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Racial Disparities in School Poverty and Spending: Examining Allocations Within Metropolitan Areas

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Racially segregated schools influence the distribution of educational opportunity. When students of different races enroll in separate schools, systematic differences in access to school resources and exposure to high levels of student need can emerge. Using recently available national school-level finance data, we find that typical Black and Hispanic students attend schools with higher per-pupil spending but also higher proportions of low-income students and English learners than typical White students living in the same metropolitan area. Drawing on estimates of the additional spending required to provide high-need students with equal educational opportunities, we find that cost-adjusted spending in the average Black and Hispanic students' schools ranges from zero to 17.2% less than that in the average White students' schools. Racial disparities in cost-adjusted spending are larger in the largest metropolitan areas and in the Northeast, indicating that many Black and Hispanic students are disadvantaged by these inequities.

Keywords: *race, equity, disparities, finance, descriptive analysis*

Racial segregation across schools in the United States remains stubbornly high. A recent analysis reports that across the 100 largest metropolitan areas during the 2018–2019 school year, the percentage of students who are White in the average White student's school was 43 points higher than in the average Black student's school and 30 points higher than in the average Hispanic student's school (Potter, 2022). Owens (2020) reports that while Hispanic–White segregation decreased somewhat between 1990 and 2020, Black–White segregation increased over the same period.

The fact that Black and White and Hispanic and White students tend to enroll in separate schools creates the possibility that educational experiences and opportunities differ significantly across racial groups. At least two factors influence the educational experience students receive in school. One is the level of school spending. Studies have demonstrated that higher levels of school spending help to improve student outcomes and close academic achievement gaps (Hyman, 2017; Jackson & Mackevicius, 2024; Jackson et al., 2016; Lafortune et al., 2018). A second factor is the educational needs of students attending the school, which for multiple reasons influence the amount of spending required to provide opportunities to achieve educational outcomes. For instance, students from low-income backgrounds, on average, will require more compensatory education and student support services to progress successfully through school. In addition, high-poverty schools have difficulty attracting and retaining high-quality teachers.

The Every Student Succeeds Act required school districts to provide school-level spending data, which allow more precise examination of school funding disparities than district-level data traditionally used to develop measures of school finance equity. Recent studies have used these data to assess differences in school funding by race and find that across districts within states and across schools within districts, per-pupil spending in 2018 tended to favor Black and Hispanic students compared with White students (Blagg et al., 2022; Lee et al., 2022).[1] Like these other studies, we use these nationwide school-level spending data. However, we add to previous studies by considering racial differences in school funding in conjunction with racial differences in exposure to student needs. By doing so, the analyses presented here help to provide a more complete assessment of racial differences in educational opportunities created by school segregation.

In this study we estimate within-metropolitan area differences in per-pupil spending in the average Black, Hispanic, and White students' schools. Consistent with the results in Lee et al. (2022) and Blagg et al. (2022), this comparison indicates that per-pupil spending in the average Black and Hispanic students' schools are, respectively, 8.8% and 5.1% higher than in the average white students schools. Next, going beyond the analyses in these other studies, we demonstrate that there are large differences in the level of educational needs in the schools attended by average Black, Hispanic, and White students. For instance, among schools

in the same metropolitan area, the percentage of low-income students in the average Black student's school is 85% greater than that in the average White student's school, and the average Hispanic student attends a school with more than two and a half times the percentage of English-language learners (ELLs) in the average White student's school.

Next, we draw on estimates of the additional cost of serving low-income and ELL students drawn from the literature to compute adjusted measures of per-pupil spending. Although other studies have adjusted estimates of average school spending for Black, Hispanic, and White students for differences in teacher wages, no recent studies have adjusted these school spending estimates for differences in the level of student need faced by different schools. Judgments about whether the additional spending that schools attended by Black and Hispanic students receive is sufficient to address the additional costs associated with higher levels of student need depend on the estimates of those additional costs. Using estimates of these costs based on existing literature, we find that the typical Black students' school receives between zero and 14.1% and the typical Hispanic students' school receives between 3.3 and 17.3% less than the cost-adjusted per-pupil spending in the typical White students' school. These disparities are particularly large in the largest metropolitan areas and in the Northeast.

The rest of this paper is organized as follows: The second section provides a brief conceptual discussion relating school segregation, school funding, and equal educational opportunity that justifies some of our analytic choices. The third section describes the data and sample. The fourth section describes our measures of racial disparities in school spending, in exposure to classmates with various educational needs, and in cost-adjusted school spending. The fifth section presents the results, and the final section concludes.

Segregation and Equal Opportunity

Other studies have focused on racial and other disparities in spending across schools within school districts and across school districts within states. Such analyses provide important insights. In this study we are interested in the effects of racial segregation across schools within a metropolitan area on the distribution of educational opportunities. Racial segregation is primarily a metropolitan-level phenomenon in two senses. First, most racial segregation occurs across district boundaries rather than between schools within the same district. Second, most of the forces driving racial segregation happen within metropolitan areas rather than between metropolitan areas. For this reason, we focus on differences in factors influencing educational opportunities across different racial groups living in the same metropolitan area.

Housing market segregation is a major factor contributing to school segregation within metropolitan areas (Monarrez, 2023). Racial segregation within housing markets results from several factors, including the cost of providing housing in different areas, income differences across racial groups, differential demand for locational amenities, preferences over the racial composition of neighborhoods, and historical and ongoing discriminatory practices. The placement of school district boundaries influences these segregating processes by generating differences in public service and local tax policies within metropolitan areas that contribute to geographic sorting by race and income (Monarrez, 2023; Saporito & Sohoni, 2006;). Recognizing that residential segregation spans school district boundaries, many policy efforts have focused on metropolitan area–wide, interdistrict efforts to promote school integration such as those undertaken in Connecticut and the St. Louis, Seattle, and Louisville areas (Cobb et al., 2011; Hogrebe & Tate, 2019; Liu, 2007; Orfield, 2015; Orfield & Frankenberg, 2011).

Although some studies of segregation document segregation across regions and states, a larger number of studies recognize that racial segregation is primarily a metropolitan-level phenomenon and use metropolitan areas as a unit of analysis (Ayscue & Orfield, 2015; Bischoff, 2008; Clotfelter, 1999; Owens et al., 2016; Sohoni & Saporito, 2009). A recent example is the School Segregation in Cities Across America Mapped project (Potter, 2022). In addition to high levels of racial segregation within metropolitan areas, this study finds that the bulk of White–non-White school segregation in U.S. metropolitan areas is between districts, although a significant proportion also occurs within districts. Because we are interested primarily in understanding the consequences of school segregation, we follow the bulk of the segregation literature and focus on differences across schools and students within metropolitan areas.

In assessing the consequences of school segregation, we are interested in whether the largely separate schools attended by students of different races provide equal opportunities to learn. The notion of equal opportunity is notoriously difficult to define. In terms long familiar in the school finance literature, the difficulty lies in specifying the object that ought to be distributed equally across racial groups. In a classic treatment, Berne and Stiefel (1984) identify three categories of objects: (1) inputs or physical resources, (2) outputs such as student achievement, and (3) outcomes such as lifetime earning potential, income, and welfare. Few would argue that dollars spent is an adequate measure of any of these objects. Because the costs of educational resources, most notably teachers, varies across geographic areas, dollars alone do not provide a good estimate of resources provided by a school. In addition, schools with concentrations of low-income students, ELLs, and other categories of students who tend to enter school with greater educational needs than other students will need to provide additional services and thus require additional resources to provide their

students equal chances of achieving academic standards or outcomes on par with other groups (Duncombe et al., 2015).

The analyses presented here focus on assessing whether school funding provides Black, Hispanic, and White students equal chances of achieving academically. Thus, the primary object in these analyses corresponds to Berne and Stiefel's notion of outputs. As Bifulco (2005) points out, however, the notion that equal opportunity requires providing equal chance to achieve academic outcomes has some ambiguity. On one version of this standard, which Bifulco (2005, p. 174) calls "equal services," expected achievement (e.g., the percent achieving proficiency) in school *s* should equal the expected achievement in any other school were that other school to have the same mix of students as school *s*. The equal expectation standard, in contrast, demands that the expected achievement in school *s* be the same as in any other school regardless of the mix of students served. In the case of racial equality, the equal expectation" standard demands that expected achievement in the typical Black or Hispanic student's school equals that in the average White student's school.[2]

Which standard, equal services or equal expectations, is more appropriate for assessing funding disparities between racial groups depends on one's view of what the ideal of equal opportunity entails[3] and of the role public schools should play in promoting racial equality. Given this country's history of racial discrimination and oppression, a strong case can be made for the equal expectation standard, but this is not the place for that argument. An assessment of our progress relative to either standard is likely to be of interest to anyone concerned with racial equality in education.

In this study we attempt to provide a more complete assessment of whether differences in per-pupil funding across schools provide Black and Hispanic students with educational opportunities on par with those provided in the typical White student's school. Using measures developed by Bifulco (2005) and conceptually similar to those used by Carr et al. (2007), we develop measures of racial disparities that account for both the distribution of spending across schools and the additional costs in schools that have higher levels of student need. Unlike Bifulco (2005), we compute these disparity measures using school-level rather than district-level measures of spending and student needs and thus provide more precise as well as more recent estimates of racial disparities. Estimates of these racial disparity measures add to recent school-level examinations by Lee et al. (2022) and Blagg et al. (2022) by assessing whether spending differences across racial groups are sufficient to address differences in student needs across schools.

Data and Sample

The data used for the analysis are drawn from National Center for Education Statistics' Common Core of Data (CCD) school-level enrollment and directory files for the 2018-2019 school year, the Edunomics Lab School Spending Data Hub, the Stanford Education Data Archive (SEDA), and the Civil Rights Data Collection. Our sample is limited to schools located in U.S. metropolitan areas. We do this for three reasons. First, consistent with much of the literature on segregation, we are concerned primarily with understanding the consequences of segregation across schools and districts resulting from sorting processes within metropolitan areas. Second, the efficacy of within-district desegregation efforts is limited by the fact that a large portion of segregation is between districts, and efforts to influence the movement of populations between metropolitan areas are usually beyond the scope of educational policy. Thus, efforts to address school segregation often involve interdistrict and even metropolitan-wide strategies. Finally, the costs of educational resources, most notably teachers' wages, vary across metropolitan areas, and limiting comparisons with schools in the same metropolitan area helps to make the funding figures we examine more comparable.[4]

Among schools located in metropolitan areas, the sample is limited to schools operated by districts classified by the CCD as regular local school districts or local school district components that serve one or more grades between kindergarten and grade 12. Only districts with valid, normed school level spending data are included in the sample.[5] We also dropped schools that have extreme per-pupil spending values[6] and do not have valid counts of economically disadvantaged students or students eligible for free or reduced-price lunch, ELLs, or special education students. Finally, we dropped charter schools, special education schools, and schools in metropolitan areas where $<50\%$ of the schools remained after applying the above-listed sampling restrictions. The final sample includes 57,508 schools in 6,168 school districts and 351 metropolitan areas. The sample includes 79.3% of all schools with enrollment in one or more grades between kindergarten and grade 12 located in a metropolitan area. About 75% of all Black and Hispanic students in the United States in 2018 attended one of the schools in our sample.

The key variables in our analysis are school-level measures of per-pupil spending and the percentages of students who are eligible for free or reduced-price lunch (which we take as an indicator of residing in a low-income family), ELL status, and receiving special education services. School-level spending estimates for the 2018–2019 school year are drawn from the National Education Resources Database on Schools (NERD$). We use the NERD$ per-pupil total normed spending at the school level. The normed per-pupil spending variable is intended to be comparable across states and includes salary and benefits of full-time staff as well as the school's share of central expenditures. Expenditures on transportation, food services, debt, capital, equipment, special education transfers to private schools, adult education,

TABLE 1
Summary Statistics for Sample and Population, 2018–2019

Statistic	Schools and districts in		
	Study sample	U.S. metropolitan areas	United States
Number of schools	57,508	72,530	93,835
Number of districts	6,168	7,215	13,346
Number of metropolitan areas[a]	351	383	383
Total enrollment	35,871,592	42,344,711	49,113,877
% Black	15.4	15.7	14.9
% Hispanic	28.8	29.7	27.5
% White	44.4	43.4	46.9
% Low income	50.4		
% English language learner	11.8		
% Special education	16.0		
Per-pupil spending	13,744		

[a]Our sample excludes metropolitan areas where <50% of the schools in the area remain after applying our school-level sampling restrictions.

and pre-K expenditures are excluded from the normed spending figure. The percent eligible for free or reduced-price lunch in each school is drawn from Stanford Education Data Archive (SEDA) and school-level percentages of ELL and special education students from the Civil Rights Data Collection.[7]

Some portion of school spending reported in the NERD$ is for resources located in central school offices and/or that support multiple schools in the district. Despite efforts to standardize reporting, the treatment of such costs may differ across districts, which has implications for comparison of spending between schools in different districts. If some districts classify a larger portion of spending as central district expenditures, those costs are allocated to schools on a simple per-pupil basis, and the actual distribution of benefits from district resources is correlated with the racial composition of a school, then this could create bias in measures of resource disparities across schools. To assess the extent of bias in our estimates of racial disparities in school spending, Appendix A presents several alternative estimates of these disparities, each of which makes different assumptions about the allocation of central district resources. The results of these robustness checks are discussed further in the "Results" section.

With the onset of direct certification for free-lunch eligibility and particularly the adoption of the Community Eligibility Provision beginning around 2011, free or reduced-price lunch eligibility has become less comparable across districts. As explained by Greenberg et al. (2019), as states adopt the CEP, some report free or reduced-price lunch eligibility in CEP schools as 100% of students receiving free or reduced-price lunch, whereas others report information from the most recent administration of paper forms or report direct certification counts instead. To address these issues, we use free or reduced-price lunch eligibility data prepared by the Stanford Education Data Archive, which makes a number of improvements to free or reduced-price lunch eligibility data reported in the CCD. The Stanford Education Data Archive measures set free lunch and free or reduced-price lunch eligibility rates at 100% in CEP schools and counts of zero equal to missing and then draw on past years' free or reduced-price lunch eligibility counts, the proportion of students at each school who are classified as economically disadvantaged in EDFacts data, information provided directly by state departments of education, and schools' racial and ethnic composition, urbanicity, and grades served to impute all missing free or reduced-price lunch eligibility values.[8,9]

Table 1 compares schools in our sample with the broader populations of schools in metropolitan areas and all schools in the United States. Although only slightly more than half of all school districts in the United States are located in metropolitan areas, districts outside metropolitan areas tend to have small enrollments. Also, Black and Hispanic students are overrepresented in metropolitan areas, and as a result, nearly 91% of all Black students and 93% of all Hispanic students in the United States attend a school located in a metropolitan area. Due to the data limitations described earlier, we are not able to include all schools and districts in metropolitan areas. However, the racial composition of the schools and districts in our sample is similar to that for all schools and districts located in metropolitan areas.[10]

Measures of Racial Disparities

School Spending Disparities

To measure racial disparities in access to school funding, we compare per-pupil spending in the average Black and Hispanic students' schools to that in the average White student's school in the same grade and metropolitan area. We begin by computing the average per-pupil spending for

Black, Hispanic, and White students in each grade and metropolitan area—a total of three racial groups × 13 grades × 351 metropolitan areas = 13,689 different averages. Within each grade and metropolitan area, we use school-level spending data to compute these averages as follows:

$$\overline{Y}_r = \sum_{i=1}^{i=S} \frac{n_{ir}}{N_r} Y_i(100) \quad (1)$$

where $\overline{Y}_r$ is the average per-pupil spending for the racial group r in a given grade and metropolitan area, n_{ir} is the count of students in racial group r in the grade in school i, N_r is the count of students in the racial group in the grade in the metropolitan area, and Y_i is the per-pupil spending in school i.

Next, we compute the ratio of the per-pupil spending for Black (Hispanic) students over the percent for White students, again for each grade-by-metropolitan area: $D_{gm} = \overline{Y}_{r1} / \overline{Y}_{r2}$. To obtain a single overall disparity measure for a metropolitan area, we take a weighted average across each of the grade-specific disparities, and for a single measure across multiple metropolitan areas, we take a weighted average of each metropolitan-specific disparity. The weights for the Black–White disparity measures are based on the count of Black students, and for the Hispanic–White disparity measures we use the count of Hispanic students.

The resulting measures can be interpreted as the ratio of per-pupil spending in the average Black (Hispanic) student's school and in the average White student's school, controlling for metropolitan area and grade. Values over (under) one indicate that average per-pupil spending in schools attended by Black or Hispanic students is greater (less) than average per-pupil spending in schools attended by White students. The measure is similar to what would be obtained from a student-level regression of the log of per-pupil spending in student i's school on the student's race controlling for metropolitan area-by-grade fixed effects. Basing this disparity measure on comparisons of students in the same metropolitan area ensures that the measures are not contaminated by differences in the cost of educational inputs (e.g., teacher wages) across metropolitan areas. Also, by basing our measure on comparisons of students in the same grade, we do not confound differences across races with differences in the grade level of the school.[11]

Disparities in Exposure to High-Need Classmates

To assess differences in student needs in the schools attended by Black, Hispanic, and White students, we use measures similar to the measures of racial disparities in school spending. We compute the percentage of free and reduced-price lunch–eligible, ELL, and special education students in schools attended by Black, Hispanic, and White students by replacing Y_i in equation (1) with the percent of each need category in the school. These measures are sometimes referred to as *exposure measures* in the school segregation literature—in this case exposure to students in each specific need category. We take a weighted average of exposure for each racial group across grades and metropolitan areas as described earlier. Our disparity measure is the ratio of Black (Hispanic) students' exposure to the students in a given need category to White students' exposure to students in that need category and has a similar interpretation as the measure of spending disparities.

Disparities in Cost-Adjusted Spending

To assess whether differences in school spending across races are sufficient to address differences in student needs across schools attended by different racial groups, we compute measures of per-pupil spending that adjust for differences across schools in the costs of achieving academic standards. Several factors influence the cost of achieving academic standards. One is resource prices, most significantly competitive wages for teachers. School size can affect the ability to exploit economies of scale, and the sizes of school catchment zones can affect cost of auxiliary services such as transportation. Also, several categories of students may require extra services, and thus additional resources, to achieve educational goals. Low-income students, on average, have fewer supports at home and face more stressors outside of school that require additional services to address. Similarly, ELLs and special education students require additional services (Duncombe et al., 2015).

Because the spending disparity measures discussed earlier are based on a comparison across schools in the same metropolitan areas, they effectively control for differences in teacher wages and other resource prices across local labor markets. Also, past studies suggest that the effects of school or district size on costs and the correlation between racial composition and school size (within metropolitan areas) are not large enough to substantially affect estimates of racial disparities (Bifulco, 2005). Thus, in our analysis, we focus on adjusting for additional costs of providing students in high-need categories with an equal chance of achieving academic standards—which include both the cost of any compensating wage differentials required to attract and retain high-quality teachers in high-need schools and the cost of additional services required to provide high-need students with equal expectations of achieving academic standards.

Various approaches for estimating differences in the costs of achieving educational standards across schools have been developed. These include professional judgment, successful schools, and cost-function approaches (Duncombe et al., 2015). Both the professional judgment and successful schools approaches specify a set of services and service models that will enable schools with different characteristics and student bodies to reach achievement standards.[12] The resources required to provide these services are then identified and priced. A criticism of these approaches is that there is often little evidence that the service models specified

actually allow schools to achieve academic standards or that other service models could not achieve academic standards at lower cost (Rose et al., 2004). The cost-function approach, in contrast, estimates the empirical relationship between school spending and cost factors such as teachers' wages, school size, and percentages of students in various high-need categories controlling for student achievement. The parameter estimates from these models allow us to predict the spending required by a school with given characteristics to achieve a specified educational standard. This approach does not specify services or service models that schools might use but rather allows that performance standards may be achieved in a variety of ways.

Cost-function estimates allow the calculation of pupil weights that reflect how much more spending is required, on average, to give students in a particular need category the same likelihood of achieving academic standards as students not in that category (Duncombe & Yinger, 2005a). Pupil weights can be incorporated into the calculation of the cost-adjusted disparity measures as follows:

$$CD_m = \frac{\sum_{s=1}^{S}\left[\frac{B_{sm}}{B_m} Y_{sm} / \left(1+\sum_i W^i C^i_{sm}\right)\right]}{\sum_{s=1}^{S}\left[\frac{W_{sm}}{W_m} Y_{sm} / \left(1+\sum_i W^i C^i_{sm}\right)\right]} \quad (2)$$

where CD_m is a measure of the cost-adjusted Black–White (or Hispanic–White) spending disparity in metro area m; B_{sm} / B_m is the share of Black (Hispanic) students in metropolitan area m who attend school s; W_{sm} / W_m is the share of White students in metropolitan area m who attend school s; Y_{sm} is per-pupil spending in school s; C^i_{sm} are the proportions of students in the school in various need categories such as free lunch–eligible, ELL, and receiving special education services; and W^i are weights that reflect how much more, proportionally, it costs to educate a student in need category i than students not in that category. The term $\left(1+\sum_i W^i C^i_{sm}\right)$, which appears in the numerator and denominator, adjusts spending downward in the schools with greater shares of high-need students.

This approach to adjusting per-pupil spending for costs depends crucially on the pupil weight parameters used (W^i) in equation 2). Many states use pupil weights of this kind in state aid formulas (Education Commission of the States, 2021). The empirical basis for the weights used in state aid formulas is unclear, and the weights are as likely to reflect political considerations as estimates of educational costs. For this analysis, we rely on empirically based pupil weights derived from studies that estimate educational cost functions. To address uncertainty about the value of pupil weight parameters, we estimate alternative Black–White and Hispanic–White disparity ratios applying three sets of weights, which we refer to as low, medium, and high. Appendix C describes our selection of low, medium, and high weights, which are based on the most recent estimates for each of the states included in Table A3. For free and reduced-price lunch–eligible students, the low, medium, and high weights are 0.33, 0.50. and 1.25, respectively. For ELLs, the weight is set to 0.10 for the low-weight case, 0.16 for the medium-weight case, and 0.92 for the high-weight case. The cost-function studies do not provide reliable guidance for choosing special education weights, and because differences in exposure to special education students across racial groups are small, the weight used for special education students has little effect on estimated racial disparities. Thus, we do not adjust for the share of special education students.

The measure defined by equation (2) tells us how much is spent in the average Black (or Hispanic) student's school relative to how much a school with that share of high-need students is required to provide its students with the same chance of achieving academic standards as students in the average White student's school. Thus, this measure reflects how far the current system is from achieving the equal expectations standard of school funding equity across racial groups. There are several limitations in this measure worth noting. First, it does not allow assessment of the equal services standard of school funding discussed earlier, which might be of interest to many. Second, cost-function estimates and the pupil weights derived from them can be sensitive to choices regarding functional form and the set of cost variables to include in the model. We have tried to choose weights based on studies that are consistent with the way the weights are deployed in equation (2). Third, the additional cost of educating high-need students may vary across schools and contexts. If so, applying the same pupil weights for all schools in our sample may lead to errors in our cost-adjusted spending measures. Given these limitations, rather than interpreting them as precise measures of racial disparities, it is best to view the measures of cost-adjusted spending disparities as illustrating the extent to which differences in the cost of serving high-need students can influence our assessment of racial equality in education funding.

Our racial disparities measures capture disparities due to the combination of differences across districts within metropolitan areas and across schools within districts. In supplementary analyses, we estimate the extent to which the racial spending disparities we document here are due to within-district and across-district differences in spending. These analyses are discussed in the next section.

Results

Disparities in Per-Pupil Spending

Table 2 presents racial disparities in school spending. Nationally, in 2018–2019, the typical Black student in our sample attended a school that received 8.8% more per-pupil spending than the typical White student, and the typical Hispanic student in our sample attended a school that spent 5.1% more than the typical White student's school. These findings, which imply $1,027 and $557 more in per-pupil funding for Black and Hispanic students, respectively, suggest somewhat larger Black and Hispanic advantages than the findings reported in Lee et al. (2022). The difference from that early study could be due either to our focus on metropolitan areas or our use of normed rather than raw NERD$ spending figures.

These national summary measures hide a considerable amount of variation across metropolitan areas. Figure 1 examines how racial disparities in spending vary across the metropolitan areas included in the sample. The standard deviation of the Black–White and Hispanic–White disparity measures are, respectively, 0.073 and 0.050. Although in 298 of the metropolitan areas in the sample more funding is provided to the average Black student's school than to the average White student's school, funding distributions favor White students in 53 metropolitan areas. In 288 metropolitan areas, more funding is provided to the average Hispanic student's school than to the average White student's school, and more funding is provided in the average White student's school in 63 metropolitan areas. The bottom panel of Table 2 shows that Black–White spending disparities are greatest in the Midwest, where spending in the average Black student's school is 13.4% higher than in the average White student's school. In contrast, spending in the average Black student's school is only 4.2% higher than in the average White student's school in the Northeast. Hispanic–White disparities are largest in the West and smallest in the Northeast.

Disparities in Student Needs

The top panel of Table 3 presents our measures of racial disparities in school-level exposure to classmates with educational needs. It indicates that the average Black student and the average Hispanic student attend a school where the percent low income is substantially greater than in the average White student's school. If we compute simple exposure indices, without controlling for grade or metropolitan area, we find that the percentages of free lunch–eligible students in the average Black, Hispanic, and White students' schools are, respectively, 66.4, 65.9, and 36.7% (not shown in the table). Our measures of racial disparities in exposure to low-income classmates reported in Table 3, which are based on comparisons of students in the same grade and metropolitan area, as described earlier, indicate that the percent low income in the average Black student's school is 85% higher and in the average Hispanic student's school is 76% higher than in the average White student's school.

TABLE 2
Racial Disparities in Per-Pupil Spending, 2018–2019

Measure	Black–White	Hispanic–White
National	1.088	1.051
Northeast	1.042	1.015
South	1.082	1.045
Midwest	1.134	1.031
West	1.097	1.074

Note. Measures indicate the per-pupil expenditures for the average Black students in a metropolitan area as a proportion of per-pupil expenditures for the average White student in the metropolitan area. Metropolitan areas in Maine, New Hampshire, New York, Massachusetts, Rhode Island, Connecticut, New Jersey, and Pennsylvania are classified as Northeast. Metropolitan areas in Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Alabama, Mississippi, Louisiana, Arkansas, Oklahoma, and Texas are classified as South. Metropolitan areas in Michigan, Wisconsin, Minnesota, North Dakota, South Dakota, Ohio, Indiana, Illinois, Iowa, Nebraska, Missouri, and Kansas are classified as Midwest. West refers to metropolitan areas in Idaho, Washington, Colorado, Utah, New Mexico, Nevada, Oregon, and California.

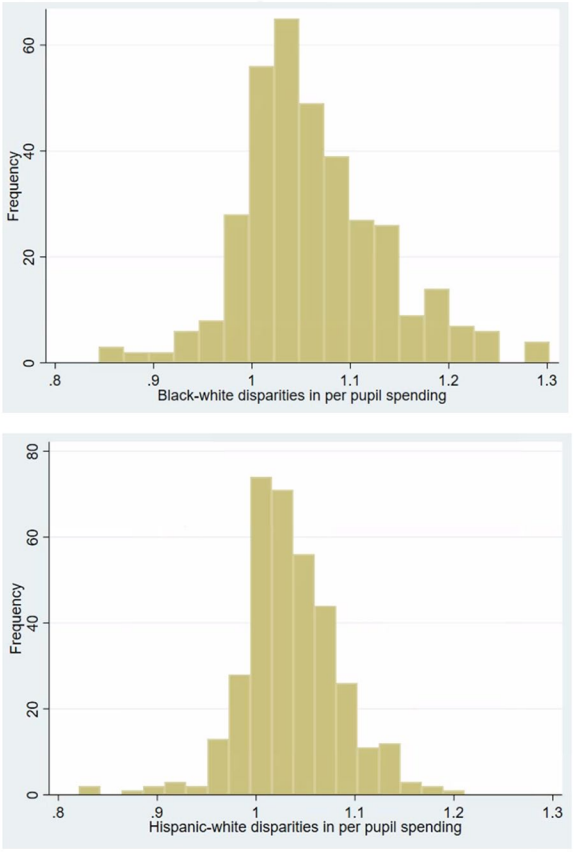


FIGURE 1. *Distribution of Racial Disparities in Per-Pupil Spending, 2018–2019*

TABLE 3
Racial Disparities in Exposure to Student Need Categories, 2018–2019

Measure	Black–White	Hispanic–White
National		
Percent free-lunch eligible	1.85	1.76
Percent English-language leaner	1.87	2.57
Percent special education	1.02	0.99
Northeast		
Percent free-lunch eligible	2.38	2.34
Percent English-language leaner	2.84	3.81
Percent special education	1.04	0.98
South		
Percent free-lunch eligible	1.63	1.53
Percent English-language leaner	1.59	2.28
Percent special education	0.98	0.96
Midwest		
Percent free-lunch eligible	2.11	1.95
Percent English-language leaner	2.01	3.16
Percent special education	1.13	1.05
West		
Percent free-lunch eligible	1.84	1.74
Percent English-language leaner	1.81	2.28
Percent special education	1.03	1.01

Note. Regions are defined as in Table 2.

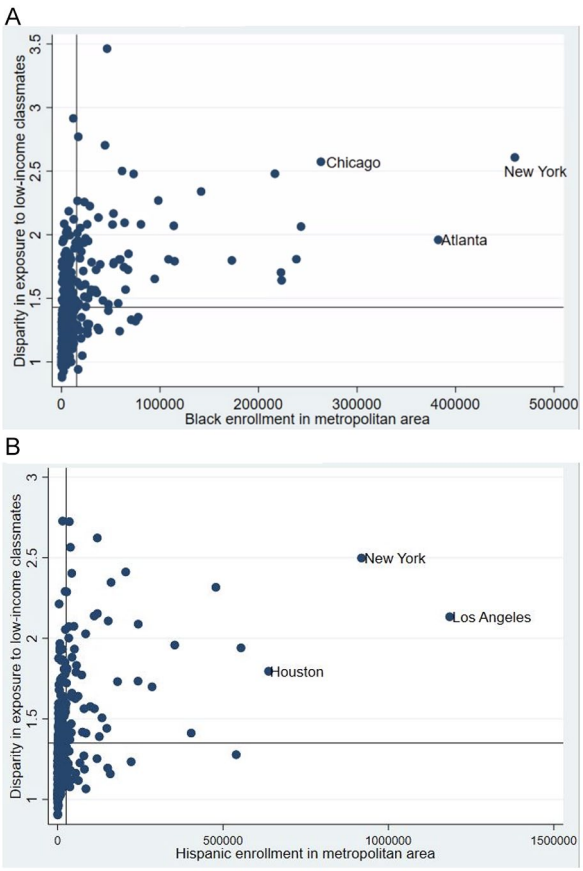


FIGURE 2. *Distribution of Racial Disparities in Exposure to Low-Income Classmates Across Metropolitan Areas, by Minority Group Enrollment, 2018–2019: (A) Black–White Disparities; (B) Hispanic–White Disparities*

Figure 2 displays the distributions across metropolitan areas for the measures of disparity in exposure to low-income students. These figures show considerable variation across metropolitan areas in the extent to which Black and Hispanic students face greater exposure to low-income classmates than White students. The mean of the distribution of Black–White disparities is 1.43. The fact that the mean of the distribution across metropolitan areas is considerably less than the disparity measure reported in Table 3 reflects the fact that disparities are largest in large metropolitan areas, which receive weights proportional to enrollment in the disparity measures presented in Table 3. For instance, the 15 metropolitan areas with the largest Black enrollments all have Black–White disparity ratios well above average, and New York City, Atlanta, and Chicago—the three metropolitan areas with the largest Black student enrollments—have disparities measures of 2.61, 1.96, and 2.57, respectively. The amount of variation across metropolitan areas is reflected by the fact that while in 17 metropolitan areas Black students' exposure to low-income classmates is actually lower than White students' exposure, in 29 metropolitan areas, Black exposure is more than twice that of White students.[13]

The distribution of Hispanic–White disparities across metropolitan areas is similar to that for Black–White disparities. Hispanic–White disparities also tend to be larger in large metropolitan areas. Los Angeles, New York City, and Houston are the three metropolitan areas with the largest numbers of Hispanic students and have disparity measures of 2.13, 2.50, 1.80, respectively. Hispanic students' exposure to low-income classmates is lower than that of White students in nine metro polytan areas, but it is more than twice as high as for White students in 22 metropolitan areas.

Across regions, racial disparities in exposure to low-income classmates are largest in the Northeast and smallest in the South. Black–White disparities are also relatively large in the Midwest. This fact is not surprising because other studies have shown the school racial segregation is also greatest in the Northeast and Midwest (Potter, 2022).

Nationwide, the percentages of ELLs in the average Black, Hispanic, and White students' schools are, respectively, 10.5, 21.8, and 5.8% (not shown in the table). When we compare exposures across racial groups within grade and metropolitan areas, percent ELLs in the average Black student's school is 87% higher, and in the average Hispanic student's school it is 157% higher (more than two and a half times higher) than in the average White student's school.

As in the case of disparities in exposure to low-income classmates, Hispanic–White disparities in exposure to

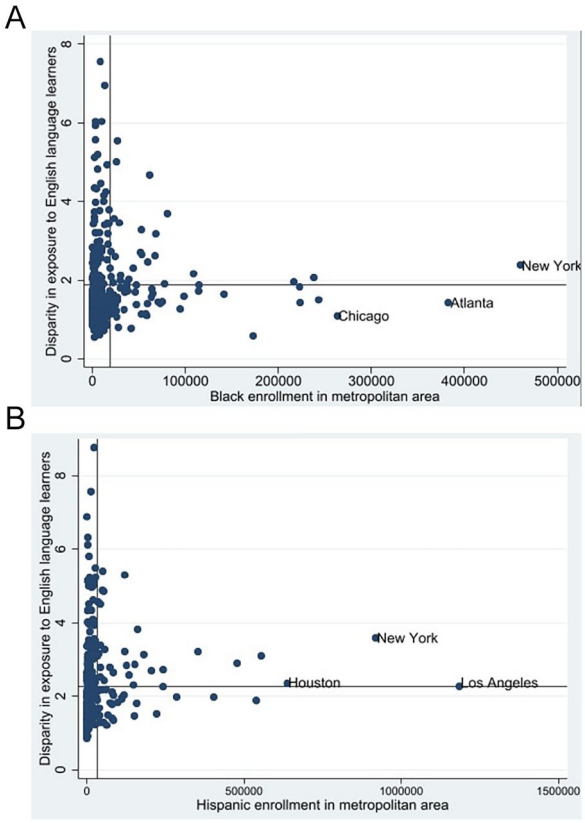


FIGURE 3. *Distribution of Racial Disparities in Exposure to English-Language Learners Across Metropolitan Areas, by Minority Group Enrollment, 2018–2019: (A) Black–White Disparities; (B) Hispanic–White Disparities*

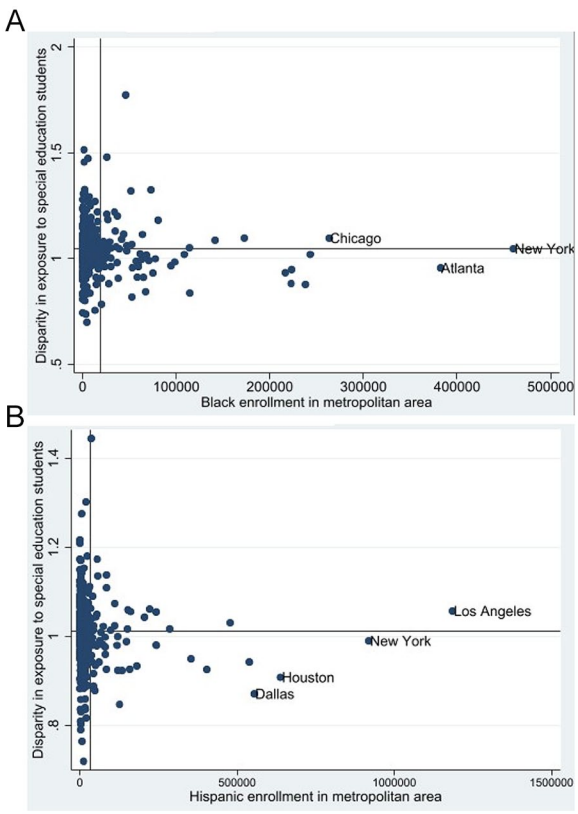


FIGURE 4. *Distribution of Racial Disparities in Exposure to Special Education Students Across Metropolitan Areas, by Minority Group Enrollment, 2018–2019: (A) Black–White Disparities; (B) Hispanic–White Disparities*

ELLs varies considerably across metropolitan areas and tend to be largest in the metropolitan areas with the largest Hispanic enrollments. For instance, as shown in Figure 3B, Hispanic–White disparities are well above average in Los Angeles, New York, and Houston and are above 2.0 in nine of the 10 metropolitan areas with the largest Hispanic populations. In contrast, the size of the Black population in the metropolitan area is not strongly related to the Black–White disparity in exposure to ELLs (see Figure 3A). Across regions, both Black–White and Hispanic–White disparities in exposure to ELLs are greatest in the Northeast, followed by the Midwest.

Racial differences in exposure to special education students are much less marked than differences in exposure to either low-income students or ELLs. For the nation as whole, the average Black, Hispanic, and White student attends a school that is 16.6, 15.5, and 16.4% special education, respectively. Our measures of racial disparities in exposure to special education classmates (presented in Table 3) are correspondingly small. Also, as shown in Figure 4, the variation in exposure to special education students across metropolitan areas is more constrained than in the cases of exposure to low-income classmates and ELLs and is not correlated with metropolitan size. Black exposure to special education classmates is roughly 13% higher than White exposure in the Midwest, but in all other regions, racial differences in exposure to special education students are small.

Disparities in Cost-Adjusted Spending

In sum, Black and Hispanic students tend to enroll in schools that spend more per pupil than do White students. Black and Hispanic students also tend to enroll in schools with much higher levels of poverty and a higher percentage of ELLs than White students. These findings raise the question of whether the additional levels of school spending Black and Hispanic students tend to have access to are sufficient to overcome the higher level of student need in the schools they attend.

The top panel of Table 4 displays estimates of cost-adjusted disparities in school-level spending. We focus first on estimates based on low-end estimates of the additional costs associated with student needs. These estimates indicate that cost-adjusted per-pupil spending in the average Black student's school is nearly equal to that in the average White

TABLE 4
Racial Disparities in Cost-Adjusted Spending, 2018–2019

	Using low-end weights		Using median of pupil weights		Using high-end weights	
Measure	Black-White	Hispanic-White	Black-White	Hispanic-White	Black-White	Hispanic-White
School-level spending						
National	0.999	0.967	0.965	0.936	0.859	0.827
Northeast	0.928	0.909	0.885	0.868	0.750	0.734
South	1.006	0.976	0.976	0.950	0.885	0.858
Midwest	1.024	0.941	0.983	0.907	0.859	0.792
West	1.012	0.986	0.979	0.953	0.871	0.838
District-level spending						
National	1.015	0.990	0.995	0.971	0.927	0.905
Northeast	0.928	0.903	0.895	0.872	0.783	0.768
South	1.013	0.994	1.001	0.982	0.957	0.938
Midwest	1.068	0.984	1.032	0.958	0.915	0.864
West	1.026	1.009	1.006	0.989	0.942	0.919

Note. Measures indicate the cost-adjusted per-pupil expenditures for the average Black (Hispanic) student in a metropolitan area as a proportion of cost-adjusted per-pupil expenditures for the average White student in the metropolitan area. Regions are defined as in Table 2. Weights are defined and discussed in Appendix C.

student's school and that the average Hispanic student has access to 3.3% less in cost-adjusted spending than the average White student. It is also noteworthy that in the Northeast, even when we assume low-end estimates of the additional costs associated with low-income students and ELLs, cost-adjusted spending in the average Black and Hispanic students' schools fall considerably short of that in the average White student's school. Hispanic students also have access to considerably less cost-adjusted spending than White students in the Midwest.

Using midrange estimates of the additional costs associated with low-income and ELL students that are set equal to the median of estimates provided by cost-function studies, the average Black student and the average Hispanic student, respectively, have access to 3.5 and 6.4% less cost-adjusted spending than the average White student. Although cost-adjusted spending for Black and Hispanic students falls short of spending for White students in all regions, racial spending disparities are particularly marked in the Northeast. The estimates in the middle panel of Table 4 indicate that in the Northeast, cost-adjusted spending in the average Black and Hispanic students' schools would need to be increased by 11.5 and 13.2%, respectively, to achieve parity with the average White student's school.

If we assume pupil weights closer to the high end of estimates from cost-function studies, racial disparities in cost-adjusted spending become quite large in all regions. These estimates indicate that the average Black and Hispanic students, respectively, have access to 14.1 and 17.3% less spending than is available to White students. Clearly, our assessments of racial differences in school funding depend crucially on how much additional costs are associated with low-income students and ELLs.

Figure 5 presents the distribution of cost-adjusted spending disparity measures across metropolitan areas—assuming midrange estimates of the additional costs associated with student needs. There is considerable variation in Black–White disparities across metropolitan areas. The Black–White disparity measure is <1, indicating disadvantage for Black relative to White students in 194 metropolitan areas, and >1 in 157 metropolitan areas. Also, disparities are relatively large in the metropolitan areas with the largest Black enrollments. Seven of the eight metropolitan areas with Black enrollments $>200{,}000$ have above-average Black–White spending disparities, and these disparities are particularly large in New York, Chicago, and Philadelphia. Hispanic–White disparity measure also tend to be large in metropolitan areas with the largest Hispanic enrollments. For 10 of the 12 metropolitan areas with $>200{,}000$ Hispanic students, the Hispanic–White disparity in cost-adjusted spending is larger than average. Hispanic–White disparities in cost-adjusted spending are particularly high in New York and Chicago.

The size of the racial disparities in cost-adjusted spending for a metropolitan area is related to the amount of segregation in the area. Figure 6 shows scatterplots of Black–White and Hispanic–White cost-adjusted spending disparities on measures of Black–White and Hispanic–White segregation. The segregation measure used is the well-known dissimilarity index, which indicates the percent of Black (or Hispanic) students in the metropolitan area who would need to change schools to achieve an even distribution of Black and White (or Hispanic and White) students across schools.[14] Higher

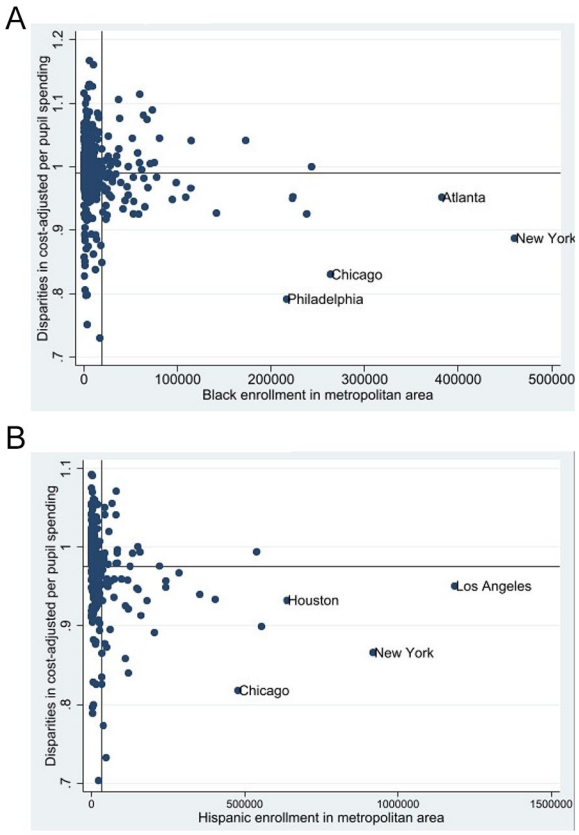
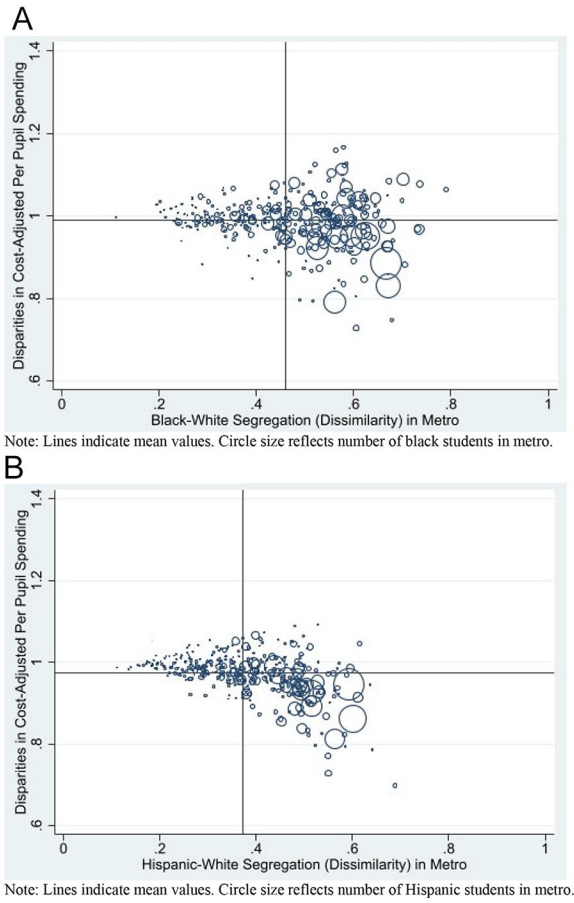


FIGURE 5. *Distribution of Racial Disparities in Cost-Adjusted Per-Pupil Spending, 2018–2019: (A) Black–White Disparities; (B) Hispanic–White disparities*



Note: Lines indicate mean values. Circle size reflects number of black students in metro.

Note: Lines indicate mean values. Circle size reflects number of Hispanic students in metro.

FIGURE 6. *Distribution of Racial Disparities in Cost-Adjusted Per-Pupil Spending Across Metropolitan Areas, by Segregation (Dissimilarity) in the Metropolitan Area, 2018–2019: (A) Black–White Disparities; (B) Hispanic–White Disparities.*
Note. Lines indicate mean values. Circle size reflects number of black students in metropolitan area.

dissimilarity indices indicate higher levels of segregation. The scatterplot shows that higher levels of segregation are associated with larger disparities in cost-adjusted spending, that is, lower Black–White and Hispanic–White spending ratios. Indeed, bivariate regressions using the entire sample of metropolitan areas shows that both the Black–White and Hispanic–White cost-adjusted spending ratio has a statistically significant negative relationship with its respective segregation measure.[15] The relationship is relatively weak among metropolitan areas with below-average levels of segregation and is relatively strong among areas with above-average levels of segregation. Of course, segregation is not a perfect predictor of cost-adjusted spending disparities because, in some metropolitan areas, particularly for Black students in the Midwest, a high level of segregation is accompanied by a relatively large unadjusted spending advantage for Black or Hispanic students.

The extent to which cost-adjusted spending disparities are driven by differences across district and by differences across schools within districts can by determined by recomputing our disparity measures using district-level spending figures rather than school-level spending. These results are shown in the bottom panel of Table 4. The fact the spending disparities are larger (less favorable for Black and Hispanic students) in the top panel of Table 4 indicates that the differences across schools within districts contribute to the cost-adjusted spending disparities. However, the extent to which cost-adjusted spending disparities are driven by differences across districts and by differences across schools within districts varies widely across metropolitan areas and particularly by region. Focusing on the midrange estimates in Table 4, we can see that in the Northeast and the Midwest, where districts tend to be smaller and more homogeneous, differences across districts play the larger role. In the Northeast, for instance, 91% of the Black–White gap and 97% of the Hispanic–White gap are due to differences across districts.[16] In contrast, in the South and West, where there are many countywide school districts, within-district differences play a larger role than in the Northeast and Midwest. For instance, in the South, none of the small gap

in Black–White spending is due to differences across districts, and all of it is due to differences across schools within districts, and only 36% of the Hispanic–White gap is due to differences across districts.

Although there are distinct regional patterns, there is also variation within region in the extent to which across-district and within-district factors account for the spending disparities documented here. The design of school finance policies to address the disparities documented here does depend on whether disparities occur largely within or between districts. However, variation across districts and metropolitan areas makes it difficult to provide general conclusions about the sources of these disparities. Policy responses will depend on patterns of segregation as well as state- and district-level finance policies and thus need to be tailored to particular metropolitan areas. Because our primary purpose here is to document disparities rather than make policy recommendations, we do not present more extensive analyses comparing within- and between-district disparities, but they are available from the authors upon request.

Conclusions and Implications for Policy

This paper contributes a new perspective on how school segregation, concentration of student needs, and school spending interact to create racial disparities in educational opportunity. Our findings extend prior research to demonstrate that while school spending allocations are progressive for Black and Hispanic students compared with their White peers, in most metropolitan areas, the progressivity of current allocations does not offset the high costs faced by schools serving Black and Hispanic students. Specifically, we find that nationwide cost-adjusted spending in the average Black student's school lags that in the average White student's school by zero to 14.1% and cost-adjusted spending in the average Hispanic student's school lags that in the average White student's school by 3.3 to 17.3%. Although assessment of racial equity in school funding clearly hinges on estimates of how much more it costs to provide low-income students and ELLs equal chance of achieving educational outcomes, examination of variation in cost-adjusted funding disparities across metropolitan areas indicates that large numbers of Black and Hispanic students are disadvantaged by segregation within metropolitan areas.

In metropolitan areas in the Northeast, where racial differences in the exposure to low-income classmates and ELLs are largest and per-pupil differences in spending are smallest, cost-adjusted spending disparities are quite large. Even with low-end estimates of the additional costs associated with low-income students and ELLs, Black and Hispanic students in the Northeast have access to significantly less cost-adjusted school spending than their White counterparts, and our high-end estimates indicate that in the Northeast, cost-adjusted spending on Black and Hispanic students would have to increase by roughly 25% to achieve parity with White students. Also, disparities in exposure to students with needs and hence cost-adjusted spending disparities tend to be large in the metropolitan areas with the largest Black and Hispanic populations. Thus, regardless of how we assess average racial differences in school funding across the United States as a whole, there are clearly many metropolitan areas where racial inequities exist and a large number of Black and Hispanic students are disadvantaged by these inequities.

The key takeaway for policymakers is that given current patterns of school segregation within metropolitan areas, progressive elements of school finance system have been insufficient to secure equal educational opportunities for students of different races. Although school financing systems do drive additional school spending for Black and Hispanic students relative to White students, racial segregation results in Black and Hispanic students attending schools with considerably higher levels of need. Indeed, metropolitan areas with the highest levels of school segregation tend to show the highest levels of cost-adjusted spending disparities. To achieve equal educational opportunities across racial groups will require school finance systems to go further in targeting additional resources toward schools with high needs and/or efforts to reduce racial disparities in exposure to high levels of student need by decreasing segregation across schools.

Reducing segregation or adopting more progressive funding policies within school districts has a role to play in reducing the disparities we document, particularly in the South, where those disparities are driven in large part by differences across schools within districts—a fact that only school-level analysis made possible by the NERD$ data reveals. However, other regions, including the Northeast and Midwest, racial disparities arise primarily across districts. Because of this fact and the fact that so much school segregation occurs across district boundaries, in many metropolitan areas, interdistrict efforts to decrease segregation across districts may be required to promote equal educational opportunities.

Appendix A: Racial Disparities in School Spending Using Alternative Assumptions About the Allocation of Central District Resources

On average, across all the schools in our sample, 18.9% of school spending is classified as central district spending. In 48% of districts (and 66% of districts where schools classify part of their spending as central district spending), central district resources are allocated to schools on a simple per-pupil basis. If some schools benefit more from central district resources, simple per-pupil allocation of these resources will make the school spending figure in the

NERD$ an inaccurate reflections of school resources. If the extent to which schools within these districts benefit from central district resources is correlated with the racial composition of schools, then our measures of racial disparities in school spending may be biased.

The fact that, on average, only 18.9% of school spending is classified as central district spending suggests that the scope for the allocation of central district spending to create bias in our measures of racial disparities is limited. To assess the potential size of any bias created by this issue more fully, we have recomputed per-pupil school spending and our measures of Black–White disparities in school spending using several alternative assumptions about the allocation of central district resources. The results are presented in Table A1.

The first column reproduces our main findings (reported in Table 2), which assume that the allocation of central district resources reported in the NERD$ is accurate. The second column assumes that all district spending (not only central district resources) is allocated equally across schools or, in other words, that any school has the same per-pupil spending as all other schools in the same district. This assumption is essentially what analyses that use district-level spending data must use. The fact that the estimated disparity is larger using the NERD$ data than what would be obtained using district-level spending data suggests that comparisons based on district-level spending can miss an important source of racial differences in school spending, which is the motivation for using the school-level spending data.

The third column assumes that the distribution of central district spending across schools matches the distribution of spending classified as school site specific in the NERD$ such that if a school has a higher level of per-pupil site spending than we assume, it also receives a higher amount of per-pupil central district spending. Our measure of Black–White funding disparity under this assumption is similar to the measure under the assumption that the allocations reported in the NERD$ are correct. The similarity of these two estimates of spending disparities indicates that the allocation of central district spending reported in the NERD$ tracks closely the distribution of site-specific resources across schools. The fact that the estimates of spending disparities are slightly higher in the third column than in the first column indicates that the distribution of site-specific spending is slightly more favorable toward schools with higher concentrations of Black students than is the allocation of central share spending to schools.

Of course, it is possible that the actual use of central district resources differs from what is reported in the NERD$ and is either more or less favorable toward schools with concentrations of Black students than is the distribution of site-specific resources. The fourth column in Table A1 presents an estimate of Black–White spending disparities that assumes that central district resources are allocated based on the count of Black students in the school such that, within the district, per-pupil central district spending in a school is perfectly correlated with the percent of students in the school who are Black. Under this assumption, the allocation of central district resources to schools is done in a way that maximizes the average per-pupil spending for Black students in the district. Thus, the estimated disparity in the first column minus the estimated disparity in the fourth column ($1.088 - 1.121 = -0.033$) represents an upper bound on the negative bias that might be introduced by the fact that many districts allocated central district spending on a simple per-pupil basis. Because the assumption that district resources are perfectly targeted in relation to the percent Black students in the school is an extreme and implausible assumption, the actual bias introduced by allocating central district spending on a per-pupil basis is likely much smaller.

The last column of Table A1 assumes that central district resources are allocated based on the count of White students in the school. This assumption maximizes the average per-pupil spending for White students in a district. Thus, the estimated disparity in the first column minus the estimate disparity in the last column ($1.088 - 1.062 = 0.026$) represents an upper bound on the extent to which the estimates based on the NERD$ are positively bias. Thus, the potential bias in the estimate of Black–White spending disparities presented in Table 2 introduced by those districts that allocate central district spending on a per-pupil basis ranges from -0.033 to $+0.026$, and because these are bounds under rather extreme and unlikely assumptions, the bias is likely much smaller in absolute terms.

The bottom panel of Table A1 presents the same alternative measures of Black–White spending disparities by region. Focusing on the last two columns relative to the first column, we see that the range of potential biases in estimates of Black–White spending disparities due to the allocation of central district spending in the NERD$ is narrower than for the nation as whole, in the South, and in the Midwest. In the Northeast and the West, however, the potential for bias due to this issue is larger. Potential biases in the Northeast and West are larger primarily because in these regions the percent of districts that allocate central district resources on a simple per-pupil basis is higher than elsewhere, and among schools allocating on a simple per-pupil basis, the percentage of school spending classified as central district spending tends to higher than average. Thus, there is wider scope for bias in the Northeast and West, although how much of this bias is actually realized in our primary estimates of resources disparities is likely much less than the upper and lower bound estimates indicate.

TABLE A1

Black-White Spending Disparity Measures under Alternative Assumptions about Distribution of Central District Resources

Area	Allocation reported in NERD$	Per-pupil school spending = per-pupil district spending	Central district spending distributed in proportion to on-site spending	Allocation of central district spending perfectly correlated with percent Black[a]	Allocation of central district spending perfectly correlated with percent White[a]
National	1.088	1.055	1.097	1.121	1.062
Northeast	1.042	1.026	1.051	1.120	0.983
South	1.082	1.041	1.091	1.098	1.069
Midwest	1.134	1.115	1.141	1.153	1.125
West	1.097	1.062	1.104	1.181	1.027

[a]For districts where central share resources are allocated on a per-pupil basis (so that per-pupil central share spending is equal across all schools in the district). For districts that allocate central resources on other than a per-pupil basis, the allocation in the NERD$ is assumed.

Appendix B: Racial Disparities in Exposure to Low-Income Classmates Using Alternative Poverty Measures

With the onset of direct certification for free-lunch eligibility and particularly the adoption of the Community Eligibility Provision, researchers have worried that free lunch eligibility has become less comparable across districts and overtime (Greenberg et al., 2019; Gutierrez et al., 2022). Inconsistencies in how accurately free lunch eligibility is reported across districts can distort our measures of racial disparities in exposure to low-income students. For instance, if schools where Black students are concentrated are more likely to use the Community Eligibility Provision and thereby overcount (or undercount) free lunch–eligible students relative to the schools where White students tend to enroll, then our measures of Black–White disparities in exposure to low-income classmates would overestimate (or underestimate) the exposure of Black students relative to White students.

To explore this issue, we recompute our measures of racial disparities in exposure to low-income classmates using an alternative indicator of student poverty. Specifically, we replace the percent free-lunch eligible in equation (1) with the Model Estimates of Poverty in Schools (MEPS) recently developed and released by researchers at the Urban Institute. The MEPS is intended to be "a school-level measure of the share of students living in poverty that is comparable across states and time and reflects, as closely as possible, the students who attend each school" (Gutierrez et al., 2022, p. 2).

Table B.1 compares the school-level racial disparity measures for 2018–2019 computed using the MEPS and using free-lunch eligibility. Measures of Black–White and Hispanic–White disparities computed using the MEPS are somewhat larger than those computed using the free-lunch eligibility measures. The MEPS estimates the percent in the school or district living in households with incomes below the poverty line. The poverty line is a lower income threshold than the threshold for free and reduced-price lunch eligibility, and a substantially lower percentage of students are below the poverty line than are eligible for free and reduced-price lunch. Thus, the fact that the estimates using the MEPS suggest larger Black–White and Hispanic–White disparities may reflect the notion that in schools where Black and Hispanic students are concentrated, a relatively high percentage of free and reduced-price lunch–eligible students live in households below the poverty line. Both sets of estimates show the same patterns of disparities across regions with larger disparities in the Northeast and Midwest and smaller disparities in the South and West. Table B.1 suggests that our estimates of disparities in exposure to low-income classmates in 2018–2019 are not overestimated and may be underestimated because of the reliance on free and reduced-price lunch eligibility counts.

TABLE B1

Racial Disparities in Exposure to Low-Income Students, 2018–2019, Using Alternative Measures of School Poverty

Region	Using MEPS		Using free and-reduced price lunch eligibility	
	Black–White	Hispanic–White	Black–White	Hispanic–White
United States	2.05	1.87	1.85	1.76
Northeast	2.63	2.45	2.38	2.34
South	1.79	1.66	1.63	1.53
Midwest	2.51	2.08	2.11	1.95
West	1.87	1.83	1.84	1.72

Note. The MEPS is a model that estimates poverty in schools developed by the Urban Institute (see Gutierrez et al., 2022).

Appendix C: Cost Functions and Pupil Weights

Most cost-function estimates take the following form:

$$Y_s = \alpha_o A_s^{\alpha_A} X_s^{\alpha_X} \exp\left(\sum_i \beta_i C_s^i\right) \quad \text{(C.1)}$$

where Y_s is per-pupil spending in district or school s, A is a vector of student performance measures for s, X is a vector of control variables, C^i is the share of students in need category i in district or school s, and α and β are parameters to be estimated. Duncombe and Yinger (2005a) demonstrate that pupil weights for each need category that represent the additional cost of giving a student in that category an equal chance of reaching a given level of achievement relative to students not in that category can be calculated using estimates of this cost function as follows:

$$W_s^i = \frac{\exp\left(\beta_i C_s^i\right) - 1}{C_s^i} \quad \text{(C.2)}$$

Deriving pupil weights from cost-function estimates depends on the functional form of the cost function estimated. However, 15 of the 18 cost-function studies that we reviewed present estimates of the form presented in equation (C.1), and equation (C.2) can be used to derive weights from these studies.

Using weights derived with this formula, the amount that a school needs to provide its students an equal chance of achieving standards as a school without any high-need students is

$$Y_s^* = Y_s^0\left(1 + \sum_i W_s^i C_s^i\right) \quad \text{(C.3)}$$

where Y_s^0 is the cost of achieving standards in a school with no high-need students. Equation (C.3) demonstrates that the weights derived from cost-function estimates of the form of equation (C.1) using equation (C.2) are additive weights. That is, adjustments to per-pupil spending requirements resulting from applying extra weight to students in one high-need category are added to (rather than, say, multiplied by) the adjustment resulting from applying extra weight to students in another high-need category.

Let Y_{blk}^* and Y_{whi}^* equal the amounts needed to achieve given academic standards in schools where the shares in each need category equal the shares in the average Black student's school and in average White student's school, respectively. Then

$$\frac{Y_{blk}^*}{Y_{whi}^*} = \frac{1 + \sum_i W_{blk}^i C_{blk}^i}{1 + \sum_i W_{whi}^i C_{whi}^i} \quad \text{(C.4)}$$

tells us how much more, proportionally, needs to be spent in the average Black student's school than in the average White student's school for chances of achieving standards that are the same at the two schools. The measure of Black–White resource disparities presented in equation (2) in the main text of this article can be derived by dividing the ratio of actual spending in the average Black and the average White students' districts by equation (C.4). The result can be interpreted as how much is spent in the average Black student's district relative to how much a school with that share of high-need students requires to provide its students with the same chance of achieving academic standards as students in the average White student's school.

This disparity measure depends crucially on the weights used for each high-need category. Our analysis bases weights on existing cost-function studies. Comparing pupil weight estimates derived from different cost-function estimates is complicated by at least three considerations. First, because it depends on the share of students in high-need categories C^i, the weights computed using equation (C.2) vary by school. Often a single constant weight for a category of students is computed by averaging the weights for that category across schools. If the constant weight is based on average shares of high-need students in the sample used to estimate the cost function, the weights will vary across studies due to differences in the samples. To address this issue, we use the average percentage of high-need students across the sample we used in this article to derive a constant weight from each of the studies we reviewed. Because the weights computed using equation (C.2) are greater for schools with high level of needs, our method of adjusting spending for the cost of high-need students likely understates the adjustments required for schools with high shares of high-need students and overstates the adjustments for low-need schools. This bias will tend to understate the cost-adjusted spending disparities between Black and White and between Hispanic and White students.

A second issue is that the estimate of β_i for any specific high-need category depend on what other cost factors are included in the cost function. Perhaps most noteworthy, most cost-function estimates we reviewed included a teacher wage index on the right-hand side to control for differences in wages across metropolitan areas and schools. If the wage index used varies across schools within metropolitan areas to reflect compensatory wages that need to be paid in schools

with high levels of student need, then the estimates of β_i will reflect only the part of the impact of high-need students on the cost of education that occurs because high-need students require additional services to reach academic standards and not the fact that schools with high shares of high-need student often must offer higher wages to attract and retain high-quality teachers. If, however, the estimated cost function includes a teacher wage index that varies only across metropolitan areas and is the same for all schools in the same metropolitan area, then estimates of β_i will reflect the effect of both the extra services and compensatory wages required in high-need schools and thus will tend to be larger than in cost functions that include more comprehensive wage indices.

Because they are based on within-metropolitan-area comparisons, our cost-adjusted racial disparities measures control for differences in teacher wages across metropolitan areas. They do not, however, adjust for compensatory wage differentials across schools within metropolitan areas. Thus, the pupil weights we use to adjust for the differential costs of achieving standards should reflect the effect of both the extra services and the compensatory wages required in high-need schools. Several of the studies we reviewed included a more comprehensive teacher wage index in the cost functions estimated, and thus the estimates of β_i in these studies reflect only the cost of extra services required in high-need schools and thus are likely to provide underestimates of the weights needed for the cost-adjusted spending measures we use.

Finally, differences in pupil weights derived from different studies may reflect the possibility that the additional cost to give high-need students an equal chance of achieving standards may vary across different contexts. If this is true, assuming that pupil weights are the same in different contexts may lead to errors in our cost-adjusted spending measures. Whether such differences are likely to lead to underestimates and overestimates of cost-adjusted racial spending disparities is difficult to say.

We reviewed 18 cost-function studies, which provide estimates of 17 cost functions of the form depicted in equation (C.1), 16 of which provide estimates of either free or reduced-price lunch or English-language learner (ELL) weight. Table C.1 provides information on these 16 cost-function estimates. To select weights for free and reduce-price lunch students, we first exclude studies for which the controls for teacher wages used reflect compensating wage differentials, and next, for states with multiple estimates, we consider only the most recent estimates. The remaining eight estimates range from 0.33 to 1.25 with a median of 0.50, which we take as our low, high, and medium case weights, respectively.

Excluding studies that control for compensating wage differentials, we have ELL weights from seven states. The lowest estimated ELL weight among these seven states is −0.23, which is based on a very imprecisely estimated cost-function coefficient (t statistic = 0.91), and the highest value is 1.67, which is far above the next-highest estimate. Rather than using these extreme values, we use the next-lowest and next-highest estimates as our low and high case weights and the median value of the seven estimates as our medium case. Thus, the low, medium, and high ELL weights that we use are 0.10, 0.16, and 0.92, respectively.

Special education students and/or students with disabilities are measured differently in each study, and the variables used are different from our measure of special education students. As a result, these studies do not provide much guidance on what weight should be used for special education students in computing our cost-adjusted spending measures. Because the average percent special education, as measured in our data, does not vary significantly across racial groups, the weight chosen for special education students has little impact on our estimates of racial disparities in cost-adjusted spending. For these reasons, we have chosen not to adjust per-pupil spending for the percent of students in special education.

TABLE C1

Pupil Weights Derived from Cost-Function Studies

State (study)	Student need variables included	Control for compensating wage differentials	FRPL weight[a]	ELL weight[a]
Wisconsin (Reschovsky & Imazeki, 1998)	FRPL, disability, severe disability, high school	No	0.44	—
New York (Duncombe et al, 2003)	Poor, LEP	No	—	1.15
Texas (Imazeki & Reschovsky, 2003)	FRPL, disabled, severely disabled, LEP, high school	Yes	0.66	−0.17
Wisconsin (Imazeki & Reschovksy, 2003)	FRPL, disabled; severely disabled, LEP, high school	No	0.42	−0.23
New York (Duncombe & Yinger, 2005b)	FRPL, disability	No	1.52	—
Kansas (Duncombe & Yinger, 2005b)	FRPL, FRPL × density, bilingual	No	0.75	0.14
Texas (Imazeki & Reschovsky, 2004)	FRPL, learning disabled, other disability, LEP, Black, Hispanic, high school	Yes	0.40	−0.326
California (Imazeki, 2008)	FRPL, LEP (Spanish speaking), LEP (other), special education, severe disabilities, high school	Unspecified	0.33	0.10
Missouri (Duncombe, 2007)	FRPL, FRPL × density	No	0.63	—
Kansas (Duncombe, 2007)	FL, FL × density, bilingual	No	0.49	0.16
Missouri (Baker, 2011)	FRPL, FRPL × density, ELL, disabled	No	0.51	0.14
New York (Yinger & Gutierrez, 2017)	FRPL, LEP, severe disabilities	Unspecified	1.25	0.61
Kansas (Taylor et al., 2018)	Economically disadvantaged, ELL, special education	Yes	1.12	0.08
New Hampshire (Atchison et al, 2020)	FRPL, ELL, disabilities, pre-K, high school	No	0.83	0.92
Vermont (Kolbe et al., 2021)	FRPL, ELL, mild disabilities, other disabilities, middle school, high school	No	0.38	1.67
Connecticut (Zhao, 2023)	FRPL, child in single-headed household	No	0.70	—

FRPL, free and reduced-price lunch; ELL, Englis-language learners; LEP, limited English proficiency; FL, free lunch

[a]Computed for schools with a share in the need category equal to the average of our sample.

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Notes

1. Lee et al (2022) also show that between-states per-pupil spending does not favor Black students and disfavors Hispanic students.

2. Here achievement level could be understood as percent achieving a minimum level of proficiency, which would be akin to the notion of equity in many conceptions of "adequacy," or average achievement scores, which would be akin to the notion of equity inherent in a relative equality standard.

3. For an extended treatment of the concept of equal opportunity, which argues for a conception that is consistent with the standard of equal expectation articulated here, see Roemer (1998).

4. Wages required to hire and retain quality teachers also can vary within metropolitan areas, primarily due to perceived working conditions in different schools and the percent of poor and other high-need students in the school. The effect of poor and high-need students on wages may be part of the pupil weights used to adjust per-pupil spending measures for student needs depending on the specification of the cost-function models from which pupil weights are derived. This issue is discussed further later.

5. A large proportion of schools in California do not have normed spending figures in the NERD$. To ensure that estimates were based on more complete samples of schools, we replaced normed spending with raw spending figures reported in the NERD$ and dropped observations flagged in the NERD$ data as having financial variable values that are implausible or otherwise problematic. Our results do not change significantly if we use normed spending figures for schools in California

6. Less than $1,500, >$50,00 and flagged by NERD$, or >$70,000. These restrictions dropped 0.25% of schools from the sample.

7. We use the 2017 file as the best approximation of student counts in 2018.

8. For details, see Fahle et al. (2021).

9. In Appendix B we recompute measures of racial disparity in exposure to low-income classmates using an alternative measure of school-level poverty and assess the extent to which inconsistencies in the reporting of free-lunch eligibility might influence our findings.

10. Differences between our sample and the population of schools and districts in metropolitan areas arise for two reasons. First, only 351 of 383 metropolitan areas in the United States are included in the sample. Most excluded metropolitan areas are small. Second, not all schools and districts in a metropolitan area are included in our sample. The median percentage of schools in a metropolitan area included in our sample is 91.7.

11. For instance, if high schools tend to spend more per pupil than elementary schools (or vice versa), and Black and Hispanics are underrepresented among high school students, then differences in school spending by race due to segregation would be confounded with differences in spending by race due to different age profiles. In fact, differences in spending across grade levels are small, so this adjustment has little effect on the estimates of funding disparities presented later.

12. For a recent example of the professional judgment approach, see Levin et al. (2018).

13. All 17 metropolitan areas have small to very small Black enrollments. These districts have a mean Black enrollment of 2,147. In contrast, the mean Black enrollment for the 29 metropolitan areas where Black exposure is more than twice that of White students is 77,207. In total, 0.6% of Black students attend schools in metropolitan areas with a Black–White disparity index of <1.0, whereas 38.8% are in a metropolitan area with a disparity index of >2.0.

14. We also examined the association with an alternative measure of segregation that compares actual Black–White and Hispanic–White exposure measures to exposure that would be observed if Black and White and Hispanic and White students were distributed evenly across schools. The results are quite similar to those we see using the dissimilarity index.

15. Results are available on request.

16. These percentages are computed by dividing 1 – the district-level spending disparity measure ($1 - 0.895 = 0.105$ for the Northeast using median pupil weights) by 1 – the school-level spending disparity measures using school-level spending ($1 - 0.885 = 0.115$ for the Northeast using median pupil weights).

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