity models, as shown, for example, in figure 1.

Given this data structure, we define the regression discontinuity estimate of the "jump" between the demographics as one crosses the boundary as the absolute value of the ordinary least squares coefficient from a regression of the Black or Hispanic share of the block population on an indicator for which side of the boundary the block lies in. These models are fit using only the regression discontinuity sample of blocks near the boundary and use population weights. Therefore, the regression discontinuity coefficient is approximately given by $|A - B|$, where A is the Black or Hispanic share of the population living within 500 meters on the A side of the boundary and B is the same value for the other (B) side of the boundary. Thus, the regression discontinuity coefficient provides an estimate of the jump on demographic composition around a school boundary. This framework allows us to generate a statistic summarizing racial and ethnic inequity across every adjacent school boundary pair in the country. This is critical for getting a handle of the extent of the issue and for assessing how egregious some of these cases might be relative to all other boundaries in the country. It may not come as a surprise that many of the regression discontinuity estimates are close to zero, which makes the cases in which they are not zero all the more stark.

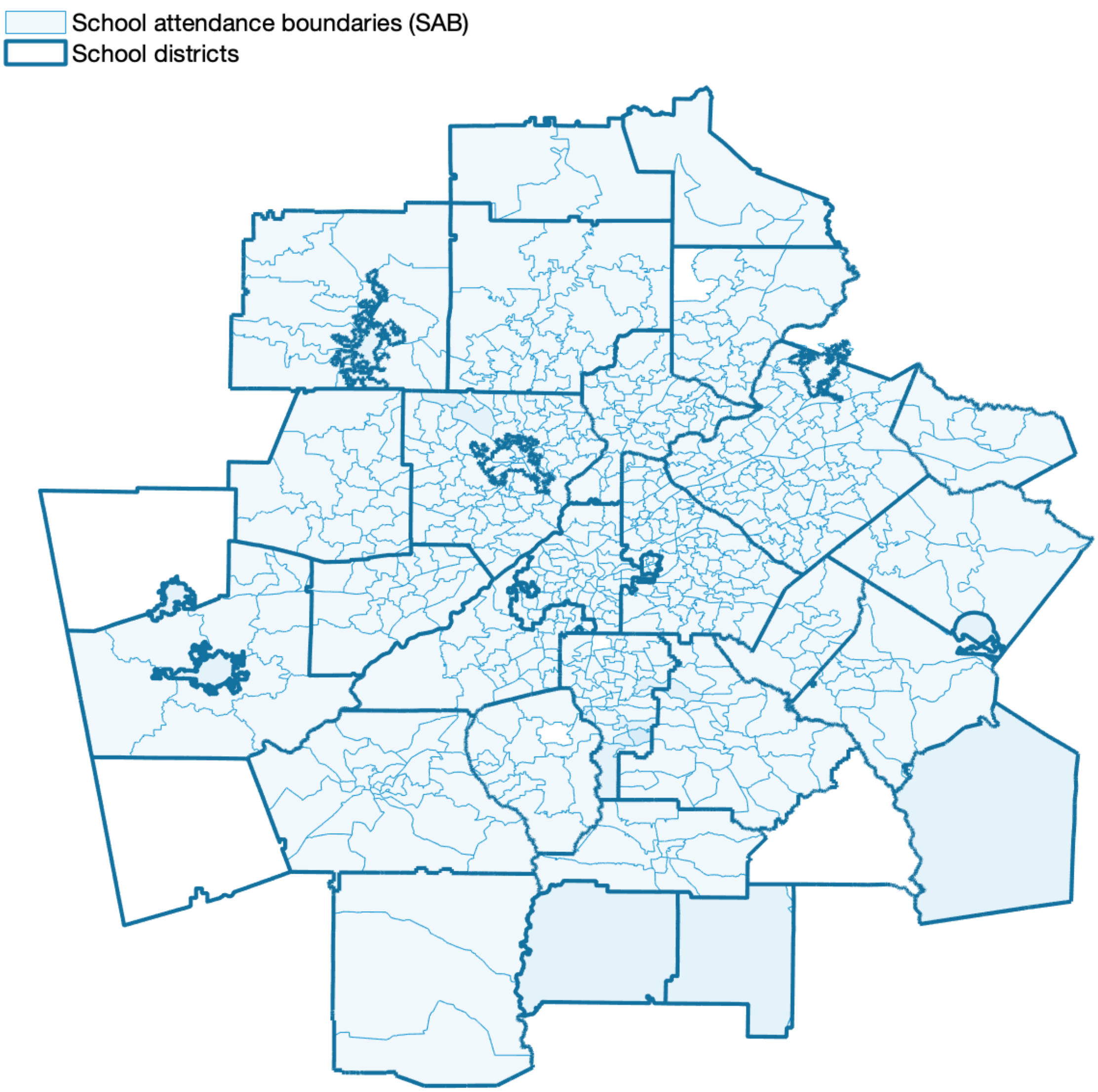
In practice, these regression discontinuity estimates can be noisy, especially for school boundaries with low population density or lopsided cases in which there are a lot of people living on one side but

not the other. It may also be the case that there is an unobserved policy that may help balance enrollments between unequal boundaries, meaning that it would be unfair to highlight such a boundary as highly inequitable. To ensure that our list of the most unequal boundaries does not suffer from such shortcomings, we define the unequal boundary index used to make our figures and tables as the product of four terms: (1) the absolute value of the estimated boundary discontinuity, (2) the absolute difference in the Black or Hispanic share of the population in the entire SAB area, (3) the absolute difference in the Black or Hispanic share of total enrollment, and (4) the total population residing near the boundary.

They key advantage of this index is that it will be approximately "zeroed out" if any of the values of the first three terms is near zero. In other words, the unequal boundary index will be positive and relatively large only if all three of the following are the case: (1) there is a jump in demographics at the boundary, (2) the SABs as a whole are really different in composition, and (3) the enrollments in the associated schools reflect large differences in racial and ethnic composition. Finally, the index weighs observations by total population, giving boundaries affecting more people more importance.

FIGURE A.1

School Attendance Boundaries and School Districts in the Atlanta Metropolitan Area



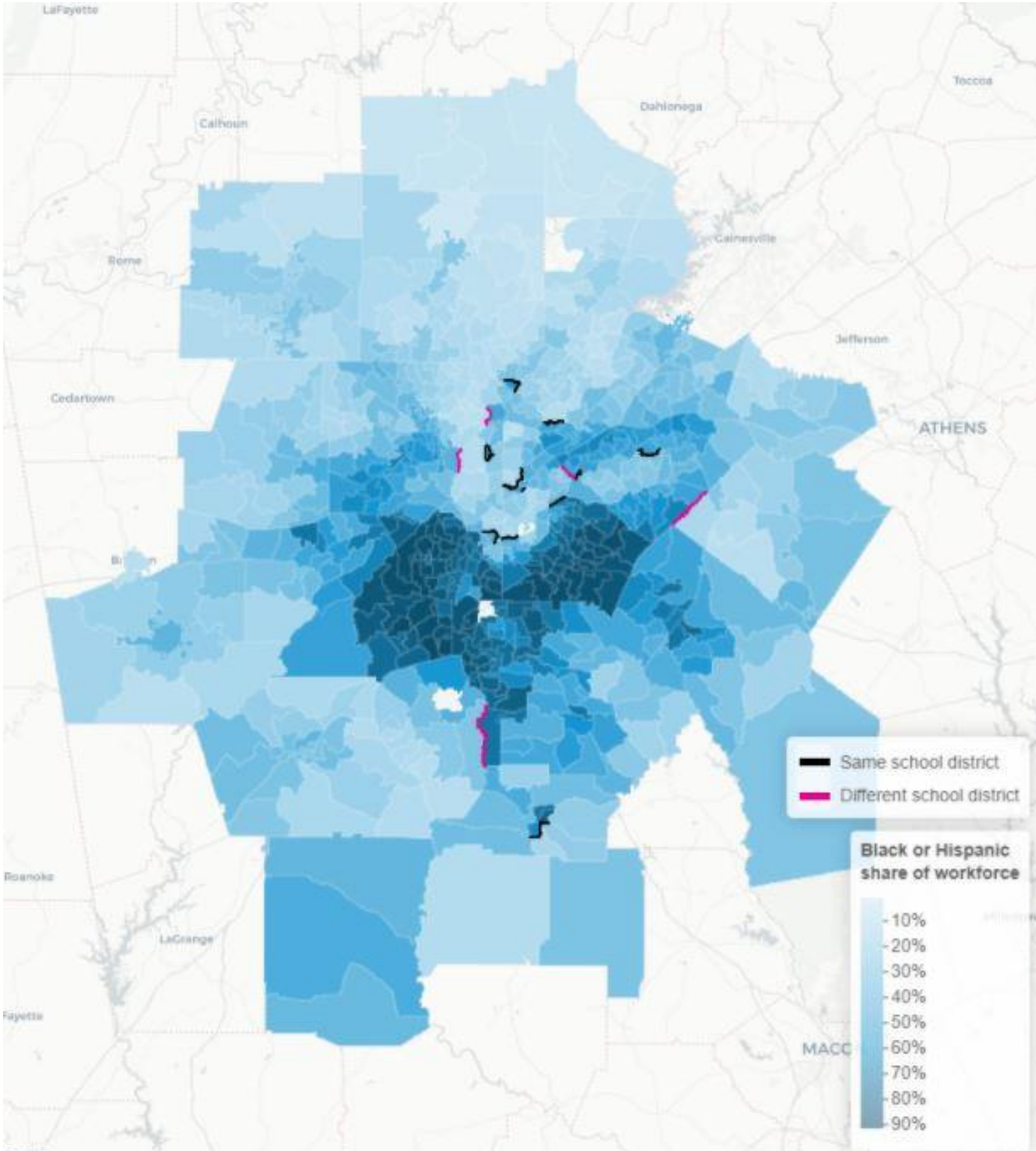
URBAN INSTITUTE

Sources: National Center for Education Statistics Education Demographic and Geographic Estimates and Precisely.
Note: School boundary data are not available for Haralson County, Heard County, and Butts County.

Figure A.2 displays the racial and ethnic composition of the workforce aggregated to the school attendance boundary level, with the boundary lines representing the most-segregated school pairs highlighted. Although we use 2010 Decennial Census data in the report, these 2017 data help confirm that the trends in 2010 have persisted in more recent years.

FIGURE A.2

School Attendance Boundary Segregation in the Atlanta Metropolitan Area, 2017 Workforce



URBAN INSTITUTE

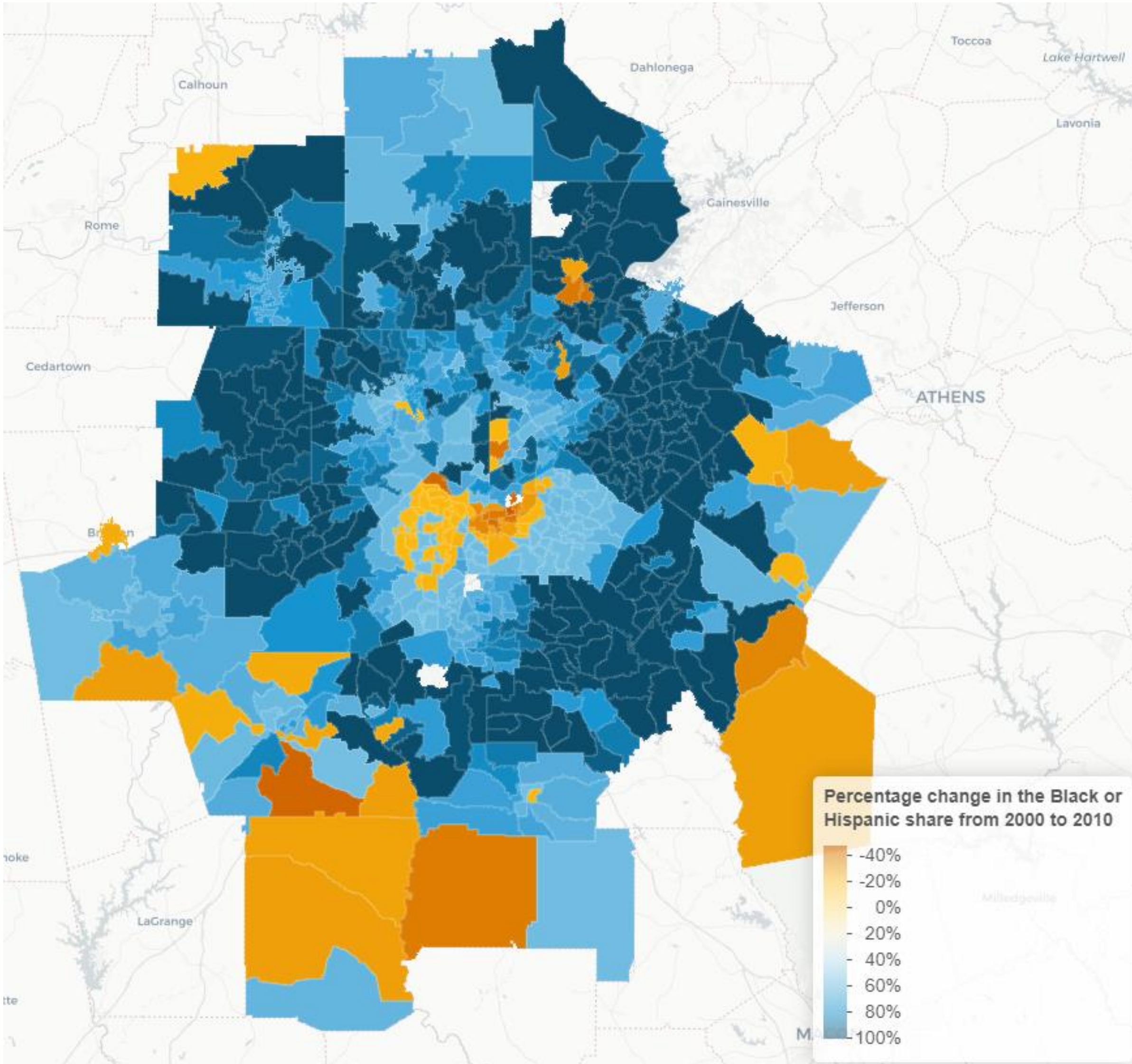
Source: Urban Institute analysis of 2017 data from the US Census Bureau's Longitudinal Employer-Household Dynamics Origin-Destination Employment Statistics.

Notes: Bold line segments in black and pink denote the 25 most-unequal school boundaries in the Atlanta metropolitan area, identified using the methodology outlined in the appendix. Black lines are school attendance boundaries within a school district. Pink lines are school attendance boundaries that coincide with school district jurisdictional boundaries.

Figure A.3 visualizes the change in racial and ethnic composition from 2000 to 2010 based on block-level decennial census data aggregated to the school boundary level. The map shows significant demographic changes. Black and Hispanic residents make up a smaller share of the total downtown Atlanta population in 2010 than in 2000 but make up a larger share of many surrounding suburbs. In the school boundary zones represented by the darkest shade of blue, the share of the population that is Black or Hispanic has more than doubled. In many cases, the Black or Hispanic share in 2010 is two to five times what it was in 2000.

FIGURE A.3

Change in the Black or Hispanic School Attendance Boundary Share, 2000–10



URBAN INSTITUTE

Source: Urban Institute analysis of 2000 and 2010 Decennial Census block data and school attendance boundaries in 2019–20.
Note: This map shows 2000–10 demographic changes in the Atlanta metropolitan area, using the breakdown of 2019 school attendance boundaries.

Figure A.4 displays 2008–14 achievement data from the Stanford Education Data Archive, after matching it to Atlanta's SABs.[18] The data combine math and English test score averages across grades at the school level and standardize them to be nationally comparable. Scores represent the number of grade levels students score above or below the national average.[19] Each of the school boundary pairs we identify as highly segregated also have significant disparities in test score data, even in cases where

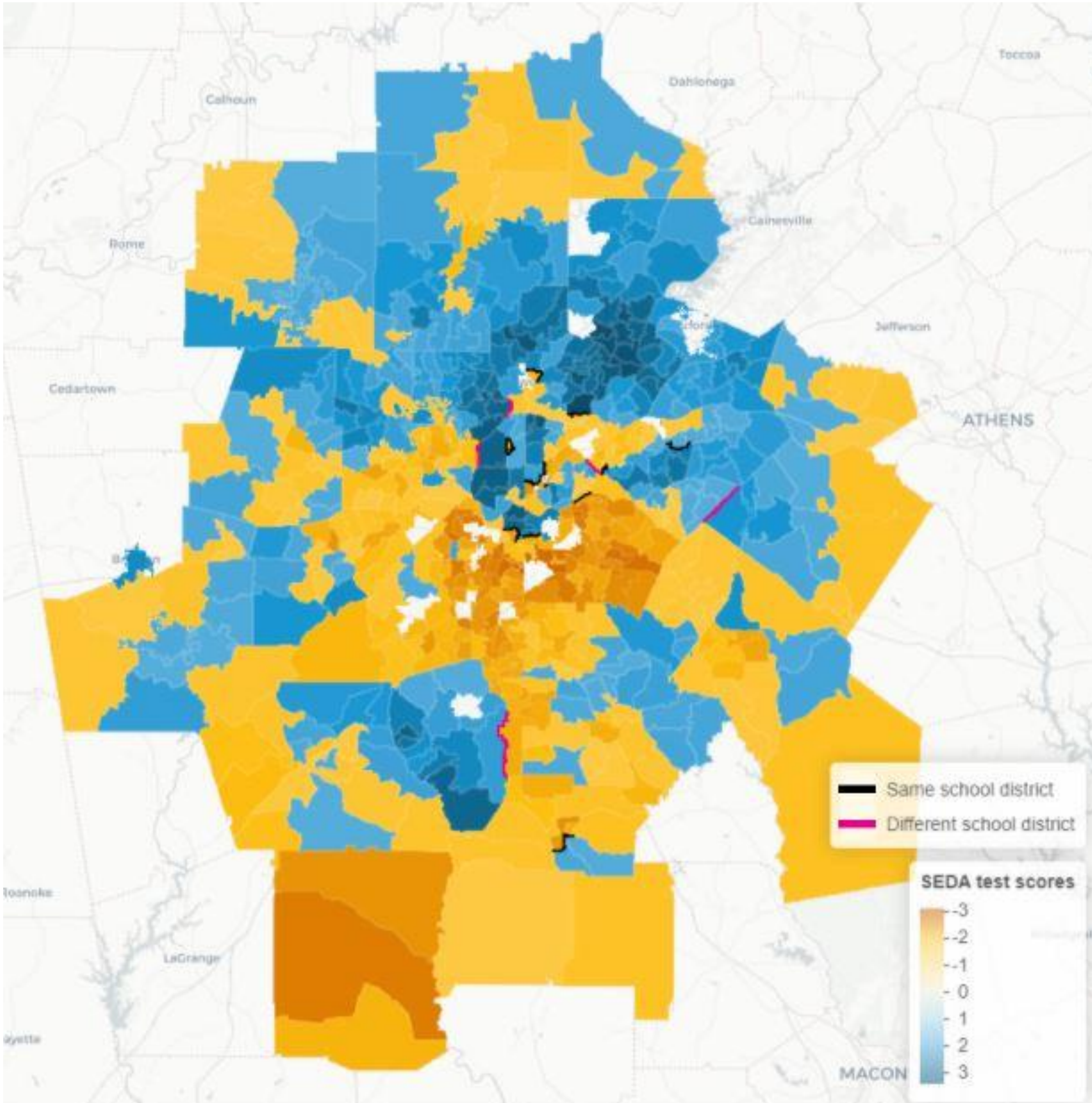
schools in a pair are both above or below the national average. But not all the starkest school pair test score differences are captured in our measure.

One of the largest disparities in terms of both test score data and school segregation is between Hope-Hill Elementary School (–1.66) and its neighbors in the Atlanta Public School District, Springdale Park Elementary School (2.71) and Mary Lin Elementary School (2.12). This suggests that Hope-Hill's standardized test average is several grades below some of its closest neighbors. Disparities in educational measures, including standardized test performance, has been attributed to several causes, particularly differences in school, neighborhood, and family resources.

Standardized test scores do not reflect the entirety of a student's or a school's experiences or strengths, but they can illustrate the role of institutional racism in limiting opportunities for Black or Hispanic students. They also weigh heavily in the measures of school quality used by popular websites for parents of prospective students. On the website GreatSchools, Hope-Hill received a 4/10 rating, while Springdale and Mary Lin received 8/10 and 7/10, respectively. Residential choices made by affluent families in response to these data can exacerbate residential and school segregation (Hasan and Kumar 2019).

FIGURE A.4

Average School Achievement and School Attendance Boundaries in Atlanta



URBAN INSTITUTE

Source: sean reardon, Demetra Kalogrides, Andrew Ho, Ben Shear, Erin Fahle, Heewon Jang, and Belen Chavez, "Stanford Education Data Archive (Version 3.0)," accessed February 23, 2021, http://purl.stanford.edu/db586ns4974.
Notes: SEDA = Stanford Education Data Archive. Achievement data are not available for some schools.

TABLE A.2

The Most-Unequal Middle School Boundaries in Atlanta

Racial and ethnic breakdown of neighboring attendance boundaries

Rank	School name	Black (%)	White (%)	Hispanic (%)	Asian (%)	School name	Black (%)	White (%)	Hispanic (%)	Asian (%)	Bndy. type	District bndy.
1	Chamblee MS	9.1	69.8	11.6	6.9	Sequoyah MS	9.3	20.2	64.5	4.8	Other	No
2	Druid Hills MS	48.3	39.5	3.0	6.6	Mary McLeod Bethune MS	83.4	11.1	3.5	0.4	Hwy.	No
3	Trickum MS	15.0	39.5	13.3	29.5	Lilburn MS	28.5	21.7	35.2	12.1	Other	No
4	Inman MS	30.3	61.3	3.3	2.2	King MS	48.6	42.8	4.1	1.9	Res.	No
5	John Lewis Invictus Ac.	92.4	3.2	2.4	0.7	Sutton MS	31.4	50.7	12.9	1.9	Other	No
6	Harper-Archer MS	92.4	3.2	2.4	0.7	Sutton MS	31.4	50.7	12.9	1.9	Other	No
7	Whitewater MS	19.5	68.9	6.3	2.4	Eddie White MS	65.4	25.6	4.2	1.8	Other	Yes
8	Lovinggood MS	26.5	57.9	9.8	4.0	Smitha MS	37.8	29.9	26.8	2.7	Hwy.	No
9	Henderson MS	22.9	45.1	20.0	9.2	Sequoyah MS	14.9	18.5	56.8	8.4	Hwy.	No
10	Loganville MS	5.1	86.1	6.7	1.1	Grace Snell MS	40.0	45.3	9.5	1.7	Other	Yes
11	Sandy Springs MS	30.0	53.3	9.4	3.3	Dickerson MS	3.0	86.2	1.7	7.4	Other	Yes
12	Druid Hills MS	21.8	54.1	8.7	11.9	Sequoyah MS	19.4	20.4	52.8	5.0	Hwy.	No
13	Richards MS	32.4	24.4	28.5	12.3	Five Forks MS	20.1	51.5	15.5	10.4	Other	No
14	Crews MS	9.0	76.0	3.8	8.4	Richards MS	25.7	42.9	16.6	12.3	Other	No
15	Renfroe MS	31.7	61.1	2.8	1.7	King MS	47.7	46.8	2.3	1.1	Res.	Yes
16	Shiloh MS	48.2	31.7	10.1	6.7	Five Forks MS	18.1	63.3	6.9	8.5	Hwy.	No
17	Elkins Pointe MS	14.2	56.3	21.1	5.6	Northwestern MS	6.9	74.0	4.8	12.0	Other	No
18	Hampton MS	17.0	74.8	4.0	1.1	Eddie White MS	68.4	16.2	10.8	2.4	Other	Yes
19	Bear Creek MS	59.5	26.4	12.0	0.1	Madras MS	22.2	61.5	14.1	0.0	Other	Yes
20	Radloff MS	43.3	13.5	20.8	19.5	Hull MS	31.2	16.2	11.8	36.8	Hwy.	No
21	Richards MS	53.2	5.2	35.9	2.2	Hull MS	26.0	12.2	9.9	49.0	Hwy.	No
22	Crews MS	16.3	62.1	6.4	12.5	Snellville MS	57.2	26.8	10.3	2.1	Hwy.	No
23	Brown MS	90.3	4.5	2.8	0.7	Centennial Ac.	57.2	29.1	4.1	6.8	Hwy.	No
24	Pointe South MS	82.6	7.4	6.0	1.1	Bennett's Mill MS	31.6	61.1	5.2	1.6	Other	Yes
25	Clements MS	53.4	40.2	3.8	0.1	Indian Creek MS	71.5	18.9	7.8	0.1	Other	No

Source: Urban Institute analysis of 2019–20 Precisely middle school attendance boundaries and 2010 US Census Bureau data.

Notes: Ac. = academy; bndy. = boundary; Hwy. = highway; MS = middle school; Res. = residential. "Other" boundary types are those that do not coincide with roads. Rankings are based on an analysis of 2,624 school boundary pairs in the Atlanta metropolitan area, using geographic information system analysis and using an unequal boundary index capturing absolute differences in the (1) demographics of blocks near the schools' shared boundaries, (2) demographics of all blocks in the schools' attendance boundaries, and (3) demographics in the schools' enrollment, according to the 2018–19 National Center for Education Statistics Common Core of Data.

TABLE A.3

The Most-Unequal High School Boundaries in Atlanta

Racial and ethnic breakdown of neighboring attendance boundaries

Rank	School name	Black (%)	White (%)	Hispanic (%)	Asian (%)	School name	Black (%)	White (%)	Hispanic (%)	Asian (%)	Bndy. type	District bndy.
1	Towers HS	83.4	11.1	3.5	0.4	Druid Hills HS	48.3	39.5	3.0	6.6	Hwy.	No
2	Grady HS	57.2	29.1	4.1	6.8	Booker T. Washington HS	90.3	4.5	2.8	0.7	Hwy.	No
3	Meadowcreek HS	28.5	21.7	35.2	12.1	Parkview HS	15.0	39.5	13.3	29.5	Other	No
4	Cross Keys HS	11.0	25.3	56.1	6.2	Chamblee Charter HS	4.9	47.1	41.2	5.1	Res.	No
5	Discovery HS	29.9	30.9	23.7	13.0	Brookwood HS	15.0	62.7	10.2	9.5	Other	No
6	Whitewater HS	19.5	68.9	6.3	2.4	Lovejoy HS	65.4	25.6	4.2	1.8	Other	Yes
7	Hillgrove HS	26.5	57.9	9.8	4.0	Osborne HS	37.8	29.9	26.8	2.7	Hwy.	No
8	Lakeside HS	22.9	45.1	20.0	9.2	Cross Keys HS	14.9	18.5	56.8	8.4	Hwy.	No
9	North Atlanta HS	31.4	50.7	12.9	1.9	Douglass HS	92.4	3.2	2.4	0.7	Other	No
10	Loganville HS	5.1	86.1	6.7	1.1	South Gwinnett HS	40.0	45.3	9.5	1.7	Other	Yes
11	Meadowcreek HS	26.2	11.5	54.4	6.0	Lakeside HS	29.0	30.2	33.7	4.7	Other	Yes
12	North Springs HS	30.0	53.3	9.4	3.3	Walton HS	3.0	86.2	1.7	7.4	Other	Yes
13	Fayette County HS	30.4	59.1	7.3	2.0	Mundy's Mill HS	80.0	8.3	6.5	2.6	Other	Yes
14	Cross Keys HS	19.4	20.4	52.8	5.0	Druid Hills HS	21.8	54.1	8.7	11.9	Hwy.	No
15	Shiloh HS	48.2	31.7	10.1	6.7	Brookwood HS	17.4	64.3	7.2	8.0	Hwy.	No
16	Maynard H. Jackson Jr. HS	50.1	41.4	4.1	1.9	Grady HS	34.4	56.6	3.6	2.3	Res.	No
17	Marietta HS	39.6	25.9	27.2	2.6	Wheeler HS	30.6	45.3	13.2	6.1	Other	Yes
18	Lakeside HS	47.0	30.0	13.8	6.5	Stone Mountain HS	76.5	12.5	3.3	4.9	Hwy.	No
19	Douglass HS	94.4	2.0	2.1	0.1	Grady HS	71.6	22.5	3.5	0.8	Other	No
20	Creekside HS	59.5	26.4	12.0	0.1	Northgate HS	19.9	56.5	21.8	0.0	Other	Yes
21	Hampton HS	17.0	74.8	4.0	1.1	Lovejoy HS	68.4	16.2	10.8	2.4	Other	Yes
22	Decatur HS	31.7	61.1	2.8	1.7	Maynard H. Jackson Jr. HS	47.7	46.8	2.3	1.1	Res.	Yes
23	Brookwood HS	15.4	63.4	7.7	11.1	South Gwinnett HS	57.2	26.8	10.3	2.1	Hwy.	No
24	Hillgrove HS	24.1	68.3	3.9	1.7	McEachern HS	37.5	46.1	11.0	3.4	Other	No
25	Meadowcreek HS	29.0	14.1	46.9	7.9	Tucker HS	22.3	56.8	11.4	6.7	Other	Yes

Source: Urban Institute analysis of 2019–20 Precisely high school attendance boundaries and 2010 US Census Bureau data.

Notes: bndy. = boundary; HS = high school; Hwy. = highway; Res. = residential. "Other" boundary types are those that do not coincide with roads. Rankings are based on an analysis of 2,624 school boundary pairs in the Atlanta metropolitan area, using geographic information system analysis and using an unequal boundary index capturing absolute differences in the (1) demographics of blocks near the schools' shared boundaries, (2) demographics of all blocks in the schools' attendance boundaries, and (3) demographics in the schools' enrollment, according to the 2018–19 National Center for Education Statistics Common Core of Data.

Notes

[1] Even in school systems that have implemented school choice mechanisms, student residential addresses and attendance boundaries still play an important role in determining the order in which students are admitted into oversubscribed schools.

[2] Alvin Chang, "We Can Draw School Zones to Make Classrooms Less Segregated. This Is How Well Your District Does," *Vox*, last updated August 27, 2018, https://www.vox.com/2018/1/8/16822374/school-segregation-gerrymander-map.

[3] Nikole Hannah-Jones, "Choosing a School for My Daughter in a Segregated City," *New York Times Magazine*, June 12, 2016, 34, https://www.nytimes.com/2016/06/12/magazine/choosing-a-school-for-my-daughter-in-a-segregated-city.html.

[4] "Fault Lines: America's Most Segregating School District Borders," EdBuild, accessed February 21, 2021, https://edbuild.org/content/fault-lines.

[5] We define elementary schools as any school serving grades K through 5 or that has "elementary" in the name. Middle schools are those that serve any grades 6 through 8. High schools are those that serve grades 9 through 12.

[6] We link school attendance boundaries to census blocks using centroid matching. In most urban contexts, census blocks are smaller than SABs, so centroid matching generates an accurate representation of the population assigned to a given school. For cases in which census blocks overlap imperfectly with SABs, we assume the block is fully assigned to the SAB in which its centroid is contained.

[7] Another option could be pairing schools in some places that would not involve changes to the boundaries so much as changing grade structures.

[8] J. D. Capelouto, "What History and State Law Say about the Push for Buckhead to Become Its Own City," *Atlanta Journal-Constitution*, January 21, 2021, https://www.ajc.com/news/atlanta-news/what-history-and-state-law-say-about-the-push-for-buckhead-to-become-its-own-city/X427EODULFFMTL3YKCT3U5REEM/.

[9] See appendix figure A.2 to view 2017 estimates based on LODES employment data.

[10] In some cases, a given geographic line can separate more than one school pair. This happens when schools share almost identical attendance zone polygons, which is uncommon in most school districts.

[11] Tim Henderson, "A Change in Politics with More Black Voters in the Deep South," *Stateline* (blog), Pew, August 12, 2019, https://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2019/08/12/a-change-in-politics-with-more-black-voters-in-the-deep-south.

[12] "The Changing Face of Atlanta," Georgia State University, Andrew Young School of Policy Studies, Center for State and Local Finance, accessed February 15, 2021, https://cslf.gsu.edu/changing-face-atlanta/#1522901338628-b7688652-d976.

[13] "School Zones and Boundary Maps," Atlanta Public Schools, accessed February 22, 2021, https://www.atlantapublicschools.us/page/832.

[14] We identify whether boundaries coincide with different types of roads by linking our data to the US Census Bureau's TIGER/Line shapefiles on US roads.

[15] Freeman v. Pitts, 503 U.S. 467 1992.

[16] "Ashford Park Elementary School," GreatSchools.org, accessed February 15, 2021, https://www.greatschools.org/georgia/atlanta/778-Ashford-Park-Elementary-School/.

[17] See the National Historical Geographic Information System technical documentation on geographic crosswalks between decennial census data: "Geographic Crosswalks," IPUMS, accessed February 22, 2021, https://www.nhgis.org/user-resources/geographic-crosswalks.

[18] sean reardon, Andrew Ho, Ben Shear, Erin Fahle, Demetra Kalogrides, Heewon Jang, and Belen Chavez, "Stanford Education Data Archive (Version 4.0)," accessed February 25, 2021, https://edopportunity.org/get-the-data/seda-archive-downloads/.

[19] We use the archive's Grade Cohort Standardized scale, which standardizes the unit means relative to the average difference in National Assessment of Educational Progress scores between students one grade level apart.

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