Spatial Inequality of Educational Opportunity: A Portrait of Schools Serving High- and Low-Income Neighborhoods

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Abstract

Neighborhoods and schools are both important contexts for children's well-being, including educational outcomes. While often posited, little evidence documents inequalities in schools serving high- and low-income neighborhoods. In this article, we use geospatial techniques to combine five administrative datasets to examine the characteristics of local public schools serving high- and low-income neighborhoods in U.S. metropolitan areas in 2013-14. We find that high-income neighborhoods are served by schools with greater social, financial, and instructional resources and greater student achievement than schools serving low-income neighborhoods. Moreover, when metropolitan neighborhoods are highly segregated by income, these inequalities are exacerbated. Our results demonstrate the link between neighborhood and school disadvantage, with implications for policymakers concerned about social mobility and inequality.

Keywords: neighborhoods, schools, income segregation, residential segregation

Neighborhoods and Schools

The robust neighborhood effects literature demonstrates that neighborhoods are a critically important context for children's development and well-being, including educational outcomes (Chetty, Hendren, and Katz 2016; Sharkey and Faber 2014). Hypotheses about *why* neighborhoods matter—the mechanisms linking contextual features of neighborhoods like socioeconomic disadvantage to children's outcomes—have been proposed, but little evidence on these mediating mechanisms is available. One proposed mechanism through which neighborhoods affect children's educational outcomes is neighborhood institutional resources (Jencks and Mayer 1990; Leventhal and Brooks-Gunn 2000), specifically the local schools linked to children's neighborhoods. In many countries, where a child lives determines or at least influences where she attends school, so one way neighborhoods shape children's outcomes is by affecting what school they attend.

Large bodies of research demonstrate the effects of both neighborhoods and schools on individuals' educational outcomes. The extant literature often considers these two contexts separately. The studies that do consider neighborhoods and schools jointly when predicting students' outcomes reach differing conclusions about the relative importance of each context. For example, studies in the U.S. (Ainsworth 2002; Carlson and Cowen 2015), Sweden (Brannstrom 2008), Finland (Kauppinen 2008) and the Netherlands (Sykes and Musterd 2011) show that school characteristics largely mediate the effect of neighborhood characteristics on educational outcomes. However, in recent work on the U.S., Wodtke and Parbst (2017) find that school poverty does not account for the effect of neighborhood disadvantage on children's achievement, and their results suggest that changing a child's school makes little difference as long as he continues to live in a disadvantaged

neighborhood. Identifying the independent effects of neighborhoods and schools is challenging because in many places, children from the same neighborhood attend the same or observationally similar schools, so variation may not be sufficient to generate causal evidence. Neighborhood and school contexts also interact with one another in complex ways (Owens 2010) and may have differential effects on different student groups (Pong and Hao 2007). School desegregation programs in the U.S. provide one opportunity to examine the causal effects of changing a student's school while not changing his or her neighborhood, and research demonstrates large positive school effects on black and low-socioeconomic status (SES) students' educational outcomes, even while their neighborhoods do not change (Guryan 2004; Reber 2010; Schwartz 2012). However, observational studies comparing neighborhood and school segregation conclude that *neighborhood* segregation is a more powerful predictor of educational success than school segregation, implying that integrating schools without altering neighborhood contexts has limited effects (Card and Rothstein 2007).

Studies are not strictly comparable because they vary in their designs and measurement of school and neighborhood features, but a puzzle remains as to whether schools are an important pathway through which residence in a particular neighborhood leads to children's success or failure. This article takes a different approach to the investigation of schools as potential mediators for neighborhoods' effects on children's educational outcomes. Rather than estimate effects of neighborhoods and schools (and family characteristics) on individual outcomes, we focus on the degree to which school characteristics vary across neighborhoods of different income levels and how this variation is exacerbated by income segregation in metropolitan areas. This approach is consistent

with Oberti (2007)'s call for the need to examine "the link between social profiles of urban spaces and social profiles of schools" to better understand the complex relationship between neighborhood and school segregation. While scholars, media, and the public often posit that children living in disadvantaged neighborhoods attend lower-quality, lesser-resourced, or lower-performing schools than children living in advantaged neighborhoods, little empirical evidence evaluates this claim.[1] This article fills this gap in the literature by documenting the student body composition, school climate, teacher characteristics, school funding, and achievement levels in the local public schools serving high- and low-income neighborhoods in the U.S. In the U.S. over the past several decades, children's neighborhoods have become increasingly unequal. Income segregation between neighborhoods among families with children increased nearly 20% from 1990 to 2010 (Owens 2016), so more children live in either homogenously affluent or homogenously poor neighborhoods than in the past. Therefore, we also document how neighborhood income segregation contributes to inequalities between the local public schools serving the highest- versus lowest-income neighborhoods in a metropolitan area. Altogether, our analyses of local school characteristics provide a portrait of the educational opportunities available to children growing up in high- and low-income neighborhoods.

Measuring School Characteristics

The educational research literature has identified many aspects of schools that may predict students' success. This article focuses on several theoretically-informed

[1] Some research shows that disadvantaged children attend schools with fewer resources than advantaged children, but these studies do not evaluate spatial inequalities between neighborhoods (Goyette 2017; Phillips and Chin 2004).

characteristics of schools that are associated with students' achievement levels, both inputs—student body, teacher, and school characteristics—and outputs—student achievement and achievement growth. Analyses here are limited by characteristics easily quantified and measured by national administrative datasets, so we focus on these characteristics rather than more process-driven characteristics like classroom culture or peer interactions.

First, we document the student body composition—racial/ethnic, economic, and ability—of schools serving high- versus low-income neighborhoods. Since at least the Coleman report (1966), researchers have examined the role of peers in contributing to students' success. Peers' racial composition and the impact of racial segregation on the black-white educational achievement gap has received significant attention (Card and Rothstein 2007; Cutler and Glaeser 1997). A review of the literature indicates that attending school with more black peers disadvantages black, and to a lesser degree, white students (Vigdor and Ludwig 2008). The effect size is small—Vigdor and Ludwig indicate that a 10% increase in black student share reduces achievement test scores for black students by between 0.025 and 0.08 standard deviations. With respect to peers' economic backgrounds, Schwartz (2012) provides causal evidence that low-income children's achievement and achievement growth is greater in higher- than in lower-income schools, finding that low-income students attending schools with a poverty rate below 35% scored about 0.4 standard deviations higher on math assessments, with smaller effects on reading. Research also demonstrates that attending school with higher-achieving peers improves children's outcomes. Hanushek et al. (2003) analyze administrative data from Texas public schools and find that a 0.1 standard deviation increase in peer achievement corresponds to

a 0.02 standard deviation increase in achievement. Overall, peer effects studies demonstrate that who a student goes to school with influences his or her achievement. Note that we do not argue that school racial/ethnic, income, or ability composition is a measure of school quality in and of itself. Rather, we argue that school peers are important if they shape the economic, social, or cultural resources available to a child, such as teacher quality, school funding, parental involvement, or peers' orientation toward achievement (Rumberger and Palardy 2005).

Second, we consider the attendance and disciplinary climate in schools. Research demonstrates that chronic student absences are detrimental not only to the absent students' achievement, but to the achievement of other students in the classroom of chronically absent students (Gottfried 2011). Similarly, having more classroom peers that have been grade-retained reduces non-retained students' achievement test scores (Gottfried 2013). A one standard deviation increase in unexcused absences or retained peers corresponds to declines of about 0.04-0.06 standard deviations in both reading and math. Researchers, educators, parents, and the media have also paid considerable attention to inequalities in disciplinary actions experienced by students of different racial/ethnic or socioeconomic backgrounds (Skiba et al. 2002). We examine whether there are inequalities in the disciplinary actions in schools serving high- or low-income neighborhoods. Disciplinary action may proxy for disruptive student behavior, which has spillover effects on peers, reducing test score performance (Figlio 2007) or these measures may capture differences in disciplinary practices. Broadly, the disciplinary and attendance variables provide one measure of the atmosphere or climate of the school.

Third, we examine inequalities in teacher characteristics between schools serving high- and low-income neighborhoods. Teachers are perhaps the school input that researchers have most closely linked to student's achievement (Goldhaber and Brewer 1997; Rivkin, Hanushek, and Kain 2005). However, the characteristics of teachers that predict student success are not well understood. There is mixed research on whether teacher credentials matter as much as often thought, while more robust evidence indicates that teacher experience is an important predictor of children's outcomes (Clotfelter, Ladd, and Vigdor 2007; Greenwald, Hedges, and Laine 1996; Loeb and Page 2000; Rivkin et al. 2005). Clotfelter and colleagues, for example, find that teachers with 3 to 5 years of experience produce gains in math and reading that are about 0.02 standard deviations larger compared to teachers with 1 to 2 years of experience. Teachers with over 20 years of experience produce gains about twice as large as do teachers with 1 to 2 years of experience. Some research demonstrates that teachers' salaries are positively linked to students' achievement and attainment (Hedges, Laine, and Greenwald 1994; Jackson, Johnson, and Persico 2016). We examine whether these teacher characteristics vary across schools serving higher- or lower-income neighborhoods in metropolitan areas.

Fourth, considerable research examines the impact of school funding on students' outcomes. School funding derives from federal, state, and local sources, so variation is primarily at the district, rather than school, level. Families are segregated between school districts by income (Owens, Reardon, and Jencks 2016), so high- and low-income neighborhoods are often located in separate districts that may have different funding levels. Local school revenues in the U.S. are based, in part, on district property taxes, so higher-income districts typically have greater local revenues than lower-income districts.

School finance reform since the 1970s has reduced inequalities in the funding levels of high- and low-income districts, but in many states, high-income districts still receive more resources than low-income districts due to revenues from income and sales taxes (Baker et al. 2017; Baker and Corcoran 2012). Moreover, income segregation creates districts of concentrated poverty, where the costs of educating one poor child may be higher than in more integrated districts. Few states have sufficient compensatory funding to produce the same outcomes for a poor student in a low-income compared to a high-income district (Baker and Green 2015). Scholars debate whether school spending contributes to students' achievement (Hanushek 2003), but recent comprehensive causal evidence indicates that higher per-pupil spending increases students' educational attainment and future economic outcomes (Jackson et al. 2016).

Finally, we explore measures of school quality in terms of outputs: students' test scores. We assess how schools perform on their states' accountability tests, compared to other schools in the state. Achievement levels are of course an imperfect way to capture schools' quality and efficacy, as they are conflated with the demographic and pre-existing ability composition of the student body (Downey, von Hippel, and Hughes 2008). A preferred, though still imperfect, measure is to consider growth in proficiency levels over time, which we examine.

Data and Methods

Defining High- and Low-Income Neighborhoods

We use the five-year aggregate 2011-15 American Community Survey (ACS) data to classify census tracts (neighborhoods) according to their median household income. We

create quintiles of neighborhoods by median household income within their metropolitan area, including city and suburban neighborhoods.[2] We replicated analyses defining neighborhood socioeconomic status (SES) by poverty rate and concentrated disadvantage, which support substantively identical conclusions.[3] Appendix Table 1 presents additional socioeconomic indicators by neighborhood income quintile. We present results based on neighborhood income quintile because of its clearer link to income segregation between neighborhoods, the second part of our analysis. We define neighborhoods as tracts to be consistent with the bulk of quantitative neighborhood research in the U.S.

Linking Neighborhoods and Schools

To identify the schools serving each tract, we use a school-neighborhood link dataset created by Candipan (2017). The dataset provides a crosswalk between public schools' attendance zone identifiers and identifiers for multiple Census geographies, including blocks and tracts. The dataset draws on the 2013-14 school attendance boundary shape files provided by the School Attendance Boundary Survey (SABS) and, using geospatial techniques, links blocks and tracts to attendance boundaries for U.S. public schools.[4] Ninety-five percent of blocks, the smallest level of U.S. Census geography, are circumscribed within attendance boundaries, while tracts are more frequently bisected,

[2] Metropolitan areas are defined by the 2013 Office of Management and Budget definitions of core based statistical areas and divisions.

[3] Alternative neighborhood SES measures included (1) categorizing neighborhoods as < 10%, 10 to 19.9%, 20 to 29.9%, 30 to 39.9%, and 40%+ poor (Jargowsky 1997); and (2) creating a concentrated disadvantage index (Sampson, Sharkey, and Raudenbush 2008; Wodtke, Harding, and Elwert 2011) using factor analysis to combine neighborhoods' rates of unemployment, welfare, female-headed household, poverty, and residents with at least a college degree or less than a high school diploma. We then created quintiles of neighborhoods by their concentrated disadvantage score within metropolitan areas. We present results from household income quintiles; results from concentrated disadvantage quintiles are very similar. Results from the poverty categories differ slightly because the majority of neighborhoods have poverty rates below 10%, with most neighborhoods in the two 30% poor or more categories falling in the top quintile of concentrated disadvantage.

[4] Local school districts reported attendance boundary data. Maps, descriptions, and address lists were converted into shape files that can be overlaid onto Census geography.

served by multiple schools. On average, about 2.5 schools serve each tract. The crosswalk provides population weights to indicate the share of the tract's population served by each school, based on total block-level population data. When tracts are served by more than one school (the maximum number is 11, the median is 2), we take a weighted average of the characteristics of all schools serving that neighborhood. We focus on elementary schools and use the 4th grade crosswalk, so we present characteristics of the average school serving neighborhoods in different income quintiles.

Geographic coverage is not universal in SABS—approximately 17% of tracts in the 2011-15 ACS are not linked to school attendance boundaries in 2013-14. Analyses of tract characteristics, including median household income, between those included and excluded from SABS do not reveal notable differences. We present results for all tracts covered by SABS, which includes at least one tract from 378 (of 380) metropolitan areas in the U.S. On average, 84% of tracts in each metropolitan area are included in the sample, and at least 75% of tracts are included in over 75% of metropolitan areas. Appendix Table 2 presents sociodemographic characteristics of the metropolitan areas in the sample. Limiting the analysis sample to tracts in metropolitan areas with full geographic coverage (N=92 metropolitan areas) produces substantively consistent results (available upon request).

School Characteristics

We measure characteristics of the local public schools linked to each neighborhood via three administrative datasets provided by government agencies: Common Core of Data (CCD), Office of Civil Rights (OCR) data, and EDFacts. The CCD publishes school-level enrollment counts by race/ethnicity and economic status annually. The CCD also produces the Local Education Agency (School District) Finance Survey data (F-33) on school funding.

We access the F-33 data via the School Funding Fairness Data System (SFF) (Baker, Srikanth, and Weber 2016). OCR restricted-use data provides school-level data in 2013-14 on student body, teacher, curricular, and disciplinary characteristics. EDFacts provides school-level data on state-administered proficiency tests in 2013-14. In describing the features of public schools serving high- and low-income neighborhoods, we exclude charter and magnet schools to focus on the local neighborhood schools. We explore the following school characteristics from these datasets for all public traditional elementary schools in the sample, with the data source indicated in parentheses:

School composition: racial composition (proportion non-Hispanic white, black, Asian, and Hispanic, CCD); free/reduced price lunch (FRPL) eligibility rate (students whose family income is less than 185% of the federal poverty threshold are FRPL eligible; this is the only nationally-available indicator of students' economic status, CCD); Limited English Proficiency (LEP) rate (OCR); Gifted and Talented (GATE) rate (OCR)[5]

School absenteeism and disciplinary climate (OCR): rates of chronic absenteeism (students absent 15 days or more), suspension (proportion of students with at least one out-of-school suspension), and grade retention

Teacher characteristics (OCR): proportion of certified teachers, proportion of first or second-year teachers, average teacher salary, adjusted by the Education Comparable Wage Index (ECWI) to account for differences in cost of living across labor markets (Taylor and Fowler Jr. 2006; Weber, Srikanth, and Baker 2016)

[5] We consider LEP and GATE as rough proxies for peer ability, though selection into GATE is influenced by school and parent practices. Past research demonstrates that having more LEP peers may reduce students' achievement (Cho 2012). School proficiency test scores also measure peer ability.

School funding: district-level total per-pupil spending (sum of spending on instruction, support services, and other), adjusted by the ECWI. For the school funding analysis, we follow past research and drop schools with values greater than 150% of the 95th percentile and less than 50% of the 5th percentile to account for outliers (Murray, Evans, and Schwab 1998)

Achievement and growth (EDFacts): EDFacts provides data on the proportion of students meeting state-determined proficiency standards on reading and math standardized accountability tests. We focus on the proportion of 4th grade students exhibiting proficiency in math and reading in 2013-14 and the school-level change in the proportion of 4th graders proficient from 2009-10 to 2013-14.[6] To account for differences between states in accountability tests and definitions of proficiency, we percentile rank all schools in each state, regardless of whether they are in the analysis sample, by their level of proficiency in 2013-14 or level of growth from 2009-10 to 2013-14 and classify schools by their achievement level or growth percentile within their state.

Measuring Income Segregation between Neighborhoods

In addition to comparing the characteristics of schools serving high- and low-income neighborhoods, we examine whether differences in these characteristics are larger in metropolitan areas with greater income segregation between neighborhoods. In metropolitan areas with high levels of income segregation, the socioeconomic differences between high- and low-income neighborhoods will be larger—the lowest quintile of neighborhoods will be more homogenously poor and the highest quintile of neighborhoods

[6] EDFacts masks the exact proficiency rate for small student populations, instead providing ranges (e.g., for schools with 31-60 4th graders, data indicate whether < 10%, 11-19%, etc. were proficient). For schools where a range was provided rather than a precise value, we assigned the midpoint value.

will be more homogenously rich. These neighborhood inequalities in more segregated places may be reflected in the schools serving high- and low-income neighborhoods. We use the rank-order information theory index (*H*) to estimate income segregation within metropolitan areas between tracts, using 2011-15 ACS data on household income. *H* compares the income distributions within neighborhoods to the income distribution in the metropolitan area. It can range from a theoretical minimum of 0 (no segregation; all neighborhoods have identical income distributions to the metropolitan area distribution) to a theoretical maximum of 1 (total segregation; all neighborhoods are composed of households in only one income category and there is no income diversity within neighborhoods) (Reardon 2009). We apply the bias-correction method to estimating income segregation with small sample sizes described in (Reardon et al. 2018). We divide metropolitan areas into quintiles of income segregation and compare characteristics of schools serving high- and low-income neighborhoods in more or less segregated places.

Analyses and Results

Linking these datasets on neighborhoods and schools provides us with a portrait of the schools serving most neighborhoods in U.S. metropolitan areas, which consist of both cities and their surrounding suburbs. We estimate the average school characteristic for neighborhoods in each income quintile (defined within metropolitan areas). Then, we estimate mean school characteristics by neighborhood income quintile across metropolitan area income *segregation* quintiles. Our analyses are descriptive and bivariate; we do not argue that neighborhood conditions cause or contribute to school characteristics. Rather

we are describing the inputs and outputs of schools serving neighborhoods of different incomes.

School Composition

Figure 1 presents the average racial/ethnic composition of the student body in schools serving neighborhoods in each income quintile. The left bar represents schools serving the lowest-income neighborhoods, and these schools have the smallest proportion of white students and the largest proportions of Hispanic and black students. In contrast, schools serving the highest-income neighborhoods (right bar) have the largest white populations and smallest Hispanic and black populations, significantly different from the schools serving the lowest-income neighborhoods (Appendix Table 3 presents corresponding figures and significance tests). Schools serving the highest-income neighborhoods are, on average 63% white compared to 24% in schools linked to the lowest-income neighborhoods (the national public school rate was 50% in 2014).

[Figure 1]

Figure 2 presents the FRPL, LEP, and GATE rates in schools serving neighborhoods in each income quintile. The left bar indicates that schools serving the lowest-income neighborhoods have the most disadvantaged student bodies, with 78% FRPL eligibility, 21% classified as LEP, and 7% GATE students (compared to the national rates of 52%, 10%, and 7% respectively (National Center for Education Statistics 2015)). In the schools serving the highest-income neighborhoods (right bar), 30% of the students are FRPL eligible, fewer than 8% are classified as LEP, and 10% are identified as GATE students. These differences are statistically significantly (Appendix Table 3).

[Figure 2]

The gradient from lowest- to highest-income neighborhoods in these figures demonstrates inequalities in the composition of the student populations in the schools serving advantaged and disadvantaged neighborhoods. It is not surprising that schools serving disadvantaged neighborhoods have disadvantaged student populations. It is, however, troubling—the peer effects literature indicates that attending school with more disadvantaged peers can have negative effects on student achievement, suggesting that these schools with socially and economically disadvantaged populations may exacerbate the challenges that many of its students face at home and in their neighborhoods.

School Attendance and Disciplinary Climate

Figure 3 presents the rates of chronic absenteeism, suspension, and grade retention in the schools serving neighborhoods in each income quintile. Inequalities between the schools serving higher and lower income neighborhoods are evident, though more modest than the patterns observed for school composition. In the lowest-income neighborhoods (left bars), about 15% of students are chronically absent, compared to 8% in the highest-income neighborhoods (nearly a 1 standard deviation difference). We also see higher rates of suspensions (5 v 1.3%) and grade retention (3 v. 1.7%) for schools serving the lowest- versus the highest-income neighborhoods, differences of ½ to ¾ of a standard deviation. These data cannot adjudicate between claims that either the children living in different neighborhoods act differently or that the schools they attend treat them differently; instead, these data show differences in the climates of elementary schools serving advantaged versus disadvantaged neighborhoods. Research indicates that these attendance and discipline practices may have spillover effects on students who do not exhibit the

behavior. The magnitude of these differences may grow in high schools when the level of behavior problems is generally higher.

[Figure 3]

Teacher Characteristics

Figure 4 describes two features of schools' teachers: the proportion who are not certified and the proportion that are in their first or second year of teaching. Across schools serving all neighborhoods, the average rate of teachers who are not certified by the appropriate agencies is very low, less than 3%, though the rate is more than twice as high in schools serving the lowest- versus highest-income neighborhoods. Unfortunately, OCR data do not provide information on more subtle aspects of certification, like subject matter expertise or advanced degrees. We do estimate the proportion of teachers in their first or second year, and schools serving the lowest-income neighborhoods tend to have a greater proportion of inexperienced teachers than schools serving the highest-income neighborhoods, 14% compared to 9%, on average.

[Figure 4]

Appendix Table 3 presents the mean teacher salary, adjusted by the ECWI, in schools by neighborhood income quintile. Teachers in schools serving the highest-income neighborhoods are paid nearly $3,500 more than in schools serving the lowest-income neighborhoods ($54,351 versus $57,787; results using unadjusted teacher salary are comparable). Average teacher salary might be higher in schools serving high-income neighborhoods because teachers are more experienced, as Figure 4 showed. Regression-adjusted estimates of teacher salary controlling for the proportion of first or second year teachers in the school indicate smaller salary differences across neighborhood income

quintiles, reducing the gap between the highest- and lowest-income neighborhoods to $2,203. Differences of this magnitude correspond to roughly 2% of a standard deviation difference in student achievement (Greenwald et al. 1996) and 1% difference in graduation rates (Loeb and Page 2000).[7]

School Funding

Per-pupil spending varies modestly between the schools serving higher- and lower-income neighborhoods. Schools across all neighborhood income quintiles spend approximately $10,500, with schools serving the lowest-income neighborhoods spending $350 *more* than schools serving the highest-income neighborhoods (Appendix Table 3). The similarity in funding across neighborhood income levels is a sign that school finance reform has been somewhat effective. (These differences are statistically significant, given the large sample size.) For the average child, the substantive impact of a 3% increase in spending, as observed here between the highest- and lowest-income neighborhoods, corresponds to about 0.1 more completed years of education, 2% higher wages, and 1 point reduction in adult poverty risk (Jackson et al. 2016). However, estimates indicate that the cost of educating a low-income child is higher (estimates range from 5 to 160% higher) than that of educating a high-income child (Duncombe, Nguyen-Hoang, and Yinger 2015), especially a low-income child in a school where 78% of peers are also low-income, as we demonstrate is the case in low-income neighborhoods. Therefore, equal or slightly progressive funding across neighborhoods by income may not indicate equal outcomes.

[7] Greenwald et al. indicates that an additional $12,500 in teacher salary corresponds to an increase in achievement of 0.16 standard deviations. In 2013 dollars, this is approximately $20,225. Dividing the difference in teacher salary observed between schools serving the highest and lowest-income neighborhoods by this amount = 0.11. A difference of $2,203 in teacher salary translates to a 2% standard deviation increase (0.11 * 0.16 = .027). $2,203 corresponds to about a 4% difference in salary across high and low income neighborhoods, Loeb and Page estimate a 10% salary difference corresponds to a 3-4% difference in graduation rates.

Proficiency Achievement Levels and Growth

Figure 5a presents reading (green) and math (gray) achievement proficiency percentiles for 4th graders of schools serving neighborhoods in each income quintile. We present percentile ranks of proficiency levels within states. Schools serving neighborhoods in the highest-income neighborhoods had proficiency levels in reading and math at about the 70th percentile, on average, in their state. Lower-income neighborhoods are served by schools ranked lower in their state. The lowest-income neighborhoods are served by schools that are, on average, at about the 30th percentile of reading and math achievement. Examining raw proficiency rates without regard to within-state rankings, over 75% of students in schools serving the highest-income neighborhoods were proficient in math and reading compared to about 52% in schools serving the lowest-income neighborhoods.

[Figure 5a]

Figure 5b presents reading and math achievement *growth* between 4th grade cohorts in 2009-10 and 2013-14, classifying schools by their within-state growth percentile. Figure 5b indicates that the schools serving the highest-income neighborhoods rank higher in proficiency growth compared to schools serving the lowest-income neighborhoods (percentile rankings of 55-57 versus 44-45 for math and reading). Consistent with past work, there are starker differences in the *level* of achievement than in achievement growth between schools serving advantaged and disadvantaged populations.

[Figure 5b]

Are School Inequalities Exacerbated by Residential Income Segregation?

Income segregation between neighborhoods creates very high- and very low-income neighborhoods, while neighborhoods are more economically diverse in more

integrated metropolitan areas. In more segregated metropolitan areas, neighborhoods in the highest income quintile will be more homogenously affluent and neighborhoods in the lowest income quintile will be more homogenously poor in more segregated metropolitan areas. Therefore, we expect the inequalities between the schools serving the highest- and lowest-income neighborhoods to be larger in more segregated metropolitan areas. We re-examined several characteristics with striking inequalities in our previously presented analyses or that we might think would be highly associated with income: proportion FRPL eligible, teacher salary, school expenditures, and the achievement level and growth measures associated with schools serving high and low-income neighborhoods.

[Table 1]

Table 1 presents the mean values by neighborhood income and metropolitan area segregation quintiles. For example, the first row presents the average proportion of students that are FRPL- eligible in schools serving neighborhoods in each income quintile in the least segregated metropolitan areas (segregation quintile 1). The difference in FRPL rate in schools serving the highest- and lowest-income neighborhoods is 23 percentage points (66% versus 43%). The lowest panel of the table presents the mean school FRPL rates by neighborhood income quintile in the *most segregated* metropolitan areas (segregation quintile 5), and the difference in FRPL rate in schools serving the highest-and lowest-income neighborhoods is 57 percentage points (84% versus 27%). Residential income segregation clearly exacerbates the inequalities in the schools serving high- and low-income neighborhoods. Moreover, the larger gap in highly-segregated metropolitan areas occurs both because of higher FRPL rates in schools serving low-income neighborhoods and very low FRPL rates in schools serving the highest-income

neighborhoods, demonstrating that one important way that income segregation contributes to inequality is by creating very affluent enclaves (Owens 2016; Reardon and Bischoff 2011). Table 1 shows that the average median income in the highest-income neighborhoods in the least segregated metropolitan areas is $67,850 compared to $109,713 in the most segregated metropolitan areas.

Table 1 presents the average teacher salary in the schools serving neighborhoods by income quintile in the most (bottom panel) and least (top panel) segregated MSAs in the sample. The gap in teacher salary between schools in the highest- and lowest-income neighborhoods is larger in the most than in the least segregated MSAs—$4,849 versus $3,205, differences of 9 and 6%, respectively. Adjusting for teacher experience, the gaps are $3,564 (6%) and $2,291 (4%) in the least and most segregated metropolitan areas, respectively. Again, comparing more or less segregated metropolitan areas reveals that inequalities between schools serving high- and low-income neighborhoods are exacerbated by income segregation.

Table 1 also presents the average level of per-pupil expenditures across neighborhood income quintile and metropolitan area income segregation quintile. The difference in expenditures between the highest- and lowest-income neighborhoods are fairly similar across income segregation quintiles. In fact, the gap between schools serving the lowest-and highest-income neighborhoods are nearly identical in the least versus most segregated areas ($260 versus $270). While it is encouraging that income segregation has not exacerbated spending inequality, educating low-income students will cost even more in very poor neighborhoods and schools, so more progressivity may be required in very segregated metropolitan areas (Duncombe et al. 2015). Moreover, the inequalities in

teacher salary demonstrate that schools serving high- and low-income neighborhoods may allocate their spending differently. Lafortune, Rothstein, and Schanzenbach (2016) show that little of the increase in relative funding due to school finance reforms in low-income school districts is used for instructional expenditures, while these districts must spend a considerable amount on capital (e.g., physical maintenance and renovation).

[Figures 6a and 6b]

Finally, we present inequalities in achievement level (Figure 6a) and growth (Figure 6b) in the schools serving neighborhoods by income quintile in the least (Q1) and most (Q5) segregated MSAs. The green bars represent reading scores and the gray bars represent math scores in both figures. The left set of bars in Figure 6a presents mean achievement percentile by neighborhood income quintile in the least segregated quintile of MSAs. There are disparities between schools serving the lowest income (left) and highest income (right) neighborhoods. For example, schools serving first quintile neighborhoods test in about the 40^{th} percentile for math compared to the 59^{th} percentile in highest quintile neighborhoods (Table 1). The right set of bars presents average proficiency percentiles in schools serving neighborhoods in highly segregated metropolitan areas, and the gradient across the set of bars is steeper, indicating more inequality. Schools serving first quintile neighborhoods have math proficiency in about the 31st percentile compared to the 73rd percentile in schools serving the highest-income neighborhoods.

A similar pattern emerges in Figure 6b, which presents the percentiles of reading and math proficiency *growth* from 2009-10 to 2013-14. In the least segregated metropolitan areas, differences in growth are fairly modest, while there is a clearer positive slope from the lowest to highest-income neighborhoods' schools' growth in the most

segregated metropolitan areas. For math, there is an 17 point differences in the growth percentiles of schools serving the highest compared to lowest-income neighborhoods in the most segregated metropolitan areas; in the least segregated metropolitan areas, that difference is 5 points, with a similar pattern for reading (Table 1).

Open Enrollment Schools

These analyses summarize the characteristics of traditional public schools—non-charter and non-magnet schools—serving local neighborhoods. Traditional public schools can also have open enrollment policies, serving students from all over the district, including those who reside outside of the local neighborhood. The SABS dataset includes an indicator for open enrollment schools, and approximately 6% of the schools in the sample were classified as open enrollment. As a robustness check, we removed open enrollment schools from the sample and replicated Table 1 and Appendix Table 3. Results, available upon request, are extremely similar. We prefer results for all traditional public schools because open enrollment status is complex, and a dichotomous indicator cannot capture how open or limited the student assignment policies are. Moreover, even when parents have school choice, they often prefer geographically proximate schools.

Discussion

This article links five administrative datasets together in a novel way to provide a comprehensive portrait of the local public schools serving high- and low-income neighborhoods in U.S. metropolitan areas. This rich descriptive story is missing from analyses of how neighborhood and school disadvantage reinforce or mediate one another's effects. Across nearly all school indicators, a consistent story emerges: schools serving

high-income neighborhoods have greater social, economic, and instructional resources than schools serving lower-income neighborhoods. One exception is school funding, which is fairly equal, or even compensatory, across neighborhoods of varying income levels. However, equal funding likely does not produce equal outcomes in schools serving high- and low-income neighborhoods.

Income segregation between neighborhoods exacerbates the gaps in the characteristics of schools serving high- and low-income neighborhoods. In the U.S., children have become more segregated by income over the past several decades, driven in part by the clustering of very high-income families. High-income neighborhoods in the most segregated places are served by very advantaged schools, reinforcing the contextual family and neighborhood advantages in these places.

Inequality in the schools serving high- and low-income neighborhoods is perhaps not surprising—the demographic composition of schools reflects that of local neighborhoods, and neighborhood SES contributes partially to the financial resources available in schools. However, past literature suggests that these school characteristics can shape the achievement of students, so if we take these characteristics as a portrait of the peers, climate, teachers, and resources in schools serving children from high- and low-income neighborhoods, there are troubling implications for future inequality. Students living in disadvantaged neighborhoods likely come from lower-SES families and may be negatively affected by other aspects of their neighborhood. If anything, we would hope that their schools had greater resources than schools serving advantaged students in advantaged neighborhoods. Indeed, the analyses of achievement and achievement growth show better outcomes in the schools serving higher- than lower-income neighborhoods.

While school-level achievement data cannot be used to estimate effects of neighborhood or school contexts on individual students, the schools serving disadvantaged neighborhoods appear to be struggling. One limitation of this study is that there is infrequent consensus in the literature about how much any of these school characteristics matters for student achievement. It is therefore challenging to gauge how impactful and worrisome the inequalities in school contexts are. However, our analyses clearly show that low-income neighborhoods face a confluence of factors that past research identifies as detrimental for children's outcomes.

Overall, this article fills a gap in the empirical literature by providing a rich descriptive portrait of the schools serving high- and low-income neighborhoods in metropolitan areas. Schools are both a key context in children's development and a proposed mechanism through which neighborhood residence influences children's outcomes, so documenting these inequalities is important in understanding what contributes to inequality in children's success. Both neighborhood and school contexts matter, and they are intertwined with one another. School quality shapes the residential decisions parents make, leading to neighborhood inequality; and neighborhood inequality shapes the resources available in the local schools. Where a child grows up clearly influences the type of school she attends, and policies aimed at reducing inequality must focus on breaking the link between disadvantaged schools and neighborhoods.

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Table 1. Average School Characteristics by Neighborhood Median Income Quintile by Metropolitan Area Income Segregation Quintile, 2013-14

		Neighborhood Income Quintile				
Segregation Quintile		1	2	3	4	5
1	Percent FRPL Eligible	65.95%	59.29%	54.31%	49.67%	42.98%
	Teacher Salary	$53,378	$53,528	$53,155	$55,342	$56,583
	Per-Pupil Expenditures	$11,071	$10,982	$11,050	$10,985	$10,811
	Math Achievement Pctile	40.23%	44.62%	48.64%	51.54%	58.69%
	Read Achievement Pctile	39.85%	45.12%	48.99%	52.72%	62.05%
	Math Growth Pctile	43.33	44.35	46.89	47.39	49.35
	Read Growth Pctile	45.60	45.76	46.07	47.63	49.69
	Median Neighborhood Inc	$31,985	$42,471	$48,798	$56,196	$67,850
2	Percent FRPL Eligible	71.93%	63.47%	51.71%	51.62%	41.84%
	Teacher Salary	$54,246	$55,333	$56,006	$55,473	$57,152
	Per-Pupil Expenditures	$10,898	$11,035	$11,053	$10,935	$11,062
	Math Achievement Pctile	33.56%	43.11%	50.11%	55.68%	63.67%
	Read Achievement Pctile	34.35%	43.25%	51.12%	55.67%	65.89%
	Math Growth Pctile	43.47	45.09	47.03	50.09	54.15
	Read Growth Pctile	45.93	44.68	47.24	50.30	53.34
	Median Neighborhood Inc	$31,466	$43,746	$51,826	$60,667	$78,922
3	Percent FRPL Eligible	73.69%	63.41%	53.22%	45.87%	33.92%
	Teacher Salary	$53,698	$53,316	$55,345	$54,704	$56,507
	Per-Pupil Expenditures	$10,761	$10,718	$10,813	$10,467	$10,662
	Math Achievement Pctile	35.38%	44.11%	50.55%	58.66%	67.44%
	Read Achievement Pctile	34.34%	43.49%	51.22%	59.22%	69.85%
	Math Growth Pctile	46.22	48.20	48.92	52.46	56.01
	Read Growth Pctile	47.51	47.99	49.01	51.87	55.02
	Median Neighborhood Inc	$32,724	$47,204	$57,815	$69,463	$93,151
4	Percent FRPL Eligible	74.82%	63.61%	52.94%	41.86%	28.70%
	Teacher Salary	$57,223	$56,692	$56,870	$57,362	$58,603
	Per-Pupil Expenditures	$11,175	$10,687	$10,526	$10,380	$10,408
	Math Achievement Pctile	33.45%	42.51%	50.27%	59.95%	70.56%
	Read Achievement Pctile	30.63%	40.78%	48.91%	58.51%	70.37%
	Math Growth Pctile	45.26	46.84	48.74	52.17	56.38
	Read Growth Pctile	47.95	48.56	48.83	50.49	55.55
	Median Neighborhood Inc	$31,452	$46,516	$58,071	$71,674	$99,934
5	Percent FRPL Eligible	83.95%	73.16%	59.67%	44.90%	27.30%
	Teacher Salary	$53,082	$54,590	$54,876	$55,914	$57,930
	Per-Pupil Expenditures	$10,493	$10,082	$9,869	$9,921	$10,223
	Math Achievement Pctile	30.74%	39.65%	49.54%	59.98%	73.40%
	Read Achievement Pctile	27.82%	38.18%	49.58%	61.68%	74.31%
	Math Growth Pctile	43.51	36.16	49.06	53.09	59.54
	Read Growth Pctile	44.12	46.63	49.01	52.65	56.13
	Median Neighborhood Income	$28,950	$43,979	$57,232	$73,611	$109,713

Notes: FRPL = Free or Reduced-Price Lunch. Teacher salary and per-pupil expenditures adjusted by the ECWI. Achievement and growth percentiles are within state. Segregation quintile 1 refers

to the least segregated metropolitan areas; quintile 5 refers to the most segregated metropolitan areas.

Figure 1. School Racial/Ethnic Composition by Neighborhood Median Income Quintile, 2013-14

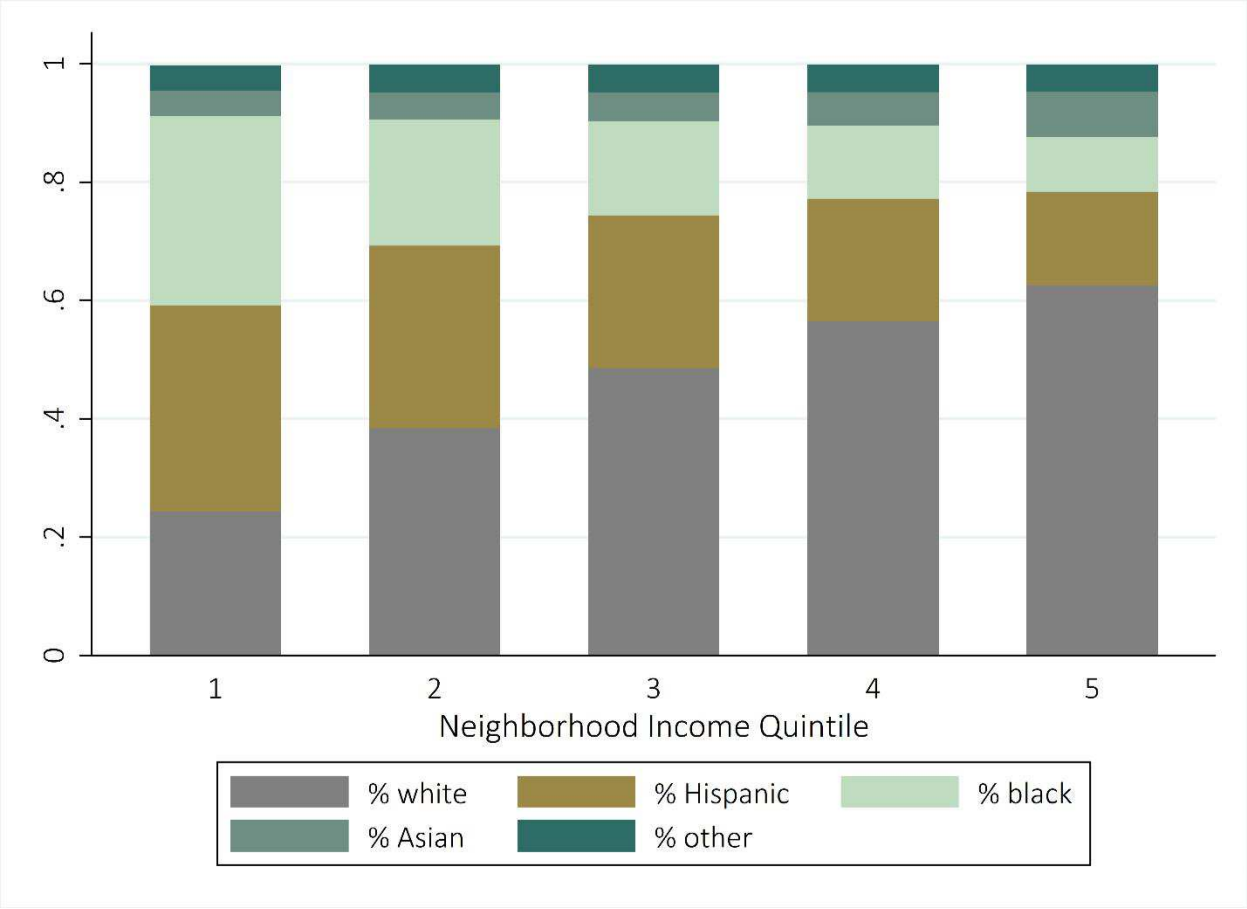
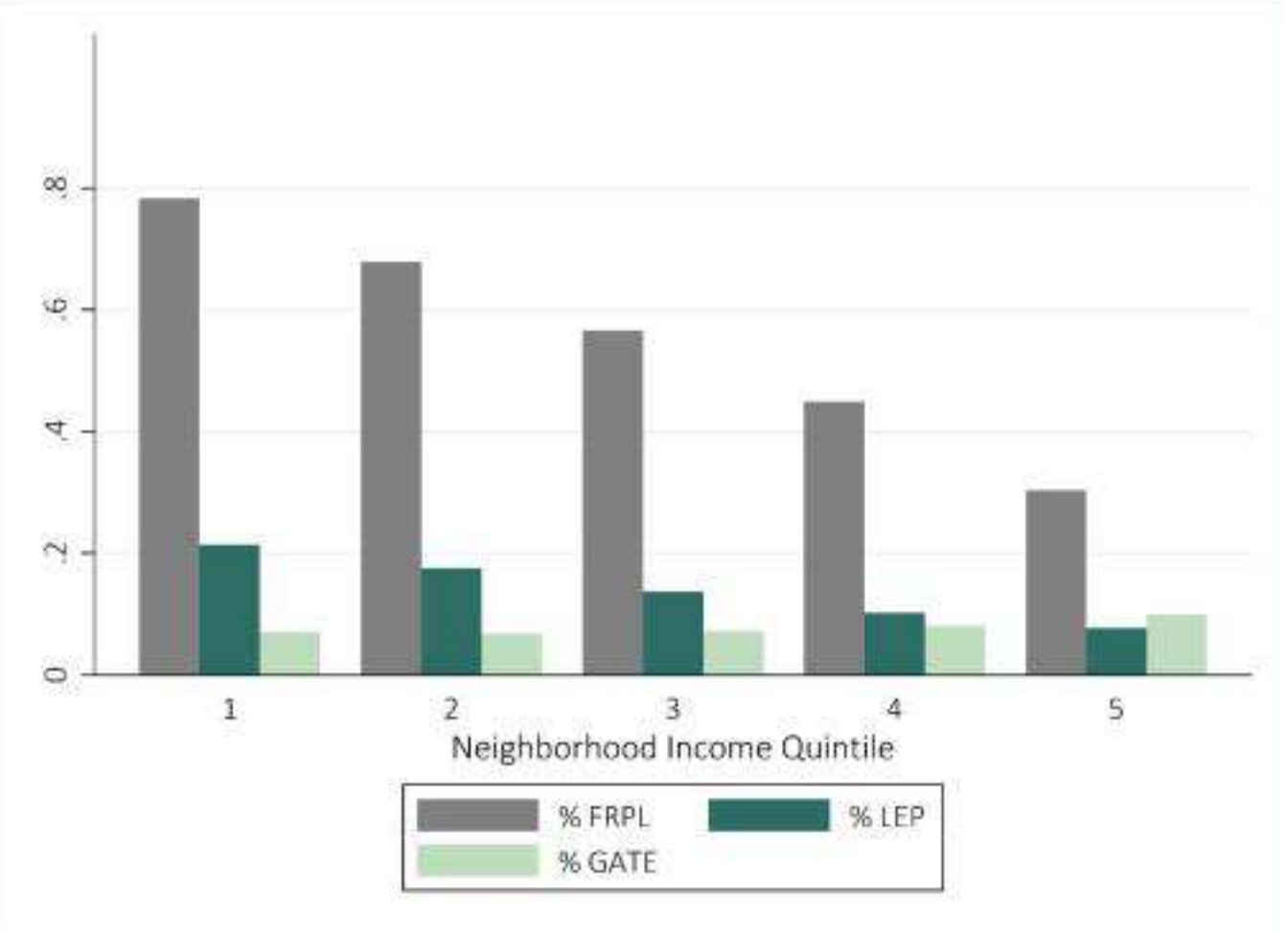
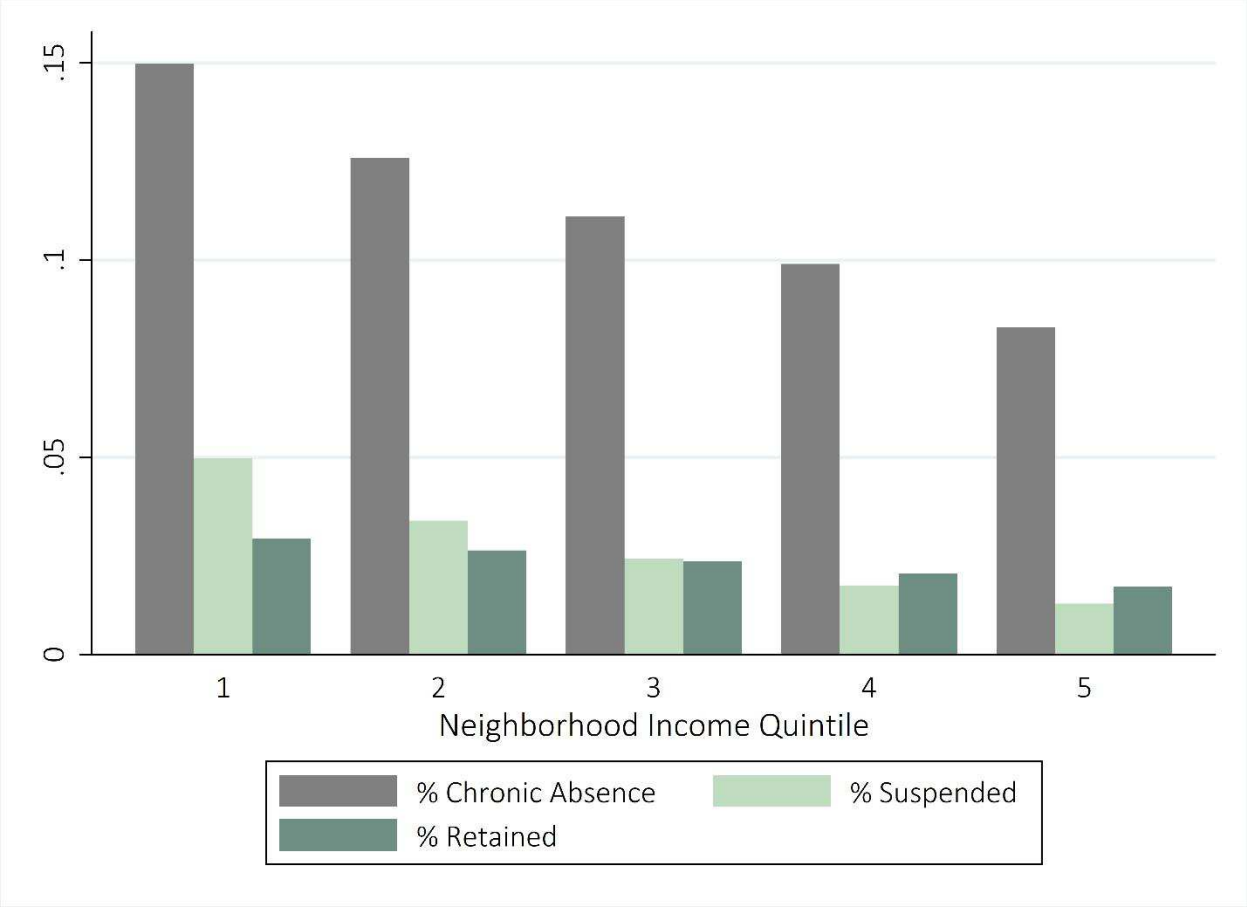


Figure 2. FRPL, LEP, and GATE Rates by Neighborhood Median Income Quintile, 2013-14



Notes: FRPL = Free/Reduced Price Lunch Eligible; LEP=Limited English Proficient; GATE=Gifted and Talented Education

Figure 3. Absence and Discipline Rates by Neighborhood Median Income Quintile, 2013-14



Notes: Chronic absenteeism defined as missing 15 days or more of school.

Figure 4. Teacher Certification and Experience by Neighborhood Median Income Quintile, 2013-14

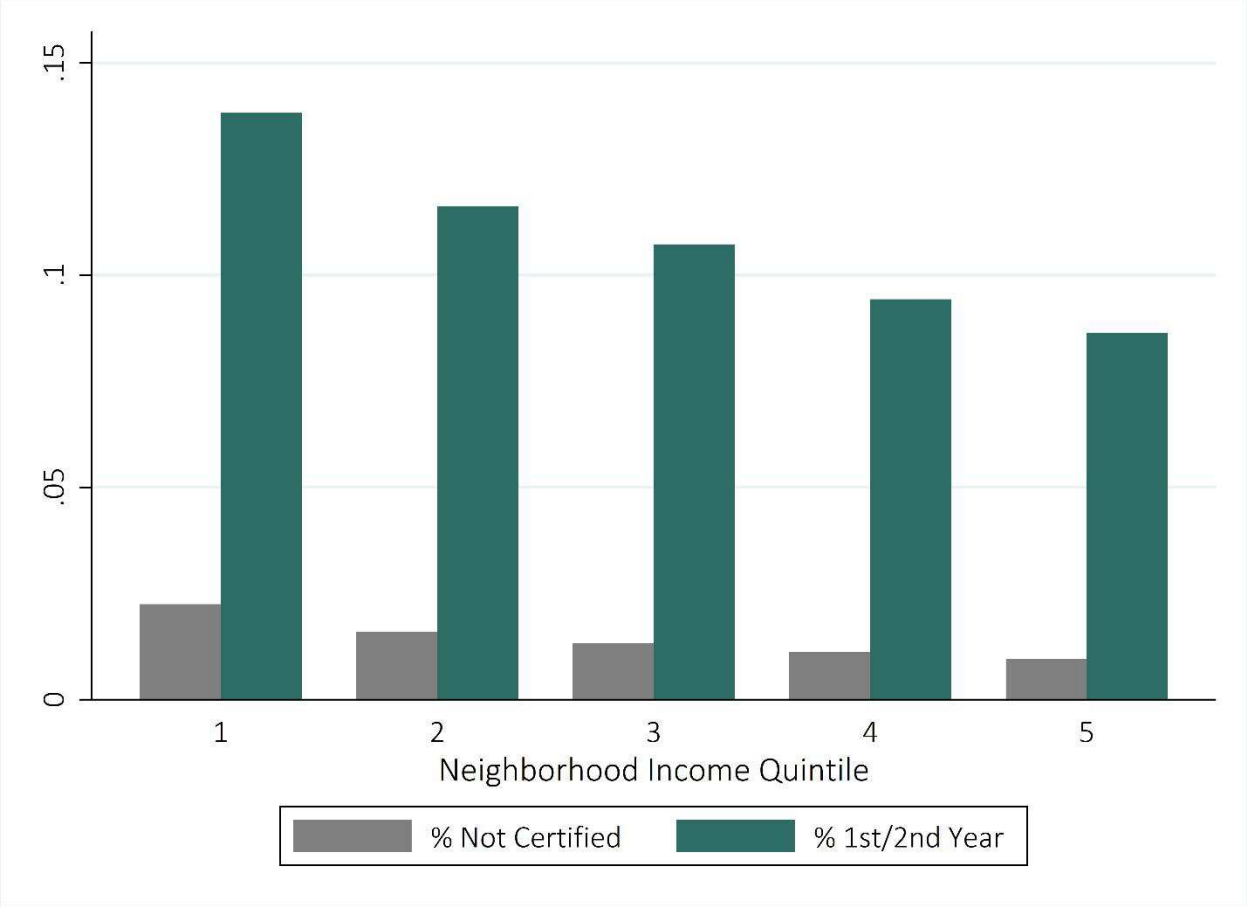


Figure 5a. Math and Reading 4th Grade Proficiency Percentiles by Neighborhood Median Income Quintile, 2013-14

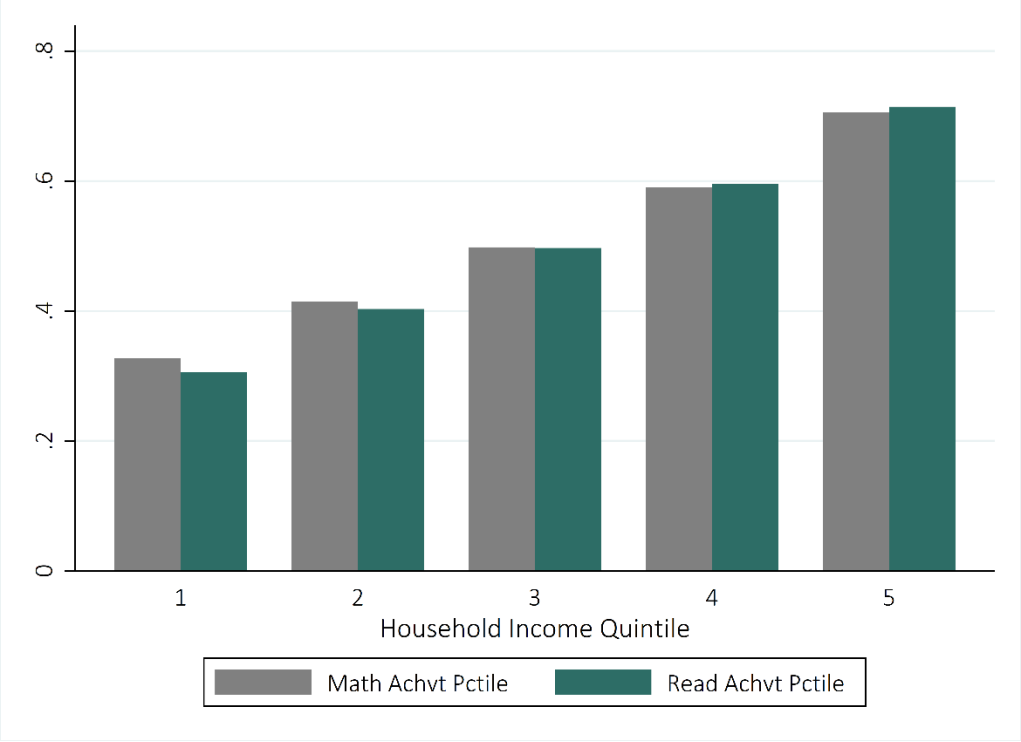
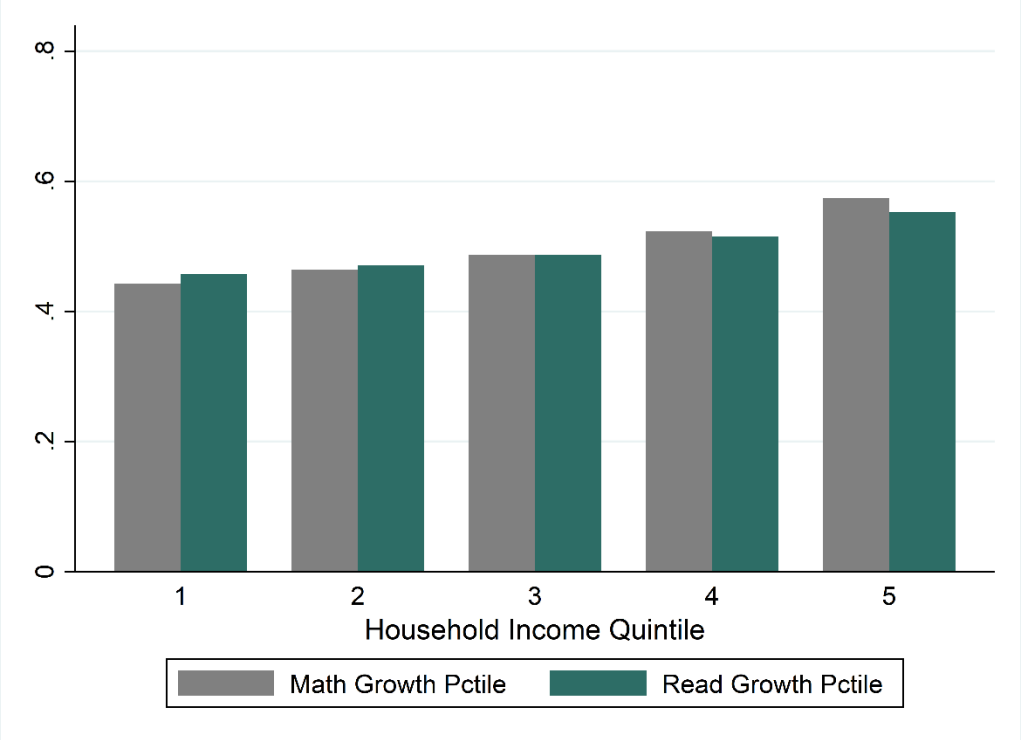


Figure 5b. Math and Reading 4th Grade Growth Percentiles by Neighborhood Median Income Quintile, 2009-10 to 2013-14



Notes: Achievement and growth percentiles are estimated within state.

Figure 6a. Math and Reading Proficiency Percentiles by Neighborhood Median Income Quintile in the Least (Q1) and Most (Q5) Segregated Metropolitan Areas, 2013-14

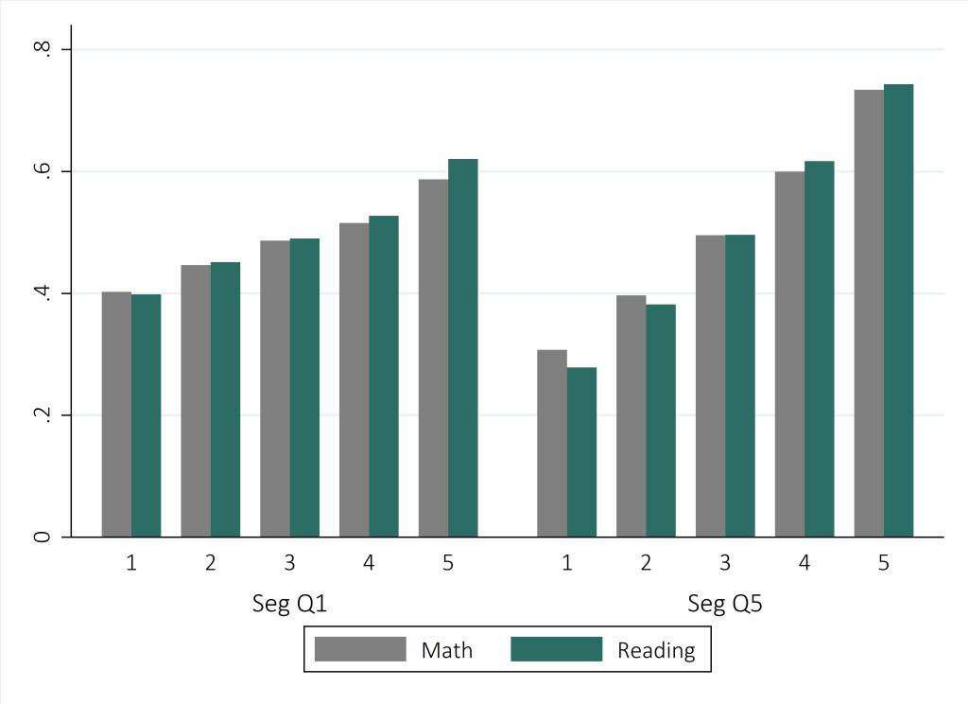
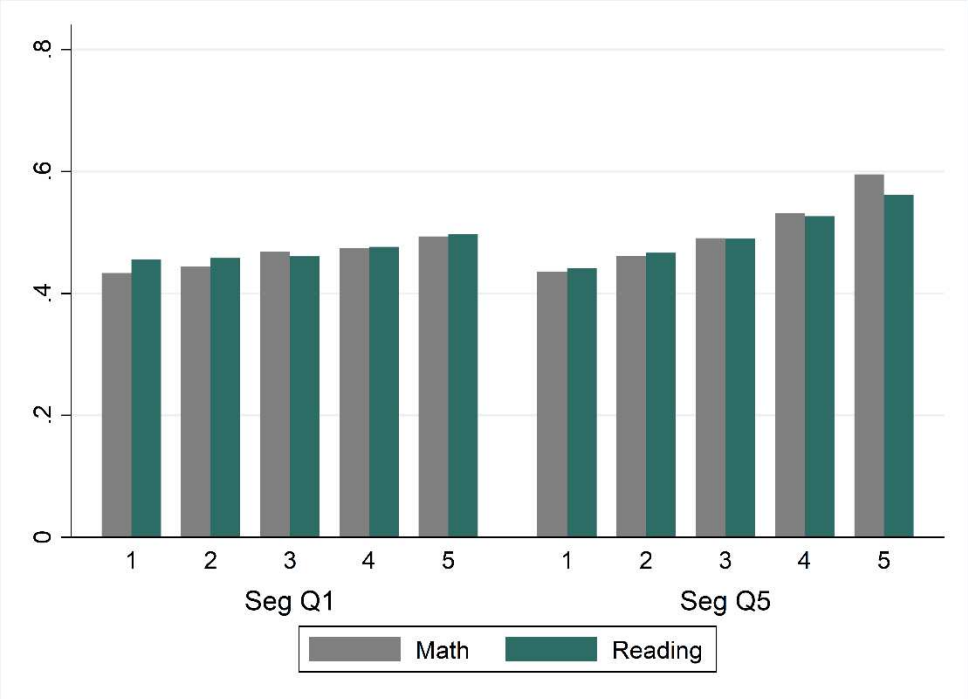


Figure 6b. Math and Reading Growth Percentiles by Neighborhood Median Income Quintile in the Least (Q1) and Most (Q5) Segregated Metropolitan Areas



Notes: Achievement and growth percentiles are estimated within state.

Appendix Table 1. Socioeconomic Characteristics of Neighborhoods by Income Quintile

	Neighborhood Income Quintile				
	1	2	3	4	5
Poverty Rate	33.74%	19.47%	13.12%	8.94%	5.43%
Unemployment Rate	14.35%	10.10%	8.11%	6.80%	5.36%
Welfare Rate	6.12%	3.61%	2.53%	1.82%	1.15%
Female-headed families Rate	47.19%	33.83%	26.07%	19.84%	13.20%
Percent without High School Degree	25.05%	17.48%	12.38%	8.65%	4.89%
Percent with BA or More	16.46%	22.52%	28.76%	35.84%	50.93%

Notes: Unemployment rate for civilian workforce over 16 years old; Educational attainment for population over 25 years old.

Appendix Table 2. Demographic Characteristics of Metropolitan Areas in the Study (N=378)

	Mean	SD
Percent White	70.34%	18.16%
Percent Black	10.19%	10.73%
Percent Asian	3.04%	3.93%
Percent Hispanic	13.21%	15.92%
Percent Less than HS	12.59%	5.42%
Percent BA or More	27.57%	8.84%
Unemployment Rate	8.12%	2.27%
Poverty Rate	15.67%	4.52%
Population	608,565	1,109,556

Notes: White, black and Asian refer to non-Hispanic persons

Appendix Table 3. Average School Characteristics by Neighborhood Median Income Quintile in Metropolitan Areas, 2013-14

	Neighborhood Income Quintile								
	1	2		3		4		5	
School Composition									
Percent Asian	4.32%	4.50%		4.92%	***	5.69%	***	7.64%	***
Percent Black	31.98%	21.35%	***	15.88%	***	12.37%	***	9.22%	***
Percent Hispanic	34.38%	30.84%	***	25.74%	***	20.67%	***	15.77%	***
Percent White	24.31%	38.43%	***	48.59%	***	56.48%	***	62.60%	***
Percent FRPL Eligible	78.38%	67.92%	***	56.59%	***	44.97%	***	30.36%	***
Percent LEP	21.43%	17.54%	***	13.72%	***	10.24%	***	7.72%	***
Percent GATE	7.12%	6.90%		7.25%		8.10%	***	10.02%	***
School Climate									
Chronic Absence Rate	14.98%	12.59%	***	11.11%	***	9.90%	***	8.30%	***
Suspension Rate	4.97%	3.39%	***	2.43%	***	1.76%	***	1.29%	***
Retention Rate	2.94%	2.64%	***	2.36%	***	2.06%	***	1.72%	***
Teacher Characteristics									
Percent Not Certified	2.24%	1.60%	***	1.33%	***	1.13%	***	0.95%	***
Percent First/Second Year	13.83%	11.61%	***	10.72%	***	9.43%	***	8.63%	***
Teacher Salary	$54,351	$54,960	*	$55,441	***	$56,064	***	$57,787	***
School Funding									
Per-Pupil Expenditures	$10,768	$10,443	***	$10,317	***	$10,241	***	$10,417	***
Achievement									
Math Achievement Pctile	32.72%	41.41%	***	49.85%	***	59.04%	***	70.55%	***
Reading Achievement Pctile	30.58%	40.31%	***	49.70%	***	59.59%	***	71.45%	***
Math Growth Pctile	44.24%	46.39%	***	48.70%	***	52.26%	***	57.44%	***
Reading Growth Pctile	45.76%	47.10%	***	48.65%	***	51.53%	***	55.28%	***
Median Neighborhood Income	$30,432	$44,964	***	$56,666	***	$70,663	***	$100,725	***

Notes: FRPL = Free or Reduced-Price Lunch; LEP=Limited English Proficient; GATE=Gifted and Talented Education. Teacher salary and per-pupil expenditures adjusted by the ECWI. Achievement and growth percentiles are estimated within state. Two-tailed significance tests indicate differences from Q1. ^≤0.10; *≤0.05; **≤0.01; ***≤0.001