The Geography of Rural Educational Opportunity

JESSICA DRESCHER, ANNE PODOLSKY, SEAN F. REARDON, AND GABRIELLE TORRANCE

We use nearly 430 million standardized test scores, including test scores from more than 6,500 rural school districts, to describe educational opportunity in rural America. Although we find modest differences in outcomes between rural and nonrural students overall, these disparities are larger for specific socioeconomic, racial-ethnic, and geographic groups. We also find that the relationship between socioeconomic status and achievement is somewhat weaker in rural areas compared to nonrural areas. Variation in third-grade achievement and learning rates is considerable among rural districts, indicating that rates of early and middle childhood educational opportunity are not evenly distributed throughout rural America.

Keywords: rural, opportunity, inequality, education

Until recently, no comprehensive data source described local educational opportunities and outcomes in rural America. Many rural school districts are small, most state achievement tests are not comparable, and urban education issues have historically commanded more policy and research attention than rural ones. Nonetheless, rural youth collectively make up 20 percent of public school students in the United States; the nine million-plus students who attend rural schools amount to more than the enrollments of New York City, Los Angeles, Chicago, and the next seventy-five largest school districts combined (Showalter et al. 2019). Policymakers are often unfamiliar with the unique challenges of teaching and learning in rural settings, and even within academia, conflicting narratives about rural education and opportunity persist. Fortunately, recent developments in the field have opened the door to a more robust view of educational opportunity in rural places.

Jessica Drescher and **Anne Podolsky** are PhD candidates in education policy at the Stanford Graduate School of Education, Stanford University, United States. **Sean F. Reardon** is the Endowed Professor of Poverty and Inequality in Education at the Stanford Graduate School of Education, Stanford University, United States. **Gabrielle Torrance** is an analyst at the University of Chicago Center for RISC, United States.

 Drescher, Jessica, Anne Podolsky, Sean F. Reardon, and Gabrielle Torrance. 2022. "The Geography of Rural Educational Opportunity." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 8(3): 123–49. DOI: 10.7758/RSF.2022.8.3.05. The research described here was supported by a grant from the Institute of Education Sciences (R305B140009). The article would not have been possible without the assistance of Belen Chavez and Demetra Kalogrides. The opinions expressed are those of the authors and do not represent views of the Institute of Education Sciences or the U.S. Department of Education. Direct correspondence to: Jessica Drescher, at jesscboyle@stanford.edu, 520 CERAS Building, Stanford University, Stanford, CA 94305, United States.

In this article, we provide new insight about the state of educational opportunity in rural America. Our analysis is based on data from the Stanford Education Data Archive (SEDA, version 4.0; Reardon et al. 2021), which uses nearly 430 million standardized test scores from all U.S. public school students in grades three through eight to construct measures of educational opportunity and academic achievement for every community in America. The test score measures in SEDA are placed on a common scale, making it possible to compare student achievement and learning rates nationwide, even though the tests vary across states, grades, and years (Reardon, Kalogrides, and Ho 2019). We use the SEDA data to examine differences in student outcomes in rural versus nonrural settings, as well as to examine differences among rural communities. Our analysis uses data from nearly 12,500 public school districts—including more than 6,500 rural districts—representing 97 percent of all school districts in the United States.

We use two measures of educational outcomes: average test scores in third grade and average learning rates between third and eighth grade. We interpret the average third-grade test scores among students in a given community as a measure of the average set of early childhood educational opportunities available to children in that community; this includes educational opportunities provided by families, as well as opportunities children have to learn in their neighborhoods, from their peers, in their childcare and preschool settings, and in their kindergarten and early elementary schools. We interpret learning rates between third and eighth grade as measures of the average set of available middle childhood educational opportunities, particularly opportunities to learn provided by local elementary and middle schools. Although learning rates may also be affected by average family resources, neighborhood characteristics, the availability of afterschool programs, and other local conditions, learning rates largely reflect the quality of local elementary and middle schools, given the central role of schooling in teaching math and reading skills for this age group (for additional details, see Reardon 2019). Under this conceptualization, gaps in achievement and learning rates between student groups are understood as opportunity gaps: that is, they reflect local inequalities in educational opportunity undergirded by differential access and exposure to resources and stressors (Flores 2007; Ladson-Billings 2013; Reardon, Kalogrides, and Shores 2019).

Using these measures, we investigate differences in average third-grade achievement and average learning rates between rural and nonrural students. Because rural America encompasses a wide variety of heterogeneous communities—as Shelley Clark, Sam Harper, and Bruce Weber (2022) describe in their introduction to this issue—we explore patterns of variation in these measures among rural school districts, describing differences in student outcomes by region, relative geographic isolation, and characteristics of the local economy. Given that average patterns of both early and middle childhood educational opportunity are closely linked with community socioeconomic status and racial-ethnic composition, we investigate how much of this variation is associated with demographic differences among rural communities. Our goal is to describe rural levels of achievement and learning rates at a level of granularity not previously possible and to highlight the ways in which place, geographic isolation, and local economy influence educational opportunities for different populations of rural students.

Our results suggest that rural students have, on average, modestly higher third-grade achievement but modestly lower learning rates than nonrural students. In addition, the outcomes of students in rural communities vary significantly across several dimensions, including by students' socioeconomic and racial-ethnic backgrounds, region, degree of geographic isolation from larger and denser communities, and type of business activities underpinning their local economies. Although the average socioeconomic status of families within a district most strongly predicts this variation in outcomes, socioeconomic status is less predictive of student achievement in rural districts than in nonrural districts.

GEOGRAPHIC VARIATION IN EDUCATIONAL OPPORTUNITY

Research conducted on geographic variation in educational outcomes has often focused on achievement disparities within and across urban and suburban spaces, generally finding that achievement gaps are larger in cities or metropolitan areas with higher levels of racial-ethnic and socioeconomic inequality and segregation (Owens 2018; Owens and Candipan 2019; Reardon, Kalogrides, and Shores 2019). In addition, the literature on neighborhood effects on educational outcomes in densely populated areas is robust (Chetty, Hendren, and Katz 2016; Sharkey and Faber 2014). These analyses provide important insights on the distribution of educational opportunity as well as racial-ethnic and socioeconomic gaps in opportunity across the country's largest metropolitan areas, but do not extend their reach to the rural areas.

Descriptive research on geographic variation in educational opportunity that includes rural areas is sparse but growing. A recent paper used national 2010–2011 data to examine racial-ethnic educational disparities and segregation across rural communities and found that rural elementary schools, on average, have poverty rates that are only modestly lower, and test scores that are only modestly higher, than urban schools in nearby metropolitan areas. These findings complicate the typical narrative comparing predominantly Black and Hispanic students in city schools with predominantly White students in wealthy suburban schools and point to the need to better understand the experience of students in poorer rural schools (Logan and Burdick-Will 2017). Because the paper includes only within-state comparisons, however, it does not provide a comprehensive national portrait of educational opportunities in rural America. Another recent working paper that focused on rural student learning rates found evidence suggesting that rural White students appear to learn more in elementary and middle school than White students elsewhere. Rural Black, Hispanic, and Native American students' learning rates in the same grades, however, appear slower rates than their groups' respective national averages (Johnson, Kuhfeld, and Soland 2021). It relies on data from a large but nonrepresentative sample of schools that includes 25 percent of all public schools in the United States in the 2016–2017 school year. Although these papers have made useful contributions to the literature, neither provides a thorough description of educational patterns in rural communities.

We have identified one paper that uses SEDA to explore rural educational outcomes. Douglas Gagnon and Marybeth Mattingly (2018) find evidence that racial-ethnic test score gaps are smaller in rural districts than they are in urban districts—a difference that persists even after accounting for socioeconomic factors, levels of segregation, and other district characteristics. Although the authors were unable to determine whether this smaller gap is attributable to higher performing White students in high-gap districts or to higher performing Black and Hispanic students in low-gap districts, their finding suggests the importance of local context in mediating test score gaps. The authors additionally find that, unlike city and suburban districts, the level of relative affluence in a rural district has little bearing on local test score gaps. These recent findings are a helpful start, but more evidence is required for a comprehensive picture of educational opportunity across America's wide variety of rural communities.

Our analysis aims to fill this gap in the literature by providing a detailed descriptive analysis of third-grade achievement and third- through eighth-grade learning across rural America. We conduct a set of analyses to address the following questions:

> How do patterns of average academic performance and learning rates differ for rural versus nonrural students? Do these patterns vary for different student groups?
>
> Among rural districts, do student achievement and learning rates vary across region of the country, relative geographic isolation, and type of local economy?
>
> If present, are regional differences in student achievement and learning rates simply an artifact of demographic factors such as community socioeconomic status and racial-ethnic composition?

EDUCATIONAL OUTCOMES IN RURAL COMMUNITIES

By definition, rural communities have smaller and more widely dispersed populations than their metropolitan counterparts. Beyond this, they differ in ways that might be linked to educational opportunity: through community socioeconomic and racial-ethnic composition, through relative geographic isolation, and through local economic conditions. These factors might lead to differences in educational opportunities, which we discuss in the following section.

Regional Differences and Demographics

The demographic makeup of rural America differs from region to region. Although White students are the majority in rural classrooms in most areas, rural minorities are often clustered geographically and thus make up significant portions of the student body in particular rural communities across the country: Black students are largely found in the rural south, Hispanic-Latinx students are disproportionately found in the rural southwest, Native American students are concentrated in the west north central and west south central states, and Asian students make up large portions of the student body in the rural west (Housing Assistance Council 2012; Lichter 2012). Many of these groups have traditionally been integral to rural America, but immigrants are increasingly settling in as well, offsetting population loss and increasing population diversity. Between 2000 and 2010, racial and ethnic minorities accounted for 83 percent of rural population growth, and as of the 2010 census, minority children made up nearly 28 percent of the child population in rural areas (Johnson 2012; Crockett, Carlo, and Temmen 2016). Lisa Crockett, Gustavo Carlo, and Chelsie Temmen posit that "the diversity of rural settings and the heterogeneity of racial and ethnic minorities mean that the implications of rural residence for minority youth and children will depend both on their individual (and group) characteristics and on the specific features of the rural communities they inhabit" (2016, 11). Given these regional differences in rural demographics, we consider whether and how regions differ in educational opportunity and outcomes for different student groups.

Additionally, rural schools may lead to differences in educational opportunity for different student groups by virtue of size and relative integration of the student body. Although nonrural students of different racial-ethnic and socioeconomic backgrounds can lead entirely different lives, "it stands to reason that the more limited range of possibilities and conditions in many rural locations could serve to attenuate the differences in achievement along socioeconomic lines" (Gagnon and Mattingly 2018). Thus we investigate racial-ethnic and socioeconomic patterns of differences in student outcomes between rural and nonrural places. We anticipate that there are other ways educational outcomes will differ by region, given the differing historical, political, and economic contexts in which school systems have taken shape.

Geographic Isolation

Rural communities differ in their degree of geographic isolation from metropolitan areas, and evidence suggests that there may be meaningful differences among these different types of rural communities. These types, which are defined by the National Center for Education Statistics as "rural fringe," "rural distant," or "rural remote" based on population size and proximity to an urban cluster, have varying levels of access to social services, health resources, educational programs, and other community factors (Greenough and Nelson 2015; Hancock et al. 2017; Holder, Fields, and Lofquist 2016). Some literature has also highlighted the relationship between rurality and early childhood readiness, finding students in remote counties are less cognitively prepared for kindergarten compared to their peers in more populated areas (Morrissey, Allard, and Pelletier 2022, this issue). Because more remote rural areas have less access to these types of community resources, we expect to see lower levels of achievement and rates of learning on average as district rurality increases.

Local Economy

Research has also identified links between life outcomes and the composition of local econo-

mies. In an analysis of spatial inequality and poverty among American children, researchers found that child poverty rates are closely linked to local industrial composition (Friedman and Lichter 1998). Similarly, in a survey of poverty and opportunity structures in rural America, Ann Tickamyer and Cynthia Duncan (1990) find that rural resource-based economies are particularly vulnerable to cyclical economic forces, with such forces negatively impacting individual poverty and long-term earnings levels. Researchers have linked this to educational outcomes as well: a study on Texas school districts directly links a decline in student achievement to oil and gas booms in local regions, finding that districts in these areas increased spending on capital projects instead of on teacher salaries, and leading us to suspect that local economic dependencies may explain some variation in school district performance (Marchand and Weber 2020). An earlier study on plant closures in North Carolina in the textile and manufacturing industries finds that such closures lead to declines in local educational achievement for lower-income students, though this seems more attributable to within-family stress than structural financial changes (Ananat and Gibson-Davis 2011). Given this evidence that local economic composition imparts social and economic differences on communities, we consider whether a region's primary industry may explain some variation in local school district performance.

DATA

The primary data source for this article is the Stanford Education Data Archive (version 4.0), which reports nationally standardized measures of student achievement for nearly all schools and districts in the United States, including measures disaggregated by student race-ethnicity, gender, and socioeconomic subgroup. SEDA is based on assessment data from the ED*Facts* database at the Department of Education, which annually collects third- through eighth-grade standardized assessment results in mathematics and English Language Arts (ELA) from all fifty states and Washington, D.C. Following collection from ED*Facts*, achievement score estimates are linked to a common scale using the National Assessment of Educational Progress math and reading scales, enabling comparisons of achievement scores across the nation (for details on methods used to construct measures of achievement comparable across the country, see Reardon, Kalogrides, and Ho 2019). Estimates from SEDA v4.0 span academic years 2008–2009 through 2017–2018, including scores from approximately 430 million assessments. Further details on sample construction are available from the SEDA v4.0 technical documentation (Fahle et al. 2021).

The SEDA data include estimates of the average test scores, average learning rates (within cohorts, from grade three through eight), and trend in average test scores (across cohorts); these estimates are constructed by pooling test score data from ten years (2009–2018), six grades (grades three through eight), and two subjects (math and reading) within each school and district (for details, see Fahle et al. 2021). The estimated parameters are available for schools and districts; estimates disaggregated by race-ethnicity, gender, and economic status are available at the district level. In addition, SEDA v.4.0 includes standard errors for these estimates, as described in the technical documentation (Fahle et al. 2021). The public v4.0 data suppresses estimates for small districts and schools and those for whom the estimates are not precise: this has the effect of disproportionately removing rural schools and districts from the public data. We therefore use an unsuppressed version of the data in an effort to maximize the number of rural observations in our analysis.

The outcomes of interest here are average third-grade achievement and learning rates. As stated, we consider students' third-grade achievement scores to be a reflection of their early childhood opportunities, including the in-school and out-of-school resources often tied to a neighborhood's socioeconomic status (Reardon 2019). Our second outcome of interest is the linear grade slope on average achievement across grades three to eight (we multiply this rate by five and refer to it as the five-year learning rate), which provides a measure of how much the average student learns from third through eighth grade. Following Sean Reardon (2019), we consider this to be a reflec-

tion of middle childhood opportunity. Although these measures can be biased if in- or out-migration of high- or low-achieving students from a district or school is systematic, Reardon, John Papay, and colleagues (2019) find that these measures are, on average, unbiased and are highly correlated with average learning rate measures based on student-level longitudinal data. Estimates for both third-grade achievement and learning rates are standardized and expressed in terms of standard deviations (SD) of the national student-level test score distribution.

To interpret the magnitude of our learning rate measures, we note (following Fahle et al. 2021) that nationally, the average student's score improves by one-third of a standard deviation per grade. This measure can be used to convert differences in average test scores to rough grade-level equivalents for interpretability. For example, in a district where average test scores are 0.33 of a standard deviation higher than the national average, we can say that the average student is roughly one grade level ahead of the national average for students in her grade. Since the average student test score improves by 0.33 SD per year, a district with an average five-year learning rate of 0.033 SD per grade is one where the average student's score improves from grade three to grade eight by 0.10 grade levels relative to the national average; since the national average five-year learning rate is 5.0 grade levels per grade (by definition), students in this district are learning at a rate 2 percent faster than the national average. A district with an achievement or learning rate score of zero sits at the average of the national distribution for that outcome.

We use measures of socioeconomic status and racial-ethnic composition for both our school- and district-level analysis. The school-level covariate data is drawn from the Common Core of Data (CCD), which provides the percentage of students eligible for free or reduced-price lunch and the racial-ethnic composition of students in each school. The district-level socioeconomic status measure is estimated from the National Center for Education Statistics (NCES) Education Demographic and Geographic Estimates (EDGE) program data, which tabulates American Community Survey (ACS) data within geographic school district boundaries. The ACS and EDGE data are reported as five-year averages; we use the 2005–2009 through 2014–2018 waves of EDGE data. The socioeconomic status (SES) measure constructed by taking the first principal component of six variables reported in the EDGE data: median family income, proportion of adults with a bachelor's degree or higher, household poverty rates, proportion of unemployed adults, proportion of households receiving Supplemental Nutrition Assistance Program benefits, and proportion of households with children headed by a single mother. We use an empirical Bayes "shrunken" estimate of the SES composite in our analyses. The district-level racial-ethnic composition measure is derived from the school-level CCD data (Fahle et al. 2021).

Our analysis uses a number of community classification measures to describe a school or district's context: community locale (rurality-urbanicity), geographic region, and type of local economy. For community locale, we use SEDA's school- and district-level urban-centric locale codes sourced from the NCES. This geographic indicator categorizes communities into four primary types—rural, town, suburban, and city—that each have three subtypes according to population size or proximity to urban centers. This scheme differs from the Economic Research Service's Rural-Urban Continuum Codes commonly used by researchers performing county-level analyses in that the units are both more granular and defined by proximity to densely populated areas rather than by specific municipal boundaries. Under this scheme, rural locales are census-defined rural territories that are located outside of densely settled areas known as urbanized areas or urban clusters (for more detail, see NCES 2006). Our analysis uses these locale classifications in two ways. First, we use the four primary types to distinguish between rural and nonrural students: we consider students in rural locales to be rural students, and we consider students in city, suburb, and town locales to be nonrural students. Second, we use the three rural subtypes—rural fringe, rural distant, and rural remote—to discern the influence of relative geographic isolation on rural student

achievement (for additional definitions, see table A.1).

We use two additional community classifications. First, we classify districts according to their state's 2017 Census Bureau division code to understand how educational opportunity varies across large regions of the country (for a geographic distribution of districts by their Census Bureau division code, see table A.2). Second, we classify districts according to the economic subtype of their county using the 2015 U.S. Department of Agriculture (USDA) county typology categorization. This typology includes six mutually exclusive categories of economic dependence, including farming, mining, manufacturing, federal or state government, recreation, and nonspecialized counties. The USDA's Economic Research Service assigns economic dependence classifications based on the proportion of labor earnings or employment in relation to a set threshold for each industry, averaged from 2010 through 2012. For example, if a county's farm-based earnings accounted for at least 25 percent of the county's overall earnings, then that county was eligible for the farming-dependent classification in this period (Pender 2019). Counties are classified as nonspecialized if they did not fall into one of the other five other categories. This measure provides an understanding of the extent to which the concentration of jobs in a certain industry potentially influences local educational opportunity (for a distribution of districts by economic subtype, see table A.3).

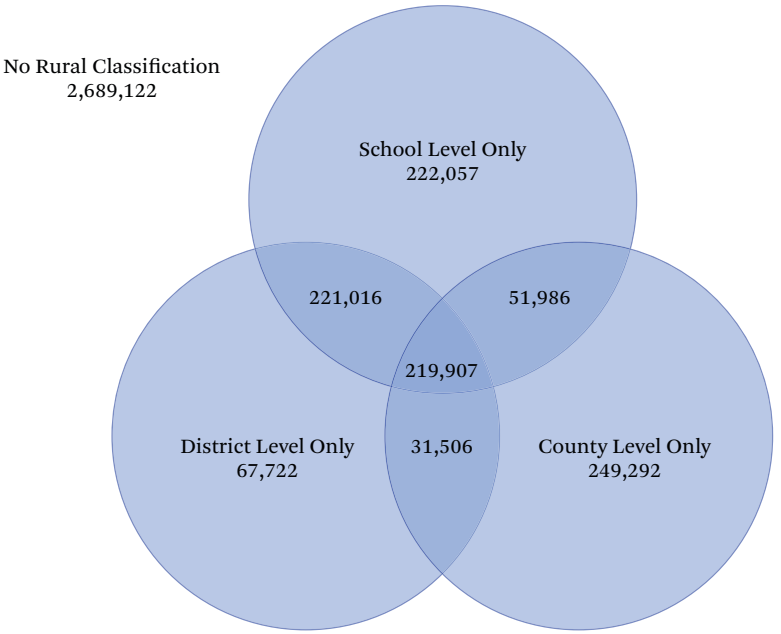
ANALYTIC SAMPLE

We focus in this article on rural students. However, the sample of students classified as rural varies across different definitions of rurality and different levels of aggregation. We use the twelve-category urban-centric definition created by NCES and the Census Bureau, which broadly defines rural areas as regions located several miles from urbanized areas and clusters. NCES categorizes schools within this framework according to the community in which the school is physically located, and categorizes districts according to the locale type assigned to the majority of its students (Geverdt 2018). As a result, a small number of students living in rural areas but attending schools in nonrural areas may be classified as nonrural; further, districts and the schools within them sometimes have different classifications (not all schools in rural districts are classified as rural; not all rural schools are in rural districts). For this reason, our sample of rural students differs depending on whether we use schools or districts as the unit of analysis.

Figure 1 provides information on the differences in the size of the rural student population depending on whether school, district, or county classifications are used. Of an average nationwide enrollment of 3.75 million students per grade, approximately 715,000 (19 percent) attend rural schools; 540,000 (14 percent) attend rural districts; and 553,000 (15 percent) are in rural counties (as defined by the NCES and USDA). Of the 814,000 students per grade (22 percent of U.S. students) in either rural schools or rural districts, only 441,000 (54 percent) are included in the sample under both classifications; 99,000 attend nonrural schools within rural districts and 274,000 attend rural schools within nonrural districts.

Because our goal is to understand geographic variation in educational opportunity for rural students, we conduct our initial analyses at both the school and district level and include both sets of results in this article. For the remainder of our analysis, however, we examine educational achievement at the district—rather than school—level. Although analysis at the school level may better capture the set of students in what we think of as locally rural places, a district-level analysis may better capture students whose broader educational context is "rural." Districts wield significant administrative authority, as Gagnon and Mattingly (2018) note, through actions such as teacher hiring, student assignment and school choice policies, and resource allocation decisions. The strong role of districts in shaping schooling contexts suggests a value in understanding district-level patterns of educational opportunity in rural America. In addition to the conceptual value of studying district-level achievement, reasons for this choice are practical: although SEDA v4.0 incorporates school-level achievement data, achievement and socioeconomic status data broken down by subgroup are not available at the school level.

Figure 1. Rural Student Enrollment per Grade, by Classification, Grades Three Through Eight, 2009–2018.



Source: Authors' calculations based on the Common Core of Data (https://nces.ed.gov/ccd/).
Note: Figures based on the sum of student enrollment within each classification type.

Our final samples include all U.S. schools and districts for which SEDA achievement estimates and covariate data are available. This amounts to 12,448 districts and 75,080 schools, representing 97 percent of all districts and 93 percent of all schools; 52 percent of these districts and 29 percent of these schools are classified as rural. In total, 99 percent of all students in the United States are included in this sample; 99.9 percent of students attending rural districts are included, along with 94 percent of students attending rural schools (for a breakdown of districts by rurality and demographic subgroup, see table A.4).

METHODS

We first provide estimates of the average achievement and learning rates in rural and nonrural communities for students from different demographic backgrounds. For these estimates, we weight SEDA's pooled achievement estimates by the per-grade enrollment of each subgroup within a rural or nonrural district (table 1) and then perform the same analysis for students within a rural or nonrural school; we do these parallel analyses in order to compare results from these slightly different samples. These estimates reflect the average third-grade achievement and learning rate of students from a given background who attend school in rural versus nonrural environments.

Next, we restrict our sample to students from rural districts and fit a set of regression models to estimate the associations between test score outcomes (third-grade average achievement and average learning rates) and district characteristics. The models take the form

$$\hat{Y}_d = \mathbf{X}_d\mathbf{B} + e_d + \varepsilon_d \quad (1)$$

where $\hat{Y}_d$ is the estimated average third-grade achievement (or learning rate) in rural district d, averaged across subjects (mathematics and ELA) and years, and $\mathbf{X}_d$ is a vector of district covariates. The model has two error terms; ε_d represents the true residual for district d, net of the characteristics in $\mathbf{X}_d$, and ε_d represents the measurement or estimation error in $\hat{Y}_d$. The true residuals are assumed homoscedastic with

Table 1. Demographic Composition of Rural and Nonrural Districts and Schools, Weighted by Enrollment, 2009–2018

	Districts				Schools			
	Rural		Nonrural		Rural		Nonrural	
Characteristic	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Socioeconomic status	0.22	0.78	0.31	0.93				
Percent F/RP lunch	50.81	19.39	52.27	22.66	49.23	22.28	52.41	27.47
Percent Native American	2.36	10.46	0.93	4.12	2.08	9.91	0.86	3.90
Percent Asian	0.97	1.64	5.92	8.52	1.60	4.35	5.89	10.38
Percent Hispanic	9.75	15.44	27.91	25.33	12.50	19.35	27.82	28.47
Percent Black	8.76	15.77	17.08	19.60	9.92	17.80	17.43	23.90
Percent White	78.15	22.84	48.15	29.43	73.90	26.90	48.00	32.52
N	6,530		5,918		21,499		53,581	

Source: Authors' calculations based on SEDA v4.0 (Reardon et al. 2021).
Note: SD is standard deviation. Percent F/RP lunch is the percentage of students eligible for free or reduced-price lunch. We use percent F/RP lunch at the school level because the socioeconomic status composite is available only at the district level.

variance to be estimated; the measurement error is assumed to be normally distributed with district-specific variance equal to the estimated sampling variance of $\hat{Y}_d$ (that is, equal to the squared standard error $\hat{Y}_d$). We fit these models via maximum likelihood, using the –`metareg`– command in Stata 15 (Harbord and Higgins 2008).

RESULTS

We start by comparing the characteristics of the rural student population when drawn at the school level versus the district level. Defining the rural student population at the school level results in a sample with higher proportions of Asian students, Hispanic students, and Black students, whereas defining the rural student population at the district level results in a sample with higher proportions of Native American and White students (table 1). Although the magnitude of these differences is relatively small, the shift is important to acknowledge. Because our composite measure for socioeconomic status is available only at the district level, we include the percentage of students eligible for free or reduced-priced lunch for both schools and districts to compare any differences; we find that these rates are essentially the same. Overall, though these samples are not directly comparable they are similar enough to suggest the potential importance of careful attention to how we define rural students.

We next compare achievement and learning rates between rural and nonrural students to answer our first research question: Do students achieve and learn at higher or lower levels in rural versus nonrural communities, and do these patterns vary by race-ethnicity, economically disadvantaged status, gender, or region? Table 2 reports the mean values for third grade achievement and learning rates for the average student in rural districts compared to the average student in nonrural districts, whereas table 3 reports a subset of these values at the school level. Because not all schools include third-grade students, table 3 reports average achievement in the middle grade of each school's tested grades in lieu of third-grade achievement.

The first row of table 2 shows that the average rural third grader performs similarly to the nonrural third grader, with only a 0.01 SD difference at the district level. We see similar results at the school level, though the difference is slightly larger (0.03 SD); in other words, the average student attending a rural school scores approximately one-tenth of a grade level higher

Table 2. Mean District Values of Third-Grade Achievement and Learning Rates, by Student Group and Location, Weighted by Enrollment, 2009–2018

	Third-Grade Achievement				Learning Rate (Five-Year)			
	Rural	Non-rural	Difference	SE[o]	Rural	Non-rural	Difference	SE[o]
All	0.01	0.00	0.01	0.00	−0.02	−0.01	−0.01	0.00
Race-ethnicity								
Asian	0.36	0.46	−0.10	0.00	0.18	0.19	0.00	0.01
Black	−0.46	−0.43	−0.03	0.00	−0.06	−0.08	0.01	0.00
Hispanic	−0.31	−0.33	0.02	0.00	0.06	0.02	0.05	0.00
Native American	−0.52	−0.37	−0.15	0.00	0.04	0.03	0.00	0.01
White	0.12	0.30	−0.18	0.00	−0.02	0.00	−0.02	0.00
Income								
Economically disadvantaged	−0.25	−0.34	0.09	0.00	−0.04	−0.03	−0.01	0.00
Not economically disadvantaged	0.30	0.41	−0.11	0.00	−0.01	0.01	−0.02	0.00
Gender								
Female	0.05	0.04	0.01	0.00	0.05	0.05	−0.01	0.00
Male	−0.02	−0.03	0.01	0.00	−0.08	−0.06	−0.02	0.00
Division								
New England	0.33	0.26	0.07	0.00	−0.01	−0.05	0.04	0.01
Middle Atlantic	0.13	0.13	0.00	0.01	−0.02	−0.02	0.00	0.01
East North Central	0.10	0.01	0.09	0.00	0.01	0.03	−0.02	0.00
West North Central	0.11	0.13	−0.01	0.00	−0.03	−0.02	−0.01	0.00
South Atlantic	0.01	0.10	−0.09	0.00	−0.10	−0.12	0.02	0.01
East South Central	−0.12	−0.11	−0.01	0.00	−0.01	−0.04	0.03	0.01
West South Central	−0.07	−0.06	−0.01	0.00	0.00	−0.01	0.01	0.01
Mountain	−0.09	−0.05	−0.04	0.01	0.04	0.07	−0.03	0.01
Pacific	−0.32	−0.19	−0.13	0.00	0.15	0.08	0.07	0.01
N	6,530	5,918			6,530	5,918		

Source: Authors' calculations based on SEDA v4.0 (Reardon et al. 2021).

Note: Third-grade achievement and five-year learning rates are measured in standard deviations of the national student-level within-grade distribution of test scores. Learning rates reflect average changes in test scores over five years (from grade three to grade eight).

[o]SE is the standard error of the difference in means between rural and nonrural districts.

than the average student attending a nonrural school. This is a very small difference, much smaller, for example, than the difference in scores resulting from being exposed to teachers of higher or lower effectiveness (Rivkin, Hanushek, and Kain 2005; Rockoff 2004; Kane and Staiger 2008).

Within each racial-ethnic group, rural students have lower third-grade achievement than those in nonrural districts, with the exception of Hispanic students, where rural students perform marginally better than their nonrural peers (0.02 SD). White students and Native American students experience the largest differences in achievement, the typical rural student scoring about a half a grade lower than their nonrural counterparts (0.18 SD and 0.15 SD, respectively). Asian students attending rural districts are scoring about a third of a grade level lower than their nonrural peers (by 0.10 SD). It may seem paradoxical that average achievement is lower among rural students within each racial-ethnic group, but higher among rural students overall. This apparent contradiction (a version of what is known as Simpson's paradox) is due to the fact that White students, who have above-average test scores in both rural and nonrural places, make

Table 3. Mean Values of School Mid-Grade Achievement and Learning Rates, by School Location, Weighted by Enrollment, 2009–2018.

	Mid-Grade Achievement				Learning Rate (Five-Year)			
	Rural	Non-rural	Difference	SE[o]	Rural	Non-rural	Difference	SE[o]
All	0.02	0.00	0.03	0.00	0.04	0.07	−0.03	0.00
Division								
New England	0.29	0.25	0.05	0.00	0.04	0.02	0.02	0.01
Middle Atlantic	0.17	0.12	0.05	0.00	0.02	0.05	−0.04	0.01
East North Central	0.12	0.03	0.09	0.00	0.07	0.09	−0.02	0.01
West North Central	0.12	0.10	0.02	0.00	0.04	0.07	−0.02	0.01
South Atlantic	0.00	0.03	−0.03	0.00	−0.07	−0.10	0.03	0.01
East South Central	−0.13	−0.15	0.02	0.00	−0.01	0.02	−0.03	0.01
West South Central	−0.05	−0.06	0.01	0.00	0.10	0.11	−0.02	0.01
Mountain	−0.02	−0.01	0.00	0.00	0.14	0.12	0.02	0.01
Pacific	−0.19	−0.15	−0.04	0.00	0.17	0.17	0.00	0.01
N	21,499	53,581			21,499	53,581		

Source: Authors' calculations based on SEDA v4.0 (Reardon et al. 2021).

Note: Achievement and five-year learning rates are measured in standard deviations of the national student-level within-grade distribution of test scores. Learning rates reflect average changes in test scores over five years (from grade three to grade eight).

[o]SE is the standard error of the difference in means between rural and nonrural schools.

up a much larger proportion of the rural student population than the nonrural population (see table 1).

Whereas economically disadvantaged students in rural districts have higher third-grade achievement than their peers in nonrural districts (by 0.09 SD), non-economically disadvantaged students in rural districts actually have lower scores than their nonrural counterparts (by 0.11 SD). In other words, wealthier rural students are about a third of a grade level behind wealthier nonrural students, and poorer rural students are nearly a third of a grade level ahead of their nonrural counterparts. Although not the focus of our analysis, we find that both male and female third graders in rural districts marginally outperform their nonrural counterparts (0.01 SD).

Tables 2 and 3 likewise present rural-nonrural comparisons in learning rates over five years. These differences are statistically significant, given the enormous samples, but are very small: the five-year learning rates differ by just 0.01 SD (the average student's score improves by 0.33 SD per year, or by 1.67 SD over five years, so a difference of 0.01 SD in five years is less than 1 percent of the average learning rate). The typical student in a rural district learns at a rate just 0.01 SD slower over five years than that of the typical student in a nonrural district, whereas the typical student attending a rural school learns at a rate just 0.03 SD slower over five years than students in nonrural schools. District-level patterns differ slightly by race-ethnicity, but the differences remain small: Black rural students improve 0.01 SD more over five years than their nonrural counterparts, and Hispanic rural students improve 0.05 SD more over five years than theirs. In contrast, rural White students improve 0.02 SD less than their nonrural peers. Asian and Native American students' scores do not differ between rural and nonrural districts. Rural economically disadvantaged students improve 0.01 SD less than economically disadvantaged students in nonrural districts, and non-economically disadvantaged students in rural districts improve 0.02 SD less than their nonrural counterparts. Finally, male and female students in rural districts learn at rates 0.02 SD and 0.01 SD slower than their nonrural counterparts, respectively.

Table 4. Mean District and School Values of Achievement and Learning Rates, by Locale, Weighted by Enrollment, 2009–2018.

	Districts				Schools			
Locale	Achievement	SE	Growth	SE[o]	Achievement	SE	Growth	SE[o]
City, large	−0.17	0.00	0.02	0.01	−0.20	0.00	0.09	0.00
City, midsize	−0.12	0.00	−0.02	0.00	−0.18	0.00	0.05	0.00
City, small	0.00	0.00	−0.02	0.00	−0.01	0.00	0.06	0.01
All cities	−0.13	0.00	0.00	0.01	−0.15	0.00	0.07	0.00
Suburb, large	0.16	0.00	−0.01	0.00	0.14	0.00	0.07	0.00
Suburb, midsize	0.07	0.00	−0.02	0.00	0.06	0.00	0.04	0.01
Suburb, small	0.03	0.00	0.01	0.01	0.00	0.00	0.05	0.01
All suburbs	0.14	0.00	−0.01	0.00	0.12	0.00	0.06	0.00
Town, fringe	0.01	0.00	0.01	0.00	0.00	0.00	0.09	0.01
Town, distant	−0.07	0.00	−0.03	0.00	−0.10	0.00	0.03	0.01
Town, remote	−0.10	0.00	0.00	0.00	−0.11	0.00	0.06	0.01
All towns	−0.06	0.00	−0.01	0.00	−0.08	0.00	0.05	0.00
Rural, fringe	0.07	0.00	−0.02	0.00	0.07	0.00	0.04	0.00
Rural, distant	−0.02	0.00	−0.02	0.00	−0.03	0.00	0.03	0.00
Rural, remote	−0.10	0.00	−0.02	0.00	−0.10	0.00	0.04	0.01
All rural	0.01	0.00	−0.02	0.00	0.02	0.00	0.04	0.00
All locales	0.00	0.00	−0.01	0.00	0.00	0.00	0.06	0.00

Source: Authors' calculations based on SEDA v4.0 (Reardon et al. 2021).

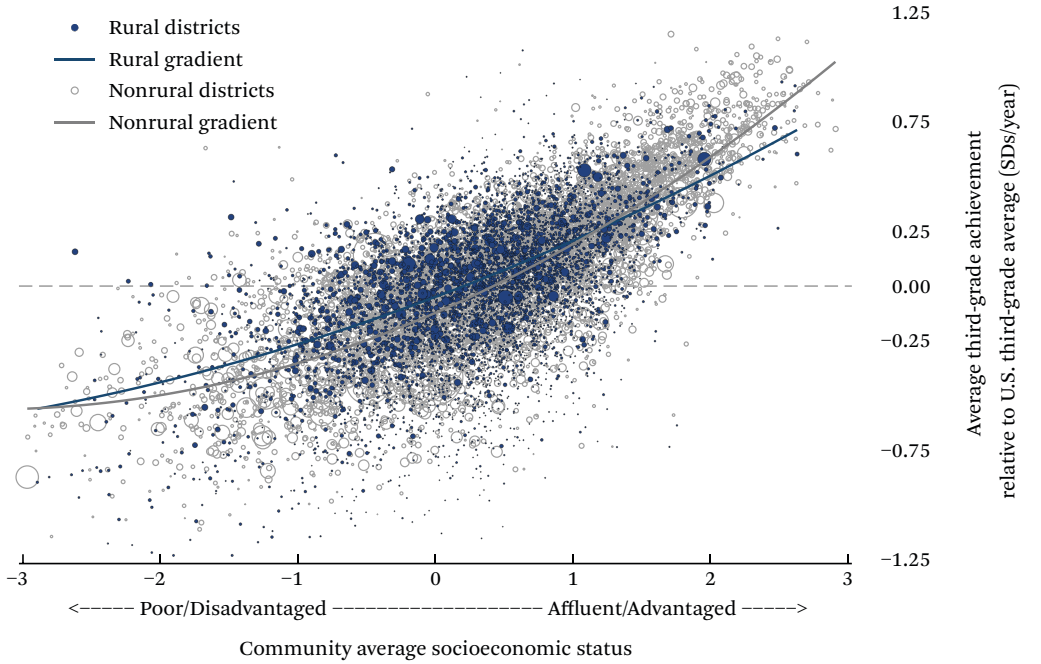
Note: Achievement and five-year learning rates are measured in standard deviations of the national student-level within-grade distribution of test scores. Learning rates reflect average changes in test scores over five years (from grade three to grade eight).

[o]SE is the standard error of the achievement and growth estimates.

Most regional differences between rural students and nonrural students are small. Rural students in the district-level sample are performing marginally worse than their nonrural peers in most divisions. This pattern has a few exceptions: rural students in the New England and east-north-central regions of the United States are outperforming their nonrural peers (by 0.07 SD and 0.09 SD, respectively), and rural students in the Pacific and south Atlantic regions are underperforming their nonrural peers (by 0.13 SD and 0.09 SD respectively). Regional differences in learning rates are also small when using the district-level sample: the largest difference occurs in the Pacific region of the United States, where rural students are learning 0.07 SD more over five years than their nonrural peers. For both achievement and learning rates, these differences become more consistent at the school level (table 3).

Because our nonrural student category represents a very heterogenous group of communities, we provide a detailed breakdown of achievement and learning rates in urban, suburban, and town environments. Although the nonrural students in aggregate are not dissimilar from rural students on these measures, table 4 shows considerable variation both within and across locales. At both the school and district level, the average city student scores well below the national average and the average suburban student scores well above it. Students living in towns—communities within an urban cluster but located outside an urbanized area—fall slightly below. Although the stark city-suburban differences in achievement harken to the dominant narrative in education research and policy, the outcomes for rural and town students—who together make up all students living outside urbanized areas—high-

Figure 2. Third-Grade Average Achievement and Community Socioeconomic Status



Source: Authors' calculations based on SEDA v4.0 (Reardon et al. 2021).
Note: Thirty-three districts with achievement greater than 1.25/less than −1.25 or SES greater than 3/less than −3 omitted to improve visual display.

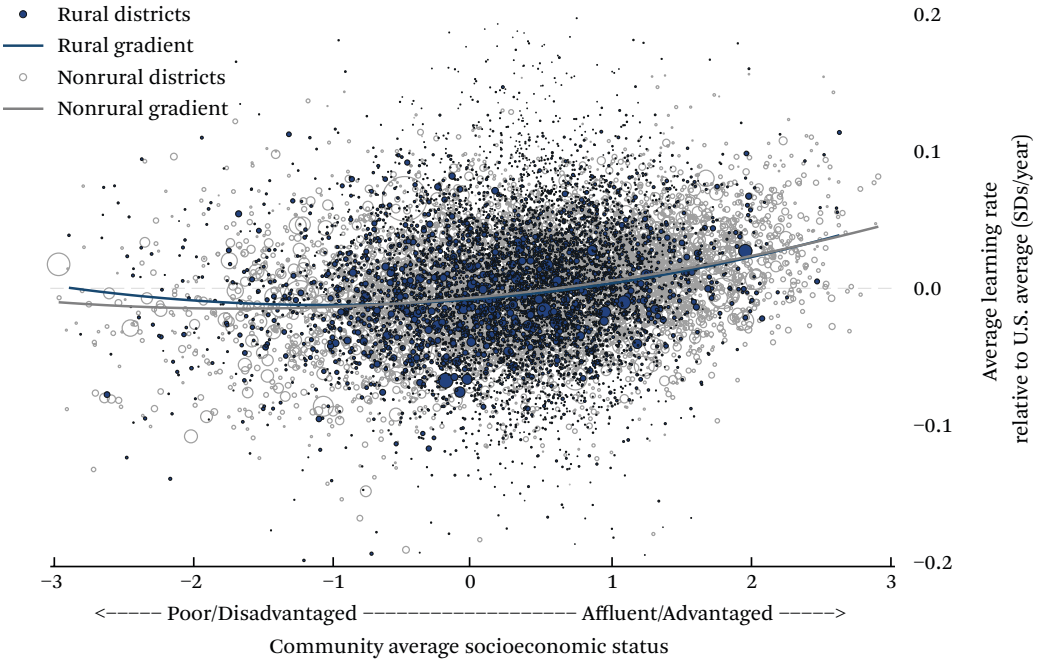
light the need to better understand what is taking place in the middle. We see little variation in learning rates between locales.

Before turning to our analysis of variation *among* rural school districts, we investigate the contrasting rural-nonrural trends for different socioeconomic groups by examining the extent to which community socioeconomic status is differentially associated with rural and nonrural test score patterns. To do this, we plotted the relationship between the average socioeconomic status of families in a district (the composite SES variable described above) and the average third-grade achievement or learning rate in a district (figures 2 and 3), weighting by district enrollment so that the fitted lines reflect the test scores of the average student, conditional on district SES.

Figure 2 shows a visibly shallower slope between district socioeconomic status and achievement for rural districts, meaning that community socioeconomic status is less predictive of average third-grade achievement in rural districts than of nonrural districts ($F_{2,12421}$ = 7.28, p < .001). This difference is modest but meaningful, showing achievement differences at extreme ends of the socioeconomic spectrum to be less dramatic in rural settings. For example, the difference between the average achievement of districts with socioeconomic values of +/-2 is approximately 10 percent smaller among rural districts than nonrural districts. Figure 2 also shows our previous finding that average third-grade achievement is higher in rural districts than nonrural districts, though this pattern reverses among the highly resourced communities. Figure 3, however, shows that the learning rate per SES gradient for rural and nonrural districts is virtually identical ($F_{2,12421}$ = 1.24, p > .288).

Having explored differences in student outcomes between rural and nonrural districts, and the extent to which these differences vary between the district and school level, we next explore variation in educational opportunity among rural districts. Because we are interested in the influence of community factors on student outcomes, our analysis focuses on dis-

Figure 3. Learning Rates and Community Socioeconomic Status



Source: Authors' calculations based on SEDA v4.0 (Reardon et al. 2021).
Note: Forty-one districts with a learning rate greater than 0.2/less than −0.2 or SES greater than 3/less than −3 omitted to improve visual display

trict- rather than student-level variation (for the corresponding unweighted district descriptive statistics, see table A.5).

Regional Variation and Community Demographics

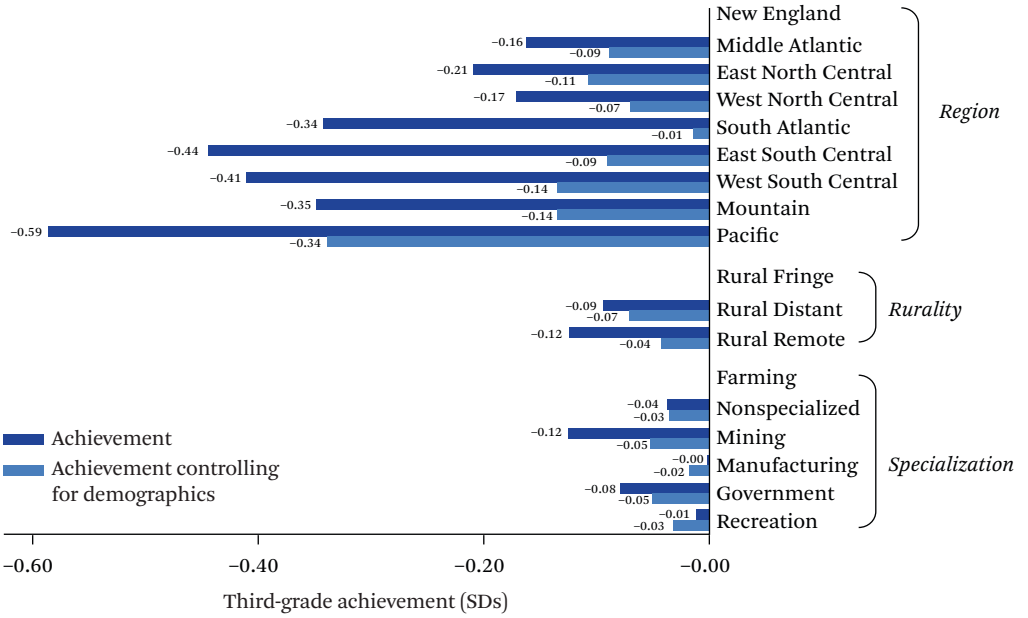
Our second research question asks whether regional differences in rural district achievement and learning rates are systemic. Figures 4 and 5 present this variation over three community classifications: division, rurality, and type of local economy.

We first examine differences in average achievement and learning rates among the nine U.S. Census divisions. Average achievement is higher in rural New England school districts (the reference category) than in any of the other divisions, and is lowest in the Pacific and the East and West South Central divisions (which include much of the South, from Kentucky, Tennessee, and Alabama west to Texas and Oklahoma). These divisional differences are large relative to the total between-district differences, accounting for 23 percent of between-district variance. Many of the differences between the regions are associated with demographics—as indicated by the smaller effects after we control for community socioeconomic status and racial-ethnic composition—but important geographic variation remains.

In contrast, regional differences in learning rates are not associated with community demographics. Regional patterns in student learning rates (figure 5) differ markedly from regional patterns in achievement: conditional on community socioeconomic status and racial-ethnic composition, districts in the Pacific and Mountain divisions are growing 9 percent and 4 percent faster than New England districts. This regional finding echoes earlier evidence (Reardon 2019) that districts with high levels of early childhood educational opportunity are not necessarily districts with high levels of middle childhood educational opportunity.

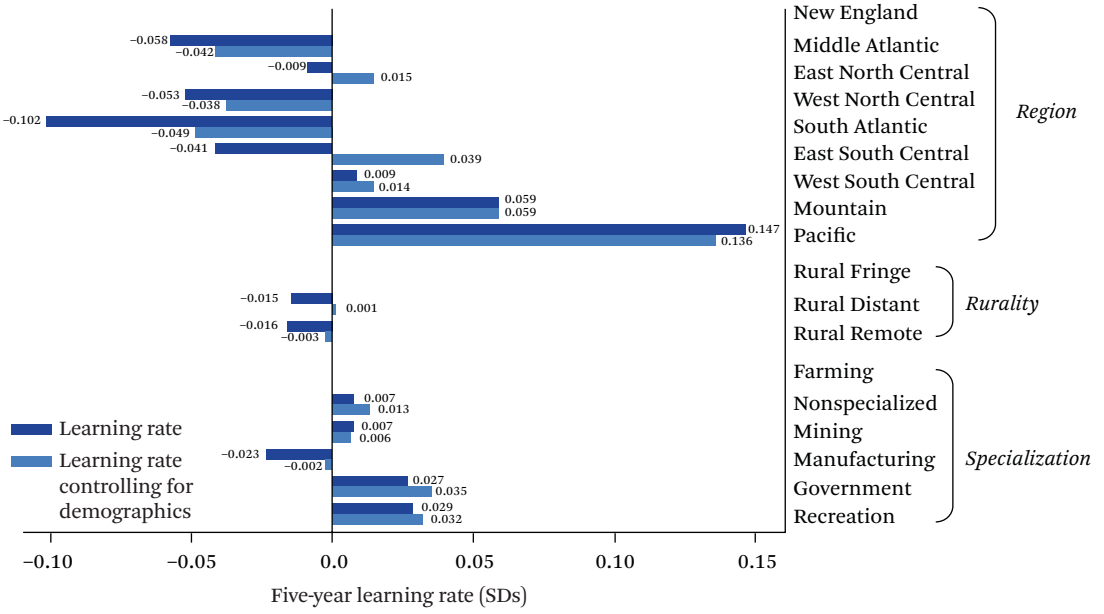
The regional variation among rural school districts' test score patterns is evident in figures 6 and 7. Overlaying the map with census division boundaries makes the relationship

Figure 4. Average Achievement and Community Classifications Among Rural Districts



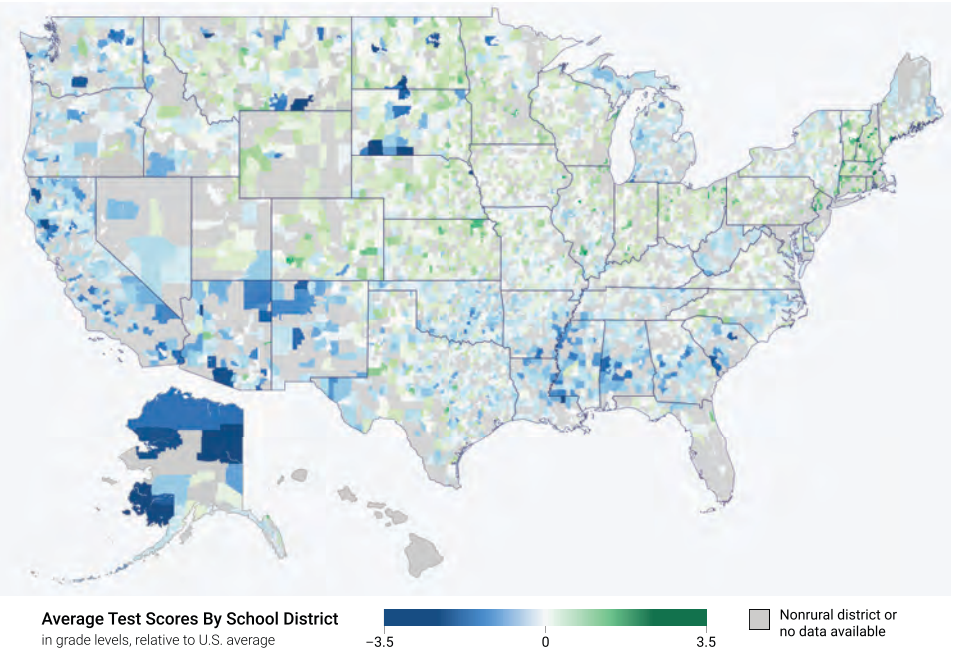
Source: Authors' calculations based on SEDA v4.0 (Reardon et al. 2021).
Note: New England is the reference category for divisions, rural fringe for rural urban locales, and farming for economic subtypes.

Figure 5. Average Learning Rate and Community Classifications Among Rural Districts



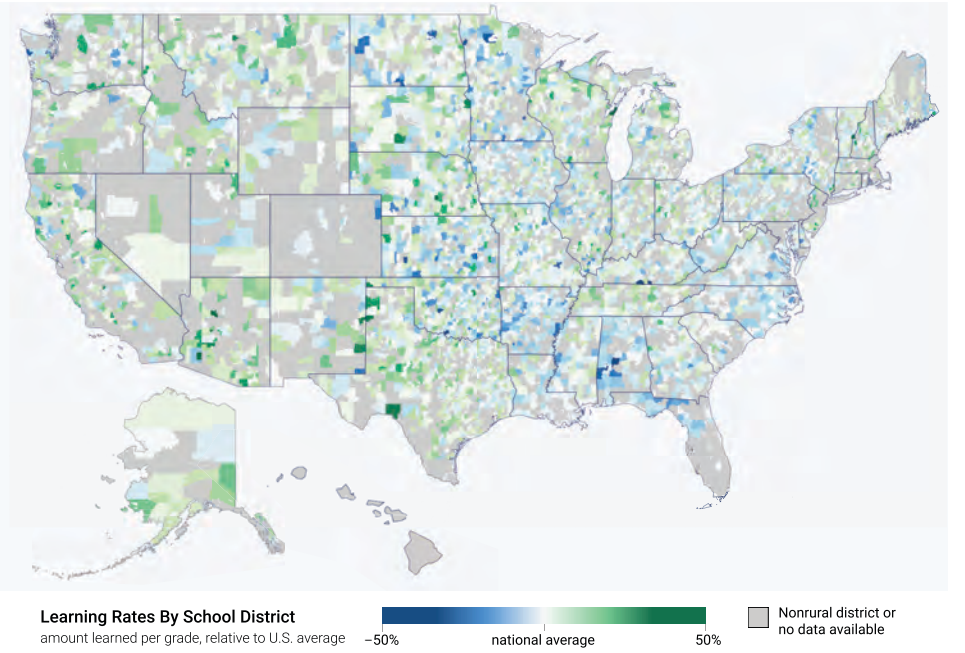
Source: Authors' calculations based on SEDA v4.0 (Reardon et al. 2021).
Note: New England is the reference category for divisions, rural fringe for rural urban locales, and farming for economic subtypes.

Figure 6. Educational Achievement Across Rural U.S. Districts



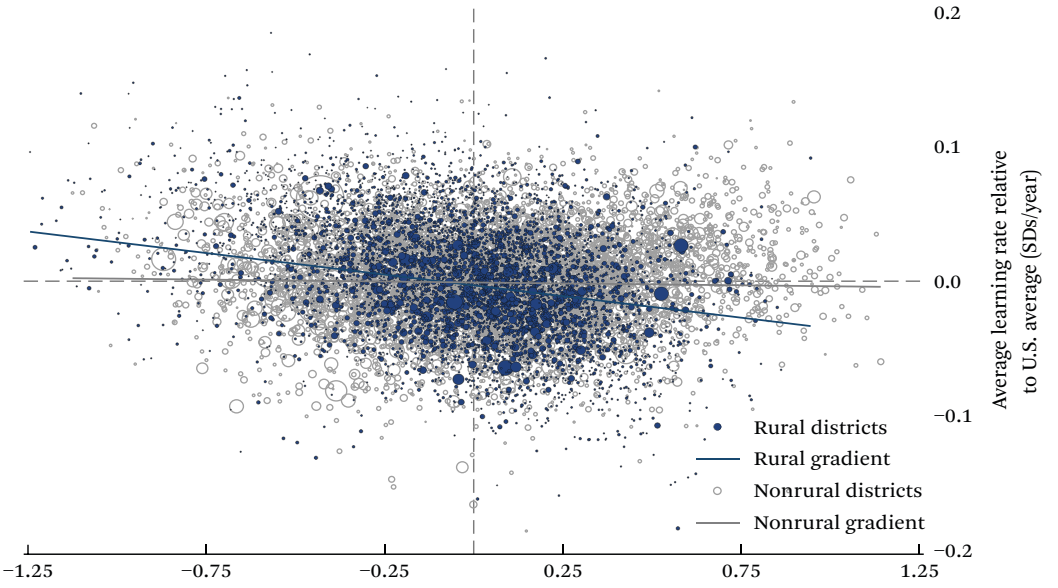
Source: Educational Opportunity Project at Stanford University (https://www.edopportunity.org).

Figure 7. Average Annual Learning Rates Across Rural U.S. Districts



Source: Educational Opportunity Project at Stanford University (https://www.edopportunity.org).

Figure 8. Third-Grade Average Achievement and Average Annual Learning Rates



Source: Authors' calculations based on SEDA v4.0 (Reardon et al. 2021).
Note: Thirty-four districts with a learning rate greater than 0.2/less than −0.2 or achievement greater than 1.25/less than −1.25 omitted to improve visual display.

clear. Although some divisions are more heterogenous than others, one can clearly see that some divisions are more advantageous for a rural student. In New England, the average rural student is performing one grade level higher than the national average for all students; the opposite is true for the West Coast, where the average rural student is performing one grade level below the national average. Rural districts in the south and west in particular have low test scores, and some—but not all—of that disparity is accounted for by differences in community demographics.

We next examine differences in educational outcomes by rurality. We find that average achievement is lower in the more remote districts. Although the amount of variation this explains is quite small relative to that explained by demographics, we find that these differences in achievement are only partially accounted for by community demographics. In other words, geographic isolation appears to have a unique association with achievement beyond what can be attributed to differences in the population who live there. Looking at learning rates, however, we find only marginal differences that disappear once we account for socioeconomic status, suggesting that slower learning rates in more remote areas are the result of fewer resources in these areas.

Finally, we examine variation in rural achievement and learning rates by economic specialization. We use farming-dependent economies as the reference category, given that it is one of the two most common specialized economies across rural districts. Looking at specific economic subtypes, we see that achievement is modestly lower in nonspecialized, government-dependent, and especially mining-dependent economies than in farming-dependent ones, which is partially explained by differences in community composition. Learning rates are modestly higher in nonspecialized, government-dependent, and recreation-dependent economies, but economic subtype explains virtually zero variance in learning rates. We find that the type of local economy is overshadowed by community demographics.

We conclude our analyses by exploring the extent to which average third-grade achievement and learning rates are related. Figure 8 shows that rural districts (but not nonrural

ones) with higher average third-grade achievement tend to have a lower learning rate. We explored the extent to which this is due to district size and socioeconomic context. We find that districts with smaller enrollment—both rural and nonrural—exhibited this negative relationship, but that among districts with larger enrollments, only rural districts exhibited this relationship. This suggests that though size is a factor, something is unique happening in rural districts. Although it is expected that districts with smaller enrollments would have a stronger relationship (because the larger measurement error in third grade achievement estimates in small districts will lead to greater apparent regression to the mean in later grades, which results in a negatively biased estimate of the association between third grade scores and learning rates), this alone does not account for the relationship. When exploring these relationships between rural and nonrural districts across the socioeconomic spectrum, we did not find any systemic differences (see figures A.1 and A.2).

DISCUSSION

No prior study has examined rural achievement and learning rates with the level of granularity as we have here. Thus our primary goal in this article is to establish a set of stylized facts regarding the trends, variation, and correlates of achievement in rural districts. Four particular patterns—and their implications—are worth noting.

First, average achievement and learning rates differ only trivially between rural and nonrural students, on average, but do differ somewhat for some student groups. The largest differences are for White and Native American students. For these groups, third graders attending school in rural districts are scoring about half a grade level lower than their nonrural counterparts. We also note large differences between rural and nonrural students in the Pacific division (Alaska, California, Hawaii, Oregon, and Washington), where third graders in rural districts are achieving, on average, roughly 40 percent of a grade level behind their nonrural counterparts (by 0.13 SD). Rural students in the South Atlantic, too, fall behind their nonrural peers (by 0.09 SD). In contrast, students in the East North Central division (Illinois, Indiana, Michigan, Ohio, and Wisconsin) perform more than a quarter of a grade level ahead of their nonrural peers.

Rural-nonrural differences within economic subgroups were sizable as well: economically disadvantaged students in rural districts are scoring nearly a third of a grade level higher than their peers in nonrural districts, whereas non-disadvantaged students in rural districts are scoring a third of a grade level lower than their nonrural counterparts. These contrasting trends are worth noting because they suggest that the achievement differences at each end of the socioeconomic spectrum appear less dramatic in rural settings. This may be due to a combination of factors. A ceiling effect may be at play in rural communities, such that the wealthiest community members experience an upper limit on the types of advantages they are able to secure for their children. Similarly, a floor effect is also possible by virtue of the fact that rural communities, in general, do not have the critical mass to segregate the public education system: this puts the communities' poorest children in the same childcare centers and classrooms as the communities' wealthiest children, which may benefit children with fewer resources.

Outside these important differences, the overall lack of a major disparity in test scores between rural and nonrural students is noteworthy when considering academic achievement as a measure of educational opportunity and the role it plays in college enrollment and attainment. Rural students attend and graduate college at a lower rate than their nonrural peers, and our findings suggest that these trends cannot be explained by differences in achievement (Byun, Meece, and Irvin 2012). Indeed, research indicates that rural students face a number of hurdles to educational attainment, including financial burden, a lack of nearby jobs that require a degree, geographic isolation from higher education institutions, reduced access to rigorous curricula in high school, and family and societal expectations to not attend college (Byun, Meece, and Irvin 2012; Byun, Irvin, and Meece 2015; Roscigno and Crowley 2001; Roscigno, Tomaskovic-Devey, and Crowley 2006).

Second, socioeconomic status is less predictive of achievement in rural America than in nonrural America. In other words, the average SES for families within a district appears to matter more for student achievement in nonrural districts than it does in rural districts. This echoes our previous observation of contrasting rural-nonrural trends for economically disadvantaged versus non-economically disadvantaged students, where disadvantaged rural students are scoring higher than their nonrural counterparts and advantaged rural students are scoring lower. Despite this finding, we still find that, of all covariates examined, socioeconomic status is most strongly predictive of rural student achievement. This suggests that although poverty levels may be a weaker predictor of the early educational opportunity in rural communities than in nonrural communities, it still plays an important role in rural student outcomes.

The third pattern is that place matters for rural students, both in terms of geographic location and community demographic composition. We find that census divisions account for 23 percent of the variance in early childhood educational opportunity (third-grade test scores) and 7 percent of that in middle childhood educational opportunity (five-year learning rate between third and eighth grade). Although the extent to which census divisions accounted for variation in educational opportunity surprised us, we suspect that this may be due in part to differences in the historical development of school systems across the country. Our other community classifications explained very little of the variation in comparison, though our results suggest that achievement is slightly lower in more remote districts and in communities with mining-dependent economies. Compared to these community classifications, community demographics explain a lot more variation: census division, socioeconomic status, and racial-ethnic composition explain more than half of the variation in rural third-grade test scores and 10 percent of variation in learning rates. That community demographics overshadow these regional measures is perhaps not surprising: decades of research have highlighted differences in educational outcomes by socioeconomic status and race-ethnicity that are often the result of policies and practices that produce structural inequalities within and across schools, districts, communities, and states. These findings point to the need to better understand the intersecting ways that racism, economic deprivation, and regional policies may be fundamentally shaping rural educational opportunity across the country.

Fourth is a somewhat surprising finding: third-grade achievement has a strong negative association with learning rates in rural areas and explains three times the variation in rural learning rates that community demographics and geographic location do. In other words, rural communities that provide more early childhood educational opportunity tend to provide less middle childhood opportunity, and those that provide less early opportunity tend to provide more. This pattern is not evident in nonrural communities or among all school districts (Reardon 2019). This negative association is evident even after controlling for regional, economic, and demographic differences among rural communities, though we find it does flatten slightly among larger districts.

One possible explanation for these trends is that both smaller districts and rural districts have fewer resources with which to support high-achieving students. One such resource is high-quality teachers: smaller schools are less likely to employ teachers with high levels of education and training and tend to require passing scores on standardized teaching assessments at a lower rate than their larger peers (Monk 2007). These trends are true for both rural and small schools, though more prevalent in the latter. Further, existing literature on gifted student programs suggests that rural schools struggle to provide differentiated learning options because of staffing and funding limitations (Weinlein 2019). Taken together, it is reasonable to expect that rural schools, especially smaller ones, are limited in their ability to provide challenging, differentiated instruction to support high-achieving students, and must prioritize their efforts on ensuring that all students meet a minimum level of proficiency. These hypotheses, however, require further study.

These analyses provide a more nuanced un-

derstanding of the variation in educational outcomes among rural districts and suggest that further attention should be paid to how differences in local policies, practices, and norms in rural communities may account for the varying educational trends we observe. This article has several limitations. One is that the patterns we describe apply only to grades three through eight, so we cannot speak to the trends in rural achievement in earlier or later grades, which may differ from what we observe. In addition, we cannot explain the mechanisms underlying the different trends we see in terms of the learning rates and achievement of rural versus nonrural students; we are merely describing associations.

We hope that future work will build on the insights from this research because more work is needed to consider policy implications for the disparities we find. Future work should consider other features of local context that might influence student achievement and learning rates, such as additional characteristics of the local educator labor market and more detailed measures of the local health and social ecosystems. More research is also needed to understand the negative association we identify between achievement and learning rates in rural communities. Further, our later analyses focus on school districts characterized as rural, which omits many rural schools located in nonrural districts. Future analyses might benefit from using the population of rural schools rather than rural districts, though fewer contextual data are available for schools than for districts. This important analysis would allow for a more precise understanding of rural student outcomes, given that districts are often large and encompass many different types of schools. As figure 1 shows, a sample selected at the district level encompasses the outcomes of many students who do not, in fact, live in a rural environment. The differences in these samples are not inconsequential: analyzing rural districts instead of rural schools disproportionately drops rural southern schools. Finally, it is worth exploring trends in rural achievement over time, particularly because all of the data in our analysis was gathered from years directly following the 2008 recession, which had a varying impact on rural and nonrural communities nationwide (Hertz et al. 2014). These types of additional analyses will be critical for continuing to shed a light on the state of education as well as the conditions that best support students in rural America.

Table A.1. Urban-Centric Locale Code Definitions

Locale Name	Definition
City, large	Territory inside an urbanized area and inside a principal city with population of 250,000 or more.
City, midsize	Territory inside an urbanized area and inside a principal city with population less than 250,000 and greater than or equal to 100,000.
City, small	Territory inside an urbanized area and inside a principal city with population less than 100,000.
Suburb, large	Territory outside a principal city and inside an urbanized area with population of 250,000 or more.
Suburb, midsize	Territory outside a principal city and inside an urbanized area with population less than 250,000 and greater than or equal to 100,000.
Suburb, small	Territory outside a principal city and inside an urbanized area with population less than 100,000.
Town, fringe	Territory inside an urban cluster less than or equal to ten miles from an urbanized area.
Town, distant	Territory inside an urban cluster more than ten miles and less than or equal to thirty-five miles from an urbanized area.
Town, remote	Territory inside an urban cluster more than thirty-five miles of an urbanized area.
Rural, fringe	Census-defined rural territory less than or equal to five miles from an urbanized area, as well as rural territory less than or equal to 2.5 miles from an urban cluster.
Rural, distant	Census-defined rural territory more than five miles but less than or equal to twenty-five miles from an urbanized area, as well as rural territory more than 2.5 miles but less than or equal to ten miles from an urban cluster.
Rural, remote	Census-defined rural territory more than twenty-five miles from an urbanized area and more than ten miles from an urban cluster.

Source: Authors' tabulation based on NCES 2006.

Table A.2. Geographic Distribution and Definitions of Districts

	States	Rural	Nonrural
Region 1, Northeast			
Division 1, New England	CT, ME, MA, NH, RI, VT	542	476
Division 2, Middle Atlantic	NJ, NY, PA	555	1,119
Region 2, Midwest			
Division 3, East North Central	IL, IN, MI, OH, WI	1,248	1,375
Division 4, West North Central	IA, KS, MN, MO, NE, ND, SD	1,467	577
Region 3, South			
Division 5, South Atlantic	DE, FL, GA, MD, NC, SC, VA, DC, WV	345	333
Division 6, East South Central	AL, KY, MI, TN	293	292
Division 7, West South Central	AR, LA, OK, TX	1,190	659
Region 4, West			
Division 8, Mountain	AZ, CO, ID, MT, NV, NM, UT, WY	576	342
Division 9, Pacific	AL, CA, HI, OR, WA	597	837
Total		6,813	6,010

Source: Authors' calculations based on SEDA v4.0 (Reardon et al. 2021) and U.S. Census Bureau Region and Division Codes (U.S. Census Bureau 2018).

Table A.3. Distribution of Districts by Economic Subtype

Economic Subtype	Rural	Nonrural
Nonspecialized	2,797	3,840
Farm-dependent	961	122
Mining-dependent	410	205
Manufacturing-dependent	961	696
Federal or state government-dependent	783	615
Recreation-dependent	901	532
Total	6,813	6,010

Source: Authors' calculations based on SEDA v4.0 (Reardon et al. 2021) and U.S. Department of Agriculture Economic Research Service County Typology Codes (Parker 2017).

Table A.4. Availability of District Subgroup Observations

Subgroup	Rural	Nonrural
All	6,813	6,010
Asian	673	3,896
Black	1,505	4,605
Economically disadvantaged	6,604	5,888
Female	6,691	5,979
Hispanic	3,295	5,401
Male	6,695	5,991
Native American	1,050	2,046
Non-economically disadvantaged	6,523	5,936
White	6,652	5,941

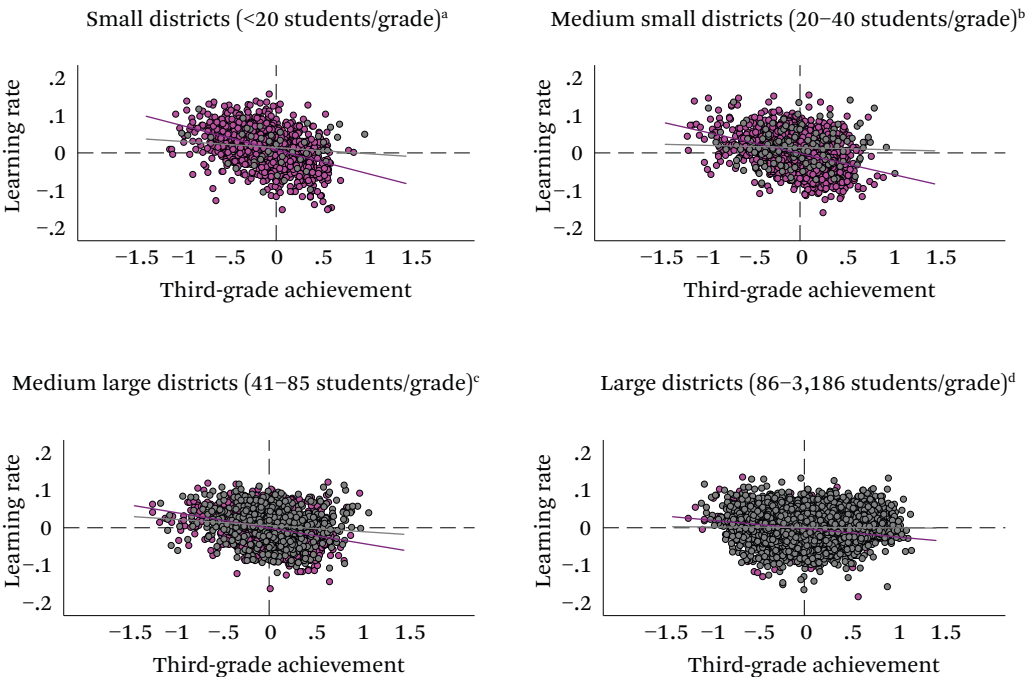
Source: Authors' calculations based on SEDA v4.0 (Reardon et al. 2021).

Table A.5. Unweighted Descriptive Statistics, Rural Districts

Variable	Mean	S.D.
Socioeconomic status	0.30	0.71
Percent Native American	4.48	14.53
Percent Asian	0.65	1.34
Percent Hispanic	10.13	17.24
Percent Black	4.12	12.02
Percent White	80.62	23.82
N	6,530	

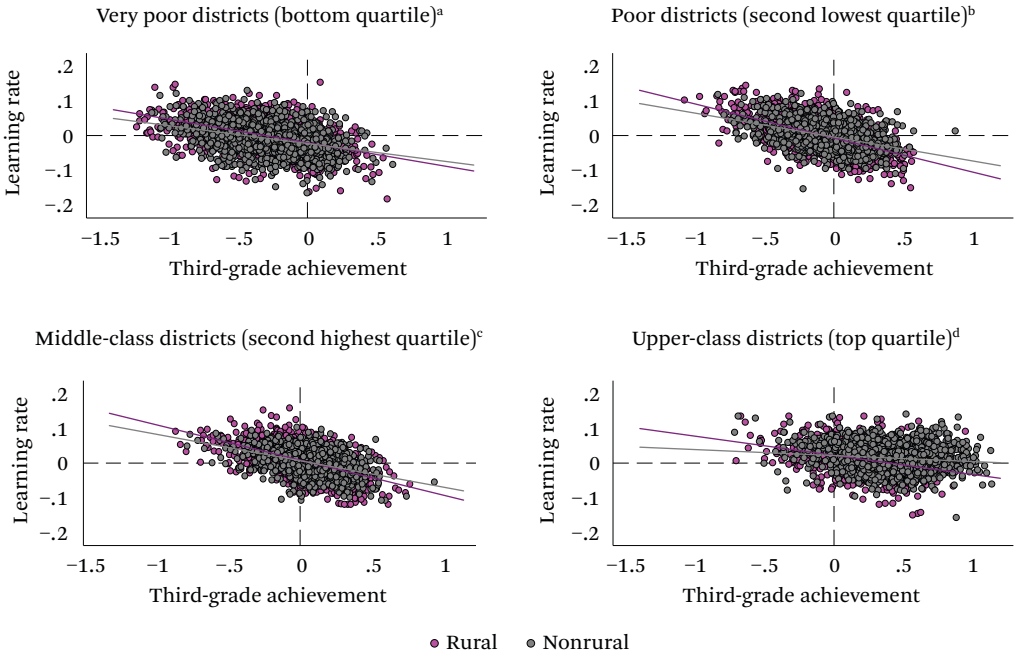
Source: Authors' calculations based on SEDA v4.0 (Reardon et al. 2021).
Note: The socioeconomic status composite variable is not available at the school level. We instead use the percentage of students who are eligible for free and reduced-price lunch.

Figure A.1. Third-Grade Achievement to Learning Rate Gradient by District Enrollment, All Districts



Source: Authors' calculations based on SEDA v4.0 (Reardon et al. 2021).
[a]96 percent of these districts are rural (n = 1,626) and 4 percent are nonrural (n = 71).
[b]91 percent of these districts are rural (n = 1,625) and 9 percent are nonrural (n = 170).
[c]69 percent of these districts are rural (n = 1,627) and 31 percent are nonrural (n = 740).
[d]25 percent of these districts are rural (n = 1,625) and 75 percent are nonrural (n = 4,803).

Figure A.2. Achievement/Learning Rate Gradient by District SES, Rural & Nonrural Districts



Source: Authors' calculations based on SEDA v4.0 (Reardon et al. 2021)

[a]47 percent of very poor districts are rural.

[b]59 percent of poor districts are rural.

[c]63 percent of middle class districts are rural.

[d]40 percent of upper class districts are rural.

REFERENCES

Ananat, Elizabeth, and Christina Gibson-Davis. 2011. "The Effects of Local Employment Losses on Children's Educational Achievement." In *Whither Opportunity? Rising Inequality and the Uncertain Life Chances of Low-Income Children*, edited by Richard J Murnane and Greg J. Duncan. New York: Russell Sage Foundation.

Byun, Soo-yong, Matthew J. Irvin, and Judith L. Meece. 2015. "Rural–Nonrural Differences in College Attendance Patterns." *Peabody Journal of Education* 90(2): 263–79. DOI: 10.1080/0161956X.2015.1022384.

Byun, Soo-yong, Judith L. Meece, and Matthew J. Irvin. 2012. "Rural-Nonrural Disparities in Postsecondary Educational Attainment Revisited." *American Educational Research Journal* 49(3): 412–37. DOI: 10.3102/0002831211416344.

Chetty, Raj, Nathaniel Hendren, and Lawrence F. Katz. 2016. "The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment." *American Economic Review* 106(4): 855–902. DOI: 10.1257/aer.20150572.

Clark, Shelley, Sam Harper, and Bruce Weber. 2022. "Growing Up in Rural America." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 8(3): 1–47. DOI: https://doi.org/10.7758/RSF.2022.8.3.01.

Crockett, Lisa J., Gustavo Carlo, and Chelsie Temmen. 2016. "Ethnic and Racial Minority Youth in the Rural United States: An Overview." In *Rural Ethnic Minority Youth and Families in the United States: Theory, Research, and Applications*, edited by Lisa J Crockett and Gustavo Carlo, 1–12.

Cham: Springer International Publishing. DOI: 10.1007/978-3-319-20976-0_1.

Fahle, Erin. M., Belen Chavez, Demetra Kalogrides, Benjamin R. Shear, Sean F. Reardon, and Andrew D. Ho. 2021. "Stanford Education Data Archive: Technical Documentation (Version 4.0)." Accessed October 15, 2021. https://stacks.stanford.edu/file/druid:db586ns4974/seda_documentation_4.0.pdf.

Flores, Alfinio. 2007. "Examining Disparities in Mathematics Education: Achievement Gap or Opportunity Gap?" *The High School Journal* 91(1): 29–42. DOI: 10.1353/hsj.2007.0022.

Friedman, Samantha, and Daniel T. Lichter. 1998. "Spatial Inequality and Poverty Among American Children." *Population Research and Policy Review* 17(2): 91–109. DOI: 10.1023/A:1005740205017.

Gagnon, Douglas, and Marybeth Mattingly. 2018. "Racial/Ethnic Test Score Gaps and the Urban Continuum." *Journal of Research in Rural Education* 33(2): 1–16. DOI: 10.18113/P8JRRE3302.

Geverdt, Douglas. 2018. "Education Demographic and Geographic Estimates (EDGE) Program: Locale Boundaries File Documentation, 2017." NCES 2018-115. Washington, D.C.: National Center for Education Statistics. Accessed October 15, 2021. https://nces.ed.gov/programs/edge/docs/EDGE_NCES_LOCALE_2017.pdf.

Greenough, Richard, and Steven R. Nelson. 2015. "Recognizing the Variety of Rural Schools." *Peabody Journal of Education* 90(2): 322–32. DOI: 10.1080/0161956X.2015.1022393.

Hancock, Christine, Heidi Mennega, Nikki King, Holly Andrilla, Eric Larson, and Pat Schou. 2017. "Treating the Rural Opioid Epidemic." Policy Brief. Washington, D.C.: Rural Health Congress. Accessed October 15, 2021. https://www.ruralhealthweb.org/NRHA/media/Emerge_NRHA/Advocacy/Policy documents/Treating-the-Rural-Opioid-Epidemic_Feb-2017_NRHA-Policy-Paper.pdf.

Harbord, Roger M., and Julian P. T. Higgins. 2008. "Meta-Regression in Stata." *Stata Journal* 8(4): 493–519. http://www.stata-journal.com/article.html?article=sbe23_1.

Hertz, Tom, Lorin Kusmin, Alex Marré, and Tim Parker. 2014. "Rural Employment Trends in Recession and Recovery." Economic Research Report no. 172. Washington: U.S. Department of Agriculture. Accessed October 15, 2021. https://www.ers.usda.gov/webdocs/publications/45258/48731_err172.pdf.

Holder, Kelly Ann, Alison Fields, and Daphne Lofquist. 2016. "Rurality Matters." Washington: U.S. Census Bureau. Accessed October 15, 2021. https://www.census.gov/newsroom/blogs/random-samplings/2016/12/rurality_matters.html.

Housing Assistance Council. 2012. *Taking Stock: Rural People, Poverty, and Housing in the 21st Century*, 4th ed. Washington, D.C. Housing Assistance Council.

Johnson, Angela, Megan Kuhfeld, and James Soland. 2021. "The Forgotten 20%: Achievement and Growth in Rural Schools Across the Nation." *AERA Open*. https://doi.org/10.1177/23328584211052046.

Johnson, Kenneth. 2012. "Rural Demographic Change in the New Century: Slower Growth, Increased Diversity." Carsey Institute Issue Brief no. 44. Durham: University of New Hampshire. Accessed October 15, 2021. https://scholars.unh.edu/cgi/viewcontent.cgi?article=1158&context=carsey.

Kane, Thomas J., and Douglas O. Staiger. 2008. "Estimating Teacher Impacts on Student Achievement: An Experimental Evaluation." *NBER* working paper no. 14607. Cambridge, Mass. National Bureau of Economic Research. Accessed October 15, 2021. http://www.nber.org/papers/w14607.

Ladson-Billings, Gloria. 2013. "Lack of Achievement or Loss of Opportunity," in *Closing the Opportunity Gap: What America Must Do to Give Every Child an Even Chance*, edited by Prudence L. Carter and Kevin G. Welner. New York: Oxford University Press. DOI: 10.1093/acprof:oso/9780199982981.001.0001.

Lichter, Daniel T. 2012. "Immigration and the New Racial Diversity in Rural America." *Rural Sociology* 77(1): 3–35. DOI: 10.1111/j.1549–0831.2012.00070.x.

Logan, John R., and Julia Burdick-Will. 2017. "School Segregation and Disparities in Urban, Suburban, and Rural Areas." *Annals of the American Academy of Political and Social Science* 674(1): 199–216. DOI: 10.1177/0002716217733936.

Marchand, Joseph, and Jeremy G. Weber. 2020. "How Local Economic Conditions Affect School Finances, Teacher Quality, and Student Achieve-

ment: Evidence from the Texas Shale Boom." *Journal of Policy Analysis and Management* 39(1): 36–63. DOI: 10.1002/pam.22171.

Monk, David H. 2007. "Recruiting and Retaining High-Quality Teachers in Rural Areas." *Future of Children* 17(1): 155–74. DOI: 10.1353/foc.2007.0009.

Morrissey, Taryn W., Scott W. Allard, and Elizabeth Pelletier. 2022. "Access to Early Care and Education in Rural Communities: Implications for Children's School Readiness." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 8(3): 100–123. DOI: https://doi.org/10.7758/RSF.2022.8.3.04.

National Center for Education Statistics (NCES). 2006. "School Locale Definitions." Washington: U.S. Department of Education. Accessed July 13, 2021. https://nces.ed.gov/surveys/ruraled/definitions.asp.

Owens, Ann. 2018. "Income Segregation Between School Districts and Inequality in Students' Achievement." *Sociology of Education* 91(1): 1–27. DOI: 10.1177/0038040717741180.

Owens, Ann, and Jennifer Candipan. 2019. "Social and Spatial Inequalities of Educational Opportunity: A Portrait of Schools Serving High- and Low-Income Neighbourhoods in US Metropolitan Areas." *Urban Studies* 56(15): 3178–97. DOI: 10.1177/0042098018815049.

Parker, Timothy. 2017. 2015 ERS County Typology Codes Update. Washington, D.C.: US Department of Agriculture Economic Research Service. Retrieved from https://www.ers.usda.gov/data-products/county-typology-codes/.

Pender, John. 2019. "USDA ERS—County Typology Codes." Washington: U.S. Department of Agriculture, Economic Research Service. Accessed October 15, 2021. https://www.ers.usda.gov/data-products/county-typology-codes.

Reardon, Sean F. 2019. "Educational Opportunity in Early and Middle Childhood: Using Full Population Administrative Data to Study Variation by Place and Age." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 5(2): 40–68. DOI: https://doi.org/10.7758/RSF.2019.5.2.03.

Reardon, Sean F., Andrew D. Ho, B. R. Shear, Erin M. Fahle, Demetra Kalogrides, Heewon Jang, and Belen Chavez. 2021. "Stanford Education Data Archive, Version 4.0." Retrieved from http://purl.stanford.edu/db586ns4974.

Reardon, Sean F., Demetra Kalogrides, and Andrew D. Ho. 2019. "Validation Methods for Aggregate-Level Test Scale Linking: A Case Study Mapping School District Test Score Distributions to a Common Scale." *Journal of Educational and Behavioral Statistics* 46(2): 138–67. DOI: 10.3102/1076998619874089.

Reardon, Sean F., Demetra Kalogrides, and Kenneth Shores. 2019. "The Geography of Racial/Ethnic Test Score Gaps." *American Journal of Sociology* 124(4): 1164–221. DOI: 10.1086/700678.

Reardon, Sean F, John P. Papay, Tara Kilbride, Katherine O. Strunk, Joshua Cowen, Lily An, and Kate Donohue. 2019. "Can Repeated Aggregate Cross-Sectional Data Be Used to Measure Average Student Learning Rates? A Validation Study of Learning Rate Measures in the Stanford Education Data Archive." *CEPA* working paper no. 19-08. Stanford: Stanford University. http://cepa.stanford.edu/wp19-08.

Rivkin, Steven G., Eric A. Hanushek, and John F. Kain. 2005. "Teachers, Schools, and Academic Achievement." *Econometrica* 73(2): 417–58.

Rockoff, Jonah E. 2004. "The Impact of Individual Teachers on Student Achievement: Evidence from Panel Data." *American Economic Review* 94(2): 247–52. DOI: 10.1257/0002828041302244.

Roscigno, Vincent J., and Martha L. Crowley. 2001. "Rurality, Institutional Disadvantages, and Achievement/Attachment." *Rural Sociology* 66(2): 268–92. DOI: 10.1111/j.1549-0831.2001.tb00067.x.

Roscigno, Vincent J., Donald Tomaskovic-Devey, and Martha Crowley. 2006. "Education and the Inequalities of Place." *Social Forces* 84(4): 2121–45. DOI: 10.1353/sof.2006.0108.

Sharkey, Patrick, and Jacob W. Faber. 2014. "Where, When, Why, and for Whom Do Residential Contexts Matter? Moving Away from the Dichotomous Understanding of Neighborhood Effects." *Annual Review of Sociology* 40(1): 559–79. DOI: 10.1146/annurev-soc-071913-043350.

Showalter, Daniel, Sara L. Hartman, Jerry Johnson, and Bob Klein. 2019. *Why Rural Matters 2018–2019: The Time Is Now*. Washington, D.C.: Rural School and Community Trust. Accessed October 15, 2021. https://files.eric.ed.gov/fulltext/ED604580.pdf.

Tickamyer, Ann R., and Cynthia M. Duncan. 1990.

"Poverty and Opportunity Structure in Rural America." *Annual Review of Sociology* 16 (August): 67–86. DOI: 10.1146/annurev.so.16.080190.000435.

U.S. Census Bureau. 2018. "2017 Census Bureau Region and Division Codes and State FIPS Codes." Washington: U.S. Census Bureau, Population Division. Retrieved from https://www.census.gov/geographies/reference-files/2017/demo/popest/2017-fips.html.

Weinlein, Vanessa L. 2019. "Rural Teachers' Perceptions and Practices of Differentiation for Rural Gifted Learners." Ann Arbor, Mich.: Widerner University. Accessed October 15, 2021. https://www.proquest.com/openview/9be0b51502dc792bc70b474c685e3540/1.