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Racial and Socioeconomic Test-Score Gaps in New England Metropolitan Areas: State School Aid and Poverty Segregation

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EXECUTIVE SUMMARY

Test-score data show that both low-income and racial-minority children score lower, on average, on states' elementary-school accountability tests compared with higher-income children or white children. While different levels of scholastic achievement depend on a host of influences, such test-score gaps point toward unequal educational opportunity as a potentially important contributor. This report explores the relationship between racial and socioeconomic test-score gaps in New England metropolitan areas and two factors associated with unequal opportunity in education: state equalizing school-aid formulas and geographic segregation of low-income students. The underlying methods do not allow a strict causal interpretation; however, both aspects are strongly related to test-score gaps, with poverty segregation between school districts especially important in New England.

The report first explores the degree to which state school aid is progressive, that is, distributed disproportionately to districts with high fractions of students living in poverty; more progressive distributions are associated with smaller test-score gaps in high-poverty metropolitan areas. All U.S. states distribute some state revenue to support local school districts, but the extent to which such aid is focused on districts with greater concentrations of poverty varies considerably. The relationships estimated in the empirical analysis suggest that New England metro areas with high average district poverty in states with more progressive aid distributions, such as Springfield, Massachusetts, should see somewhat smaller racial and socioeconomic test-score gaps than metro areas with lower district poverty in states with less progressive school aid, such as Burlington, Vermont; that predicted difference in white-Black test-score gaps amounts to about one-quarter of the actual difference between Springfield's gap and Burlington's gap.

The second factor explored is poverty segregation; test-score gaps are larger in metropolitan areas where, compared with white children or higher-income children, minority children or low-income children go to school with, or are in school districts with, more students from low-income families. Partly because school districts (and cities and towns) are relatively small geographically in New England, poverty segregation in the region's metropolitan areas is most pronounced between districts, not between schools within school districts. The sizes of the estimated relationships suggest that metro areas with the highest between-district poverty segregation, such as Bridgeport-Stamford-Norwalk, Connecticut, should have markedly larger test-score gaps than metro areas with moderate poverty segregation between districts, such as Manchester-Nashua, New Hampshire; those predicted differences amount to 60 percent to 90 percent of the actual test-score gap differences between the Bridgeport and Manchester metro areas.

States can alter either or both of these factors via policy changes. States set the terms—and thereby the progressivity—of school-aid policy. Many states include cost adjustments in their aid formulas to offset some of the additional costs of educating students from low-income families, and some recent proposals (such as for Connecticut) or policy changes (such as in Massachusetts) involve more closely targeting state equalizing aid to high-poverty districts. State policy levers regarding between-district poverty segregation are less direct and potentially more controversial. Nonetheless, statewide affordable housing policies, such as those in Massachusetts and Rhode Island, if applied more comprehensively, might reduce concentrations of poverty and provide more low-income families access to the higher-quality schools in low-poverty suburban districts.

I. Introduction

Equal educational opportunity is a core American value. Yet analysts observe that many children of low-income or minority racial or ethnic status attend public schools that are lower quality than those that children of white or high-income parents attend. And data indicate that, on average, children of low-income or minority racial or ethnic status score lower on states' elementary-school accountability tests compared with children who are not economically disadvantaged or who are white. Such test-score gaps point toward unequal educational opportunity.

Students' educational achievement depends on a host of influences, from school spending, teacher quality, and school peers to family background, parental support, and community inputs. School spending varies markedly among school districts, which obtain revenue from local taxes and from state aid; spending disparities exist despite the fact that most states distribute aid in ways intended to offset local resource disparities. Children of different races or economic statuses may attend different schools within a district or live in different school districts, exposing them to different teachers and different fellow students. Children whose parents are able to provide "enrichment" experiences beyond school tend to do better in school; communities can provide (or lack) role models highly engaged in economic activity. Thus, gaps between the test scores of students of different races or socioeconomic statuses reflect multiple factors, many of which, in turn, reflect unequal opportunity.

As is the case elsewhere, metropolitan areas in New England display substantial racial and socioeconomic test-score gaps. This report describes the extent of test-score gaps in New England metropolitan areas. While research has not fully established the underlying causes of these gaps, various studies identify metropolitan-area characteristics that are associated with larger and smaller racial and socioeconomic disparities in test scores. This report examines two of these factors in the context of New England metropolitan areas.[1] the distribution of state education aid and poverty segregation among students.

Many states direct more per-student aid to high-poverty school districts than low-poverty districts because high-poverty districts typically have fewer local resources and because educational costs are generally higher for students living in poverty. This report builds on a study (Bradbury 2021) that finds such "progressive" (tilted toward high-poverty districts) state aid is associated with smaller racial and socioeconomic test-score gaps; specifically, test-score gaps are smaller in high-poverty metropolitan areas where the state school-aid distribution is more progressive. This report quantifies this relationship in the New England context and examines how the region's states distribute aid to local public-school districts with respect to how tilted the distributions are toward districts with greater student poverty.

Racial and socioeconomic disparities in test scores, or test-score gaps, point toward unequal educational opportunity.

Research shows a strong relationship between greater segregation and larger test-score gaps across metropolitan areas in the United States. This report builds on findings that racial and socioeconomic test-score gaps are larger in metropolitan areas where segregation by race and segregation by income (poverty) are greater both within and between school districts. This report

1 The U.S. Census Bureau says, "The general concept of a metropolitan area is that of a core area containing a large population nucleus, together with adjacent communities that have a high degree of economic and social integration with that core." (See: U.S. Census Bureau, "Metropolitan Areas: Classification of Metropolitan Areas.") In this study, the Census Bureau's core-based statistical areas (CBSAs, both metropolitan and micropolitan areas), consisting of one or more counties are the geographic units; the one exception in New England is the Boston-Cambridge-Newton MA-NH CBSA, which is divided into three "metropolitan divisions," each of which consists of two or three counties.

then examines the patterns of racial segregation and poverty segregation across school districts within New England metro areas.

In a time of increased concern about both overall income inequality and racial disparities, addressing unequal opportunity in U.S. public schools seems especially important. A key step in that process and/or measure of its success is improvement in the academic performance of minority and economically disadvantaged students leading to reductions in the test-score gaps between children of different races and between children of different economic statuses. To the degree that increasing the progressive tilt of state school aid contributes to those gap reductions, it could be a useful policy lever. Similarly, reducing school and district poverty segregation may shrink test-score gaps. Even if the relationships described in the paper are not causal and these changes do not actually reduce test-score gaps, more progressive state school-aid distributions and reductions in poverty segregation are both likely to have beneficial impacts on low-income children and neighborhoods.

This report examines two factors associated with test-score gaps: the distribution of state education aid and poverty segregation among students.

II. Test Scores and Test-Score Gaps

As noted above, inequality in test scores by race or income likely reflects some degree of unequal educational opportunity. This report relies on elementary-school test scores from the Stanford Education Data Archive (SEDA). The scores have been adjusted by researchers at Stanford University to be reliably comparable across states (Reardon, Ho, et al. 2019). SEDA's metropolitan-area test scores combine those from students in grades 3 through 8 from school years 2008/09 through 2015/16 in English language arts (ELA) and math. (See the box on page 6 for more details.)

Table 1 reports average metropolitan-area test-score gaps and test-score levels for all metropolitan areas for which data are available. Metropolitan-area test-score gaps reflect the (racial or economic) differences among students across the metro area, including differences within school districts and between school districts. The test-score numbers reported in Table 1 are in standard deviation units—multiplied by 100 to make them easier to read—relative to a nationwide student cohort. (See the box for more information on SEDA's adjustments and the national cohort.) A standard deviation is a statistic that measures how "spread out" a list of numbers (in this case, a set of test scores) is relative to the average; it indicates the typical distance between an individual test score and the average test score.[2]

Table 1 indicates that average white-Black and not economically disadvantaged-economically disadvantaged test-score gaps nationwide amount to about 0.6 standard deviation (60 as reported in Table 1)—representing fairly large test-score discrepancies—and the average gaps vary substantially among regions. White-Hispanic test-score gaps are somewhat smaller on average, at 0.4 standard deviation.

Because the results are expressed relative to a nationwide student cohort, groups with below-average test scores show negative scores. The group average test scores for minority students and disadvantaged students fall below the comparison cohort's average score (defined as zero) and thus appear as negative in Table 1; on average, white students and not economically disadvantaged students score well above the nationwide average. These differences between groups

2 To evaluate the size of a test-score value or of a test-score gap expressed in standard deviation units, a useful rule of thumb in statistics is that one standard deviation on either side of the average includes about two-thirds of the values in the list and two standard deviations on either side include approximately 95 percent of the values in the list. (When the list of numbers follows a normal, or bell, curve—which is often true of test scores—this rule of thumb is very accurate.)

TEST SCORES FROM THE STANFORD EDUCATION DATA ARCHIVE

Partly as a result of the federal No Child Left Behind legislation, all U.S. states require public-school students to take "accountability" tests to evaluate school and district progress toward proficiency, on average and for population subgroups. These tests and the methods used to evaluate them are developed by individual states, which means that raw test scores cannot be compared across states. However, for the Stanford Education Data Archive (SEDA), Sean Reardon and colleagues at Stanford University publish measures of test scores that they adjust—through a detailed and comprehensive statistical approach—to be reliably comparable across states (Reardon, Ho, et al. 2019). Their statistical approach uses detailed student data on state tests and adjusts the average and spread for each state using information from each state on scores on the National Assessment of Educational Progress, a nationwide test. Those adjusted test scores, combined for students within metropolitan areas, are used in this report; they combine test results for students in grades 3 through 8 from school years 2008/09 through 2015/16 in English language arts (ELA) and math.

The student subgroups for which average test scores are published include white, Black, Hispanic, not economically disadvantaged, and economically disadvantaged; in compiling scores for the last two subgroups, researchers use each state's definition of "economic disadvantage"—representing low-income students.[a] The researchers also publish estimates of test-score *gaps* between races (white-Black and white-Hispanic) and between students who are not economically disadvantaged and those who are.

The published test-score measures are expressed relative to a national student cohort, whose scores are set at zero by definition. That nationwide student cohort includes students who were in the fourth grade in 2009, 2011, and 2013. The SEDA researchers say, "We use the average of three cohorts as our reference group because they provide a stable baseline for comparison. This metric is interpretable as an effect size, relative to the grade-specific standard deviation of student-level scores in this common, average cohort. For example, a [metropolitan area] with a mean of 0.5 [50 as rescaled in Table 1] represents a [metropolitan area] where the average student scored approximately one-half of a standard deviation higher than the national reference cohort scored in that same grade" (p. 30, Fahle et al. 2019).

a This study incorporates three measures of poverty: "economic disadvantage" as states (and hence SEDA) define it, counts of students eligible for a free school lunch (reported by the National Center for Education Statistics), and school-age children from families living in poverty as defined by the U.S. Census Bureau.

are captured by the test-score gap measures: white-Black, white-Hispanic, and not economically disadvantaged–economically disadvantaged, which are positive on average, because minority students and economically disadvantaged students obtain lower test scores, on average, than white students or not-disadvantaged students.

Table 1

Average Test-Score Gaps and Test Scores

U.S. Metropolitan Areas by Census Division and New England Metropolitan Areas by State, 2008–2016

	Number of Metro Areas	Test-Score Gaps			Test-Score Levels (Relative to National Average)					
		White-Black	White-Hispanic	Not Disadvantaged-Disadvantaged	All students	White	Black	Hispanic	Not Disadvantaged	Disadvantaged
U.S. Metro Areas by Census Division	843	57.3	41.4	60.5	-3.1	14.0	-43.1	-27.3	29.7	-30.7
New England	28	61.0	47.7	65.6	24.6	34.6	-25.7	-12.6	49.0	-16.4
Middle Atlantic	68	55.8	47.3	63.4	6.3	16.5	-39.5	-31.1	34.4	-29.1
East North Central	147	58.5	37.3	58.9	3.5	13.2	-45.0	-24.0	31.9	-26.9
West North Central	108	58.6	44.2	57.5	7.4	18.8	-39.7	-25.3	34.8	-22.7
South Atlantic	154	62.2	37.5	64.3	-4.9	17.8	-44.3	-19.6	33.8	-30.3
East South Central	84	50.9	30.4	58.7	-13.7	2.3	-48.7	-28.4	22.4	-36.2
West South Central	115	57.0	39.1	57.6	-15.3	9.6	-47.5	-29.7	21.4	-35.7
Mountain	64	52.8	51.3	56.3	-3.7	17.6	-34.3	-33.6	26.6	-29.8
Pacific	75	54.9	52.8	65.7	-15.4	8.1	-46.4	-44.9	22.4	-43.9
New England Metro Areas by State	28	61.0	47.7	65.6	24.6	34.6	-25.7	-12.6	49.0	-16.4
Connecticut	5	84.4	80.1	83.5	17.1	42.2	-42.7	-39.1	47.5	-37.0
Maine	4	54.4	29.3	57.2	11.4	15.2	-39.0	-12.9	38.0	-19.2
Massachusetts	8	58.6	61.0	65.1	35.6	48.0	-10.3	-11.5	60.2	-4.6
New Hampshire	6	46.6	32.0	54.4	29.2	31.5	-14.6	-0.9	44.4	-8.9
Rhode Island	1	67.7	76.0	75.1	12.8	32.5	-35.2	-42.0	47.6	-27.8
Vermont	4	63.1	15.7	67.1	21.1	23.0	-36.3	8.6	46.6	-20.0

Source: Stanford Education Data Archive; dataset seda_metro_pool_cs_v30.dta.

Notes: Test scores are in standardized units, multiplied by 100; that is, a gap value of 50 equals one-half a standard deviation difference in test scores; a level value of 50 indicates a test score that is one-half a standard deviation above the overall average for a national reference cohort whose scores are zero by definition (see the text box on page 6 for more information). Scores combine the test results from the school years 2008/09 through 2015/16 for grades 3 through 8 in math and English language arts. Each panel reports simple averages, by census division and state, for metro areas with data.

The top panel of the table reports averages across metropolitan areas grouped by region (census divisions), one of which is New England. Metropolitan areas in New England generally show higher average test-score gaps than all but one or two of the other divisions, raising potential concerns about unequal educational opportunity in the region. Regarding levels, New England metro areas show the highest average test-scores—most positive or least negative—on this national scale for all subgroups.

The bottom panel of Table 1 reports average metro-area test-score gaps and levels for each of the six New England states. Table 2 reports test-score data for individual New England metro areas along with other attributes, such as school enrollment and racial composition. Among the six states, Connecticut's metropolitan areas display the largest average test-score gaps, both racial and socioeconomic, while Massachusetts's metropolitan areas have the highest average test-score levels overall and for all subgroups except Hispanic students.

Figures 1 through 3 are maps that display in quartiles (from largest to smallest gaps) the distribution of test-score gaps in New England metro areas between white and Black students, white and Hispanic students, and not-disadvantaged and disadvantaged students, respectively. Connecticut's large gaps reflect above-average gaps in four of the state's five metro areas: Bridgeport, Hartford, New Haven, and Norwich-New London. What sets the fifth area—Torrington, in the northwest corner of the state—apart from the other four is its above-average score levels for Black, Hispanic, and economically disadvantaged students in combination with its lower average scores for white students and students who are not economically disadvantaged, even though the latter score averages are still above the national averages for those (relatively advantaged) groups. In addition, the Torrington metro area has the smallest total enrollment of the Connecticut metro areas and the lowest fractions (among the state's metro areas) of students who are Black or Hispanic or of school-age children who live in poverty (see right-hand columns in Table 2).

Rhode Island has only one metropolitan area, Providence-Warwick, and its test-score gaps are second largest among the New England states, behind Connecticut. Providence-Warwick is the third-largest metro area in New England in terms of student enrollment. Its test-score levels are above the national averages for each subgroup, except for Hispanic students.

The northern New England states display the smallest average test-score gaps: Vermont has the smallest average white-Hispanic gap, and Maine has the second smallest; New Hampshire reports the smallest average white-Black and not-disadvantaged–disadvantaged gaps, and Maine has the second smallest. The northern New England states are not very racially diverse, with the average share of students who are Black across metro areas at 1.6 percent in New Hampshire, 1.8 percent in Vermont, and 4.1 percent in Maine; the fraction of students who are Hispanic is similarly low in those states' metro areas, at 1.4 percent in Vermont, 1.7 percent in Maine, and 3.0 percent in New Hampshire.

New England metro areas generally show higher average test-score gaps than all but one or two of the other census divisions, raising potential concerns about unequal educational opportunity in the region.

In Vermont, all four metro areas have smaller-than-average white-Hispanic test-score gaps, mostly reflecting above-average scores for Hispanic students. Indeed, two of Vermont's four metro areas, Barre and Burlington, show average scores for Hispanic students that are positive, that is, higher than the nationwide all-student average score (defined as zero), and the state's other two metro areas, Rutland and Bennington, have average scores for Hispanic students that are below but close to the nationwide all-student average score. New Hampshire's smaller-than-average white-Black test-score gap reflects above-average scores for Black students combined with white-student scores that

Table 2

Average Test-Score Gaps and Test Scores
New England Metropolitan Areas, 2008–2016

	Test-Score Gaps			Test-Score Levels (relative to national average)						Enrollment	Student Composition (percent)		Percent School-age Children Living in Poverty
	White-Black	White-Hispanic	Not Disadvantaged–Disadvantaged	All students	White	Black	Hispanic	Not Disadvantaged	Disadvantaged		Black	Hispanic	
Connecticut													
New Haven-Milford	84.8	80.9	84.0	0.8	34.3	-51.0	-47.7	38.7	-45.2	58,018	17.3	24.2	14.4
Bridgeport-Stamford-Norwalk	114.6	95.4	106.7	28.5	65.0	-51.0	-33.7	67.4	-44.2	67,206	12.7	22.1	8.6
Hartford-West Hartford-East Hartford	89.2	102.5	98.6	17.2	48.5	-41.1	-54.5	51.3	-47.4	84,098	13.8	19.1	10.2
Norwich-New London	81.7	76.5	78.6	16.0	35.6	-47.3	-42.0	44.5	-34.3	17,673	8.8	14.6	9.0
Torrington	51.7	45.3	49.5	23.0	27.5	-23.3	-17.7	35.5	-14.0	11,470	2.2	8.0	6.2
Maine													
Bangor	29.8	18.6	55.9	15.7	15.9	-11.8	-0.3	42.7	-13.2	9,497	1.5	1.3	15.6
Lewiston-Auburn	86.9	31.0	59.0	-1.3	8.8	-77.8	-21.5	31.7	-27.3	7,269	10.0	2.0	19.5
Portland-South Portland	77.9	41.7	66.4	25.2	29.2	-48.7	-12.2	47.9	-18.1	32,422	3.8	2.0	10.4
Augusta-Waterville	23.1	26.0	47.7	6.0	7.2	-17.8	-17.7	29.8	-18.1	7,093	1.3	1.6	16.9
Massachusetts													
Barnstable Town	69.3	57.0	58.7	43.3	49.9	-19.4	-5.6	59.9	2.1	11,412	4.0	4.7	11.6
Cambridge-Newton-Framingham	67.5	79.0	85.7	49.1	62.6	-2.9	-15.1	75.5	-9.7	147,615	5.4	16.7	8.9
Pittsfield	50.6	41.3	58.6	24.9	30.2	-20.1	-11.7	50.3	-8.0	7,416	5.3	6.0	13.8
Boston	83.3	73.0	78.2	38.6	61.2	-21.7	-9.3	68.0	-8.7	120,633	15.6	15.5	11.7

Continued on next page

Source: Stanford Education Data Archive; dataset seda_metro_pool_cs_v30.dta.

Notes: Test scores are in standardized units, multiplied by 100; that is, a gap value of 50 equals one-half a standard deviation difference in test scores; a level value of 50 indicates a test score that is one-half a standard deviation above the overall average for a national reference cohort whose scores are zero by definition (see the text box on page 6 for more information). Scores combine the test results from the school years 2008/09 through 2015/16 for grades 3 through 8 in math and English language arts. School-age children living in poverty (in the right-hand column) are data reported by the Census Bureau at school-district geographies averaged over districts in each metropolitan area.

Table 2
continued

Average Test-Score Gaps and Test Scores
New England Metropolitan Areas, 2008–2016

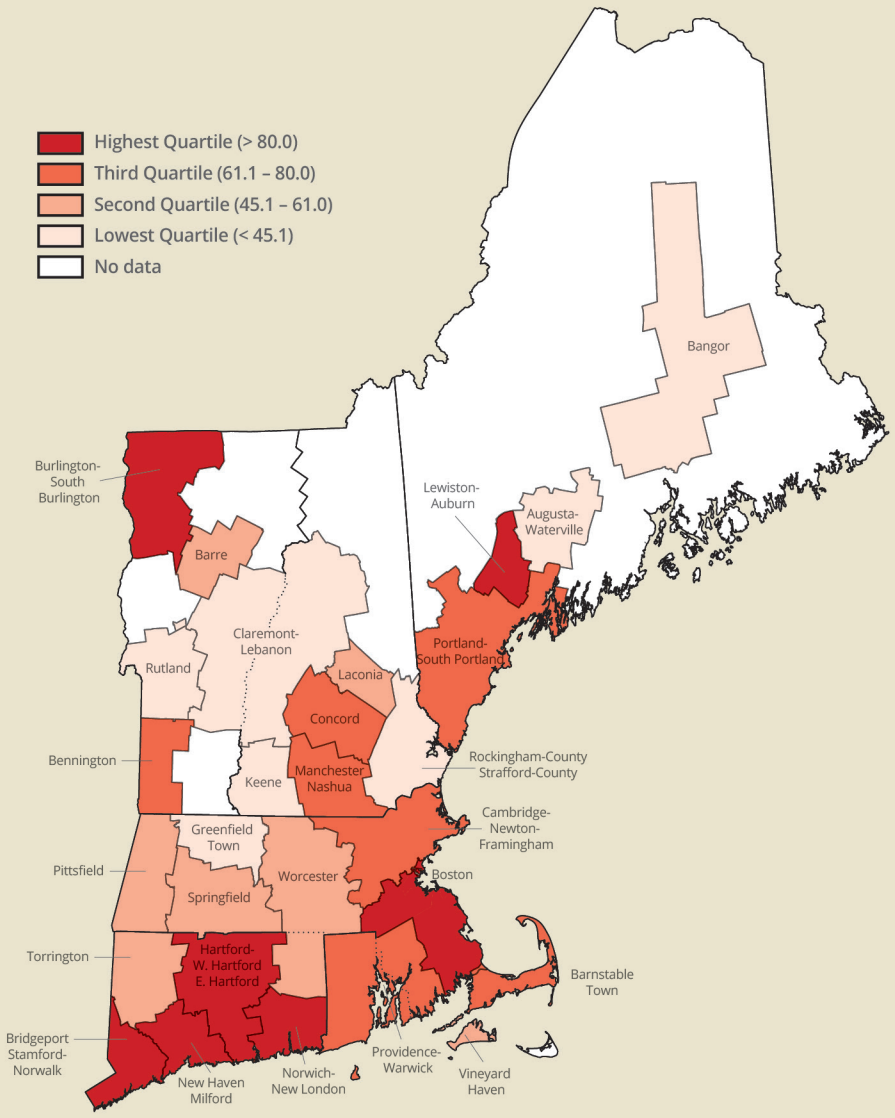
	Test-Score Gaps			Test-Score Levels (relative to national average)						Enrollment	Student Composition (percent)		Percent School-age Children Living in Poverty
	White-Black	White-Hispanic	Not Disadvataged–Disadvantaged	All students	White	Black	Hispanic	Not Disadvantaged	Disadvantaged		Black	Hispanic	
Springfield	57.4	77.0	73.4	9.0	37.1	-20.7	-40.2	47.5	-25.5	41,136	8.6	30.9	18.9
Vineyard Haven	45.6	42.9	39.5	66.4	73.9	25.4	39.0	77.8	39.2	1,006	3.3	10.8	11.0
Greenfield Town	41.2	42.3	50.2	24.1	27.5	-11.6	-15.2	46.4	-5.6	4,059	1.3	6.4	12.9
Worcester	53.9	75.2	76.4	29.2	41.4	-11.1	-33.5	56.1	-20.5	66,043	4.6	16.0	10.2
New Hampshire													
Keene	27.6	23.6	42.7	25.2	26.9	-2.7	-0.3	39.8	-2.1	3,839	1.0	1.3	10.0
Laconia	49.2	26.1	45.7	24.8	26.1	-19.0	0.6	40.5	-5.0	4,317	1.2	1.5	10.2
Manchester-Nashua	70.7	70.2	72.1	27.0	34.5	-36.3	-35.7	46.5	-25.6	27,240	3.5	9.0	8.3
Claremont-Lebanon	22.0	22.7	56.6	26.8	26.5	4.6	4.8	44.5	-9.2	12,914	1.0	1.5	11.3
Concord	65.5	21.2	55.6	33.0	35.3	-29.5	14.2	46.1	-8.1	10,454	1.9	2.0	7.6
Rockingham County-Strafford County	44.6	28.5	53.6	38.5	39.7	-4.6	11.1	49.0	-3.4	28,040	1.3	2.5	6.7
Rhode Island													
Providence-Warwick	67.7	76.0	75.1	12.8	32.5	-35.2	-42.0	47.6	-27.8	98,968	7.3	18.8	15.1
Vermont													
Barre	56.0	7.2	61.9	28.3	29.3	-25.1	23.4	49.3	-12.2	3,557	1.7	1.4	10.2
Rutland	39.2	20.5	60.8	13.6	14.3	-18.5	-0.1	39.6	-19.4	3,551	1.0	1.4	13.6
Burlington-South Burlington	92.4	25.6	80.2	32.7	38.3	-55.6	13.7	57.9	-23.5	13,242	3.4	1.7	9.7
Bennington	64.6	9.4	65.4	9.9	10.2	-45.8	-2.7	39.5	-24.9	2,059	1.0	1.0	14.7

Source: Stanford Education Data Archive; dataset seda_metro_pool_cs_v30.dta.

Notes: Test scores are in standardized units, multiplied by 100; that is, a gap value of 50 equals one-half a standard deviation difference in test scores; a level value of 50 indicates a test score that is one-half a standard deviation above the overall average for a national reference cohort whose scores are zero by definition (see the text box on page 6 for more information). Scores combine the test results from the school years 2008/09 through 2015/16 for grades 3 through 8 in math and English language arts. School-age children living in poverty (in the right-hand column) are data reported by the Census Bureau at school-district geographies averaged over districts in each metropolitan area.

Figure 1

White-Black Test-Score Gaps
New England Metropolitan Areas, 2008–2016



Source: Stanford Education Data Archive, seda_metro_pool_cs_v30.dta.

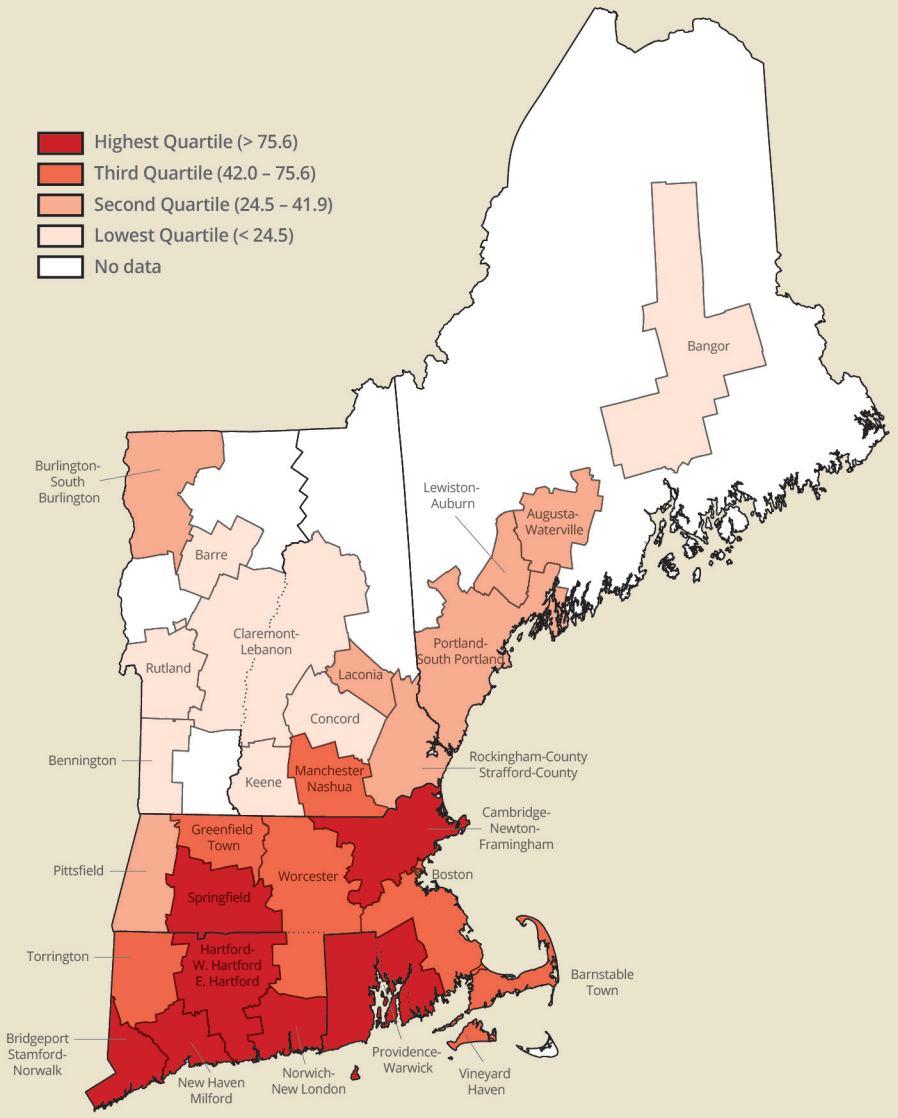
Note: Gaps are average metro-area differences between white students' test scores and Hispanic students' test scores, in standard deviation units times 100.

are also above average but to a lesser degree than the Black students' scores. A similar arithmetic holds for the small average test-score gap between not-disadvantaged and disadvantaged students in New Hampshire's metro areas. The smaller-than-average test-score gaps in Maine reflect particularly small gaps in two of the state's four metro areas, Bangor and Augusta-Waterville.

Average test-score gaps and test-score levels vary considerably across Massachusetts's eight metropolitan areas, notwithstanding the state's high test-score levels. The Vineyard Haven and Greenfield metro areas have the smallest white-Black and not-disadvantaged–disadvantaged gaps within Massachusetts, the smallest enrollments, and the lowest percentages of students who are Black; Pittsfield has the only smaller-than-national-average white-Hispanic gap among the Massachusetts metro areas. The largest white-Black test-score gap in the state is in the Boston metropolitan area (which includes all of Suffolk, Norfolk, and Plymouth counties), while the largest white-Hispanic and not-disadvantaged–disadvantaged gaps are in the

Figure 2

White-Hispanic Test-Score Gaps
New England Metropolitan Areas, 2008–2016



Source: Stanford Education Data Archive, seda_metro_pool_cs_v30.dta.

Note: Gaps are average metro-area differences between white students' test scores and Hispanic students' test scores, in standard deviation units times 100.

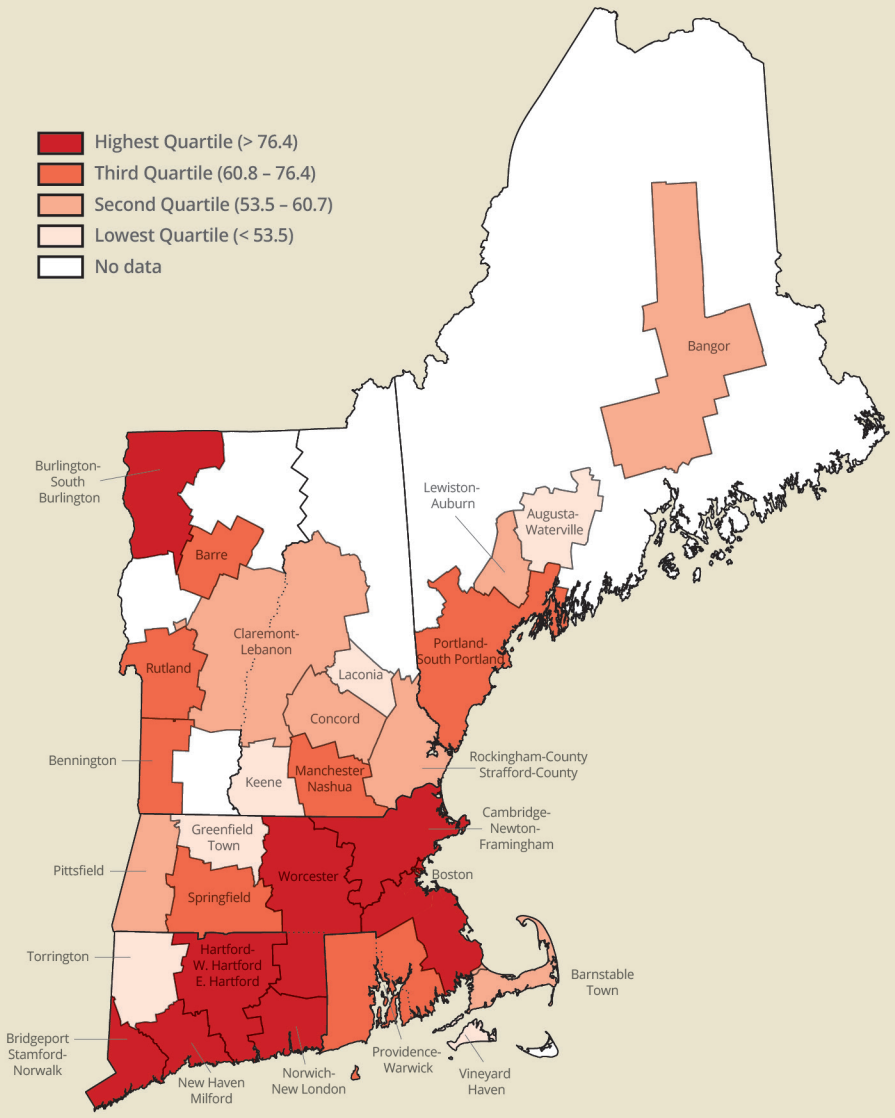
Cambridge-Newton-Framingham metropolitan area (consisting of all of Essex and Middlesex counties). The Boston and Cambridge-Newton-Framingham metro areas have the largest student enrollments in the state (and indeed in New England). Boston metro has the highest percentage of students who are Black among Massachusetts metro areas, and the Springfield metro area has the highest percentage of students who are Hispanic.

The following sections turn to a discussion of two important policy-related factors that may influence these test-score gaps: (1) how states distribute aid to school districts and (2) school-assignment policies and residential location patterns—and resulting patterns of segregation—within and among school districts.

Figure 3

Test-Score Gaps between Not-Disadvantaged and Economically Disadvantaged Students

New England Metropolitan Areas, 2008–2016



Source: Stanford Education Data Archive, seda_metro_pool_cs_v30.dta.

Note: Gaps are average metro-area differences between not-disadvantaged students' test scores and economically disadvantaged students' test scores, in standard deviation units times 100.

III. State Aid to School Districts

Public elementary and secondary education is a state-local function in the United States. Most school districts (local governments) use property taxation to fund the local public schools, and each state provides aid to local school districts to ensure an adequate and/or equitable public education for the state's children. Two key attributes of state aid to local public schools are the extent to which redistribution counteracts disparities in local revenue capacities and the degree to which the state provides additional per-pupil funds to districts that educate high-cost students, such as students living in poverty, English-language learners, and those with special needs.

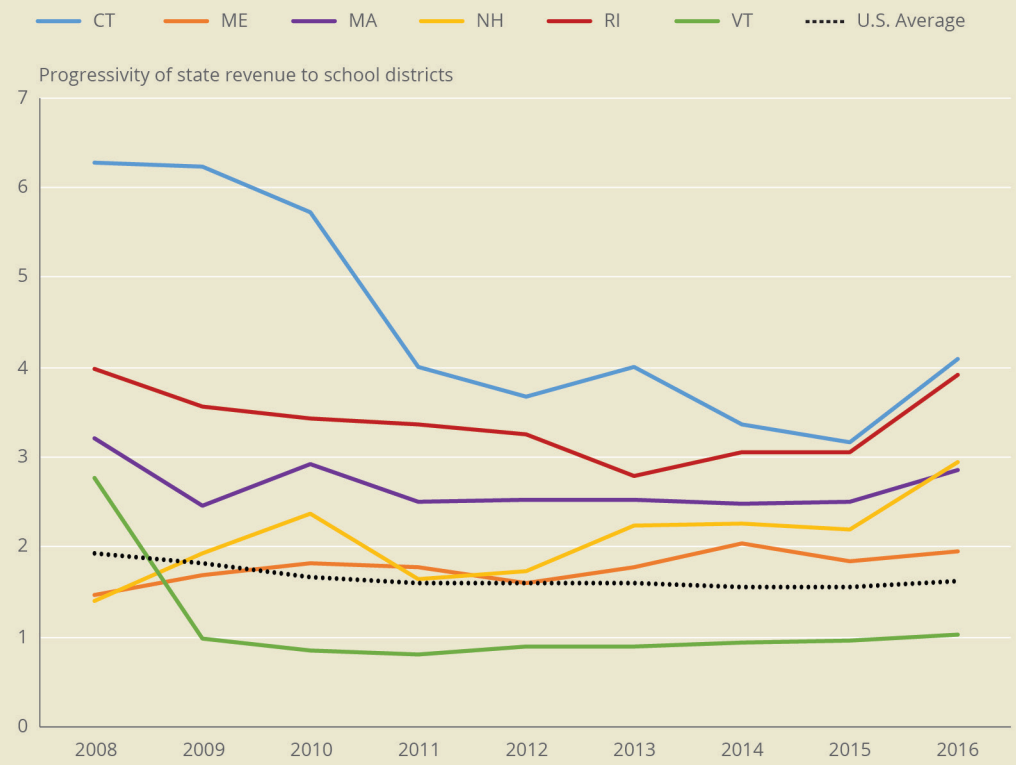
This report employs a summary measure of progressivity of state school aid published by researchers at Rutgers University Graduate School of Education/Albert Shanker Institute.[3] The

3 The data set is Baker, Di Carlo, Srikanth, and Weber (2020).

Figure 4

Progressivity of Education Aid

New England States and U.S. Average, 2008–2016



Source: Baker, DiCarlo, and Weber (2020).

Notes: "Progressivity" measures the ratio of estimated state aid for a district with 30 percent poverty to aid for a district with 0 percent poverty. U.S. average excludes Wyoming.

measure indicates the degree to which aid is tilted toward districts with greater fractions of their students living in poverty. It is defined as the ratio of estimated per-pupil state revenue provided to a school district where 30 percent of students live in poverty to that provided to a district where 0 percent of students live in poverty (Baker, Di Carlo, and Weber 2020). Figure 4 plots the measure of progressivity for the New England states and the U.S. average over the period 2008 through 2016.

The largest portion of state aid to local school districts is typically provided on a per-student basis through a foundation, power-equalizing, or tiered program. Foundation programs, which provide per-student aid to fill the gap between a state-determined foundation amount needed to educate local children and the yield from local district resources might at a standard tax rate, are the most widely used; Connecticut, Maine, Massachusetts, New Hampshire, and Rhode Island all include foundation elements in their school-aid formulas. In addition, some states include cost adjustments in their formulas. All six New England states provide greater per-student funding for districts with more students from families living in poverty than for districts with fewer such students, with the student weights (that is, additional funding) associated with this characteristic varying among the states. Two states (Massachusetts and Connecticut) also provide more aid per student living in poverty to districts with higher *concentrations* of poverty.

A. How State Aid Relates to Test-Score Gaps in New England

As noted above, this report builds on research (Bradbury 2021) that finds gaps between test scores of students of different races and between test scores of not-disadvantaged and disadvantaged students are smaller in the high-poverty metropolitan areas of states where aid formulas are more progressive (tilted toward districts with higher student poverty). The measure of progressivity used in the analysis is based on the first three years (2008 through 2010) of the progressivity data in Figure 4, combined with data on the fraction of school-age children from families living in poverty in each metro area's school districts.[4] The metro-area figure on percentage of school-age children living in poverty is a weighted average of the district percent-poverty figures across all districts in each metro area, where the weights are elementary-school student enrollment. The estimated relationship with metro-area test-score gaps reflects an interaction between the progressivity of state aid and metro-area school-age poverty.

The relationships between test-score gaps on the one hand and progressivity and metro average district poverty on the other are fairly strong in a statistical sense, but they are modest in an economic sense. And because the data are cross-sectional and applicable statistical methods are limited, the relationships cannot be interpreted as causal. A plausible causal story would suggest that as progressive aid flows to districts with higher student poverty, those districts spend the funds to improve education for all students (who on average are more disadvantaged than in other districts) and at least partially direct the aid funding toward improving scores for underperforming minority and economically disadvantaged students. Such a process could reduce test-score gaps both across districts and within districts. However, the analysis in Bradbury (2021) is able to identify only relationships or correlations among metropolitan characteristics; it does not establish causality.

The remainder of this section explores the magnitude of the estimated relationships between the pair of state-aid measures—progressivity and district poverty—and test-score gaps. To quantify those magnitudes, this report uses the estimated relationships to "predict" the difference in test-score gaps between two metro areas (or two groups of metro areas) based on the differences in their values for state-aid progressivity and for the metro-area district average fraction of school-age children living in poverty.[5] Because the two elements interact, the impact of progressivity on test-score gaps varies with district average poverty—greater progressivity is associated with smaller test-score gaps in high-poverty metro areas but comparatively larger test-score gaps in low-poverty metro areas.

The Manchester-Nashua metro area has the largest test-score gaps among metro areas in New Hampshire, more than 20[6] greater than the Laconia metro area for all three gap measures; a prediction of the differences in test-score gaps between Manchester-Nashua and Laconia based solely on the estimated relationships with state aid explains only 4 percent to 7 percent of the actual gap differences, depending on which of the three gaps is being explained. Because Manchester-Nashua and Laconia are in the same state, the measured progressivity of state aid is, of course, the same for the two metro areas; the difference in predicted aid "impact" reflects the

4 These are the U.S. Census Bureau's Small Area Income and Poverty Estimates (SAIPE), published for school-district geographies.

5 The report uses the coefficients reported in column 3 of Tables 3, 4, and 5 of Bradbury (2021) on the measure of progressivity and the measure of progressivity interacted with (multiplied by) the measure of metro average district poverty. The three tables refer to the three types of test-score gaps (between white and Black, white and Hispanic, and not disadvantaged and economically disadvantaged students).

6 Recall that test scores are measured in standard deviation units, multiplied by 100; a gap difference of 20 represents 0.2 standard deviation in normalized test scores.

differentially lower average school-district poverty in Manchester-Nashua.[7]

Within Massachusetts, the Springfield metro area displays test-score gaps that are smaller than those in the Cambridge-Newton-Framingham area. In this example, the average percentage of school-age children living in poverty is 10 percentage points higher for Springfield districts than for districts in the Cambridge-Newton-Framingham metro area, tilting state aid toward Springfield. The difference of approximately 10 between the white-Black and not-disadvantaged–disadvantaged test-score gaps for Cambridge-Newton-Framingham and Springfield is roughly explained by the pair of state-aid progressivity variables. And the relationship predicts a much bigger difference (15) in white-Hispanic test score gaps than the difference of 2 that is actually observed. These estimated "effects" are much larger than those outlined in the previous paragraph for New Hampshire metro areas in part because the difference in school-age poverty is much greater between Cambridge-Newton-Framingham and Springfield than between Manchester-Nashua and Laconia and partly because Massachusetts school aid is more redistributive toward lower-income districts.[8] The difference between the school-age poverty averages of the Boston and Pittsfield metro areas in Massachusetts is similar to the one between Manchester-Nashua and Laconia in New Hampshire, about 2 percentage points. However, the predicted test-score gap differences attributable to state aid are slightly larger for Boston-Pittsfield on all three test-score gaps than those for Manchester-Nashua and Laconia, because the poverty difference is multiplied by the higher value for progressivity in Massachusetts. The test-score gaps actually differ much more between Boston and Pittsfield than the predicted differential of 2 or 3.

Research finds that racial and socioeconomic test-score gaps are smaller in the high-poverty metropolitan areas of states where aid formulas are more progressive (tilted toward districts with higher student poverty).

Looking across states, the white-Black and not-disadvantaged–disadvantaged test-score gaps in the Providence-Warwick, Rhode Island, metro area are smaller than those in Burlington-South Burlington, Vermont. Rhode Island's state aid is more redistributive than Vermont's state aid (Figure 4), and the school districts in the Providence-Warwick area have higher fractions of school-age children living in poverty, on average, compared with districts in the Burlington-South Burlington metro area. On the basis of both these facts and the estimated relationships, the white-Black and not-disadvantaged–disadvantaged test-score gaps for Providence-Warwick would be expected to be about 5 smaller than those for Burlington-South Burlington; the actual gaps are 25 (white-Black) and 5 (non-disadvantaged–disadvantaged) smaller for Providence-Warwick. By contrast, the white-Hispanic test-score gap is larger for Providence-Warwick, at 76, than for Burlington-South Burlington (26); the estimated state-aid relationships, however, predict a gap for Providence-Warwick that is 4 *smaller* than for Burlington-South Burlington.

7 As Table 2 indicates, the metro average percentage of school-age children living in poverty is about 2 percentage points lower in Manchester-Nashua than in Laconia. Multiplying that difference by the progressivity measure (equal to 1.9, the same in both metro areas because both are in New Hampshire) and by the estimated coefficients on that interaction term (which range from 35 to 52, depending on the type of test-score gap—see column 3 of Tables 3 through 5 in Bradbury 2021) yields a predicted difference in gaps of 1.2 to 1.9, which represents 4 percent to 7 percent of the actual test-score gap differences (which range from 21 [white-Black gap] to 44 [white-Hispanic gap], as shown in the test-score gap columns of Table 2).

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A final example across state lines: the Bridgeport-Stamford-Norwalk and Hartford-West Hartford-East Hartford metro areas of Connecticut have test-score gaps that are considerably larger than those for Boston, for all three gap measures. While state-aid revenues are distributed more progressively in Connecticut than in Massachusetts (again, see Figure 4), the Boston metro area has a higher level of student poverty compared with Bridgeport-Stamford-Norwalk or Hartford-West Hartford-East Hartford. The state aid relationships predict test-score gaps for Boston that are smaller than those for either of those two Connecticut metros, accounting for one-ninth to three-quarters of the actual differences.

B. Other Reasons to Tilt State Aid toward High-Poverty Districts

The relationships described and quantified above are suggestive of positive results, in terms of shrinking racial and socio-economic test-score gaps in high-poverty metro areas and districts, when states tilt school aid toward districts that face higher student (school-age) poverty. Earlier research has established other reasons for states to use a progressive school-aid distribution. Because it is not clear that moving toward more progressivity would actually *cause* test-score gaps to shrink in high-poverty metro areas, this section lays out the findings of that research regarding other benefits of a progressive distribution of state aid. Furthermore, the way in which progressivity is measured above makes it impossible to judge the degree to which aid "should" be tilted toward high-poverty districts; it implies only that more progressivity is better from the point of view of high-poverty areas. Therefore, this section also describes other studies' findings regarding *how much* more aid should go to districts with high student poverty compared with low student poverty.

The main argument for a progressive distribution of state aid is that students whose families live in poverty are more costly to educate. William Duncombe and John Yinger investigate education costs in many papers and estimate the degree to which student poverty adds to costs. For example, in Duncombe and Yinger (2008), they say, "Districts with a high concentration of students living in poverty or with limited English proficiency face much greater challenges than other districts in helping their students reach academic proficiency" (p. 19). They summarize a range of approaches to estimating education cost differentials among school districts and include "pupil weights" (estimated differential costs of educating students to a specific standard) for students from families living in poverty. They also note that although many states use pupil weights to allocate more per-student aid to districts with higher poverty, those weights tend to be much lower than the ones estimated from cost functions.

Rutgers University researchers Bruce Baker, Matthew Di Carlo, and Mark Weber estimate cost functions for school districts across all the states (Baker, Di Carlo, and Weber 2020). Citing a long list of papers by Duncombe and Yinger, they argue that school-age-poverty is a key cost factor. Specifically, they say,

> "The most important of the factors we use in this [cost] model is poverty (using data collected by the U.S. Census Bureau). Poverty is highly significant not only because it exerts strong influence on the cost of providing education, but also because there is now broad agreement between scholars in a variety of disciplines and organizations across the political spectrum that school districts serving higher-need student populations—those with higher poverty rates in particular—require not the same, but rather *more* resources per pupil than districts serving lower-need student populations" (p. 6).

In the earlier work in which they lay out their cost model (Baker et al. 2018), the Rutgers researchers note, "Our model allows us to address the question: How much more or less does it cost to achieve national average outcomes in a district *with high poverty levels* than in more affluent…middle-class communities?" (p. 9, emphasis added).

The Rutgers researchers compare each district's costs of reaching a national average outcome with actual district spending and find that spending often falls well short of that estimated cost, especially in high-poverty districts. They present cost estimates not for individual districts, but for poverty quintiles of districts in each state. For each of the New England states, the estimated cost of achieving national average outcomes (test scores) rises monotonically across the five poverty quintiles (recall that poverty is only one of the variables on which the cost estimates are based). Specifically, the cost of achieving average outcomes in the highest-poverty quintile ranges from about twice as expensive (1.9 in New Hampshire, 2.0 in Maine) to more than 3.5 times as expensive (3.7 in Rhode Island) as the cost in the lowest-poverty quintile of districts; the costs for the highest-poverty quintiles in Connecticut and Massachusetts are each 3.1 times as expensive, and in Vermont, the cost for the highest-poverty quintile is 2.4 times the cost for the lowest-poverty quintile of districts.[9]

These estimates reinforce the Duncombe and Yinger (2008) point, noted above, that cost estimates suggest a much greater "weight" on student poverty than is typically used in state school-aid formulas attempting to adjust for the higher costs of educating students living in poverty. In a more recent study, Federal Reserve Bank of Boston researcher Bo Zhao rigorously examines Connecticut data and, regarding costs, finds that "districts with the…*highest school-age-child-poverty rates* [among other factors]…, on average, have the highest costs" (Zhao 2020, page 1, emphasis added). As Zhao and Boston Fed researcher Nicholas Chiumenti (Zhao and Chiumenti 2020) report, the cost differences across Connecticut districts are substantial, and poverty is an important cost factor in accounting for those variations. The Connecticut Department of Education sorts school districts across the state into nine reference groups, group A (highest socioeconomic status) through group I (lowest socioeconomic status). Two-thirds of the difference between groups A and I in Zhao and Chiumenti's cost index values is accounted for by differences in the percentage of school-age children from families living in poverty (4.0 percent compared with 32.5 percent), making poverty the most important contributor to cost differences.[10] Like Duncombe and Yinger and Baker and co-authors, Zhao suggests that cost measures can and should inform the state's school-aid program (Zhao 2021).

The impact of progressivity on test-score gaps varies with district average poverty—greater progressivity is associated with smaller test-score gaps in high-poverty metro areas.

The preceding overview of research indicates that student poverty is an important factor determining the cost of educating children to a given standard. State-by-state research such as Zhao's quantifies how much student poverty adds to costs and, therefore, how tilted toward student poverty state aid to local public schools should be to offset such cost differentials. As discussed above, progressive state aid may also reduce racial and socioeconomic test-score gaps in high-poverty areas.

9 The source of these cost estimates by poverty quintile is Baker, Srikanth, and Weber (2016).

10 This statement is based on the factor weights laid out in Table 1 and the District Reference Group data in Table 2 of Zhao and Chiumenti (2020).

IV. Poverty Segregation

In addition to the school-aid findings above, Bradbury (2021) finds that test-score gaps between students of different races and between not economically disadvantaged and disadvantaged students are smaller in metropolitan areas where students from low-income families are less segregated across schools within districts and across districts. Specifically, *racial* test-score gaps are smaller where white and Black students or white and Hispanic students are exposed to similar fractions of students eligible for free school lunches (low-income students), and larger where minority students are exposed to higher fractions of low-income students than are white students.[11] Similarly, test-score gaps between not-disadvantaged and economically disadvantaged students are larger where the schools and districts that higher-income students attend have fractions of free-lunch-eligible students that are lower than those of the schools and districts that low-income students attend, that is, where poverty segregation is greater.

Racial and socioeconomic test-score gaps are smaller in metropolitan areas where students from low-income families are less segregated across schools within districts and across districts.

These findings regarding racial test-score gaps and poverty segregation reinforce similar findings by Sean Reardon and his Stanford University colleagues. They analyze racial gaps in test scores in several studies, concluding that a key factor is racial differences in in-school exposure to poverty.[12] Reardon (2016) reports that "racial segregation is strongly associated with racial achievement gaps; and the racial difference in the proportion of students' schoolmates who are poor is the key dimension of segregation driving this association" (p. 47). Their most recent paper along these lines (Reardon, Weathers, et al. 2019) confirms a strong role for racial differences in exposure to poverty in explaining district, county, and metropolitan-area racial test-score gaps.

Segregation measures are based on exposure differences between children of different races or poverty statuses across schools within each district or across districts within metro areas. Thus, Black-white poverty segregation between schools is defined as the percentage of students who are low income (defined as being eligible to receive free lunch) in the average Black student's school minus the percentage of low-income students in the average white student's school. Black-white poverty segregation between districts is defined the same way, substituting "district" for "school" and looking across districts within a metropolitan area. Hispanic-white school poverty segregation and district poverty segregation are defined in a parallel way. Similarly, poverty segregation (not by race) is defined as the percentage of students who are eligible to receive free lunch in the average free-lunch student's school or district minus the percentage of students eligible for free lunch in the average non-free-lunch student's school or district.

Table 3 reports averages of selected school and district poverty segregation measures across metropolitan areas. The "within-district" figures refer to poverty segregation across schools within each district in a metro area, averaged across all districts in that metro area. Thus, columns 2 (and 5) start with a measure of school poverty segregation by race within each school district: The difference between the percentage of students eligible for free lunch in the average Black (Hispanic) student's school and the percentage of students eligible for free lunch in the average

11 Counts of students eligible for free lunches are the most widely used tally of low-income students in public schools. These counts are reported by the National Center for Education Statistics and reflect eligibility for subsidized meals provided through the national school lunch program of the U.S. Department of Agriculture. Children whose parents' incomes are below 130 percent of the federal poverty threshold are eligible for free lunches.

12 For more details about the studies, see the Educational Opportunity Project at Stanford University.

Table 3

Poverty Segregation Within and Across School Districts

U.S. Metropolitan Areas by Census Division and New England Metropolitan Areas by State, 2008–2016

	Number of Metro Areas	Black-White Poverty Segregation		Percent Black Students	Hispanic-White Poverty Segregation		Percent Hispanic Students	Poverty Segregation		Percent Low-Income Students	Total School Enrollment	Number of School Districts
		Between Schools in Average District	Between Districts in Metro		Between Schools in Average District	Between Districts in Metro		Between Schools in Average District	Between Districts in Metro			
U.S. Metro Areas by Census Division	843	4.5	7.1	12.9	4.7	5.7	15.7	7.2	6.7	46.1	24,138	12.3
New England	28	1.9	14.5	5.1	2.2	14.0	8.7	3.1	15.2	30.0	32,223	32.7
Middle Atlantic	68	1.8	13.5	8.0	1.6	11.5	7.9	3.2	11.6	35.5	36,682	25.5
East North Central	147	2.6	12.1	7.4	2.3	7.9	6.7	6.6	9.6	40.8	19,801	15.4
West North Central	108	3.3	5.8	5.4	3.8	5.0	12.0	5.4	5.1	38.5	11,699	11.5
South Atlantic	154	8.2	3.4	26.0	6.9	1.9	12.9	9.8	3.1	53.1	25,544	4.0
East South Central	84	5.6	4.6	25.7	4.7	2.3	4.7	6.7	3.9	55.5	12,871	4.9
West South Central	115	5.2	7.1	17.3	4.9	5.6	29.4	7.2	6.3	54.9	24,247	10.3
Mountain	64	3.9	1.8	1.8	6.8	3.4	29.3	9.8	5.6	43.1	21,573	9.1
Pacific	75	4.4	5.6	2.9	7.3	8.1	33.4	9.6	8.1	47.2	47,916	18.6
New England Metro Areas by State	28	1.9	14.5	5.1	2.2	14.0	8.7	3.1	15.2	30.0	32,223	32.7
Connecticut	5	3.0	29.8	11.0	3.8	27.9	17.6	4.7	28.5	27.9	47,693	32.4
Maine	4	1.5	6.8	4.1	0.5	4.5	1.7	3.1	6.9	35.3	14,070	20.8
Massachusetts	8	2.2	18.7	6.0	3.2	20.7	13.4	3.4	18.0	30.2	49,915	40.0
New Hampshire	6	1.4	4.9	1.6	1.3	3.7	3.0	2.1	8.3	24.4	14,467	31.0
Rhode Island	1	3.9	29.4	7.3	4.4	33.6	18.8	5.8	26.1	37.8	98,968	64.0
Vermont	4	0.3	4.9	1.8	0.9	3.4	1.4	1.4	8.9	33.2	5,602	25.0

Sources: Author's calculations based on data published by Stanford Education Data Archive; seda_cov_metro_pool_v30.dta and seda_cov_geodist_pool_v30.dta

Notes: Black-white and Hispanic-white poverty segregation within and between school districts reflects racial differences in exposure to low-income students in school or district; poverty segregation within and between school districts reflects differences between low-income and higher-income students in exposure to low-income students in school or district. Low-income students are defined as those who are eligible for free school lunches.

Table 4

Measures of Poverty Segregation
New England Metropolitan Areas, 2008–2016

	Black-White Poverty Segregation		Percent Black Students	Hispanic-White Poverty Segregation		Percent Hispanic Students	Poverty Segregation		Percent Low-Income Students	Total School Enrollment	Number of School Districts
	Between Schools in Average District	Between Districts in Metro		Between Schools in Average District	Between Districts in Metro		Between Schools in Average District	Between Districts in Metro			
Connecticut											
New Haven-Milford	5.1	33.2	17.3	6.8	32.7	24.2	6.7	29.3	36.5	58,018	27
Bridgeport-Stamford-Norwalk	3.0	48.6	12.7	3.5	38.0	22.1	4.8	48.4	28.5	67,206	26
Hartford-West Hartford-East Hartford	3.3	34.3	13.8	4.4	36.7	19.1	7.1	34.9	29.0	84,098	64
Norwich-New London	2.5	25.8	8.8	2.5	25.7	14.6	3.1	21.9	27.9	17,673	22
Torrington	1.3	7.3	2.2	1.9	6.8	8.0	1.8	8.1	17.8	11,470	23
Maine											
Bangor	0.1	0.3	1.5	0.5	-0.9	1.3	3.4	6.3	35.9	9,497	28
Lewiston-Auburn	3.4	10.9	10.0	1.2	6.3	2.0	4.5	7.2	43.8	7,269	7
Portland-South Portland	2.0	12.3	3.8	0.8	6.4	2.0	2.6	9.3	26.0	32,422	37
Augusta-Waterville	0.4	3.4	1.3	-0.4	6.2	1.6	1.9	4.7	35.5	7,093	11
Massachusetts											
Barnstable Town	2.3	4.6	4.0	2.3	5.0	4.7	2.2	4.4	22.7	11,412	17
Cambridge-Newton-Framingham	2.2	21.3	5.4	2.8	36.2	16.7	3.4	31.4	25.2	147,615	90
Pittsfield	3.6	10.8	5.3	5.5	5.2	6.0	5.0	9.3	34.8	7,416	18
Boston	5.7	39.1	15.6	6.2	41.7	15.5	5.9	32.7	32.2	120,633	68

Continued on next page

Sources: Author's calculations based on data published by Stanford Education Data Archive; seda_cov_metro_pool_v30.dta and seda_cov_geodist_pool_v30.dta

Notes: Black-white and Hispanic-white poverty segregation within and between school districts reflects racial differences in exposure to low-income students in school or district; poverty segregation within and between school districts reflects differences between low-income and higher-income students in exposure to low-income students in school or district. Low-income students are defined as those who are eligible for free school lunches.

Table 4
continued

Measures of Poverty Segregation
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	Black-White Poverty Segregation		Percent Black Students	Hispanic-White Poverty Segregation		Percent Hispanic Students	Poverty Segregation		Percent Low-Income Students	Total School Enrollment	Number of School Districts
	Between Schools in Average District	Between Districts in Metro		Between Schools in Average District	Between Districts in Metro		Between Schools in Average District	Between Districts in Metro			
Springfield	2.2	38.3	8.6	3.9	38.8	30.9	4.4	30.5	46.2	41,136	32
Vineyard Haven	-1.2	0.5	3.3	0.2	2.7	10.8	0.1	1.9	16.3	1,006	6
Greenfield Town	0.2	6.6	1.3	1.0	7.5	6.4	1.4	9.7	33.6	4,059	18
Worcester	2.4	28.6	4.6	3.3	28.1	16.0	4.7	24.4	30.4	66,043	71
New Hampshire											
Keene	1.5	-0.1	1.0	1.3	0.7	1.3	1.3	3.8	29.1	3,839	12
Laconia	0.8	5.7	1.2	-0.5	4.0	1.5	0.7	6.1	28.7	4,317	10
Manchester-Nashua	4.3	15.6	3.5	6.5	14.2	9.0	8.3	15.2	23.8	27,240	22
Claremont-Lebanon	0.4	-3.0	1.0	-0.6	-1.1	1.5	0.7	7.6	28.7	12,914	77
Concord	0.9	6.4	1.9	0.4	1.9	2.0	0.8	8.7	20.1	10,454	21
Rockingham County-Strafford County	0.7	4.8	1.3	0.6	2.1	2.5	1.2	8.8	15.9	28,040	44
Rhode Island											
Providence-Warwick	3.9	29.4	7.3	4.4	33.6	18.8	5.8	26.1	37.8	98,968	64
Vermont											
Barre	0.3	1.7	1.7	0.3	9.5	1.4	0.7	10.6	27.7	3,557	21
Rutland	0.7	3.7	1.0	0.4	2.5	1.4	0.2	4.0	37.1	3,551	25
Burlington-South Burlington	1.7	12.6	3.4	0.4	2.9	1.7	3.0	12.8	26.1	13,242	40
Bennington	-1.3	1.7	1.0	2.5	-1.5	1.0	1.7	8.4	41.9	2,059	14

Sources: Author's calculations based on data published by Stanford Education Data Archive; seda_cov_metro_pool_v30.dta and seda_cov_geodist_pool_v30.dta

Notes: Black-white and Hispanic-white poverty segregation within and between school districts reflects racial differences in exposure to low-income students in school or district; poverty segregation within and between school districts reflects differences between low-income and higher-income students in exposure to low-income students in school or district. Low-income students are defined as those who are eligible for free school lunches.

white student's school. For each metro area, those difference measures are averaged across all the districts in the metro area, with weighting by district enrollment. The "between-district" data report differences among districts in the metro area. Thus, column 3 (and 6) reports the difference between the percentage of students eligible for free lunch in the average Black (Hispanic) student's district and the percentage of students eligible for free lunch in the average white student's district. Columns 8 and 9, respectively, report differences between low-income (free-lunch-eligible) and higher-income students in exposure to low-income (free-lunch) students across schools within districts and across districts within metro areas.

The top panel in Table 3 summarizes the nationwide metro-area data by region (census division); the bottom panel breaks out the New England data by state. Table 4 lists the data for individual metro areas in New England. On average nationwide, racial differences in exposure to low-income students are greater *across* districts than within districts. By contrast, poverty segregation (not by race) is somewhat greater within districts than between them.

These segregation patterns differ considerably among the nine census divisions. New England and also the Middle Atlantic division (which encompasses nearly 70 metro areas in New Jersey, New York, and Pennsylvania) show high levels of poverty segregation between districts and lower levels among schools within districts. This pattern reflects, in part, that these regions have relatively small school districts and a correspondingly large number of districts within the average metro area (see right-most column in Table 3). Metro areas in the South Atlantic region (about 155 in Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia), by contrast, show the highest levels of within-district Black-white poverty segregation and within-district school segregation of low-income students (tied with the Mountain division), and the second-highest average level of within-district Hispanic-white poverty segregation. Many school districts in these states operate at the county level; the average metro area in the South Atlantic states includes very few school districts (note the South Atlantic's average of four districts per metro area in the right-hand column of Table 3 as compared with almost 33 districts in the average New England metro area).

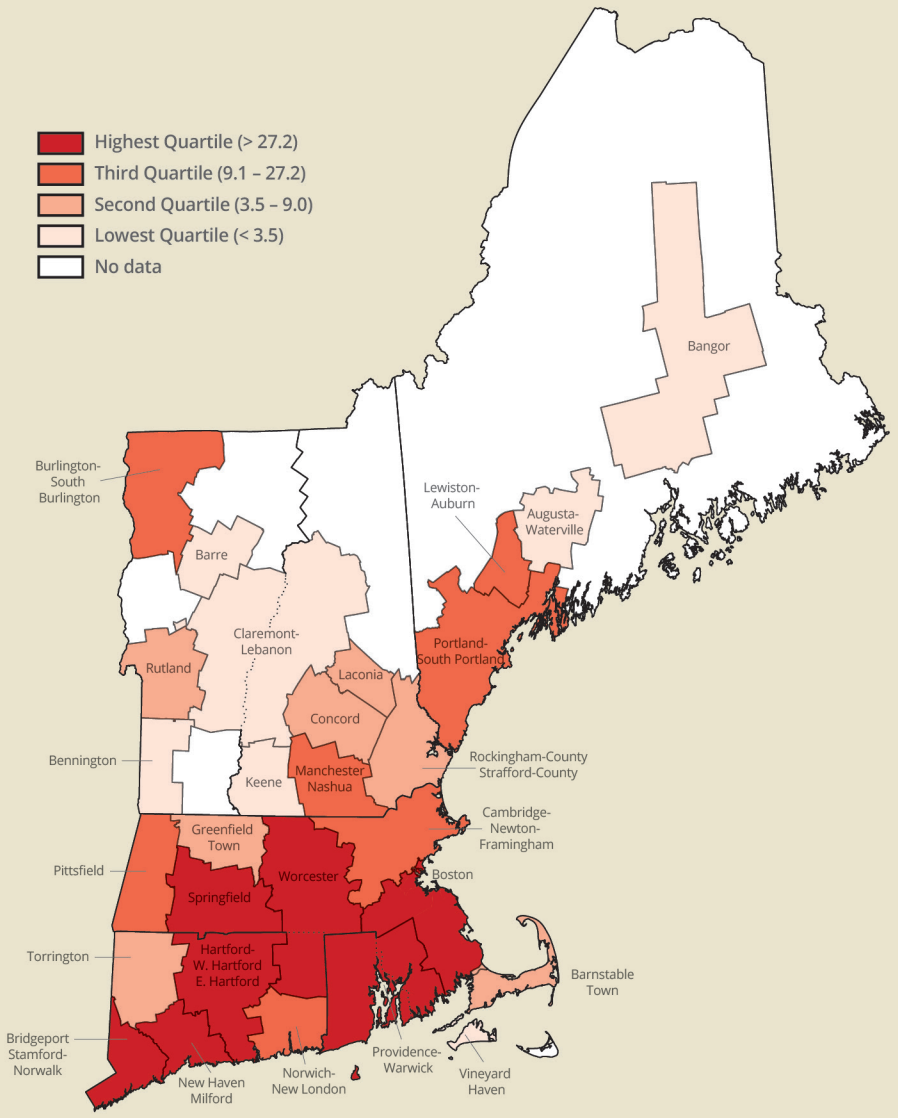
This pattern of between-district poverty segregation being greater than within-district poverty segregation (whether by race or overall) appears in each of the six New England states (see the bottom panel of Table 3). Between-district differences between Black and white students' exposure to low-income students are highest in Connecticut, followed closely by Rhode Island (the Providence-Warwick metro area); the same is true (Connecticut highest and Rhode Island second highest) for between-district poverty segregation. Overall levels of poverty segregation, whether within or between districts, are considerably higher in metro areas in the three southern New England states (Connecticut, Massachusetts, and Rhode Island) than in the less racially diverse metro areas of the three northern states (Maine, New Hampshire, and Vermont).

A. How Poverty Segregation Relates to Test-Score Gaps

As noted above, racial test-score gaps are larger in metro areas where minority students are exposed to a higher prevalence of low income (eligibility for free school lunches) compared with white students. Similarly, test-score gaps between not-disadvantaged and disadvantaged students are larger in metro areas where the schools and districts that higher-income students attend have lower fractions of low-income (free lunch) students than the schools and districts that low-income (free-lunch) students attend. The relationships that Bradbury (2021) estimates are fairly strong and highly statistically significant. The estimated coefficients are similar for within-district and between-district poverty segregation and range from 0.77 to 0.97, depending on which test-score gap is

Figure 5

Between-District Black-White Poverty Segregation
New England Metropolitan Areas, 2008–2016



Source: Author's calculations based on data published by Stanford Education Data Archive; seda_cov_metro_pool_v30.dta

Note: Black-white poverty segregation reflects Black-white difference in exposure to low-income students in school district.

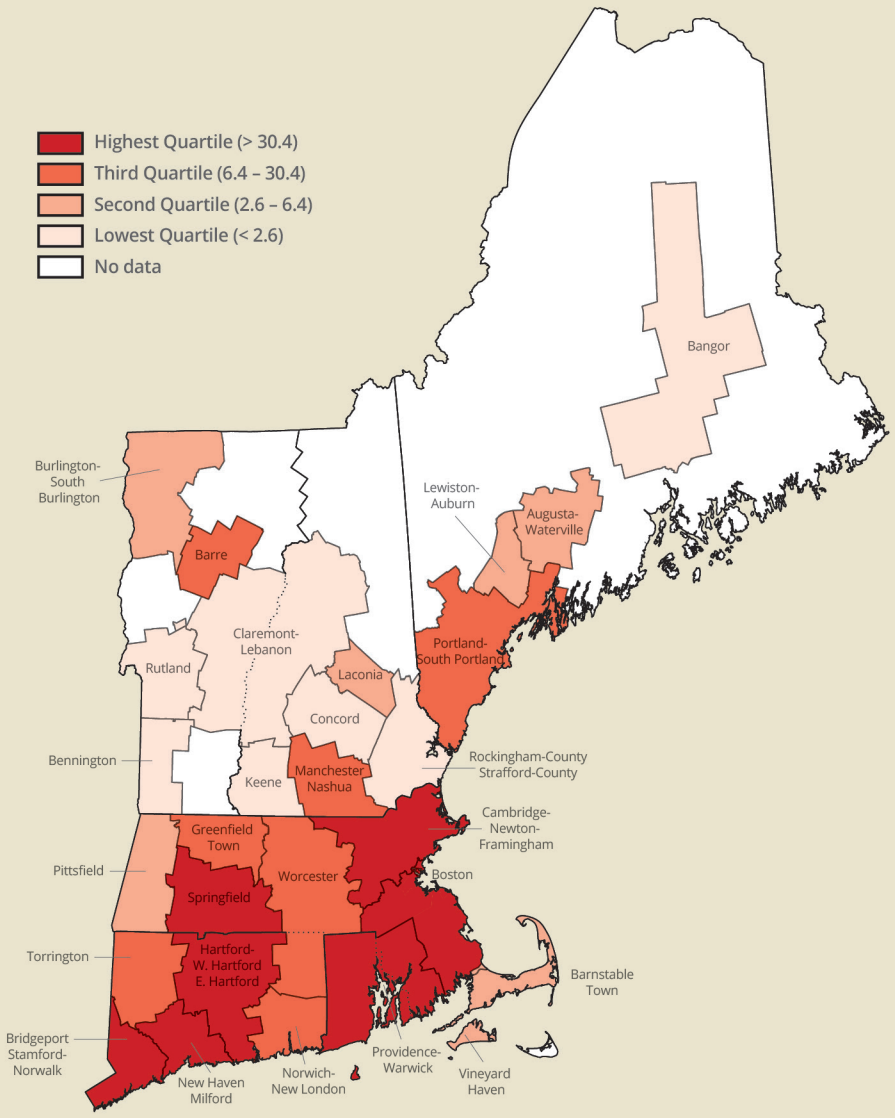
being analyzed.[13] A coefficient of 1.0 (roughly the top of the range of actual estimates) implies that a 10 percentage point difference in poverty exposure between races or between disadvantaged and not-disadvantaged students is associated with a 0.1 standard deviation difference in the test-score gap (a difference of 10 in the test-score gap as scaled in Tables 1 and 2 and Figures 1 through 3).

Because the measured segregation is much higher between districts than within districts in New England metro areas, this discussion focuses on "effects" of between-district poverty segregation. Figures 5 through 7 display quartiles of the between-district poverty segregation measures for metropolitan areas in New England. Table 4 reports these data and the other variables shown in Table 3 for the individual metro areas in New England.

13 These estimated coefficients are reported in column 3 of Tables 3, 4, and 5 of Bradbury (2021). The subset of those estimates that is used in the calculations below refers to coefficients on the *between-district* poverty segregation variables.

Figure 6

Between-District Hispanic-White Poverty Segregation
New England Metropolitan Areas, 2008–2016

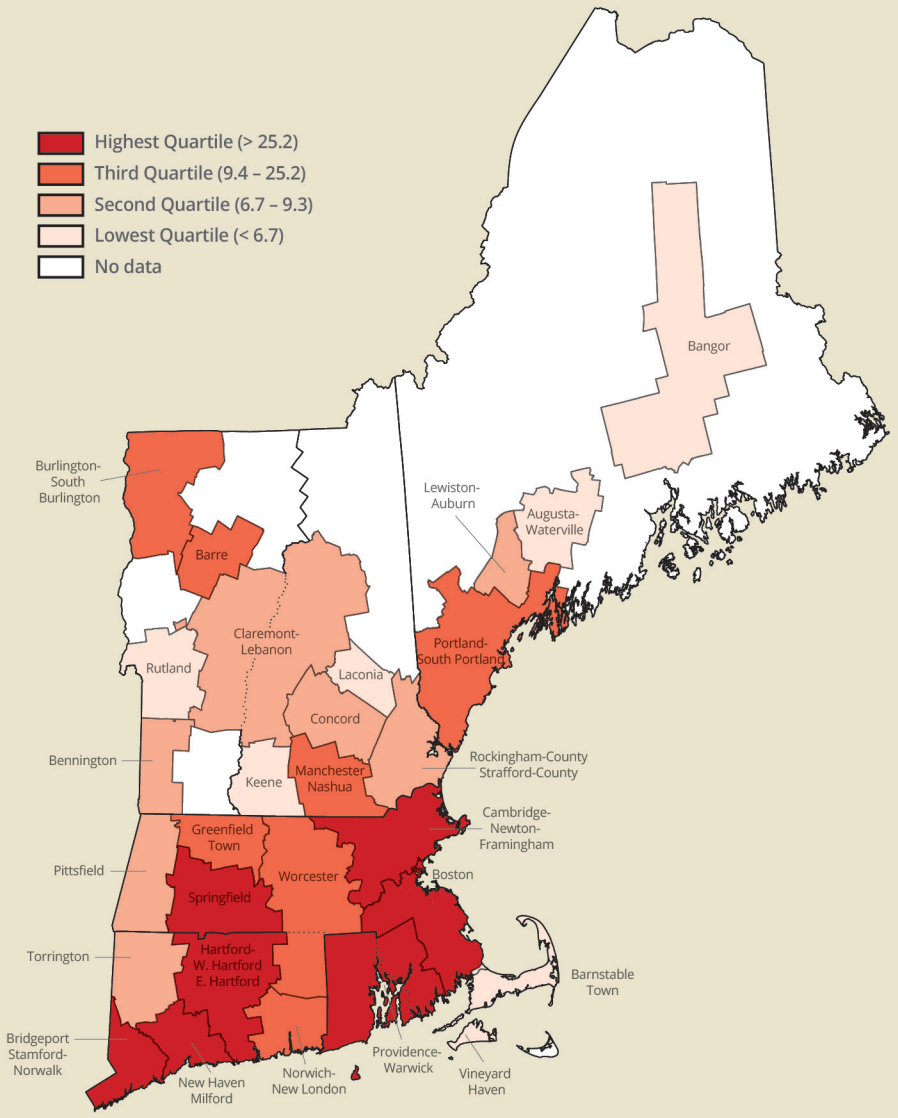


Source: Author's calculations based on data published by Stanford Education Data Archive; seda_cov_metro_pool_v30.dta
Note: Hispanic-white poverty segregation reflects Hispanic-white difference in exposure to low-income students in school district.

The similarities between Figures 1 and 5, Figures 2 and 6, and Figures 3 and 7 are striking, especially regarding the highest quartiles of test-score gaps and between-district segregation. For example, in Connecticut, the New Haven-Milford and Hartford-West Hartford-East Hartford metro areas display between-district Black-white poverty segregation of 33 to 34 percentage points and white-Black test-score gaps of 85 to 90, while the neighboring Torrington metro area registers between-district Black-white poverty segregation of 7 percentage points and a test-score gap of 52 (representing just over one-half a standard deviation in the test score); the estimated relationship "predicts" more than half (22 to 23) of the actual 33 to 38 difference in test-score gaps. The Bridgeport-Stamford-Norwalk area, with the largest New England white-Black test-score gap (115) and Black-white between-district poverty segregation measured at 49 percentage points (also the largest value in New England), would be predicted to have a white-Black test-score gap that is 35 larger than Torrington's and 12 to 13 larger than those of New Haven-Milford or Hartford-West

Figure 7

Between-District Poverty Segregation
New England Metropolitan Areas, 2008–2016



Source: Author's calculations based on data published by Stanford Education Data Archive; seda_cov_metro_pool_v30.dta

Note: Poverty segregation reflects difference between low-income and higher-income students in exposure to low-income students in school district.

Hartford-East Hartford, amounting to more than one-half the actual difference with Torrington (63) and almost one-half the 25 to 30 differences with New Haven-Milford and Hartford-West Hartford-East Hartford.[14]

At the lower end of Black-white poverty segregation and test-score gaps, compare the Barre, Rutland, and Bennington metro areas in Vermont with the Burlington-South Burlington metro area. Burlington-South Burlington has the largest white-Black test score gap in Vermont (and the second largest in New England), at 92. White-Black test-score gaps in the other Vermont metros

14 The prediction comparing Bridgeport-Stamford-Norwalk with Torrington is calculated as follows: The estimated coefficient on Black-white poverty segregation between districts in the white-Black test-score gap equation is 0.84. The difference in between-district Black-white poverty segregation between the Torrington metro area and the Bridgeport-Stamford-Norwalk metro area amounts to 41 percentage points (slightly under 49 minus slightly over 7). Multiplying that 41 percentage point difference in Black-white between-district poverty segregation times the coefficient yields a predicted difference in test-score gaps of 35, which amounts to 55 percent of the actual difference (63) in test-score gaps between Bridgeport-Stamford-Norwalk and Torrington.

range from 39 (Rutland) to 65 (Bennington). The between-district Black-white poverty segregation measures for the three smaller metros range from almost 2 (Barre and Bennington) to 4 (Rutland), while Burlington-South Burlington's between-district Black-white poverty segregation amounts to 13 percentage points; that difference suggests a test-score difference of 7 to 9, representing one-seventh to one-third of the actual test-score differences.

For Hispanic-white differentials, the Boston, Cambridge-Newton-Framingham, and Springfield metro areas in Massachusetts have white-Hispanic test-score gaps in the mid- to high 70s (73, 79, and 77, respectively) and Hispanic-white between-district poverty segregation near 40 percentage points (42, 36, and 39, respectively). By contrast, the Vineyard Haven and Greenfield metro areas in Massachusetts have white-Hispanic test-score gaps of 43 and 42, respectively, and between-district Hispanic-white poverty segregation of 3 and 8 percentage points, respectively. With an estimated coefficient on Hispanic-white between-district poverty segregation close to 1.0 (0.95), the test-score differential associated with Hispanic-white between-district poverty segregation accounts for three-quarters to almost the entire size of the actual 30 to 37 difference in test-score gaps between the two groups of metro areas.

The four metro areas in Maine have white-Hispanic test-score gaps averaging 29 and Hispanic-white between-district poverty segregation averaging 4; these measures contrast sharply with Worcester (Massachusetts) and Providence-Warwick (Rhode Island), where the white-Hispanic test score gaps are 75 and 76, respectively, (three-quarters of a standard deviation) and the Hispanic-white poverty segregation between districts is 28 and 34 percentage points, respectively. In this case, the predicted difference of 25 in test-score gaps between the two groups of metro areas amounts to more than half of the actual difference.

The calculations are similar for the contributions of between-district poverty segregation to differences in not-disadvantaged–disadvantaged test-score gaps. For example, In New Hampshire, the Manchester-Nashua metro area has a not-disadvantaged–disadvantaged test-score gap of 72 and between-district poverty segregation measured at 15 percentage points; by contrast, the Claremont-Lebanon, Concord, and Rockingham County-Strafford County metro areas have not-disadvantaged–disadvantaged test-score gaps in the mid-50s and poverty segregation of 8 or 9 percentage points. The predicted difference in test-score gaps between those three areas and Manchester-Nashua is 6, amounting to about one-third of the actual difference of 17 in test-score gaps. A comparison between the four Maine metro areas and Worcester and Providence-Warwick is instructive again regarding not-disadvantaged–disadvantaged test-score gaps.[15] The Maine areas have not-disadvantaged–disadvantaged test-score gaps ranging from 48 to 66 and between-district poverty segregation ranging from 5 to 9. Not-disadvantaged–disadvantaged test-score gaps for Worcester and Providence-Warwick are in the mid-70s, very similar to their white-Hispanic test-score gaps; at the same time, between-district poverty segregation is in the mid-20s. The estimated relationship predicts Worcester and Providence-Warwick to have test-score gaps that are 16 larger than those of the four Maine areas, accounting for five-sixths of the actual difference in their not-disadvantaged–disadvantaged test-score gaps.

The calculations and specific numbers reported above highlight the importance and strength of the relationship between poverty segregation and test-score gaps between children of different races and socioeconomic statuses. As noted earlier, this relationship is strong for both within-district and between-district poverty segregation; this report focuses on the latter because this type

15 While the Maine metro areas have considerably lower percentages of students who are Hispanic compared with Worcester or Providence-Warwick, Maine's percentages of students living in poverty are not markedly lower than those of Worcester or Providence-Warwick.

of segregation is substantial in New England metropolitan areas. The next section explores other characteristics associated with between-district poverty segregation in metro areas, especially in New England.

B. The Sources of Between-District Poverty Segregation

The calculations above, along with multiple papers by Sean Reardon and co-authors (including Reardon 2016 and Reardon et al. 2019), document that differential exposure to fellow low-income students is strongly associated with differential test-score outcomes; greater segregation of poverty between races or overall is strongly related to greater racial or socioeconomic test-score gaps. The Bradbury study measures segregation in two parts, between schools within districts and between districts within metropolitan areas, establishing that both types of segregation are strongly related to test-score gaps. In New England, as noted earlier, segregation between districts is much more pronounced than segregation within districts, although this is not the case nationwide. Segregation within districts largely reflects school-assignment policies: To what degree do children of different races or children of different economic statuses attend different schools within the district? Many districts tie school attendance, especially elementary-school attendance (which is what is analyzed here), to where students live, assigning children living in specific neighborhoods to specific elementary schools. Given that practice, school district officials possess at least one policy lever to reduce within-district poverty segregation: school-assignment policies. School districts could loosen the links between residential location and school attendance, as some urban districts have attempted to do by introducing within-district school-choice policies. But within-district school assignment is not the key element in New England poverty segregation; between-district segregation is, and between-district segregation reflects residential location across school-district boundaries.

Some individual school districts and metropolitan areas engage in school-choice programs that allow students to attend schools or districts not tied to their residence location. The Boston area, for example, has long had the METCO program, which allows some minority students living in Boston to attend the public schools in surrounding suburbs. Such programs loosen the link between the characteristics of the district of residence and those of the place where the student attends school; that is, they reduce segregation of *students* between districts.

Such *student-moving* programs notwithstanding, between-district poverty segregation in metropolitan areas results from the residential location decisions of parents across the school districts within each metropolitan area. In New England, the boundaries of elementary-school districts generally coincide with the boundaries of cities and towns—the dominant form of (very) local government in New England. Those parental location decisions are constrained in various ways, as considerable research on residential segregation by income and by race documents; they range from historical patterns of settlement and the relative cost of existing housing stocks to policies such as local zoning and state support for housing development. Higher levels of between-district poverty segregation reflect concentrations of low-income families in some school districts and other metro-area districts comprising mostly families with higher incomes.

While poverty rates are higher, on average, among minority families than among white families, the critical issue in racial test-score gaps is racial differences in exposure to poverty, not racial segregation per se. That said, racial segregation and racial differences in exposure to poverty are highly correlated; that is, metro areas where Black-white or Hispanic-white segregation (within or between districts) is high typically have high levels of Black-white or Hispanic-white poverty segregation (within or between districts). Similarly, the critical issue for test-score gaps between

not-disadvantaged and disadvantaged students is differential exposure to poverty. (By definition, free-lunch students are generally more exposed to free-lunch students [including themselves] than are students who are not eligible for free school lunches, but when the fraction of free-lunch students is the same in every district, between-district poverty segregation is zero.)

Segregation within districts largely reflects school-assignment policies: To what degree do children of different races or children of different economic statuses attend different schools within the district?

The locational constraints noted above often keep low-income families living near other low-income families and allow families with more resources to choose to live near other higher-income families. Minimum-lot zoning, density limits, and other restrictions on housing construction can make homes in some towns too expensive for low-income families to move in. For example, Rothwell (2012) reports that "across the 100 largest metropolitan areas, housing costs an average of 2.4 times as much…near a high-scoring public school than near a low-scoring public school" (p. 1). While state and federal fair housing laws prohibit discrimination against "protected classes"[16] in the sale and rental of housing, there are no such protections against "discrimination" based on income; a prospective owner or tenant must be able to pay the market price or rent.

Most federal and state subsidies for affordable housing have the effect of adding to the affordable stock in lower-income jurisdictions that already include more low-cost housing. For example, housing units produced under the nation's largest affordable housing development program, the Low-Income Housing Tax Credit (LIHTC), are "disproportionately located in higher-poverty, racially concentrated areas" (Fischer 2018, p. 3). Federal and state affordable housing subsidies are not generally adopted in higher-income communities with high-quality schools. In earlier research, Ellen and Horn (2012) document that the schools to which subsidized-housing families have access are, on average, lower quality than those of all families, all renters, and even all families living in poverty.[17] Ellen and Horn (2012) report data also by state, which show that students living in subsidized housing in the New England states are similarly prone to have access to schools of lower quality and higher poverty compared with the schools to which all low-income children in the state have access.[18]

Some states have enacted policies aimed at encouraging all localities to include some affordable housing in their development plans. When such programs succeed, the affordable housing stock is more dispersed geographically. A prime example is the chapter 40B program in Massachusetts, which streamlines the permitting process (potentially over objection of local planning boards) for eligible development proposals in local communities that do not have at least 10 percent of their housing stock categorized as affordable.[19] While some communities

16 For example, Massachusetts fair housing laws identify 14 protected classes: race, color, national origin, religion, sex, familial status (that is, whether a household includes children), disability, source of income (for example, a Section 8 voucher), sexual orientation, gender identity, age, marital status, veteran or active military status, and genetic information. See Office of the Attorney General Maura Healey, "Overview of Fair Housing Law."

17 Ellen and Horn (2012) examine four housing-subsidy groups: public housing, Project-based Section 8, Housing Choice Voucher households, and LIHTC units. Nationwide, they find that three of the four groups (all but LIHTC families) have access to schools with test scores that are lower than the test scores of the schools to which all households, renter households, and households living in poverty with children in the same state have access; LIHTC families have access to schools of lower quality than the schools to which all families with children and renter families have access; compared with households living in poverty, LIHTC families have access to schools of similar quality. The fraction of students receiving free or reduced-price lunch in the nearest school is higher for public housing and Housing Choice Voucher households than it is for all households living in poverty with children in the same state.

18 See Ellen and Horn (2012) Table 1 for U.S. data and Appendix A of that paper for state data.

19 The streamlining process can also occur in communities that otherwise fail to meet the state's criteria for affordable housing, for example, by not developing a Housing Production Plan, having it certified, and making progress on it.

build affordable housing to attain the 10 percent goal and avoid being vulnerable to a developer's 40B proposal, Chapter 40B has "supported almost all affordable housing construction in Massachusetts outside of the Commonwealth's largest cities" since its passage in 1969.[20] Massachusetts also provides subsidies to cities and towns implementing "Smart Growth" affordable housing policies to offset, at least partially, the fiscal costs of such developments: Chapter 40R, enacted in 2004, uses state financial incentives to encourage municipalities to create special zoning overlay districts that allow for increased housing densities, so long as the zoning requires that at least 20 percent of the units are affordable and that they combine mixed uses; Chapter 40S, enacted a year later, provides state subsidies to local governments to cover the net increase in education costs resulting from the development of affordable housing built under the Chapter 40R program.[21] Karki (2015) argues that the 40R and 40S programs address the key problem of most statewide affordable housing mandates by providing incentives to local governments, not only to developers. Unfortunately, a 2018 report (CHAPA 2018) finds that "unpredictable state funding for incentives and underfunding of 40S reimbursements" have limited the impact of these laws to date.

A recent report by researchers affiliated with the Brookings Institution and Boston Indicators (Crump et al. 2020) focuses on the Boston metropolitan area and argues that "high housing costs and inadequate supply are not a natural outcome of market forces; they are the result of policy choices. Too many of the cities and towns in the Boston area and places like it have used zoning and other regulations to limit new housing development, especially of small, moderately priced homes." Specifically, they say, "exclusionary zoning by affluent, mostly white communities exacerbates racial and economic segregation in the region, limiting Black and Latino or Hispanic families' access to high-opportunity communities." They argue for "a statewide policy allowing townhouses and apartments to replace single-family homes near transit."[22] Such programs are aimed explicitly at creating more housing units, denser development, and more affordable housing at least near transportation nodes throughout a metropolitan area, in line with the "Smart Growth" incentives of Chapter 40R.

Rhode Island has a law similar to Massachusetts's Chapter 40B, the Low and Moderate Income Housing (LMIH) Act of 1991. Cities and towns in Rhode Island have made some progress in attaining that state's 10 percent affordable housing goal; however, only six of the state's 39 communities have attained the goal (and most of those had already done so when the law was enacted).[23]

Inclusionary zoning or inclusionary housing policies represent another approach to providing affordable housing in low-poverty neighborhoods. Most inclusionary zoning (like exclusionary zoning) is adopted by local governments. In the New England context of small cities and towns with dependent school districts, local policies have little scope to address *between-district* segregation, since they would not result in poor families gaining access to low-poverty school districts.[24]

20 See MassHousing, "About Chapter 40B." Also, "Chapter 40B is the state's regional planning statute, and the law seeks to *ensure that all 351 of the Commonwealth's cities and towns provide housing opportunities for low- and moderate-income working households and older adults*. At the same time, Chapter 40B provides ample opportunities for municipalities to control their own housing growth" (emphasis added).

21 See Massachusetts Housing and Community Development, "Chapter40R" and "Chapter40S."

22 The quotations in this paragraph are from Crump, Mattos, et al. (2020).

23 See HousingWorksRI (2019), page 14.

24 Inclusionary zoning has proven to reduce *within-district* poverty segregation by locating affordable housing in school catchment areas for low-poverty schools. Montgomery County, Maryland, for example, has affordable set-asides for developers and allows the public housing authority to purchase a percentage of such units. Public housing students attending low-poverty schools saw elementary-school educational gains compared with similar public housing peers attending moderate-poverty schools, according to research by Schwartz (2010). Montgomery County is a large, relatively affluent school district in the suburbs of Washington, D.C. For additional examples, including Cambridge, Massachusetts, and Burlington, Vermont, in New England, see Schwartz et al. (2012).

As noted above, the New England states are characterized by geographically small cities and towns with dependent public-school districts. In this context, adoption of statewide affordable housing mandates involves trade-offs against a long history of local control of both development and schools. Such state requirements, however, address equity issues regarding exclusionary zoning, reduce socioeconomic and racial segregation, and may have payoffs in terms of reduced racial and socioeconomic test-score gaps.

V. Discussion

During a time of increased focus on inequality, both racial and economic, reducing disparities in K–12 educational success seems especially important. Equal educational opportunity is a key foundation for a more equitable society.

One important factor associated with test-score gaps is the progressivity of the state distribution of school aid, measured in terms of the degree to which the state provides more aid per pupil to high-poverty districts. As noted earlier, states have diverse goals in distributing aid to local school districts. Nonetheless, one key reason for state school aid in many states is to offset cost differentials related to student characteristics, notably the extra costs associated with educating students living in poverty. States that provide greater aid to high-poverty districts than to low-poverty districts have smaller racial and economic test-score gaps in the metro areas where high-poverty districts are concentrated. Whether this relationship is causal or not, progressive aid distributions are a worthwhile goal for states to pursue; as noted above, state-by-state studies can establish how "tilted toward poverty" the distribution should be to address poverty-related cost differentials. And if the relationship with test-score gaps were causal, a greater emphasis on state-aid progressivity would contribute to more equal educational opportunity across races and income groups.

A greater emphasis on state-aid progressivity could contribute to more equal educational opportunity across races and income groups.

Research also confirms a very strong link between test-score disparities by race or by economic disadvantage and segregation of students along the same dimensions. That is, in metro areas where minority students are in schools or districts with much greater poverty than the schools of white students, test-score gaps between the races are larger and, similarly, in metro areas where low-income students are more segregated among schools or among districts, economically disadvantaged students perform less well relative to students who are not disadvantaged. For metropolitan area test-score gaps, segregation matters both across schools within districts and across districts within metro areas. In New England, segregation across districts within metro areas is more pronounced; advocates of equal opportunity should continue to press for reductions in barriers to residential location choice among districts, which could be achieved in part through incentives for affordable housing in higher-income districts. If economically disadvantaged and not-disadvantaged students and minority and white students go to the same schools or attend schools in the same districts, the education they receive is likely, or more likely, to be similar versus their attending different schools or schools in different districts.

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