Amended Expert Report

IN RE DELAWARE PUBLIC SCHOOLS LITIGATION, C.A. No. 2018-0029-VCL STATE TRACK

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March 27, 2020

I am submitting this amended expert report to correct various tables and figures from my report dated March 13, 2020. These corrections were necessary due to certain computer coding errors that occurred in connection with the merging of data sets that had different variables with the same names, aggregation of data to the school or district level, and the classification of schools into charter or vocational categories. Although most estimates remain largely unchanged - and there are no changes to my overall opinions and conclusions - I summarize below the main changes that affect the report narrative by reference to the relevant figures and tables.

Figures 5-8 and 105-108: The relationship between SAT outcomes and district per-student expenditure is now negative in all figures.

Table 101: None of the estimates of the relationship between average percent of the achievement growth target met and per student expenditure are positive and significant at conventional levels. The largest positive coefficient of 0.00031 suggests that a $1,000 increase in per-student expenditure would raise the average percent of the growth target met by 0.3 percentage points.

Appendix Tables B1, B2, and B3: All estimates of the relationship between SBAC achievement and per-student spending are negative regardless of whether the regressions are at the school or district level, the sample includes charter schools, the regressions are weighted, or the outcome is ELA or math achievement.

Figures 23 and 24: The figures show more precisely estimated positive relationships between the share of classes classified as small and the share of students classified as low income.

Figures 25 and 26: The estimated positive relationships between share of classes in a school that are classified as small and share of students classified as low income are now positive and highly significant.

Figures 123-124: Two district observations are now dropped due to the absence of grade-specific data on class size in 2018-19 and absence of class size information on elementary schools in the two districts. The overall pattern of a positive association remains.

Figures 31-32 and 131-132: The associations between school share of teachers with 2 to 15 years of experience and share of students classified as low income became much smaller in magnitude and insignificant in both years, while the associations between school share of teachers with

greater than 15 years of experience and share of students classified as low income became negative and significant.

The revised report contains corrected tables and figures, and the revised backup material contains corrected do files and working data sets. Note that Jackson et al (2016) was inadvertently referenced as Jackson et al (2018).

My complete amended report follows.

I. Introduction

I have been retained by counsel for the state defendants to provide expert opinions in this action. The following describes my opinions, the bases and reasons for offering those opinions, as well as the facts and data that I considered and relied on. The conclusions in this report are directly related to the supporting exhibits that follow.

My testimony will provide evidence about the impact of school funding on student outcomes including test scores and high school graduation and the allocation of education inputs in Delaware public schools. I address the issues raised in the complaint in the following ways. First, I report on and discuss research on the effects of school resources on school quality as measured by the contribution of schools to achievement and future academic and labor-market outcomes. Subsequently, I present a statistical analysis of the relationship between student performance and spending in Delaware public schools. Finally, I describe the distributions of class size and teacher experience in districts and in schools by share of students classified as low income.

My overall opinion, to a reasonable professional certainty, is that neither elementary, middle or high school achievement nor the high school graduation rate in Delaware public schools is positively related to per-student expenditure at either the district or school level. These findings are consistent with the large body of research that finds little systematic relationship between school quality and expenditure. Moreover, there is little or no evidence that low-income children are enrolled in school districts that have larger classes or significantly more novice teachers as defined by less than two years of prior teaching experience. This evidence is not consistent with the notion that lower-income children have less access to education inputs that support student achievement.

II. Background and Qualifications

I am Professor and Economics Department Head at the University of Illinois at Chicago, a position I have held since January of 2012. Prior to that time, I was the Rachel and Michael Deutch Professor of Economics at Amherst College, where I taught from 1993 to 2011. I also served two terms as Economics Department chair at Amherst College. I am the Director of the John F. Kain Center for Education Research, Texas Schools Project at University of Texas, Dallas, a research associate at the National Bureau of Economic Research, and a Research Fellow at CES-IFO Research Institute, Munich, Germany. In 2011 I was a Fullbright Scholar at The Center for Economic Research and Graduate Education – Economics Institute, CERGE-EI, in Prague, CZ.

I graduated with a B.A. in Economics (High Honors) from the University of Michigan in 1984 and also attended the London School of Economics. I received my Ph.D. in Economics from UCLA in 1991. I am a member of several professional associations including the American Economic Association, Association of Public Policy and Management, the Society of Labor Economists, and the Association of Education Finance and Policy.

I have extensive experience working with state and local governments on education policy. These include service as a member of technical advisory committees on value-added models for the Chicago Public Schools and the Missouri Department of Education, and both the Research and Evaluation Advisory Group and Education Task Force on Teacher and Principal Evaluation for the Massachusetts Department of Education. I have also served on a number of technical advisory groups for research funded by the US Department of Education and as a member of the Amherst Board of Education.

I have published numerous, peer-reviewed journal articles including widely cited work on teacher quality, the relationship between spending and achievement, charter schools, class size, school segregation and the effects of racial composition on achievement. My Curriculum Vitae is attached as Exhibit C.

III. Materials Relied On

The materials that form the basis of this report include published research on school resources and teacher effectiveness as listed in the references including studies that I have coauthored and administrative data on Delaware public schools. The administrative data sets are listed in Appendix D.

IV. Analysis and Opinions

IV.a. Evidence on the Relationship Between School Quality and Per-student Expenditure

Debate over the effects of school expenditure on school quality as measured by the contributions of schools to achievement growth, educational attainment and longer-term economic and social outcomes sits in the broader discussion of the contributions of schools and teachers to variation in achievement and earnings and their role as engines of social mobility.

However, a large body of research on both the effects of overall spending and specific inputs based on US data fails to find a systematic relationship between the quality of schooling as measured by the school's contribution or value added to achievement, educational attainment or future earnings (referred to henceforth as achievement) and resources. Hanushek (2003) summarizes the results from 90 studies published between 1966 and 1994, and Figure A1 taken from Hanushek (2003) shows that the vast majority of estimates do not show a significant positive relationship between either the pupil-teacher ratio, teacher experience or teacher education and achievement, controlling for student differences. Appendix Table A1, taken from Hanushek, Rivkin and Taylor (1996) and based on virtually the same body of research, shows that only 15 percent of the estimates of the relationship between achievement and the teacher-pupil ratio and only 27 percent of the estimates of the relationship between achievement and per-student expenditure are positive and statistically significant (see rows labeled 'Total').

However, plaintiffs have asserted that recent evidence on the effects of school finance reforms finds that increased funding leads to increased achievement (see e.g., Verified Second Amended and Supplemental Complaint, Paragraph 6). LaFortune et al (2018) finds large, positive effects of additional resources to low income districts on National Assessment of Educational Progress (NAEP) scores, and Jackson et al (2016) finds large, positive effects of additional resources for low-income school districts on educational attainment and adult earnings. Each paper argues that typical comparisons of achievement and resources found in many studies in the literature are prone to bias because spending differences are not random. Rather the differences are typically correlated with other factors that also affect achievement and are not adequately accounted for in the analyses. The papers argue that a focus on expenditure changes resulting from school-finance reforms provides a much better approach to identify the causal effects of expenditure on achievement that are not confounded by other factors.

In my opinion the methods used in these two studies do not justify treating their findings as more compelling than the numerous other papers in this literature. First, the assumption that the timing of the reforms is not predictable or associated with other changes cannot be directly tested, and there is strong reason to believe that it does not hold. School finance reforms come about through political and legal processes that typically receive extensive coverage in the media. Moreover, it is highly likely that states that implement substantial changes to the school finance system also take other steps to support the education of lower-income children, particularly if the implementation is driven by court findings that cite low achievement or achievement gaps as evidence that the state has failed to provide an adequate education. These steps may include efforts to improve the quality of teacher and principal preparation, the expansion of educational choice in the form of charter schools, strengthened school accountability, and expanded support

for low-income families outside of education. State efforts that shift the policy focus toward low-income districts or families, social or economic changes that alter the balance of political power in a state, and changes in economic conditions that affect the state budget can confound estimates of expenditure effects on the outcomes of low-income children or districts relative to others.

It is informative to compare the methods of these studies with randomized controlled trials and quasi-experiments that use essentially random variation to identify variable effects. Random assignment to treatment (reform) and control (nonreform) groups would enable the unbiased estimation of reform effects, but as noted the timing and character of school finance reforms are determined by political, legislative and legal processes. This raises the specter of unobserved factors associated with the timing of school finance reform.

Quasi-experimental methods used extensively in education research use longitudinal student data to control for differences in schools and students and identify resource effects on the basis of "essentially" random differences. These analyses typically account for student differences with prior test scores and school differences by focusing on within school comparisons of achievement growth between grades, years or both; the two recent studies of school finance reforms do not take this approach.

Evidence in Hanushek, Rivkin and Taylor (1996) also suggests that the measurement of expenditures or resources at the state level may increase susceptibility to bias from factors not considered in the analysis. That study shows that aggregation of the school pupil-teacher ratio to the state average for all the schools in the sample substantially increased the magnitude and statistical significance of the regression coefficient. This is consistent with the pattern shown in Table A1 in which studies without in-state variation reported in the final row of each panel tend to have a much larger fraction of estimates that are positive and significant than studies with within-state variation reported in the penultimate row of each panel. Both LaFortune (2018) and Jackson et al (2016) use state-level variation in expenditures caused by school finance reform to identify expenditure effects on student outcomes.

Finally, the patterns of findings including their magnitudes and discrepancies between the two quite-similar studies give additional reason for pause. LaFortune et al (2018) finds that exogenous school spending increases induced by school finance reform raised achievement in lower-income districts relative to higher-income districts but did not have detectable effects on resource or achievement gaps between high- and low-income students because the average low-income student does not live in a particularly low-income district. In contrast, Jackson et al (2016) finds that exogenous school spending increases induced by school finance reform raised education attainment, wages, and family income and reduced the annual incidence of adult poverty much more for children from low-income families. It is certainly possible that the effects on NAEP scores differed from those on longer-term educational attainment, wages and family income, but this seems unlikely.

Importantly, the absence of a systematic relationship between spending and school quality does not imply that schools have little effect on achievement, academic attainment and earnings. A growing body of evidence confirms the widely held belief of substantial variation in teacher effectiveness that contributes to sizeable differences in test scores and adult earnings.

Importantly, the widely cited studies of teacher effects on achievement (Rivkin, Hanushek and Kain, 2005) and adult earnings (Chetty, Friedman and Rockoff, 2014a and 2014b) focus on within-school differences in teacher effectiveness at a point in time. Given that teachers in these samples work in districts where pay is determined almost entirely by post-secondary degree and years of experience and virtually not at all by effectiveness in the classroom, positive effects of an MA degree and experience on teacher effectiveness could potentially introduce a positive relationship with student outcomes and spending. However, the strong evidence that teachers with an MA are not more effective on average than those without an MA (see Figure A1) and that the gains from experience are concentrated in the first few years (Rivkin et al, 2005) means that the factors that determine salary growth are not strongly related to effectiveness.

Ultimately, a primary challenge faced by education policymakers and administrators is that observed characteristics account for little of the variation in teacher quality. Two randomly selected teachers who attended the same education school and have the same experience are likely to differ substantially in terms of classroom effectiveness. This has led to increased focus on evaluation including measurement of teacher contributions to achievement and its use in supporting teacher development and making personnel decisions.

In sum, a large body of evidence fails to find a systematic relationship between achievement and school resources. This is not to say that money never matters. There is evidence of benefits to smaller classes in the early grades and learning by teachers in their initial years on the job.[1] Nonetheless, the average return to additional spending in terms of better student outcomes appears to be quite low in US public schools.

IV.b. Analysis of Delaware Public Schools

This empirical analysis of Delaware public schools focuses on the questions of whether spending is positively related to achievement, achievement growth or the rate of high school graduation and whether low income children receive fewer resources. It uses school- and district- level administrative data for the 2017-2018 and 2018-2019 academic years that include information on both student outcomes and per-student expenditure.[2] The student outcomes include the shares proficient and average scores of the Smarter Balanced Assessment Consortium (SBAC), achievement tests administered to elementary- and middle- school students, and the SAT tests administered to 11th grade students, the percentages of growth targets achieved on the SBAC tests, and the high school graduation rate.[3] Per-student spending is measured at both the district and school levels, and we report on relationships between outcomes and spending for each.

Delaware's traditional public-school districts range in size from roughly 1,000 students to approximately 17,000 students. There are also a number of charter schools in Delaware. Most are separate districts, but two charter schools are part of the Red-Clay Consolidated School District.

[1] Krueger (1999) shows experimental evidence from Project Star of significant benefits of smaller classes in the early grades, and Rivkin et al (2005) finds significant benefits of the first few years of experience.
[2] Appendix D lists the data sources.
[3] The focus is on 11th grade students to avoid complications introduced by retaking the SAT or taking it outside the standard grade. Over 93 percent of ELA and math SAT tests are taken in grade 11 in 2018 and 2019.

Only charter schools in separate districts are classified as charter schools for purposes of this report. Technical and vocational high schools and districts are excluded from the analysis.

Two sets of findings on the relationship between outcomes and per-student expenditure will be reported before turning to a description of the variation in class size and teacher experience. The illustration of the relationship between outcome levels and spending begins with scatter plots that do not adjust for differences in student composition. We then consider the relationships between achievement growth and spending including an examination of the sensitivity of the relationships to the inclusion of controls that account for differences in the shares of students classified as low income, English Learners (EL) and students with disabilities (SWD). Given its importance, we also examine the sensitivity of the relationship between the high school graduation rate and spending to the inclusion of the same controls; regression results for the other outcomes are presented in appendices. The final component of the study of Delaware public schools illustrates the variation in class size in the elementary grades and teacher experience throughout K-12 by the share of students classified as low income.

IV.b.1 Associations Between Student Outcomes and Per-student spending

The relationship between student outcomes and per student spending at the district or school level comes from many sources including school resource effects on school quality and the distribution of students by school expenditure. An upward sloping or positive relationship between outcomes and spending may come from positive resource effects or disproportionate spending on the educationally advantaged. In contrast, a downward sloping or negative relationship between outcomes and spending indicates that any positive effect of resources is more than offset by disproportionate spending on educationally disadvantaged students whose achievement or rate of school completion would be lower, conditional on spending. Thus, the simple comparisons of outcomes and spending contain information on combinations of effects.

As the extensive literature on school-resource effects emphasizes, the empirical approach must account for confounding student differences across schools and districts to identify the causal effect of school inputs or spending. A widely-used approach is to use prior achievement to account for such differences. As Chetty et al (2014a,b) point out in the estimation of teacher effects, the appeal of value-added or growth models that compare students with the same initial scores comes from the fact that controls for prior achievement accounts for many differences in student skills and circumstances.

This suggests a focus on measures of achievement growth, and I therefore place additional emphasis on the relationship between the share of ELA and math achievement growth targets met and per student expenditure.[4] Because of the importance of high school graduation, I also highlight results for this outcome. Given the absence of measures of initial skills and achievement, I examine the sensitivity of the relationship between the high school graduation rate and spending to the inclusion of controls for the shares of students classified as low income, EL and SWD. I also report the sensitivity of the relationships between all outcomes and per-student expenditure at both the district and school levels to the inclusion of these controls and to weighting by enrollment.

[4] Delaware Department of Education (2019) describes the construction of the achievement growth measures.

There are figures and tables for academic years 2017-18 and 2018-19, and I focus on 2017-18 because of the availability of information on high school graduation. However, the findings are qualitatively similar for virtually all outcomes. Results for academic year 2017-18 are presented in Exhibit A and Appendix B, and results for academic year 2018-19 are presented in Exhibit B and Appendix C. Note that the numbering for the main 2018-19 figures and tables corresponds to the numbering for the 2017-18 tables except that it begins at 101 rather than 1.[5]

Figures 1 to 9 in Exhibit A show the relationship of student outcomes to district per-student expenditure for SBAC and SAT tests and the high school graduation rate by plotting each outcome and expenditure combination for each district and a line that shows the relationship between expenditure and predicted outcome generated by a regression of outcome on expenditure. Negative associations between SBAC outcomes and spending appear in Figures 1 to 4 regardless of the subject or whether the outcome is a proficient share or mean scale score. Note that the relationships tend to be noisier for ELA than for math, as the points are less tightly placed around the regression lines. The associations between the ELA and math SAT outcomes and spending shown in Figures 5 to 8 are weak, as the slopes are negative but quite small. Finally, Figure 9 shows a negative relationship between high school graduation rate and per student expenditure. Note that the corresponding figures for academic year 2018-19 shown in Exhibit B show a quite similar pattern: all have negative slopes that tend to be more precisely estimated for the SBAC than for the SAT outcomes.

The next nine figures reproduce the same plots at the school rather than the district level. There are many more schools and additional spending variation at the school rather than the district level. A clear pattern emerges in the school level plots of a negative association between student outcomes and spending. In fact, all nine plots show a negative association, and the slope is significantly different from zero at the one percent significance level in all of them. This includes the SAT outcomes that had weaker associations at the district level. Note that the comparable plots in Figures 110 to 117 for 2018-19 also show negative and significant relationships between achievement and spending.

Taken as a whole, these plots are consistent with some combination of little or no effects of school expenditure on outcomes and disproportionate spending on more educationally disadvantaged children. As noted above, absent controls for student differences they do not provide evidence of causal effects of spending on outcomes. Only one reported outcome measure, the average share of the SBAC achievement growth target met, accounts for initial achievement differences, and I now examine this outcome.

Figures 19 to 22 plot the average SBAC achievement growth targets met in ELA and math at the district and school levels based on achievement in grades 4 to 8; grade 3 provides the baseline test score for grade 4. None of the four figures show a significant, positive relationship between achievement growth and spending. Rather negative associations emerge for all four, and the corresponding plots for 2018-19 also show similar negative associations. Thus, there is little or no evidence that higher spending leads to higher achievement growth.

[5] Some observations with outcome data are dropped from analyses because school per-student expenditure exceeded $35,000 per year or district per student expenditure exceeded $28,000 per year.

To subject this finding to additional testing I use multiple regression methods to examine the sensitivity of the estimated relationship between achievement growth and expenditure to the inclusion of controls. Specifically, the average share of the growth targets achieved are regressed on per-student expenditure, controls for the shares of students classified as low income, EL and SWD, and the shares of students in each grade to account for potential differences in growth across grades (see equation below). These student factors are typically important determinants of achievement, and the sensitivity of the expenditure coefficients to their inclusion in the specification will provide information on the influences of student differences on the per-student expenditure coefficients.[6]

$$(1)\ outcome_d = \delta expenditure_d + \beta sharelowinc_d + \rho shareEL_d + \gamma shareswd_d + \sum_{lowest\ grade}^{highest-1} \theta_{gd}\ grade\ share_{gd} + \varepsilon_d$$

The top panel of Table 1 reports unweighted and enrollment weighted estimated effects of per-student expenditure on achievement growth from simple bivariate regressions with no controls (unadjusted) and from regressions of equation 1 at both the district and the school levels. All coefficients are negative regardless of subject, inclusion of controls, or weighting. Similar to the case for 2017-18, none of the estimates for 2018-19 reported in Table 101 are positive and significant at any conventional level. The inclusion of controls tends to move these estimates in a positive direction, and most of the adjusted estimates are positive though small. Note that a comparison of the coefficients in Tables B3 and C3 with those in Tables 1 and 101 show that the exclusion of charter schools has little effect on the pattern of estimates in either year. Even ignoring the imprecision of the estimates, the largest positive estimate that appears in 2018-19 suggests that a $1,000 increase in per-student spending would increase the average share of the growth target met by 0.3 percentage points. Taken as a whole, the estimated effects of spending on achievement growth therefore provide little support for the existence of a statistically or educationally significant positive relationship between per-student spending at either the district or school levels and achievement growth.

The bottom panel of Table 1 reports coefficients from regressions of high school graduation rate on spending, and again all coefficients are negative. Moreover, the inclusion of the controls has only a small effect on the magnitude of the estimates despite the absence of a control for initial achievement. This pattern of estimates is consistent with the notion that higher per-student expenditure does not raise the probability of high school graduation.

Appendix Tables B1, B2 and B3 report similar regression results for the other outcomes at the district level (B1), school level for the sample with charter schools (B2) and at the school level for the sample without charter schools (B3). All of the SBAC coefficients are negative regardless of level, the inclusion of charter schools, the use of enrollment weights, or subject. Although some of the adjusted SAT coefficients are positive, none are significant at any conventional level. The generally small, positive effects on the coefficient values resulting from the addition

[6] Data are missing for some of these categories in a small number of schools. In these cases, the shares of students in the affected categories are set to zero.

of the controls is consistent with the notion that higher spending on educationally disadvantaged children contributes to the negative relationship between outcomes and per-student spending at both the district and school levels.

IV.b.2 Distributions of Class Size and Teacher Experience

Certain evidence including the Tennessee STAR class-size experiment has provided some support for the belief that smaller elementary school classes in the elementary-school grades raise achievement, and there is also evidence of improvement in the quality of instruction in a teacher's initial years in the classroom.[7] It is therefore informative to describe the distribution of elementary school class size and teacher experience to examine whether low-income children are placed disproportionately in larger classes or classes with teachers with fewer than two years of prior teaching experience in a Delaware public school. Note that the information on class size refers to regular classes.

Figures 23 and 24 illustrate the relationships between district distributions of class size in grades Kindergarten to 5 and district share low-income in 2017-18. Because class size is reported as the shares of classes in different ranges, two alternative ceilings are used: share of classes with fewer than 21 students and share of classes with fewer than 26 students. Note that all shares are calculated over the total number of classes with 40 or fewer students. Classes with more than 40 students are dropped from the computations because they are unlikely to be regular classes taught by a single teacher. Roughly 0.1 percent of classes have more than 40 students in the elementary grades.

Figure 23 shows that between 20 and 80 percent of a district's classes have fewer than 21 students, and that share is positively and significantly associated with share low income. If the upper limit on 'small' classes rises to 25 as in Figure 24, 80 percent or more of classes in almost all districts would be considered small, and the slope of the regression remains positive and significant. The coefficients in Table 2 show that estimates of the slope in both unweighted and enrollment weighted regressions of the share of a district's classes that are small however defined and share low income are positive and highly significant. Coefficients around 0.3 indicate that a 10 percentage-point increase in share low income is associated with a 3 percentage-point increase in the share of small classes. Figures 25 and 26 repeat the same plots at the school level, and the coefficients tend to be slightly larger and more precisely estimated. Thus, the positive association between share of small classes and low-income share appears to come from both the within and between district differences in the allocation of small classes among students.

The corresponding associations between share of small classes and low-income share for 2018-19 shown in Figures 123 to 126 are similar though generally noisier than those for 2017-18. The need to approximate the class size distributions from the charts shown in the Delaware report card and the need to drop observations because of the absence of grade-specific class-size

[7] See Krueger (1999) for an analysis of the Tennessee STAR experiment. Rivkin, Hanushek and Kain (2005) provide quasi-experimental evidence showing positive and significant effects of the first and second years of teacher experience on student achievement.

information likely contributes to the noisier estimates. Nonetheless, the overall pattern of a positive relationship remains.

Figures 27 to 32 plot teacher experience against share of low income at the district and school levels for three categories of experience: fewer than two years, between two and fifteen years and greater than 15 years. Figure 27 reveals a modest and imprecise positive association between the district share of teachers with fewer than two years of experience and the district share of students classified as low income. The coefficients on district percent of teachers with less than two years of experience reported in Table 2 are quite small and insignificant regardless of whether the regression is weighted by enrollment. A coefficient of 0.2 means that a 10 percentage point increase would increase the share of teachers with fewer than two years of experience by 2 percentage points. By comparison, the relationship between the percent of teachers with between 2 and 15 years of experience and low income share is close to zero (Figure 28), and there is a modest negative relationship between the percent of teachers with greater than 15 years of experience and low income share (Figure 29).

Figures 30 to 32 show the corresponding plots at the school level. The estimated positive relationship between percent of teachers with less than two years of experience and share of students classified as low income at the school level is around the same magnitude but much more precisely estimated. By comparison, the relationship between share with between 2 and 15 years of experience and share low income is quite small and imprecisely estimated, while the association between the percent of teachers with more than 15 years of experience and the share of students classified as low-income is negative and similar in magnitude to the positive coefficient for the share of teachers with fewer than two years of experience. Not surprisingly, the corresponding Figures 130-132 for 2018-19 in Exhibit B show a similar pattern.

A comparison between Tables 3 and B4 show that the exclusion of charter schools from the sample reduces the magnitude of the associations between percent of teachers with fewer than 2 years of experience and share low income which declines by almost 40 percent. Clearly, the voluntary decision by many families to attend a charter school amplifies the positive association between share of teachers with fewer than two years of experience and share low income; a quite similar pattern appears in 2018-19.

Compensation

I am compensated at a rate of $300 per hour for my work on this case.

My research assistant Katherine McElroy is compensated at a rate of $50 per hour for her work on this case.

Prior Testimony in the last five years

None

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Steven Rivkin

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Exhibit A[8]

Figure 1. District Percent Proficient on the ELA SBAC Test for Grades 3-8 Plotted Against Per-pupil Expenditures: 2017-2018

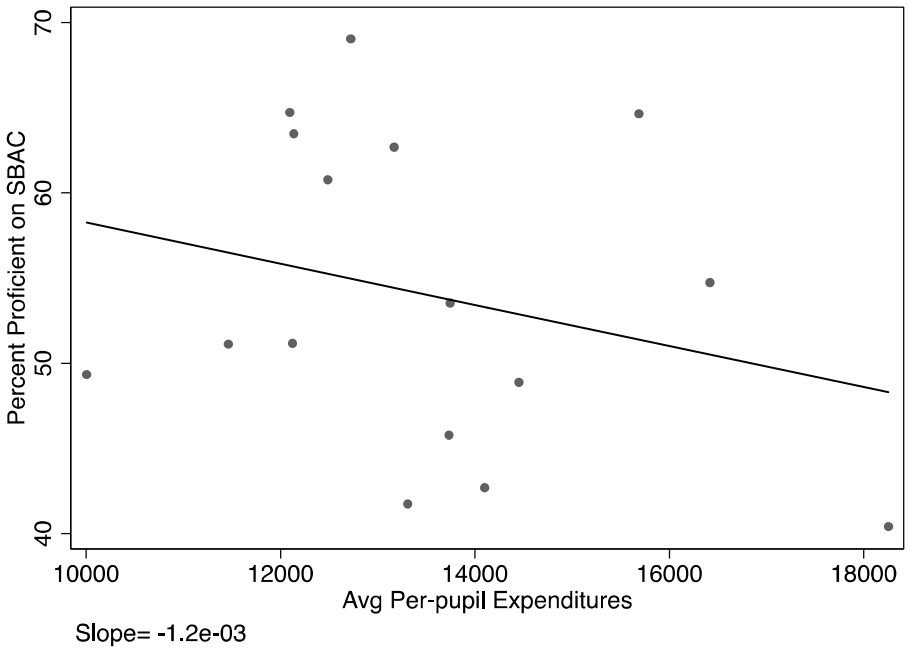
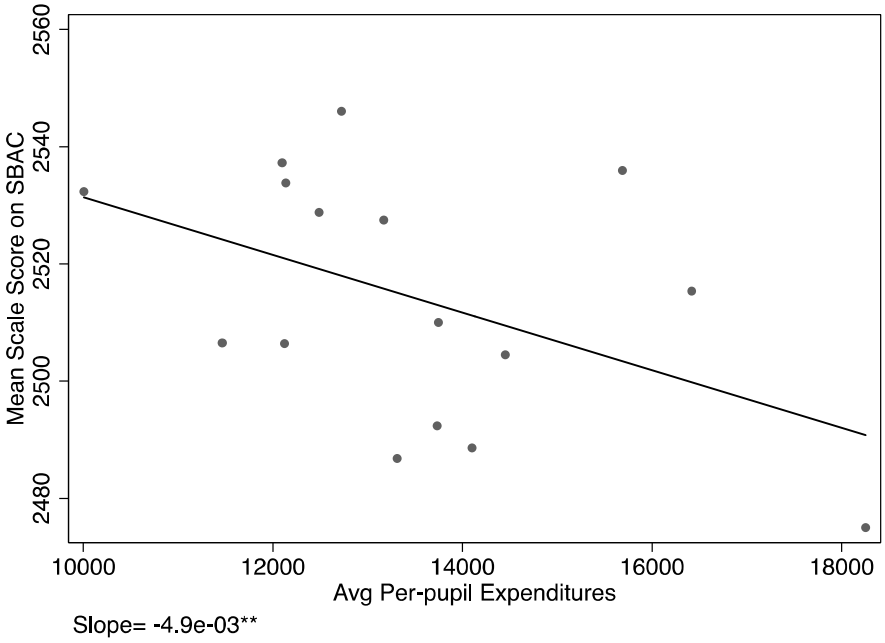


Figure 2. District Average Scale Score on the ELA SBAC Test for Grades 3-8 Plotted Against Per-pupil Expenditures: 2017-2018



[8] Asterisks indicate statistical significance at the following levels: * ten percent; ** five percent; *** one percent.

Figure 3. District Percent Proficient on the Math SBAC Test for Grades 3-8 Plotted Against Per-pupil Expenditures: 2017-2018

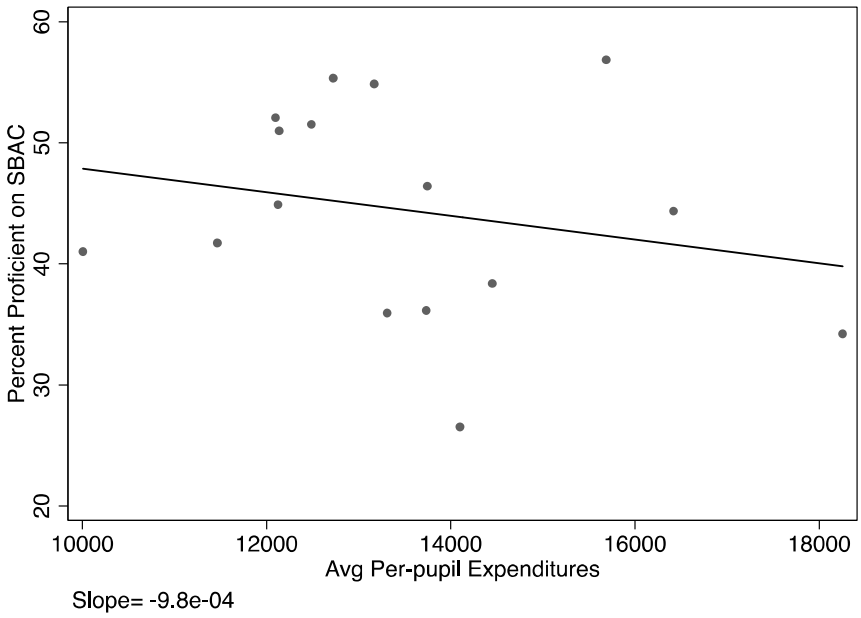


Figure 4. District Average Scale Score on the Math SBAC Test for Grades 3-8 Plotted Against Per-pupil Expenditures: 2017-2018

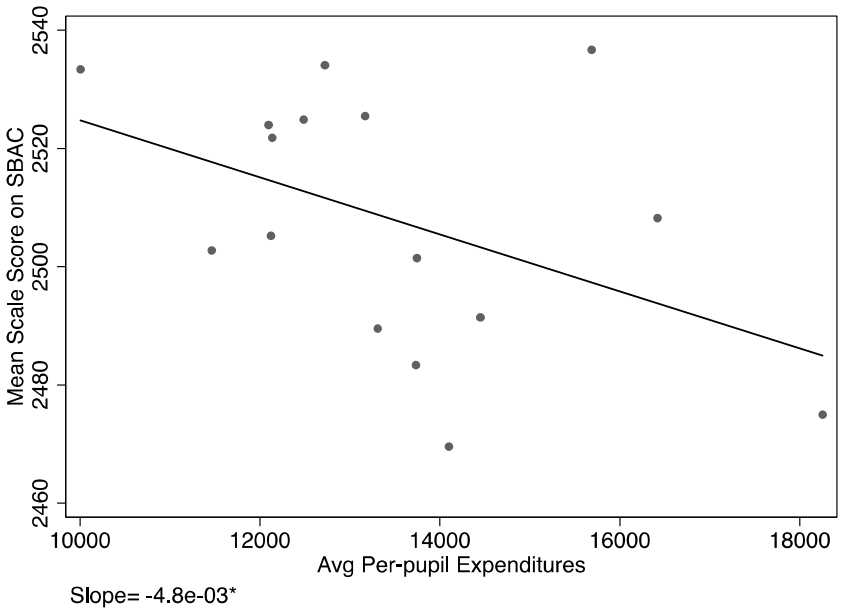


Figure 5. District Percent Proficient on the ELA SAT Test for Students in Grade 11 Plotted Against Per-pupil Expenditures: 2017-2018

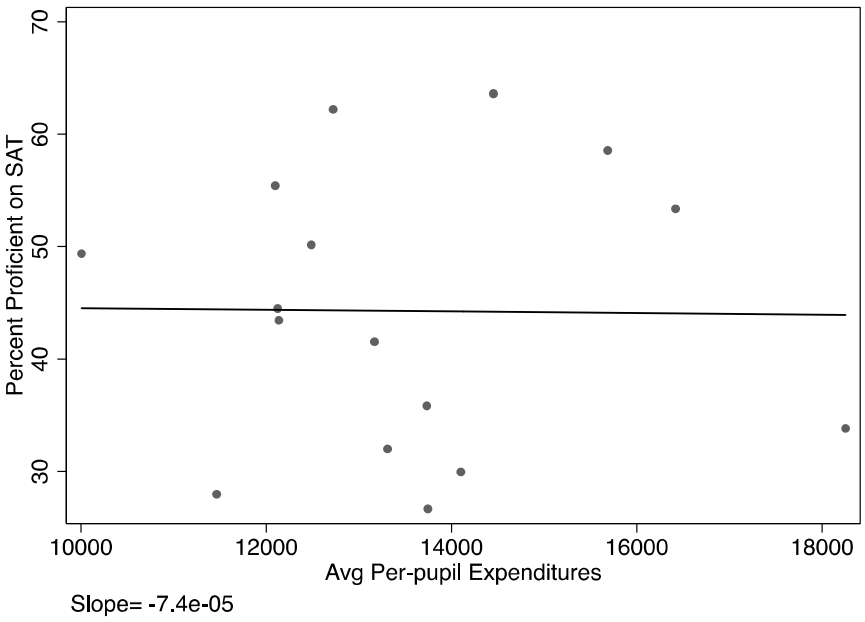


Figure 6. District Mean Scale Score on the ELA SAT Test for Students in Grade 11 Plotted Against Per-pupil Expenditures: 2017-2018

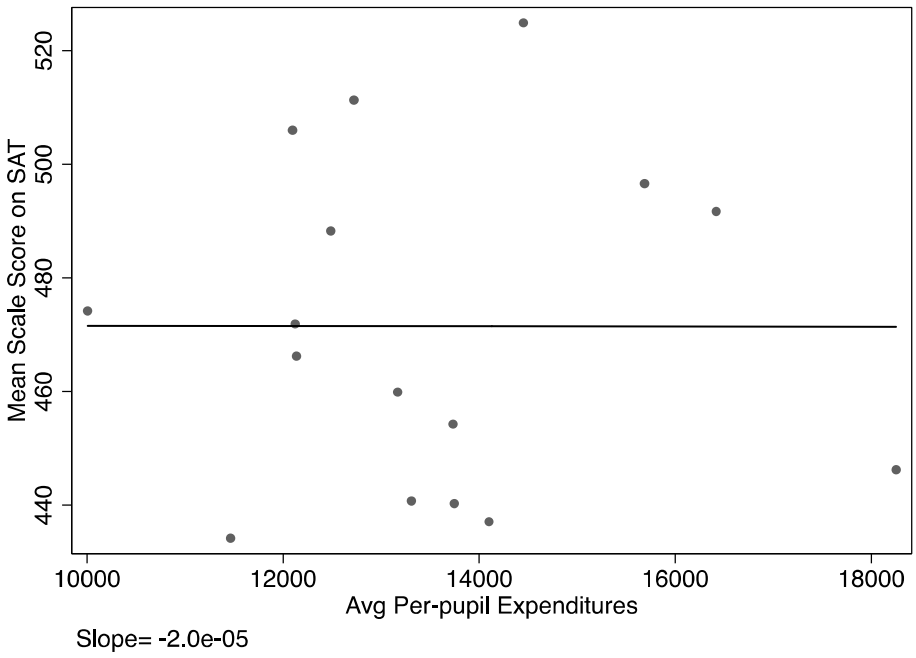


Figure 7. District Percent Proficient on the Math SAT Test for Students in Grade 11 Plotted Against Per-pupil Expenditures: 2017-2018

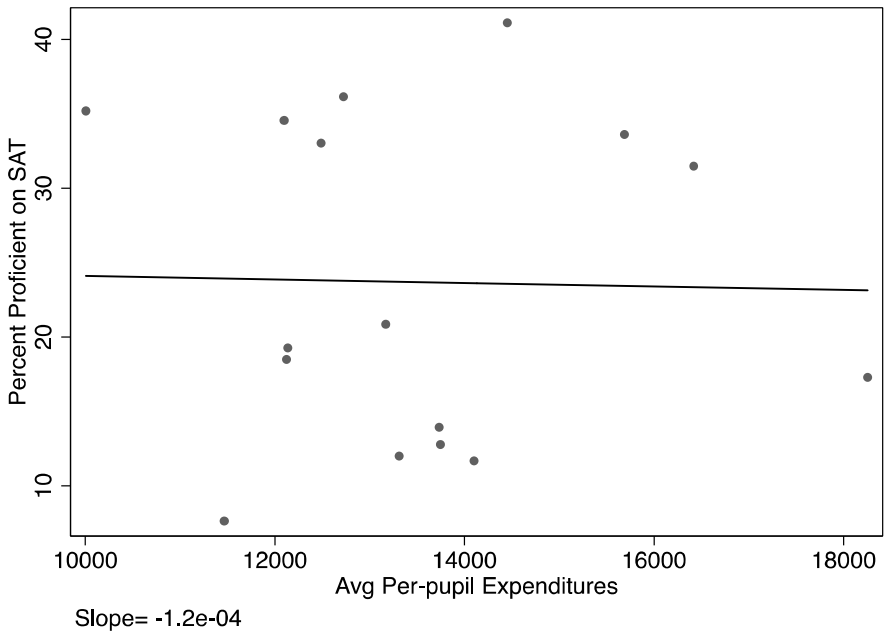


Figure 8. District Mean Scale Score on the Math SAT Test for Students in Grade 11 Plotted Against Per-pupil Expenditures: 2017-2018

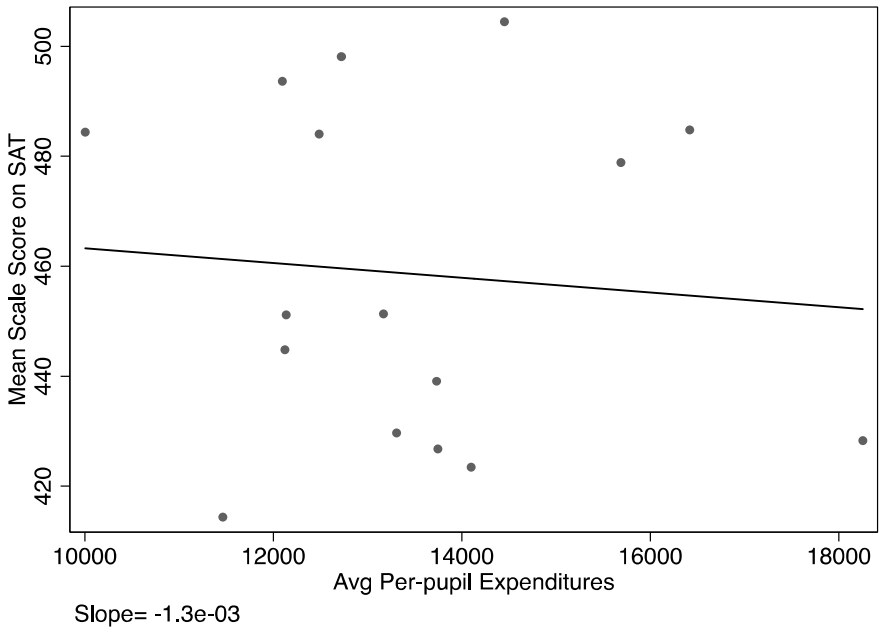


Figure 9. District High School Graduation Rate Plotted Against Per-pupil Expenditures: 2017-2018

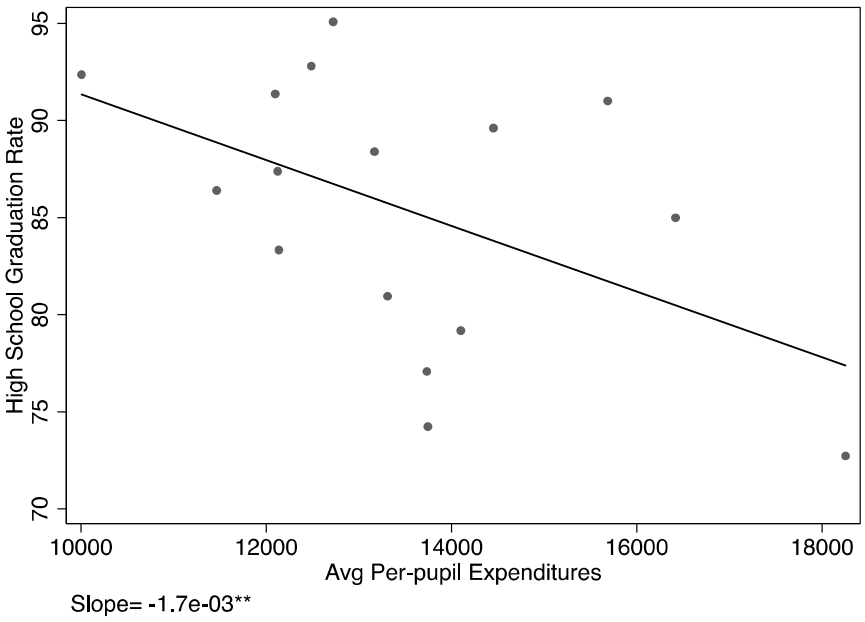


Figure 10. School Percent Proficient on the ELA SBAC Test for Grades 3-8 Plotted Against Per-pupil Expenditures: 2017-2018

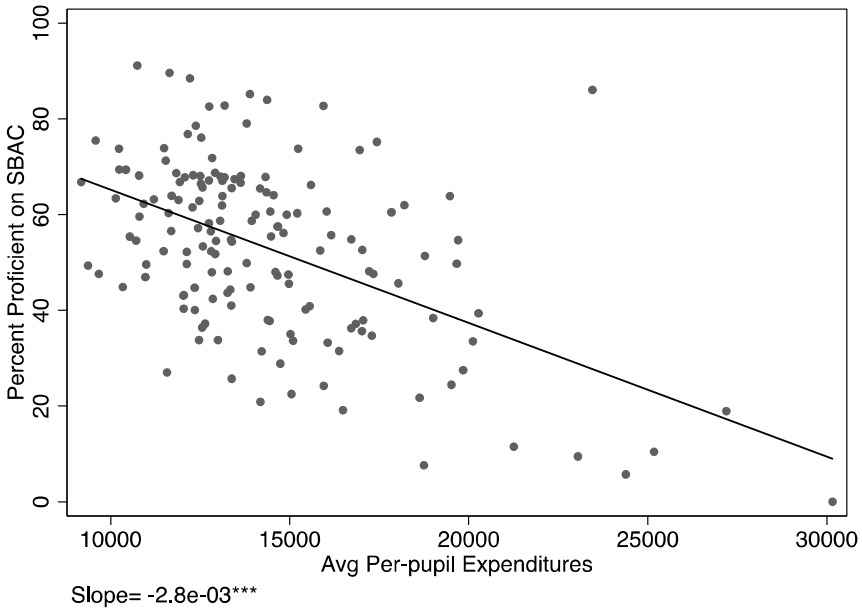


Figure 11. School Average Scale Score on the ELA SBAC Test for Grades 3-8 Plotted Against Per-pupil Expenditures: 2017-2018

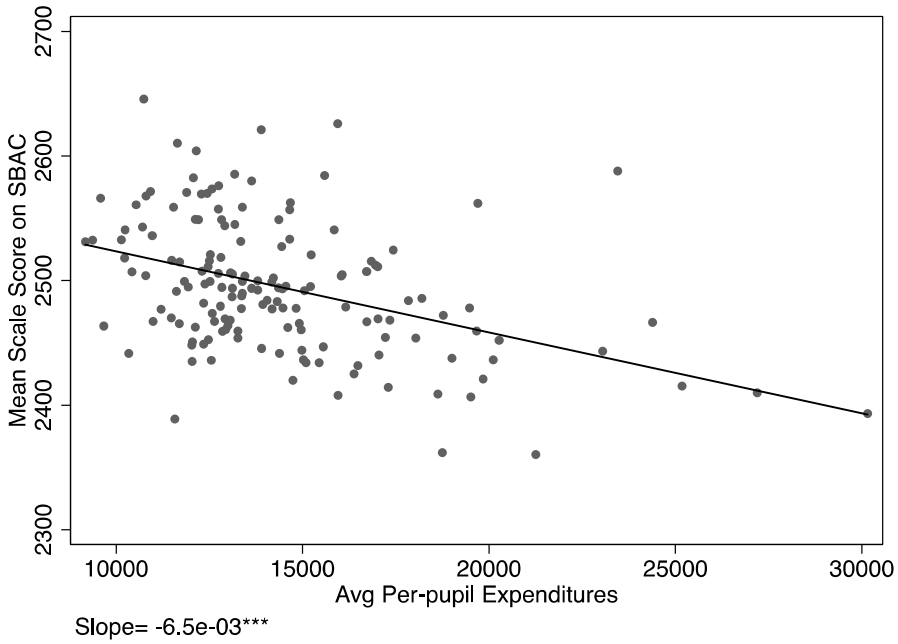


Figure 12. School Percent Proficient on the Math SBAC Test for Grades 3-8 Plotted Against Per-pupil Expenditures: 2017-2018

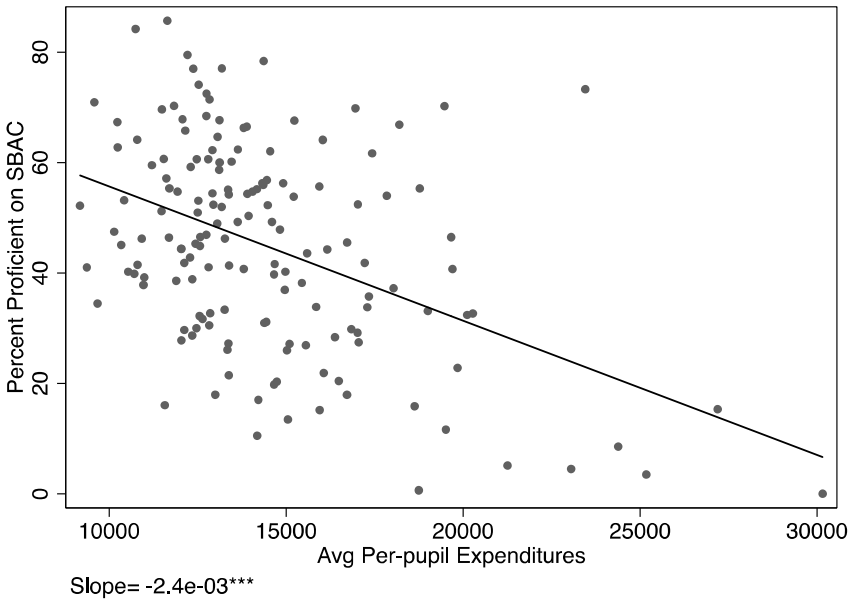


Figure 13. School Average Scale Score on the Math SBAC Test for Grades 3-8 Plotted Against Per-pupil Expenditures: 2017-2018

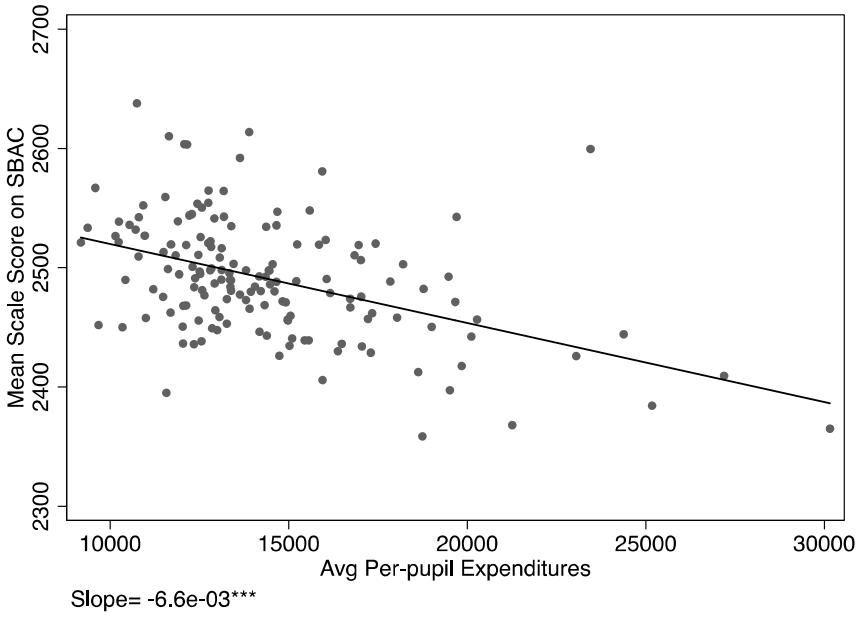


Figure 14. School Percent Proficient on the ELA SAT Test for Students in Grade 11 Plotted Against Per-pupil Expenditures: 2017-2018

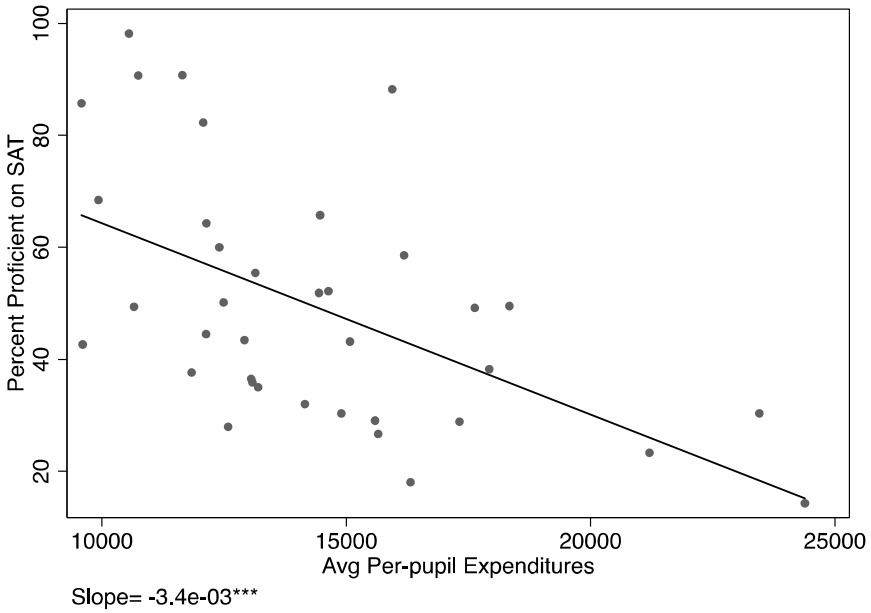


Figure 15. School Mean Scale Score on the ELA SAT Test for Students in Grade 11 Plotted Against Per-pupil Expenditures: 2017-2018

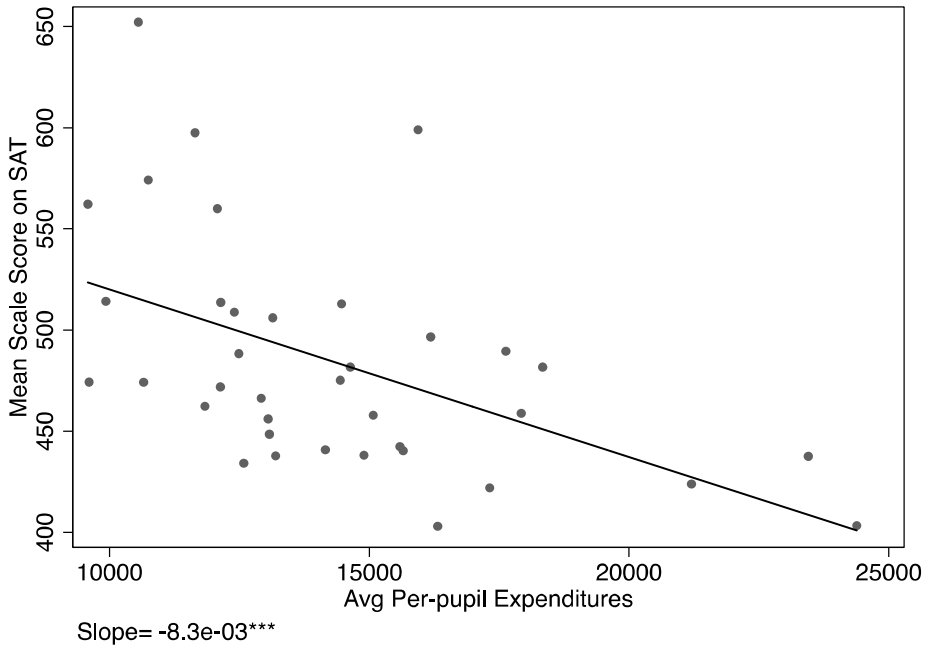


Figure 16. School Percent Proficient on the Math SAT Test for Students in Grade 11 Plotted Against Per-pupil Expenditures: 2017-2018

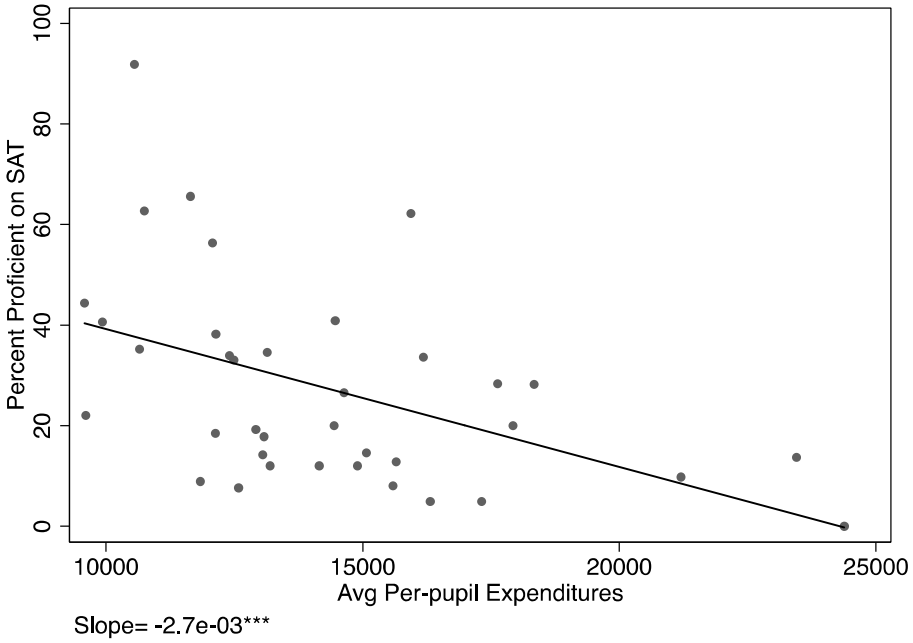


Figure 17. School Mean Scale Score on the Math SAT Test for Students in Grade 11 Plotted Against Per-pupil Expenditures: 2017-2018

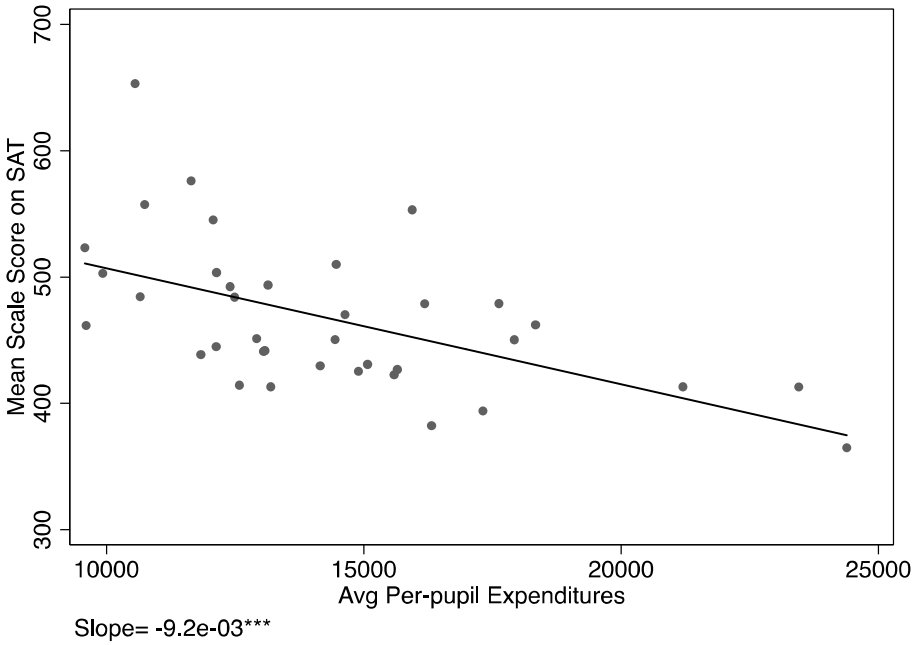


Figure 18. School High School Graduation Rate Plotted Against Per-pupil Expenditures: 2017-2018

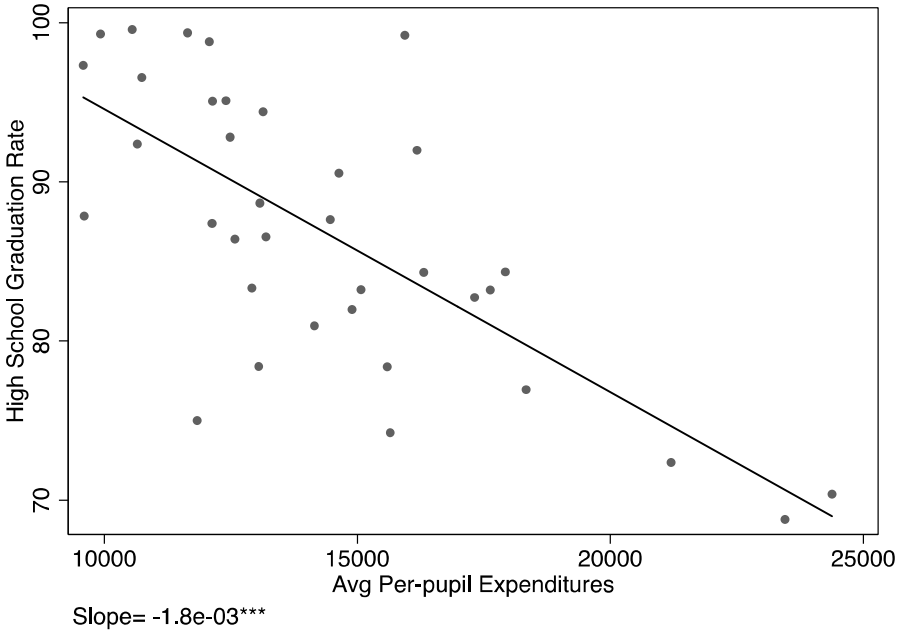


Figure 19. District Average Percent of Growth Target Met on the ELA SBAC Test for Grades 4-8 Plotted Against Per-pupil Expenditures: 2017-2018

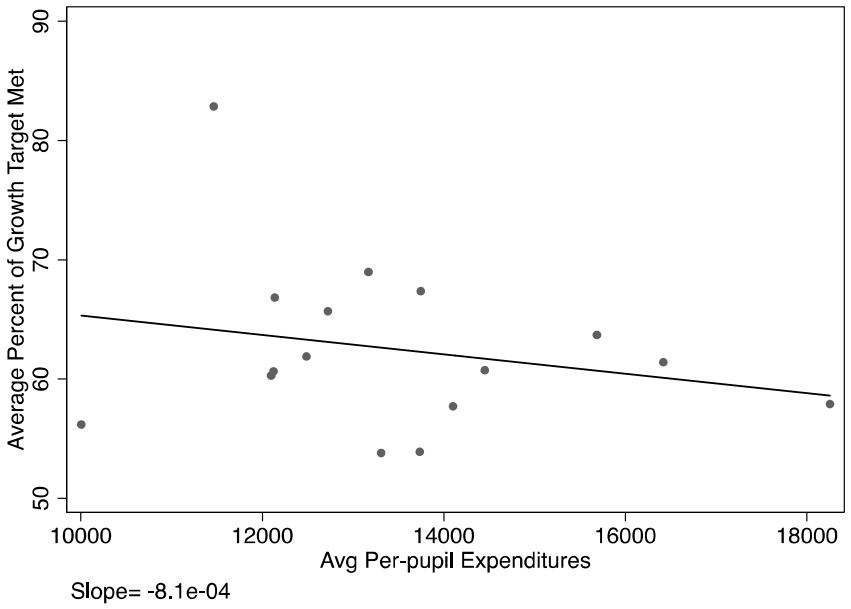


Figure 20. District Average Percent of Growth Target Met on the Math SBAC Test for Grades 4-8 Plotted Against Per-pupil Expenditures: 2017-2018

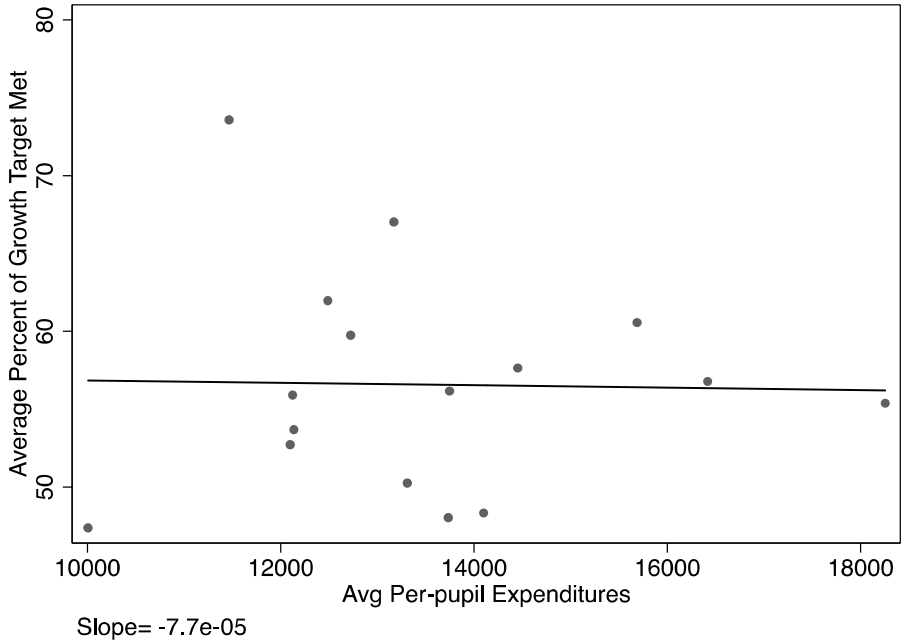


Figure 21. School Average Percent of Growth Target Met on the ELA SBAC Test for Grades 4-8 Plotted Against Per-pupil Expenditures: 2017-2018

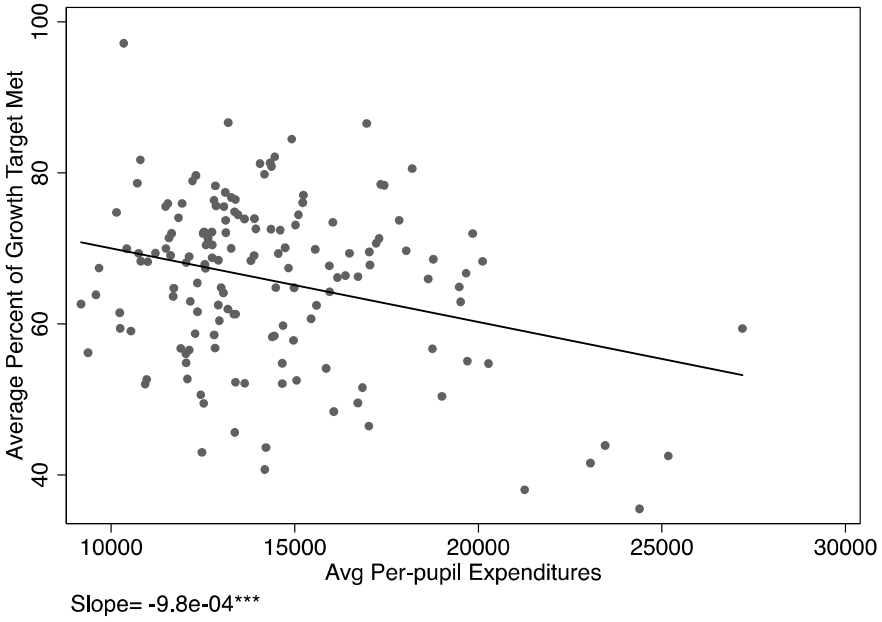


Figure 22. School Average Percent of Growth Target Met on the Math SBAC Test for Grades 4-8 Plotted Against Per-pupil Expenditures: 2017-2018

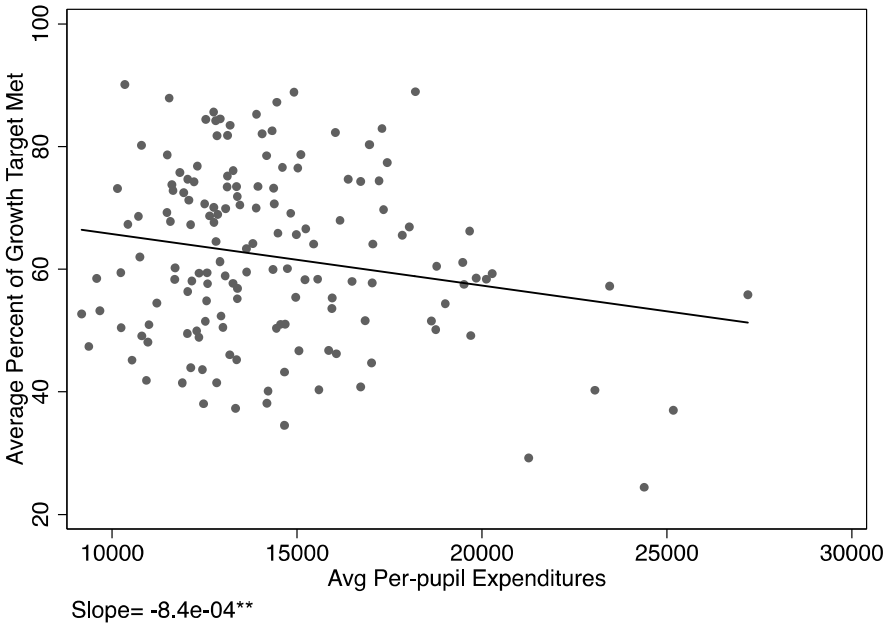


Figure 23. Share of Elementary School Classes in the District with Fewer than 21 Students Plotted Against Share of Students Classified as Low Income: 2017-2018

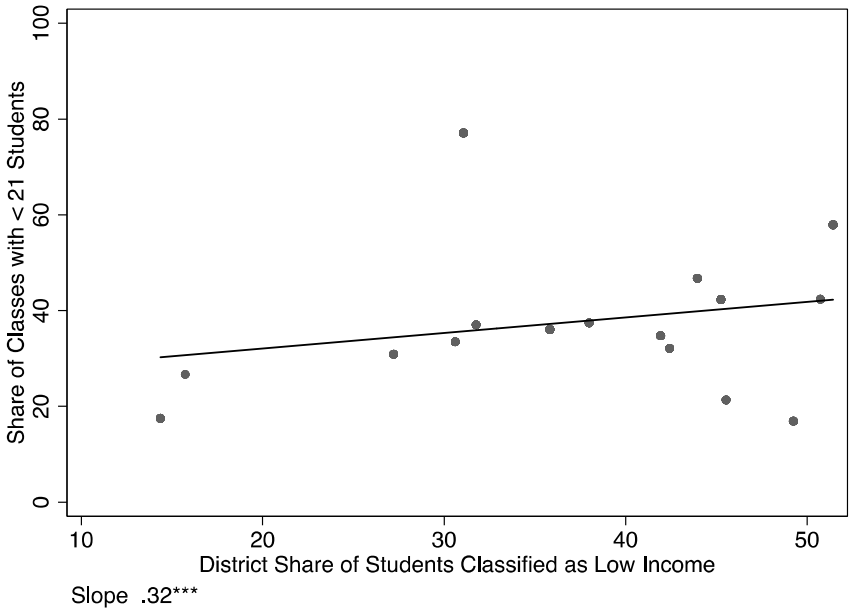


Figure 24. Share of Elementary School Classes in the District with Fewer than 26 Students Plotted Against Share of Students Classified as Low Income: 2017-2018

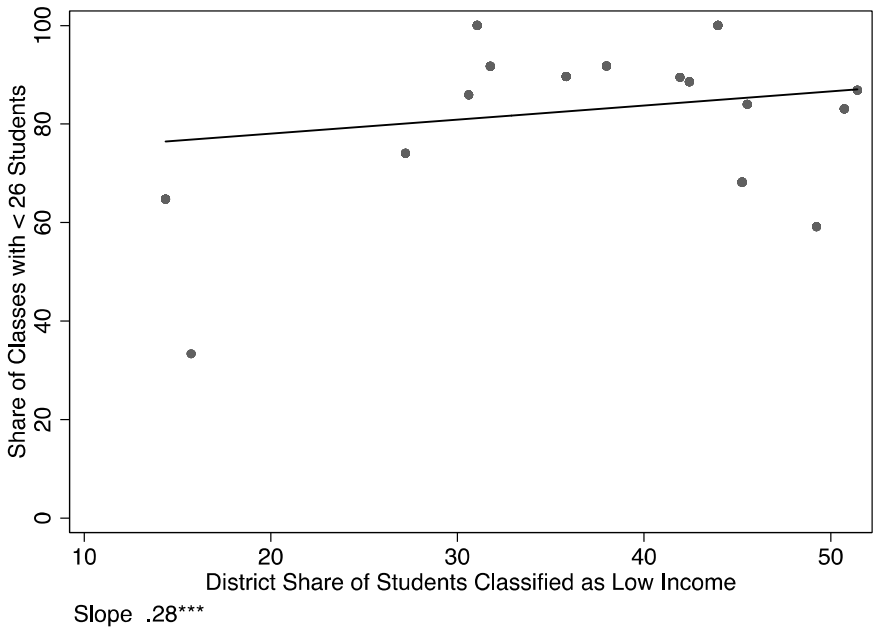


Figure 25. Share of Classes in the Elementary School with 21 or Fewer Students Plotted Against Share of Students Classified as Low Income: 2017-2018

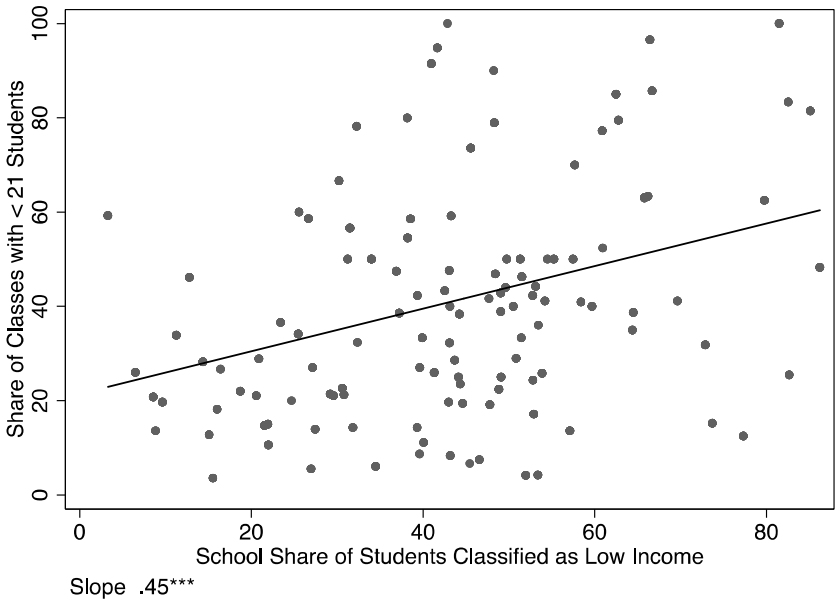


Figure 26. Share of Classes in the Elementary School with 26 or Fewer Students Plotted Against Share of Students Classified as Low Income: 2017-2018

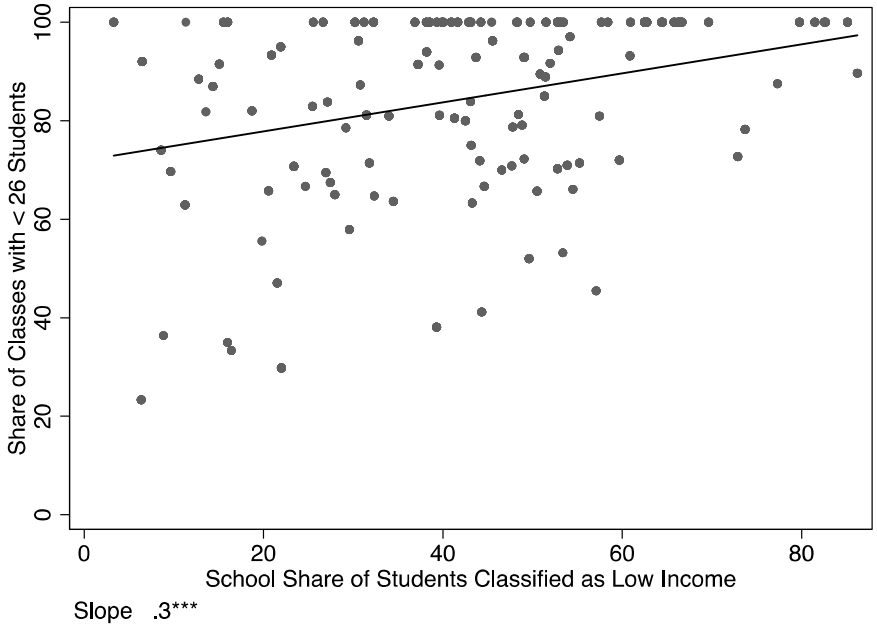


Figure 27. Share of Regular Classroom Teachers in the District with Fewer than Two Years of Experience Plotted Against Share of Students Classified as Low Income: 2017-2018

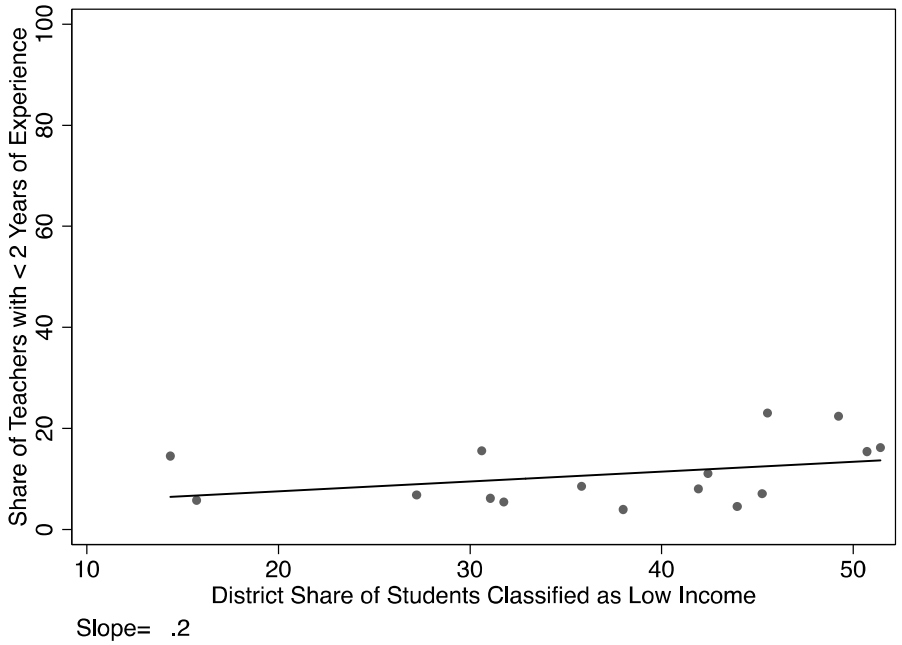


Figure 28. Share of Regular Classroom Teachers in the District with Between Two and Fifteen Years of Experience Plotted Against Share of Students Classified as Low Income: 2017-2018

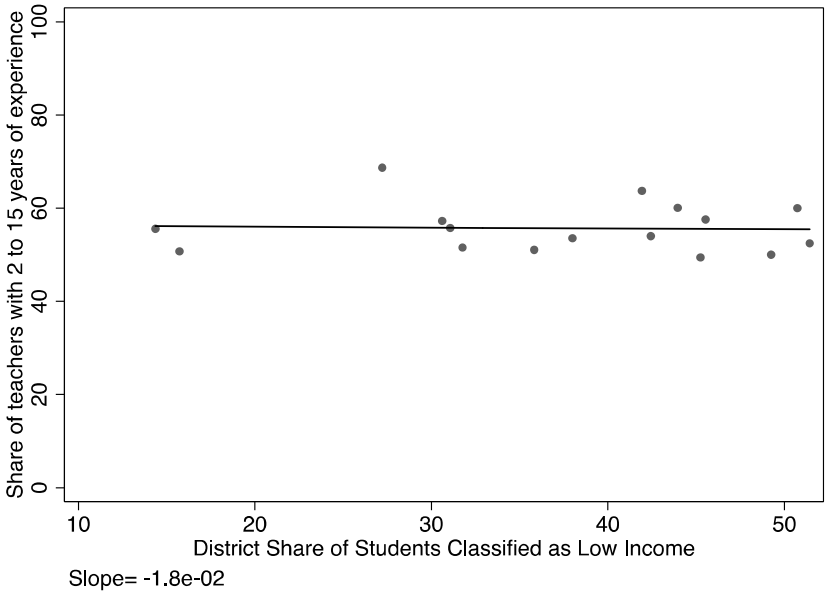


Figure 29. Share of Regular Classroom Teachers in the District with Greater Than Fifteen Years of Experience Plotted Against Share of Students Classified as Low Income: 2017-2018

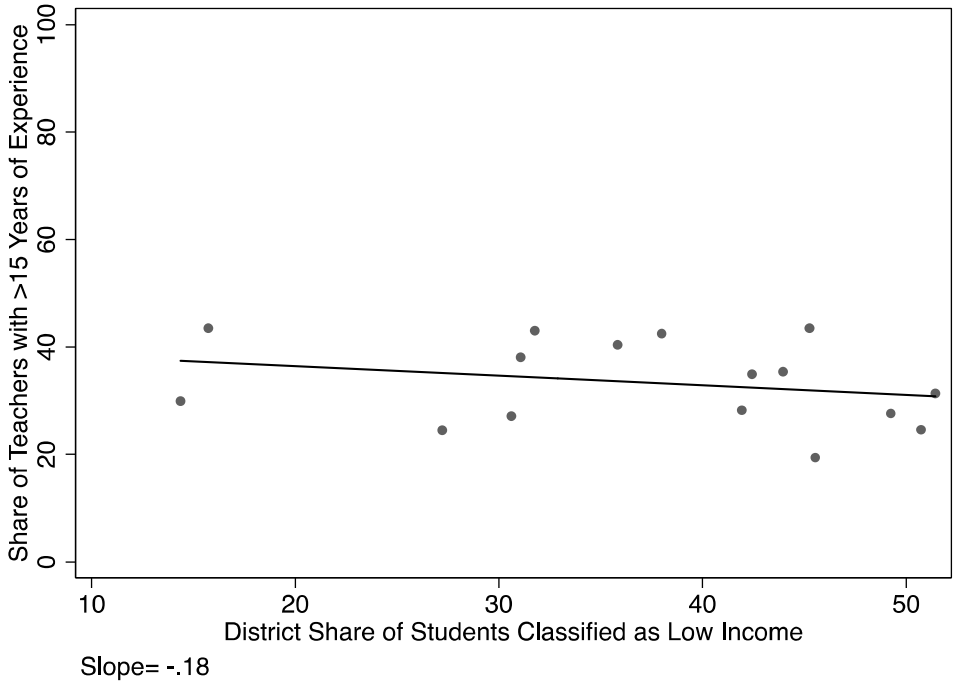


Figure 30. Share of Regular Classroom Teachers in the School with Fewer than Two Years of Experience Plotted Against Share of Students Classified as Low Income: 2017-2018

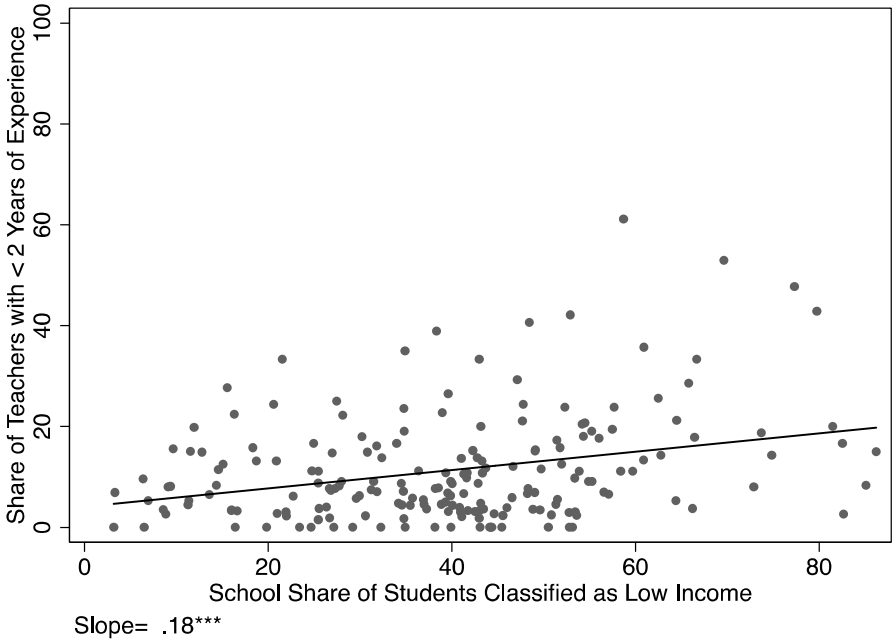


Figure 31. Share of Regular Classroom Teachers in the School with Between Two and Fifteen Years of Experience Plotted Against Share of Students Classified as Low Income: 2017-2018

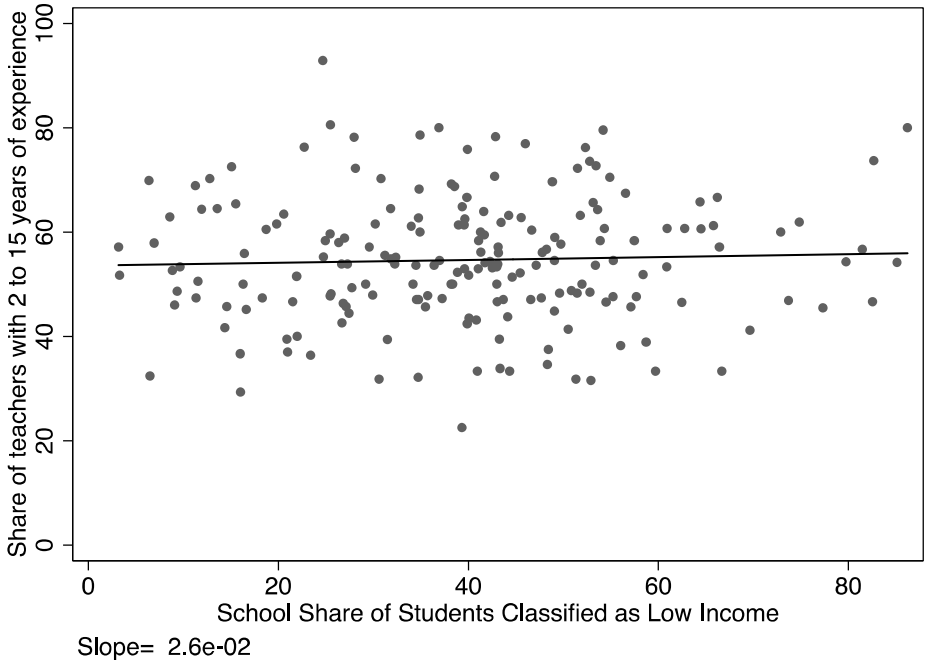


Figure 32. Share of Regular Classroom Teachers in the School with Greater Than Fifteen Years of Experience Plotted Against Share of Students Classified as Low Income: 2017-2018

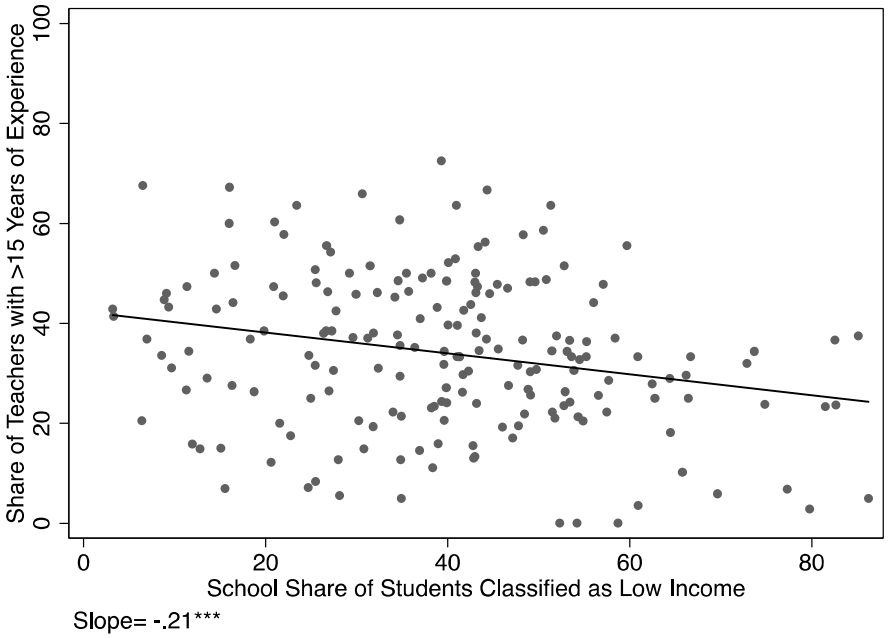


Table 1. Unweighted and Enrollment Weighted Slope Coefficients from Regressions of Achievement Growth and High School Graduation Rate on District and School Per-student Expenditure, by Adjustments for Differences in Student Income and Program Characteristics: 2017-2018 (standard errors in parentheses)

		Unweighted		Enrollment Weighted	
Controls for shares classified as low income, EL, SWD, and grade distribution.		No	yes	no	yes
1. Achievement Growth					
District level					
SBAC - ELA	average percent of growth target met	-0.00081	-0.0016*	-0.00095	-0.0010
		(0.00091)	(0.00098)	(0.00063)	(0.00077)
SBAC - MATH	average percent of growth target met	-0.00008	-0.0014	-0.00035	-0.00086
		(0.00093)	(0.00118)	(0.00075)	(0.00104)
School level					
SBAC - ELA	average percent of growth target met	-0.00098***	-0.00056**	-0.00075**	-0.00044*
		(0.00027)	(0.00023)	(0.00030)	(0.00024)
SBAC - MATH	average percent of growth target met	-0.00084**	-0.00030	-0.00041	-0.00009
		(0.00035)	(0.00031)	(0.00040)	(0.00033)
2. High School Graduation Rate					
District level		-0.0017**	-0.0014***	-0.0022***	-0.0018***
		(0.00079)	(0.00051)	(0.00074)	(0.00055)
School level		-0.0018***	-0.0014***	-0.0020***	-0.0013***
		(0.00030)	(0.00028)	(0.00035)	(0.00029)

Notes: Each cell comes from a separate regression. There is one observation per district or school in each regression. The sample size for district level achievement growth is 16 and for school level it is 152. The sample size for district level graduation rate is 16 and for school level it is 36. Charter school districts are included in the school samples.

Table 2. Unweighted and Enrollment Weighted Slope Coefficients from Regressions of Traditional Public School Class Size or Teacher Experience Category Shares on the District Share of Students Classified as Low Income: 2017-2018 (standard errors in parentheses; each cell comes from a separate regression)

	Unweighted	Enrollment Weighted
1. Class Size		
Percent of district classes <21 students	0.32***	0.57***
	(0.075)	(0.06121)
Percent of district classes <26 students	0.28***	0.21***
	(0.067)	(0.063)
2. Teacher Experience		
Percent of district teachers with <2 years of experience	0.20	0.019
	(0.14)	(0.13)
Percent of district teachers with 2 to 15 years of experience	-0.018	-0.10
	(0.13)	(0.12)
Percent of district teachers with >15 years of experience	-0.18	0.08
	(0.18)	(0.19)

Note: Each cell reports the regression coefficient and standard errors from a regression of the class size or experience percent for that row regressed on the share of students classified as low income. Charter school districts are not included in the samples.

Table 3. Unweighted and Enrollment Weighted Slope Coefficients from Regressions of Traditional Public and Charter School Class Size or Teacher Experience on the School Share of Students Classified as Low Income: 2017-2018 (standard errors in parentheses; each cell comes from a separate regression)

	Unweighted	Enrollment Weighted
1. Class Size		
Percent of school classes <21 students	0.45***	0.44***
	(0.035)	(0.033)
Percent of school classes <26 students	0.30***	0.32***
	(0.027)	(0.028)
2. Teacher Experience		
Percent of school teachers with <2 years of experience	0.18***	0.15***
	(0.042)	(0.041)
Percent of school teachers with 2 to 15 years of experience	0.026	0.013
	(0.049)	(0.050)
Percent of school teachers with >15 years of experience	-0.21***	-0.17***
	(0.062)	(0.064)

Note: Each cell reports the regression coefficient and standard errors from a regression of the class size or experience share for that row regressed on the share of students classified as low income. Charter school districts are included in the samples.

Exhibit B[9]

Figure 101. District Percent Proficient on the ELA SBAC Test for Grades 3-8 Plotted Against Per-pupil Expenditures: 2018-2019

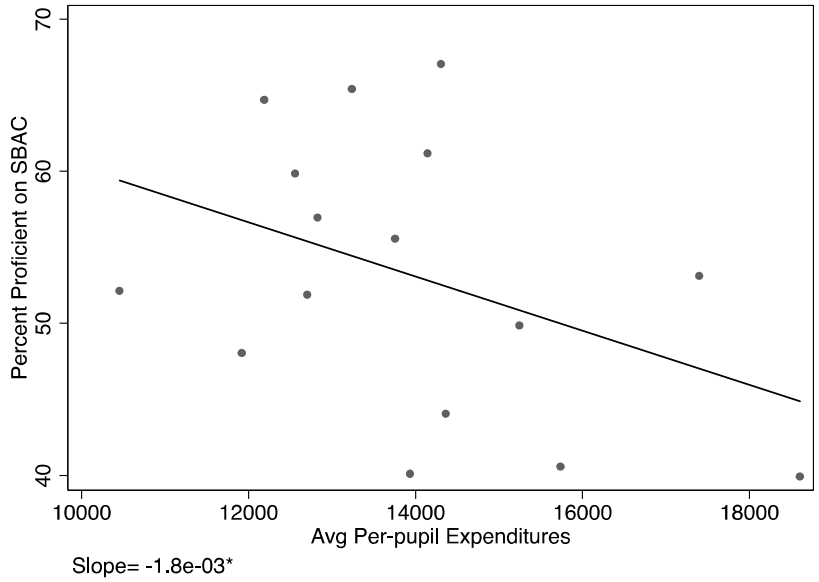
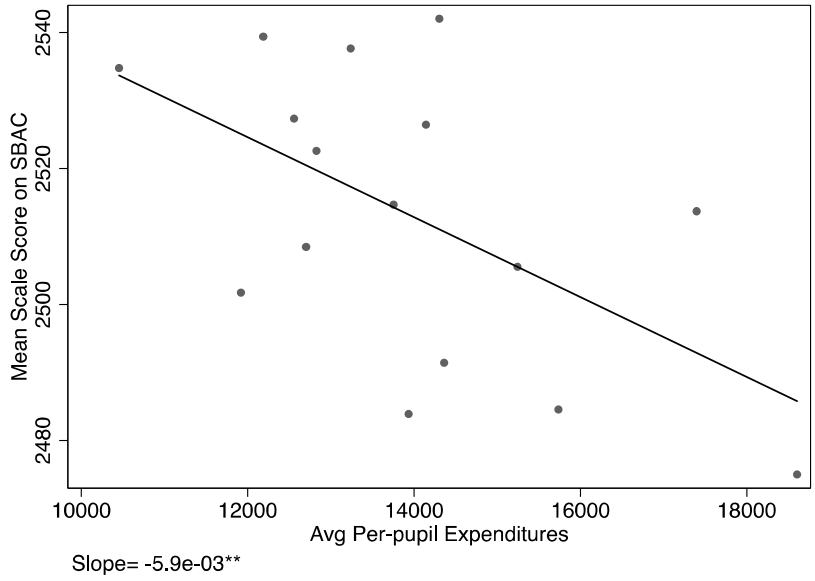


Figure 102. District Average Scale Score on the ELA SBAC Test for Grades 3-8 Plotted Against Per-pupil Expenditures: 2018-2019



[9] Asterisks indicate statistical significance at the following levels: * ten percent; ** five percent; *** one percent.

Figure 103. District Percent Proficient on the Math SBAC Test for Grades 3-8 Plotted Against Per-pupil Expenditures: 2018-2019

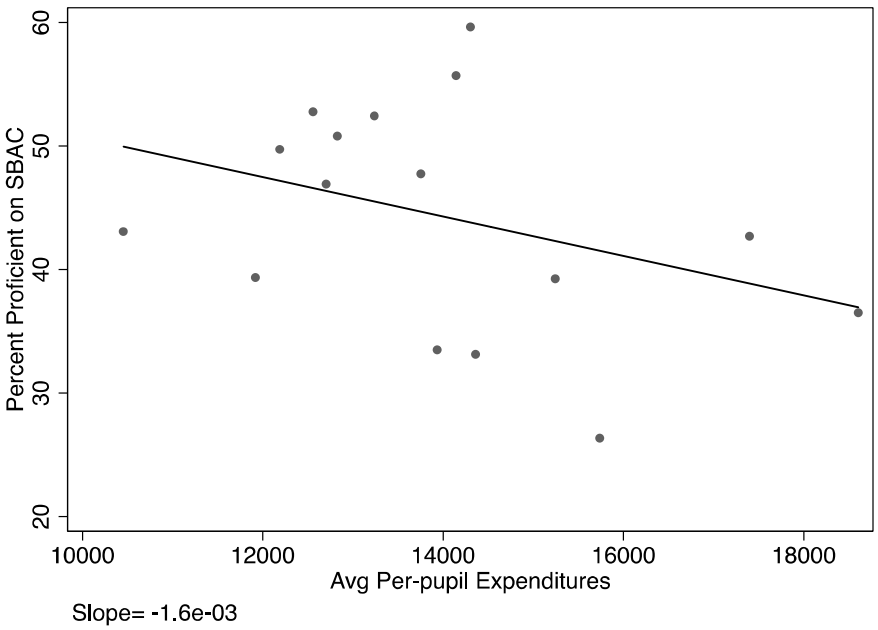


Figure 104. District Average Scale Score on the Math SBAC Test for Grades 3-8 Plotted Against Per-pupil Expenditures: 2018-2019

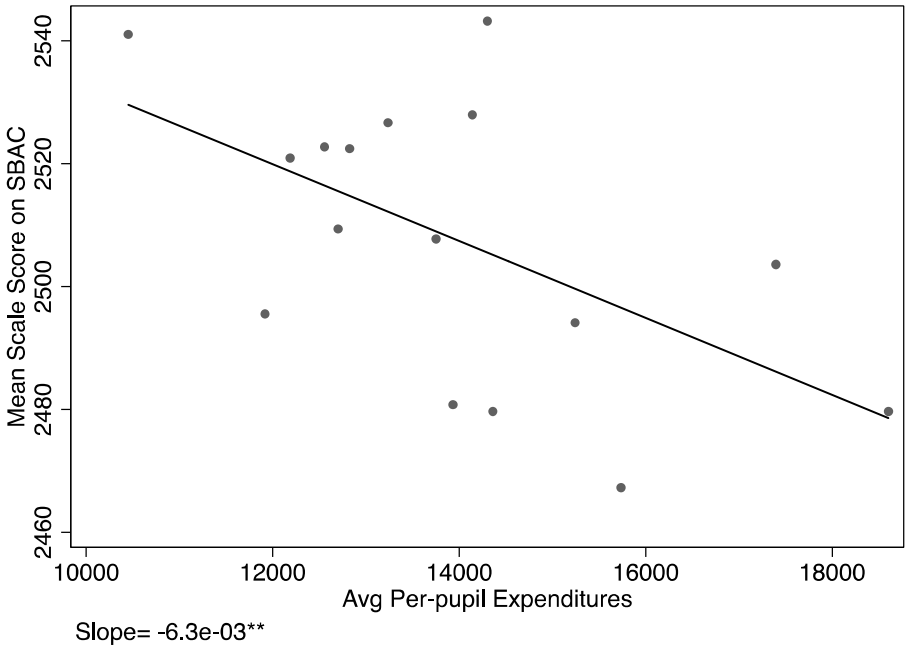


Figure 105. District Percent Proficient on the ELA SAT Test for Students in Grade 11 Plotted Against Per-pupil Expenditures: 2018-2019

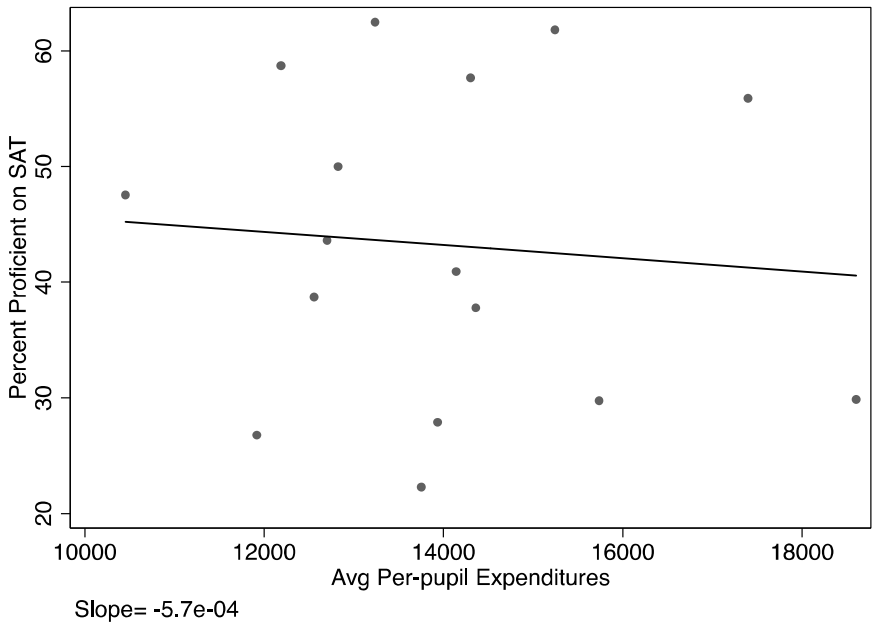


Figure 106. District Mean Scale Score on the ELA SAT Test for Students in Grade 11 Plotted Against Per-pupil Expenditures: 2018-2019

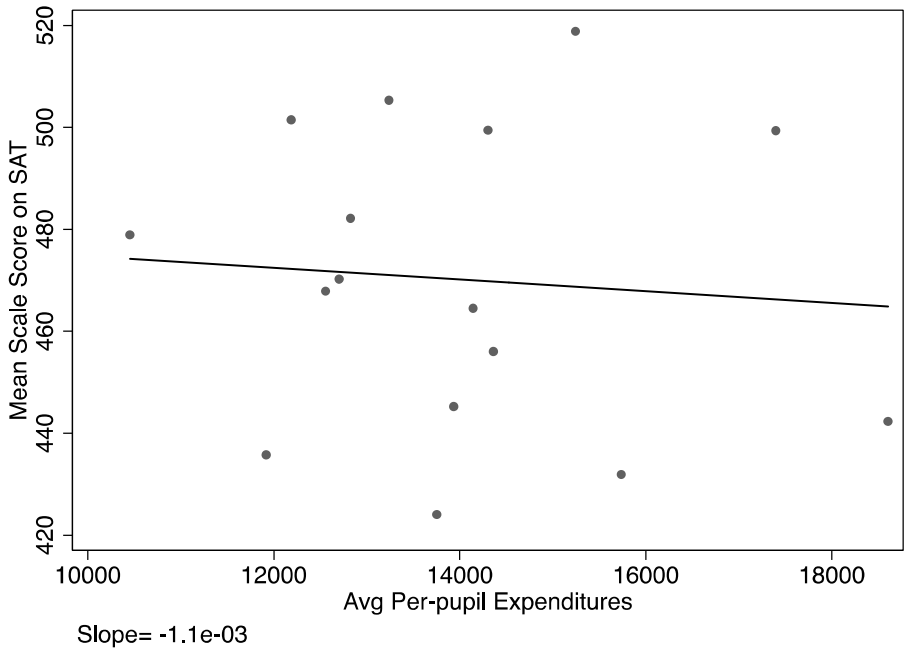


Figure 107. District Percent Proficient on the Math SAT Test for Students in Grade 11 Plotted Against Per-pupil Expenditures: 2018-2019

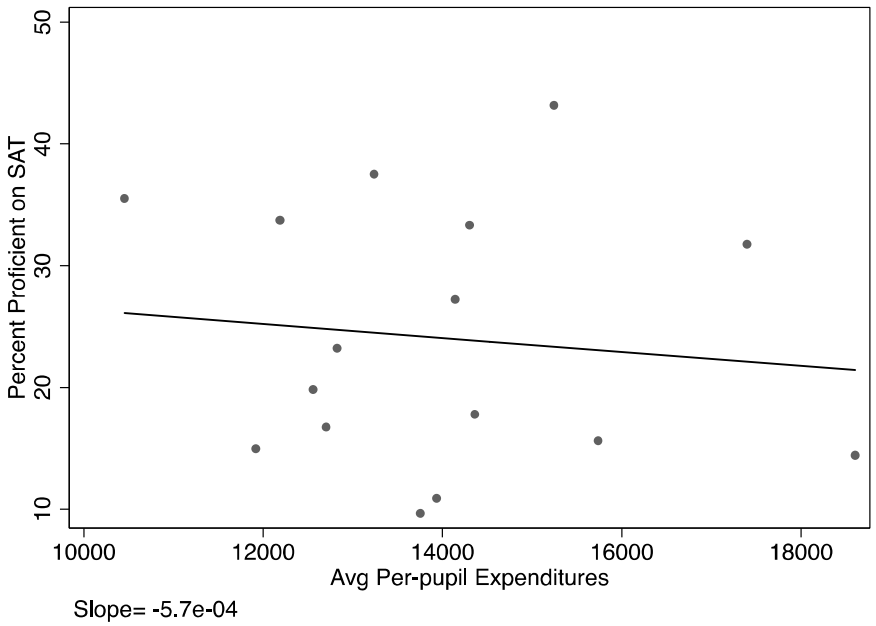


Figure 108. District Mean Scale Score on the Math SAT Test for Students in Grade 11 Plotted Against Per-pupil Expenditures: 2018-2019

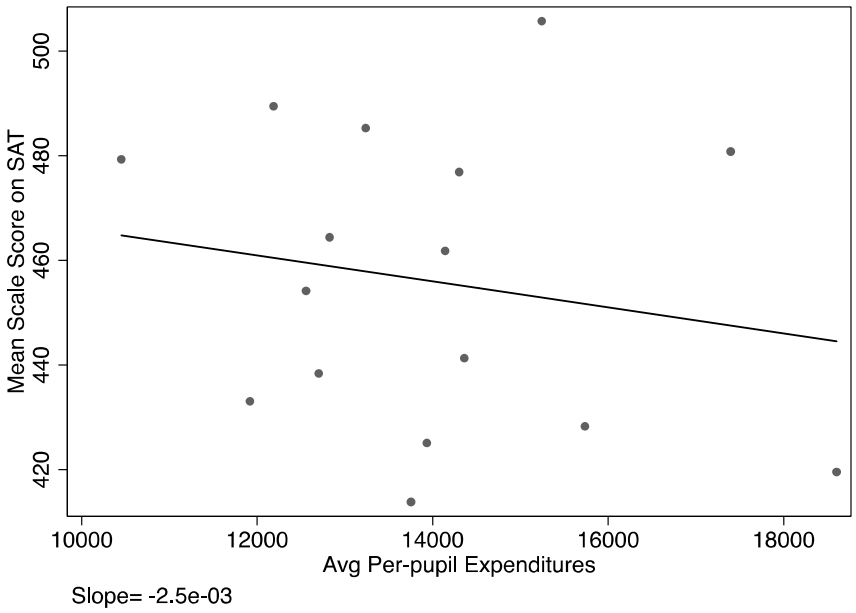


Figure 110. School Percent Proficient on the ELA SBAC Test for Grades 3-8 Plotted Against Per-pupil Expenditures: 2018-2019

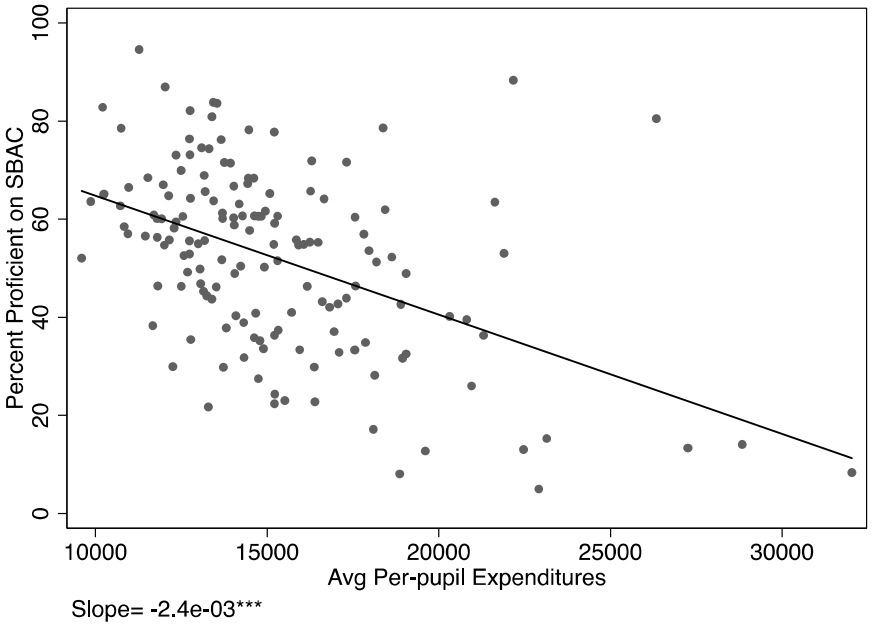


Figure 111. School Average Scale Score on the ELA SBAC Test for Grades 3-8 Plotted Against Per-pupil Expenditures: 2018-2019

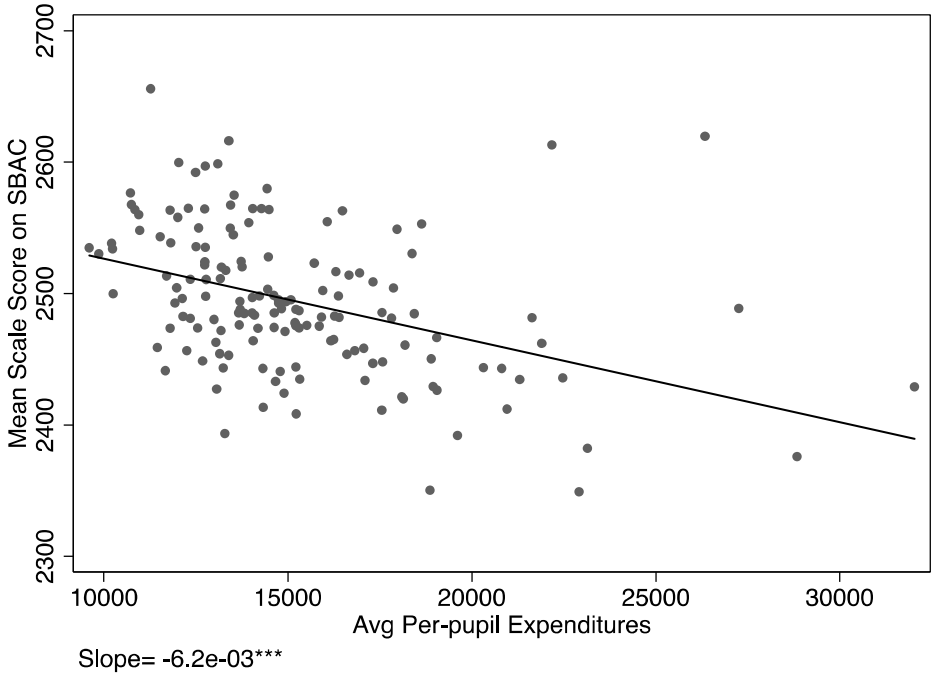


Figure 112. School Percent Proficient on the Math SBAC Test for Grades 3-8 Plotted Against Per-pupil Expenditures: 2018-2019

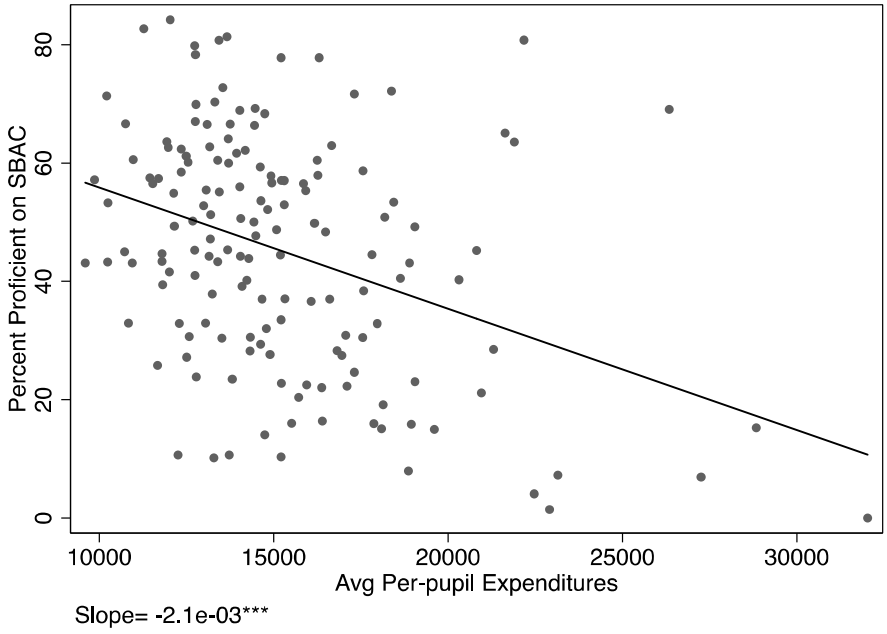


Figure 113. School Average Scale Score on the Math SBAC Test for Grades 3-8 Plotted Against Per-pupil Expenditures: 2018-2019

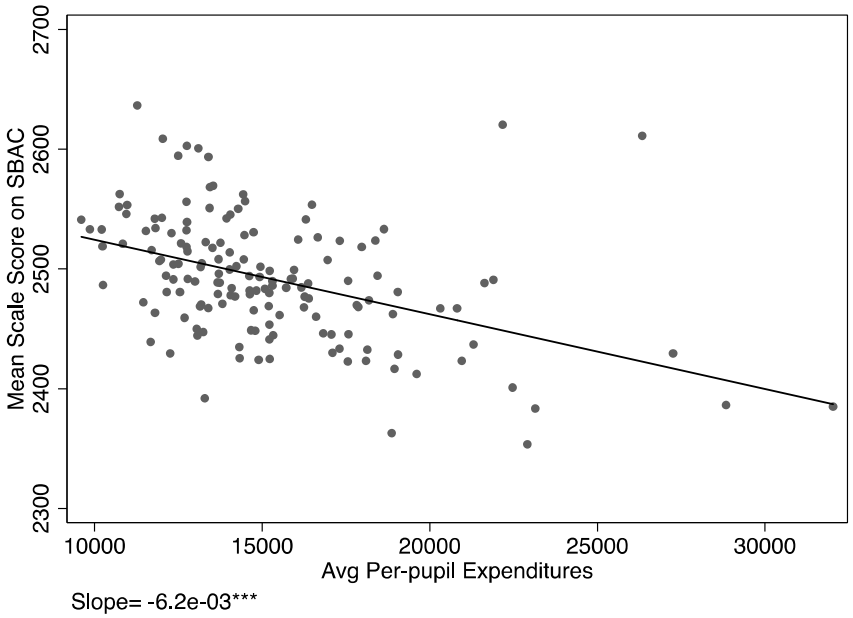


Figure 114. School Percent Proficient on the ELA SAT Test for Students in Grade 11 Plotted Against Per-pupil Expenditures: 2018-2019

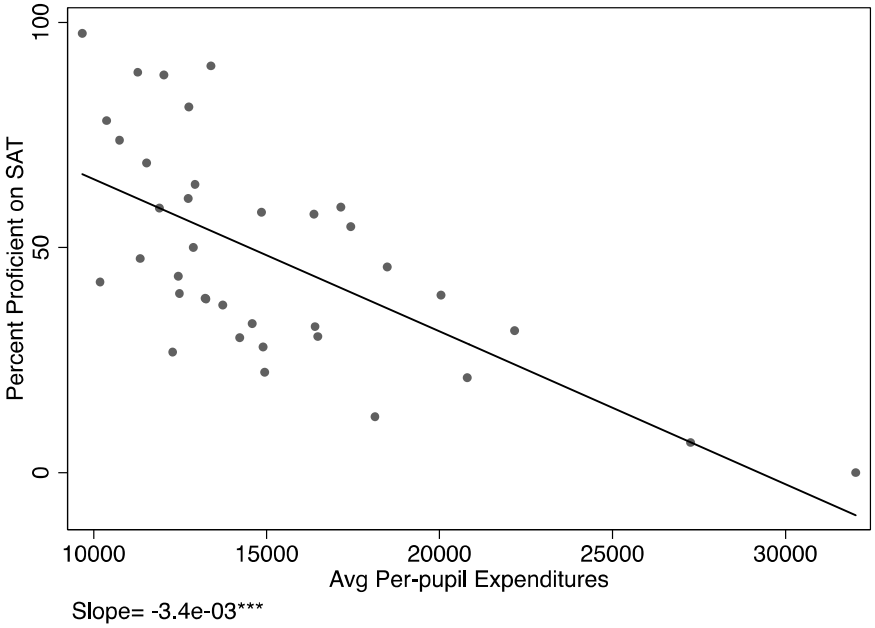


Figure 115. School Mean Scale Score on the ELA SAT Test for Students in Grade 11 Plotted Against Per-pupil Expenditures: 2018-2019

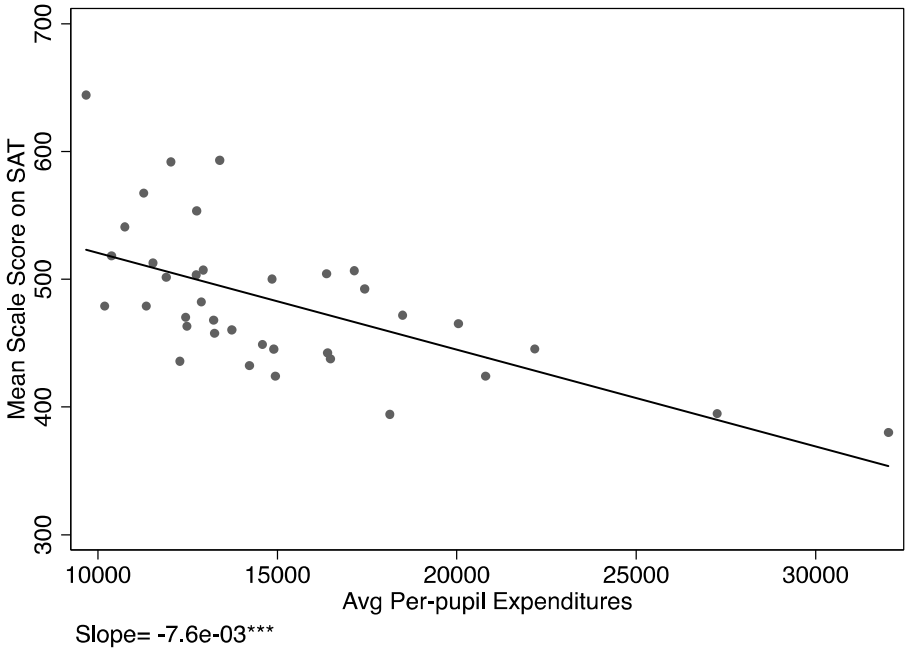


Figure 116. School Percent Proficient on the Math SAT Test for Students in Grade 11 Plotted Against Per-pupil Expenditures: 2018-2019

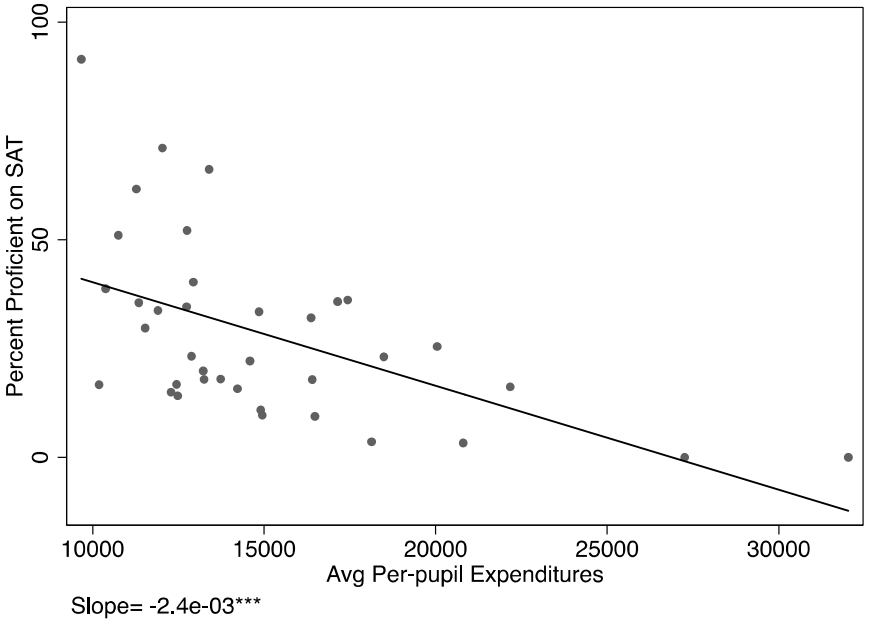


Figure 117. School Mean Scale Score on the Math SAT Test for Students in Grade 11 Plotted Against Per-pupil Expenditures: 2018-2019

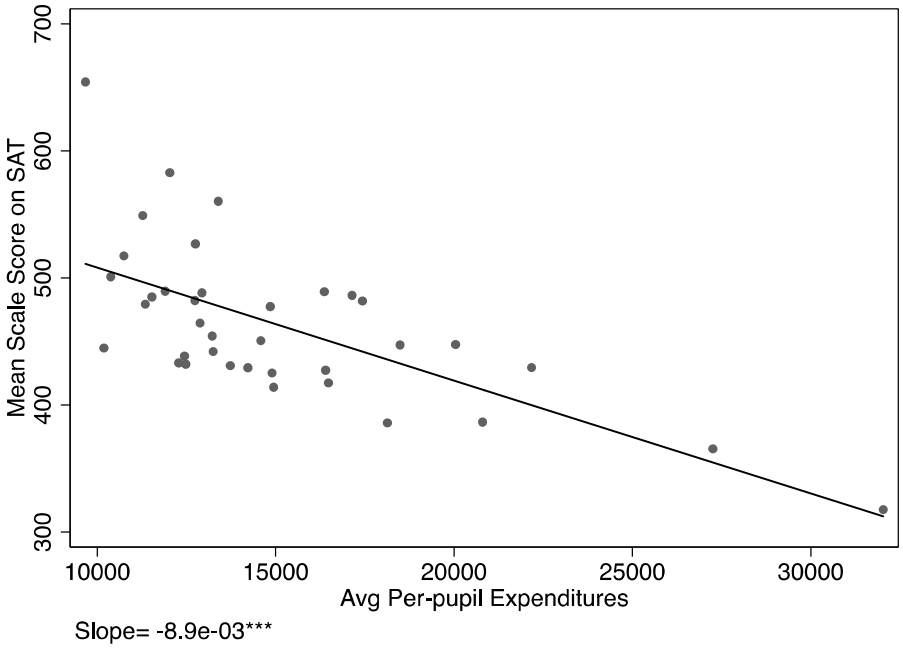


Figure 119. District Average Percent of Growth Target Met on the ELA SBAC Test for Grades 4-8 Plotted Against Per-pupil Expenditures: 2018-2019

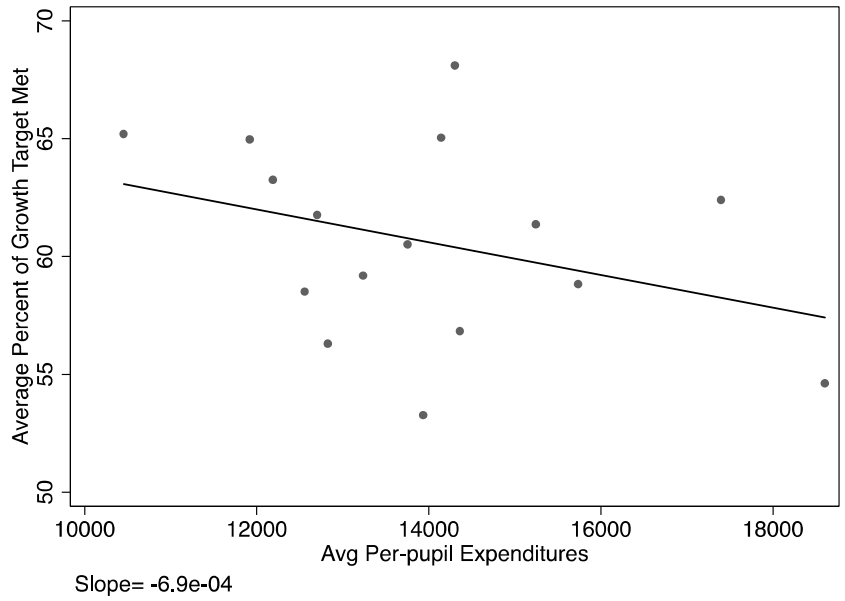


Figure 120. District Average Percent of Growth Target Met on the Math SBAC Test for Grades 4-8 Plotted Against Per-pupil Expenditures: 2018-2019

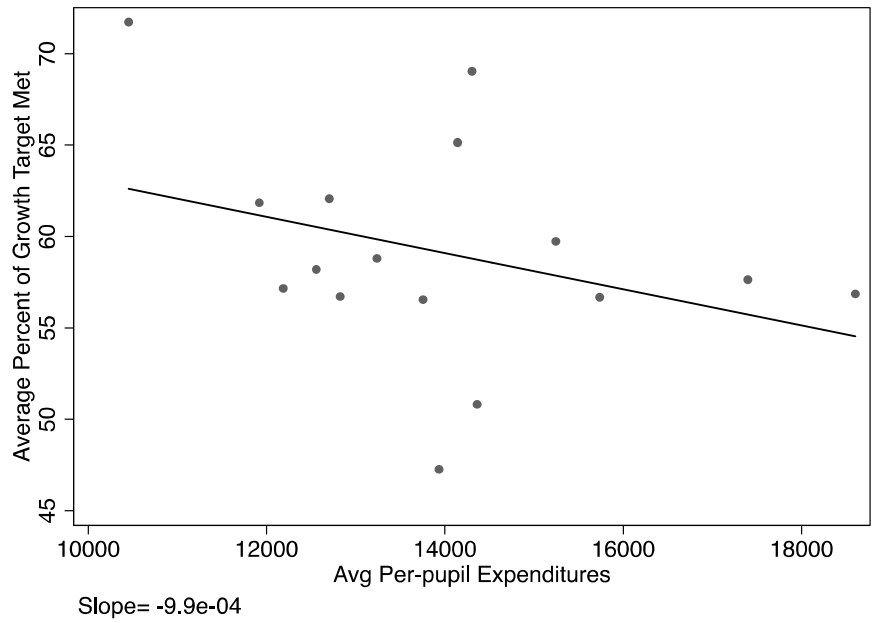


Figure 121. School Average Percent of Growth Target Met on the ELA SBAC Test for Grades 4-8 Plotted Against Per-pupil Expenditures: 2018-2019

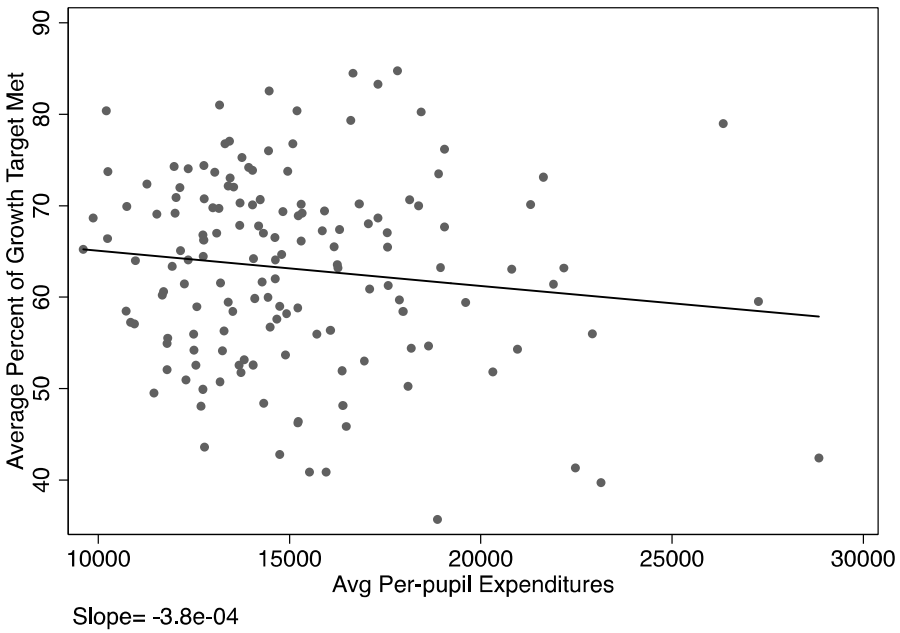


Figure 122. School Average Percent of Growth Target Met on the Math SBAC Test for Grades 4-8 Plotted Against Per-pupil Expenditures: 2018-2019

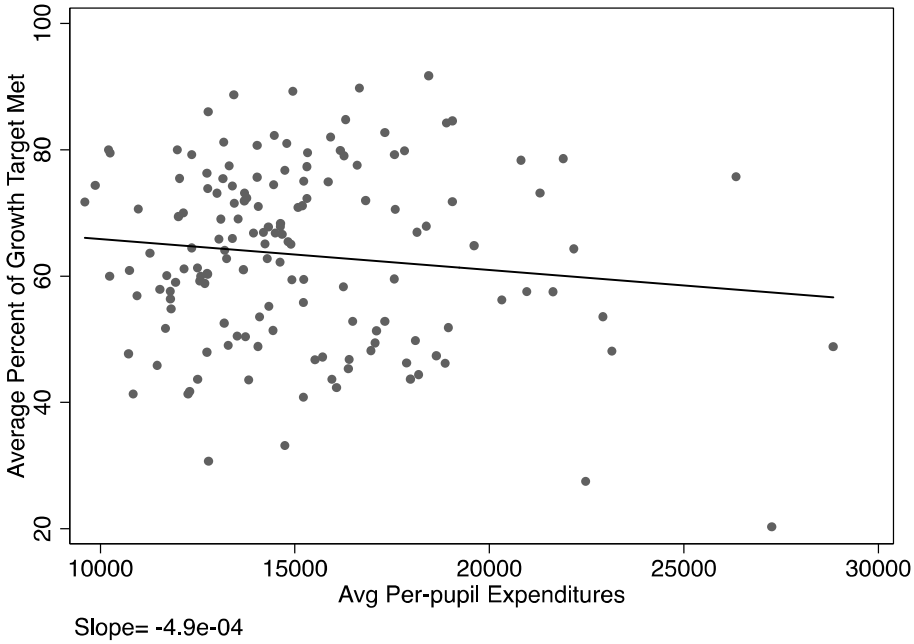


Figure 123. Share of Elementary School Classes in the District with Fewer than 21 Students Plotted Against Share of Students Classified as Low Income: 2018-2019[10]

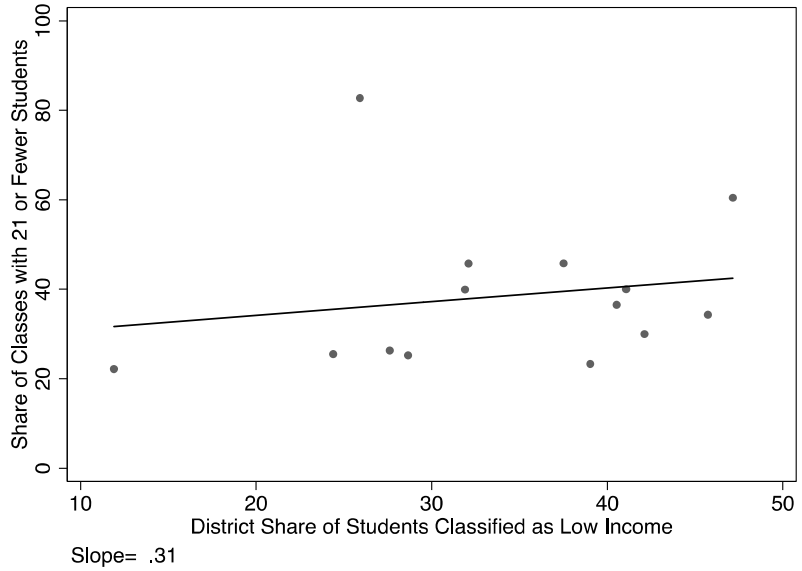
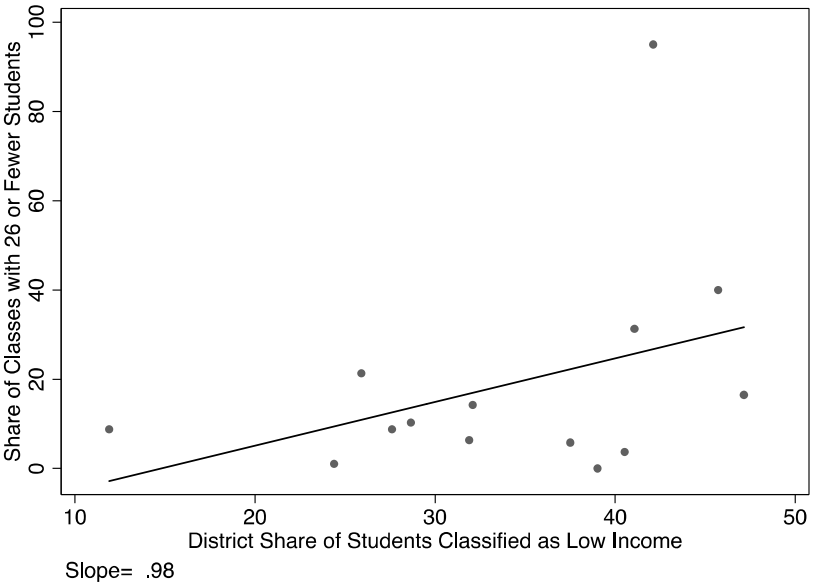


Figure 124. Share of Elementary School Classes in the District with Fewer than 26 Students Plotted Against Share of Students Classified as Low Income: 2018-2019



[10] The class size distributions for 2019 were downloaded from the Delaware Report Card. Information was only presented in bar graphs which required some estimation of the distributions. Because there was no information by grade Delmar District, which only has 5th grade in the middle school, was excluded from both the school and district plots and tables. Laurel District was also excluded due to a lack of data for 2019.

Figure 125. Share of Classes in the Elementary School with 21 or Fewer Students Plotted Against Share of Students Classified as Low Income: 2018-2019

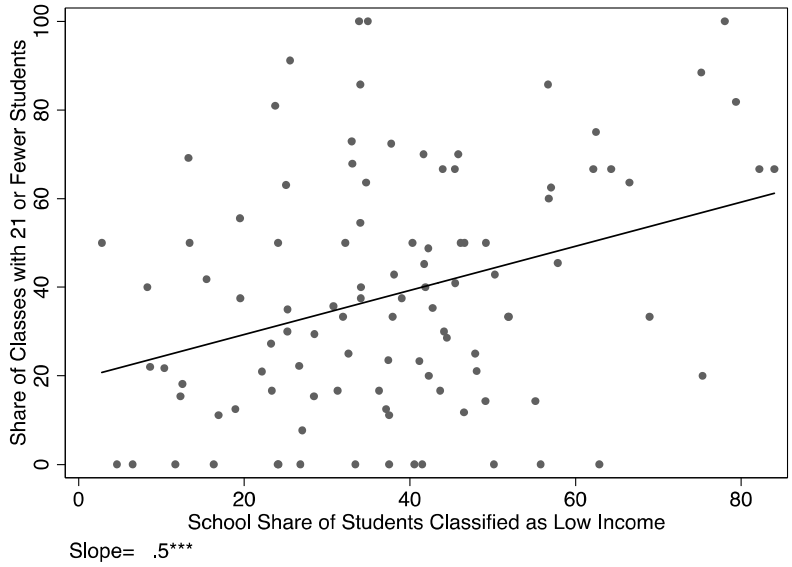


Figure 126. Share of Classes in the Elementary School with 26 or Fewer Students Plotted Against Share of Students Classified as Low Income: 2018-2019

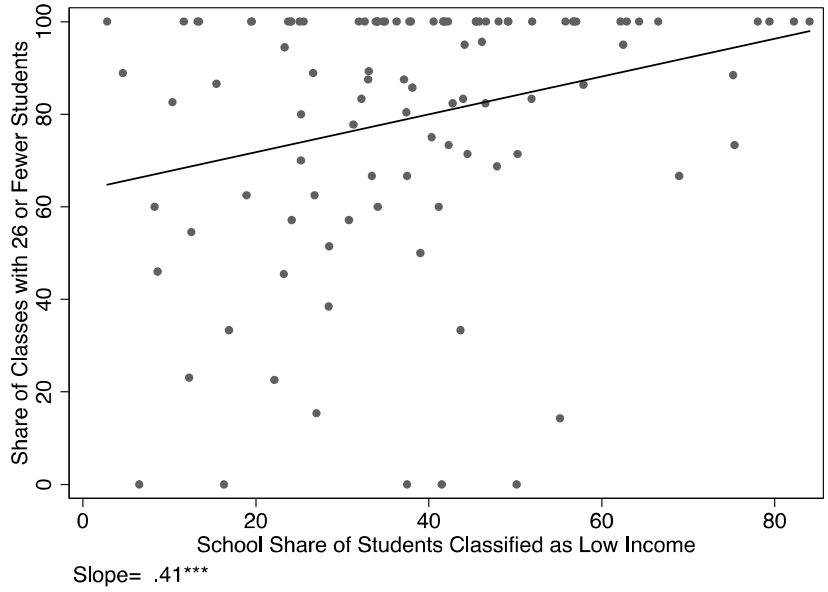


Figure 127. Share of Regular Classroom Teachers in the District with Fewer than Two Years of Experience Plotted Against Share of Students Classified as Low Income: 2018-2019

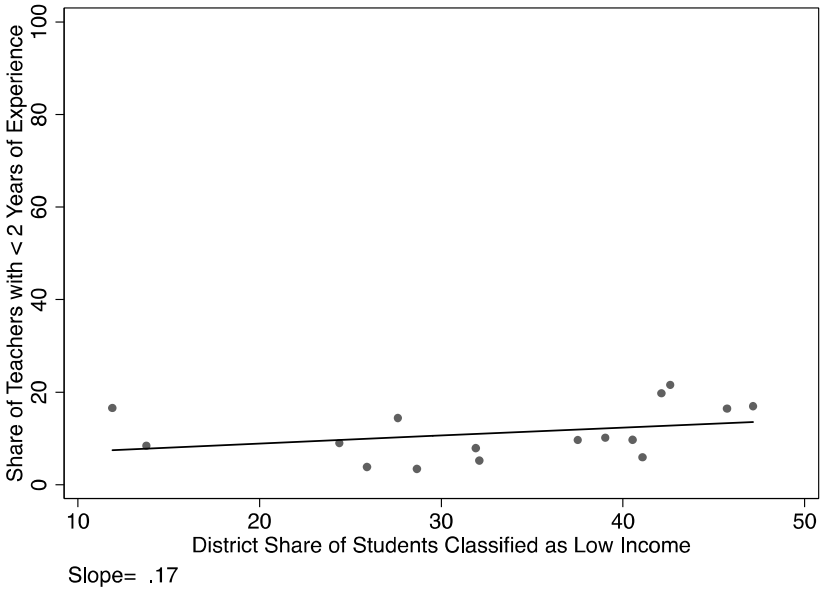


Figure 128. Share of Regular Classroom Teachers in the District with Between Two and Fifteen Years of Experience Plotted Against Share of Students Classified as Low Income: 2018-2019

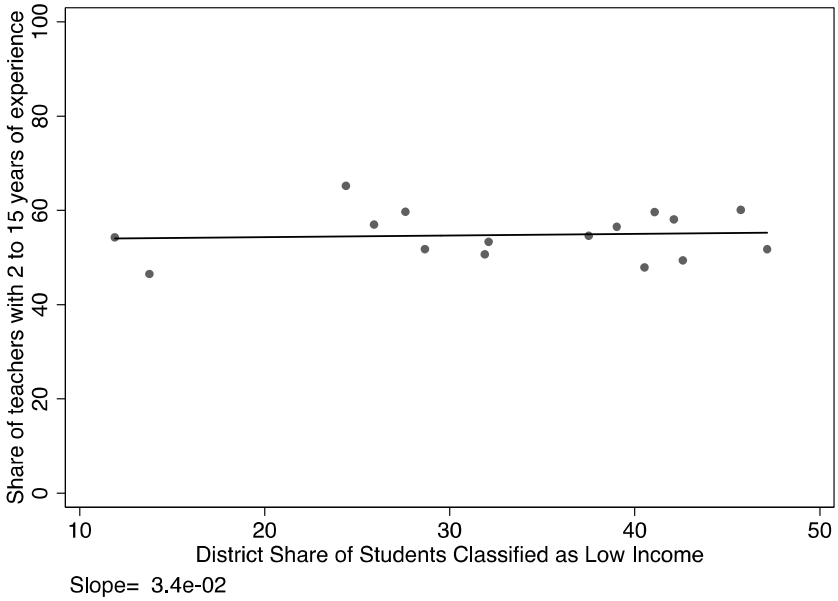


Figure 129. Share of Regular Classroom Teachers in the District with Greater Than Fifteen Years of Experience Plotted Against Share of Students Classified as Low Income: 2018-2019

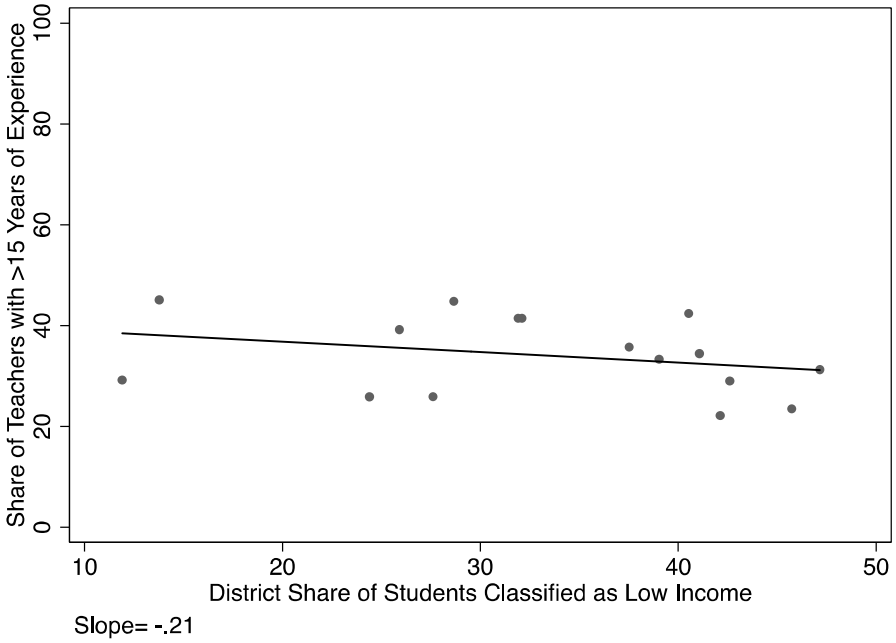


Figure 130. Share of Regular Classroom Teachers in the School with Fewer than Two Years of Experience Plotted Against Share of Students Classified as Low Income: 2018-2019

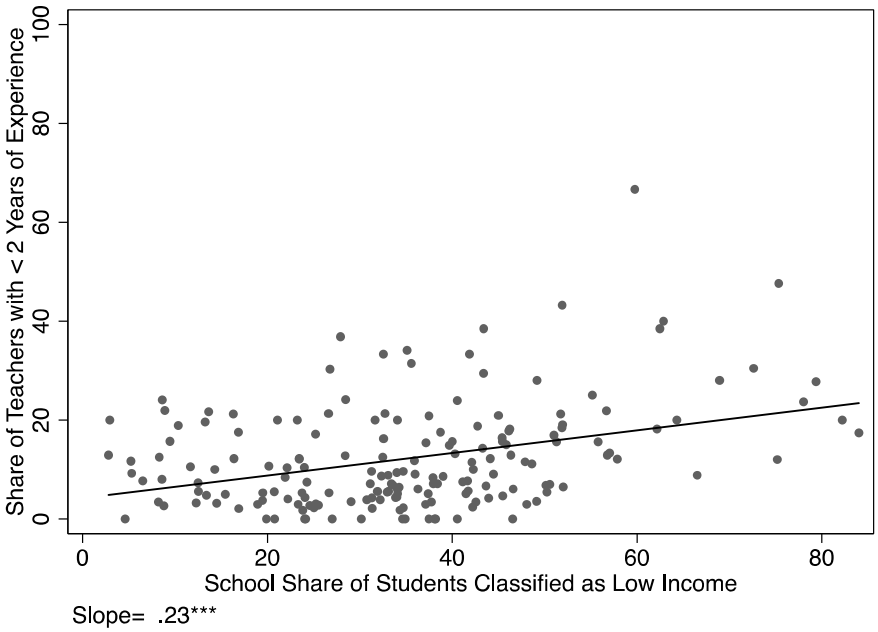


Figure 131. Share of Regular Classroom Teachers in the School with Between Two and Fifteen Years of Experience Plotted Against Share of Students Classified as Low Income: 2018-2019

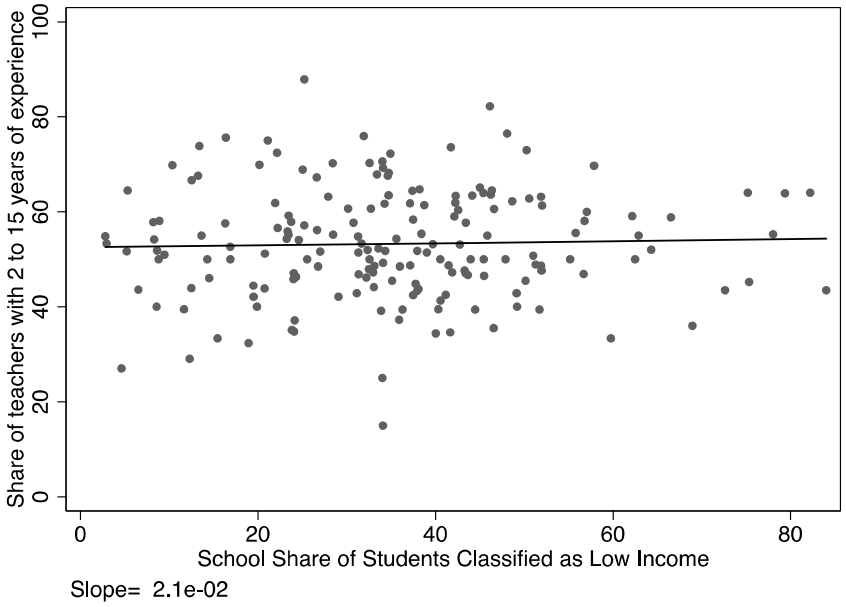


Figure 132. Share of Regular Classroom Teachers in the School with Greater Than Fifteen Years of Experience Plotted Against Share of Students Classified as Low Income: 2018-2019

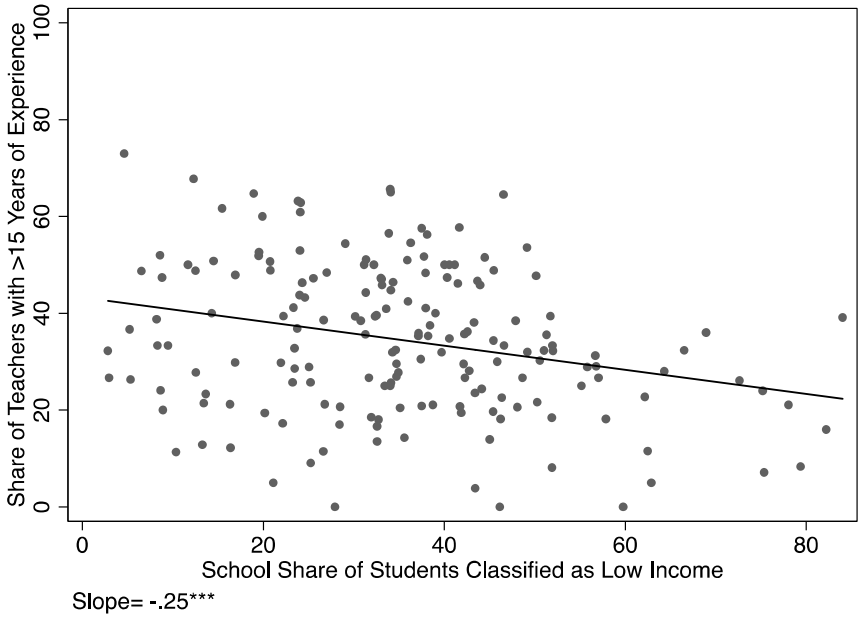


Table 101. Unweighted and Enrollment Weighted Slope Coefficients from Regressions of Achievement Growth on District and School Per-student Expenditure, by Adjustments for Differences in Student Income and Program Characteristics: 2018-2019 (standard errors in parentheses)

		Unweighted		Enrollment Weighted	
Controls for shares classified as low income, EL, SWD, and grade distribution.		no	yes	no	yes
District level					
SBAC - ELA	average percent of	-0.00069	0.00023	-0.00071	0.00031
	growth target met	(0.00051)	(0.00081)	(0.00045)	(0.00078)
SBAC - MATH	average percent of	-0.00099	-0.00025	-0.00047	-0.00026
	growth target met	(0.00074)	(0.00098)	(0.00056)	(0.00087)
School level					
SBAC - ELA	average percent of	-0.00038	0.00018	-0.00043	0.00003
	growth target met	(0.00025)	(0.00021)	(0.00028)	(0.00023)
SBAC - MATH	average percent of	-0.00049	-0.00026	-0.00024	0.00009
	growth target met	(0.00034)	(0.00027)	(0.00038)	(0.00030)

Notes: Each cell comes from a separate regression. There is one observation per district or school in each regression. The district level sample size is 16 and the school level sample size is 149. Charter school districts are included in the school samples.

Table 102. Unweighted and Enrollment Weighted Slope Coefficients from Regressions of Traditional Public School Class Size or Teacher Experience Category Shares on the District Share of Students Classified as Low Income: 2018-2019 (standard errors in parentheses; each cell comes from a separate regression)

	Unweighted	Enrollment Weighted
1. Class Size		
Percent of classes with <21 Students	0.31	0.54
	(0.49)	(0.42)
Percent of classes with <26 Students	0.98	0.42
	(0.68)	(0.46)
2. Teacher Experience		
Percent of teachers with <2 years of experience	0.17	0.021
	(0.14)	(0.14)
Percent of teachers with 2 to 15 years of experience	0.034	-0.091
	(0.13)	(0.12)
Percent of teachers with >15 years of experience	-0.21	0.070
	(0.18)	(0.20)

Note: Each cell reports the regression coefficient and standard errors from a regression of the class size or experience percent for that row regressed on the share of students classified as low income. Charter school districts are not included in the samples. Class size distributions are approximated from Delaware Report Card bar graphs.

Table 103. Unweighted and Enrollment Weighted Slope Coefficients from Regressions of Traditional Public and Charter School Class Size or Teacher Experience on the School Share of Students Classified as Low Income: 2018-2019 (standard errors in parentheses; each cell comes from a separate regression)

	Unweighted	Enrollment Weighted
1. Class Size		
Percent of classes with <21 Students	0.50***	0.38***
	(0.14)	(0.15)
Percent of classes with <26 Students	0.41***	0.37**
	(0.15)	(0.16)
2. Teacher Experience		
Percent of teachers with <2 years of experience	0.23***	0.20***
	(0.044)	(0.044)
Percent of teachers with 2 to 15 years of experience	0.021	0.013
	(0.052)	(0.054)
Percent of teachers with >15 years of experience	-0.25***	-0.21***
	(0.067)	(0.069)

Note: Each cell reports the regression coefficient and standard errors from a regression of the class size or experience share for that row regressed on the share of students classified as low income. Charter school districts are included in the samples. Class size distributions are approximated from Delaware Report Card bar graphs.

Exhibit C

VITA

Steven G. Rivkin
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Chicago, IL 60607
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email: sgrivkin@uic.edu

Academic Employment

2012-present	Professor of Economics and Department Head, University of Illinois at Chicago
1993-2011	Rachel and Michael Deutch Professor of Economics, Amherst College Department Chair 2002-2004 and 2008-2010
2011	Visiting Professor and Fullbright Scholar, CERGE-EI, Prague, CZ
1997-1998	Visiting Assistant Professor, Department of Economics, UC Berkeley
1992	Lecturer, UCLA Graduate School of Education

Other Employment

2013-present	Faculty Affiliate, Institute of Government and Public Affairs, UIC
2000-2001	Visiting Fellow, Public Policy Institute of California
2012-present	Director of the John F. Kain Center for Education Research, Texas Schools Project at University of Texas, Dallas
1997-2000	Consultant (pro bono) for International Rivers Network, an environmental organization dedicated to the preservation of rivers worldwide
1990-1994	Member and Research Fellow for the Panel on the Economics of Educational Reform
1984-85	Staff Associate at the Organization of the Northeast, a community based economic development organization in Chicago Illinois

Education

Ph.D., Economics, University of California, Los Angeles, 1991
Fields of Specialization: Labor Economics, Public Finance, and the Economics of Education

M.A., Economics, University of California, Los Angeles, 1987

B.A. (High Honors), Economics, University of Michigan, 1984

London School of Economics, 1982-1983

Fellowships, Research Grants and Awards

Arnold Foundation Grant for the Study of Teacher and Principal Evaluation in Dallas, 2014-2016
Smith-Richardson Foundation grant for the Study of School Principals in Chicago, 2013-2015

Fullbright Award for Teaching and Research at CERGE-EI and Charles University in Prague, CZ, 2011
Excellence in Refereeing Award 2009 and 2011, American Economic Review
Tinker Foundation Grant for the Study of Community Managed Schools in Honduras and Guatemala, 2007
Ford Foundation Grant for Study of Community Managed Schools in Honduras and Guatemala, 2006
Spencer Foundation Research Grant for the Study of Teacher Quality, 2006
Smith Richardson Foundation Research Grant for the Study of Teacher Quality, 2006
National Center for Education Research, Institute of Education Sciences grant funding the National Center for Analysis of Longitudinal Data in Education Research (CALDER), 2006-2017
Smith Richardson Foundation Research Grant for the Study of Charter Schools, 2000
Lazerowitz Fellowship in support of research at Amherst College, 1999
Smith Richardson Foundation Research Grant for the study of special education in Texas, 1997
Donner Foundation Research Grant for the study of U.S. public schools, 1996
Amherst College Faculty Research Grants, 1994-1996, 1997-1999, 2002-2004
National Science Foundation Post-Doctoral Fellowship for the Study of Urban Poverty, Northwestern University Center For Urban Affairs and Policy Research, 1992-1993
UCLA University Fellowship, 1985-1986

WORKING PAPERS

Gregory Branch, Eric Hanushek, Steven Rivkin and Jeffrey Schiman, "Variation and Determinants of the Productivity of Public Sector Managers: The Case of School Principals," unpublished manuscript, 2018

Hanushek, Eric, Andrew Morgan, Steven Rivkin, Lauren Sartain, and Jeffrey Schiman," Elementary and Middle School Principal Effects on Future Academic, Behavioral and Labor-Market Outcomes," unpublished manuscript, 2018

Nguyen, Minh, Steven Rivkin, Lauren Sartain, and Jeffrey Schiman, "School District Investments in General Skills: The Case of Principal Residency Programs," unpublished manuscript, 2018

Cullen, Julie, Eric Hanushek, Gregory Phelan and Steven Rivkin, "Performance Information and Personnel Decisions in the Public Sector: The Case of School Principals," NBER working paper #22881, 2016

Schiman, Jeffrey, Derek Laing, Steven Rivkin, and Jason Ward, "Decentralized Governance and the Quality of School Leadership," NBER working paper #22061, 2016

Branch, Greg, Eric Hanushek, and Steven Rivkin, "Estimating the Effect of Leaders on Public Sector Productivity: The Case of School Principals," NBER working paper #17,803, 2012

Rivkin, Steven, Peter Siegelman, and Geoffrey Woglom, "Roommate Interactions, Achievement, and Living Arrangements at an Elite Liberal Arts College," paper prepared for the APPAM Meetings, 2009

Rivkin, Steven, "Value Added Analysis and Education Policy," prepared for Urban Institute, 2007

Rivkin, Steven, "Teacher Characteristics, Market Forces, and the Distribution of Teacher Quality Among Schools and Districts," paper prepared for the U.S. Department of Education, 2006

Rivkin, Steven, "Data Requirements for Measuring Teacher Effectiveness and the Association between Teacher Characteristics/Practices and Student Learning," prepared for U.S. Dept of Education, 2006

Rivkin, Steven, and Ryan Yeung, "The New American Public School: Recent Immigrant Students and School Quality," unpublished manuscript, 2005

Hanushek, Eric, John Kain, Daniel O'Brien, and Steven Rivkin, "The Market for Teacher Quality," paper prepared for the annual meeting of the American Economic Association, 2004

Hanushek, Eric and Steven Rivkin, "Teacher Quality in Texas: Using School Administrative Data to Understand Alternative Policy Proposals," paper prepared for the NCES Research Seminar on Instructional and Performance Consequences of High-poverty Schooling, 2002

Rivkin, Steven, "The Estimation of Productivity Change in Education," paper prepared for Brookings Institution Conference on Service Sector Productivity, 1999

Hanushek, Eric, and Steven Rivkin, "Teacher Quality and Education Reform in New York," paper prepared for New York State Education Finance Symposium on Teacher Quality, 2000

Rivkin, Steven and Geoffrey Woglom, "Testing for the Importance of Small Sample Bias in Instrumental Variable Estimates," Amherst College, 1997

Rivkin, Steven, "Schooling and Employment in the 1980s: Who Succeeds?" Ph.D. Dissertation, 1991

Solmon, Lewis and Steven Rivkin, "The Demography of American Education into the Next Century," paper prepared for the meeting of the Panel on the Economics of Educational Reform, 1991

Murphy, Kevin M., Steven Rivkin and Finis Welch, "Individuals and Their Families: Trends in Age Profiles of Living Arrangements by Race and Ethnicity," Unicon Research Corporation, 1990

JOURNAL PUBLICATIONS

Feigenberg, Benjamin, Rui Yan, and Steven Rivkin, "Illusory Gains from Chile's Targeted School Voucher," Economic Journal, (forthcoming)

Baude, Patrick, Marcus Casey, Eric Hanushek, Gregory Phelan and Steven Rivkin, "The Evolution of Charter School Quality," Economica, (vol 87, 2020)

Hanushek, Eric, Steven Rivkin, and Jeffrey Schiman, "Dynamic Effects of Teacher Turnover on the Quality of Instruction," Economics of Education Review, (December 2016)

Rivkin, Steven, "Desegregation Since the Coleman Report," Education Next, (spring 2016)

Rivkin, Steven and Jeffrey Schiman, "Instruction Time, Classroom Quality, and Academic Achievement," Economic Journal, (November 2015)

McKee, Graham, Steven G. Rivkin, and Katharine R.E. Sims, "Disruption, Learning, and the Heterogeneous Benefits of Smaller Classes," Empirical Economics, (vol 48, 2015)

Herbst, Mikolaj and Steven Rivkin, "Divergent Historical Experiences and Inequality in Academic Achievement: The Case of Poland," Journal of Socio-Economics, (February 2013)

Branch, Gregory, Eric Hanushek, and Steven Rivkin, "Measuring the Impact of Effective Principals," Education Next, (winter 2013)

Hanushek, Eric A. and Steven G. Rivkin, "The Quality and Distribution of Teachers Under the No Child Left Behind Act," Journal of Economic Perspectives (2010)

Eaton, Susan and Steven G. Rivkin, "Is Desegregation Dead," Education Next, (fall 2010)

Hanushek, Eric A. and Steven G. Rivkin, "Generalizations about Using Value-Added Measures of Teacher Quality," American Economic Review Papers and Proceedings (May 2010)

Currie, Janet, Eric Hanushek, Emily Kahn, Matthew Neidell, and Steven Rivkin, "Does Pollution Increase School Absences?" Review of Economics and Statistics, (November, 2009)

Ishii, Jun and Steven Rivkin, "Impediments to the estimation of teacher value added," Education Finance and Policy (fall, 2009)

Eric A. Hanushek and Steven G. Rivkin, "Harming the Best: How Schools Affect the Black-White Achievement Gap," *Journal of Policy Analysis and Management* (summer 2009)

Hanushek, Eric, John Kain, and Steven Rivkin, "New Evidence about Brown v. Board of Education: The Complex Effects of School Racial Composition on Achievement" Journal of Labor Economics (July, 2009)

Jepsen, Christopher and Steven Rivkin, "Class Reduction and Student Achievement: The Potential Tradeoff between Teacher Quality and Class Size, Journal of Human Resources (Winter, 2009)

Hanushek, Eric, John Kain, Steven Rivkin, and Gregory Branch, "Charter School Quality and Parental Decision Making with School Choice," Journal of Public Economics, (June, 2007)

Rivkin, Steven, Eric Hanushek and John Kain, "Teachers, Schools and Academic Achievement," Econometrica, (March, 2005)

Hanushek, Eric, Steven Rivkin and John Kain, "Disruption versus Tiebout Improvement: The Costs and Benefits of Switching Schools," Journal of Public Economics, (August, 2004)

Hanushek, Eric, John Kain, and Steven Rivkin, "Why Public Schools Lose Teachers," Journal of Human Resources, (Spring, 2004)

Hanushek, Eric, J. F. Kain, and Steven Rivkin, "The Revolving Door," Education Next, (Winter 2004)

Hanushek, Eric, John Kain, Jacob Markman and Steven Rivkin, "Does Peer Ability Affect Student Achievement?," Journal of Applied Econometrics, (September/October 2003)

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Rivkin, Steven, "Tiebout Sorting, Aggregation and the Estimation of Peer Group Effects," Economics of Education Review, 20, 2001

Rivkin, Steven, "School Desegregation, Academic Attainment and Earnings," Journal of Human Resources, Spring, 2000

Hanushek, Eric and Steven Rivkin, "Understanding the 20th Century Explosion in U.S. School Costs," Journal of Human Resources, Winter, 1997

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Rivkin, Steven, "Residential Segregation and School Integration," Sociology of Education, October, 1994

Lau, Lawrence, Dean Jamison, Shu-Cheng Liu and Steven Rivkin, "Education and Economic Growth in Brazil: Some Cross-Sectional Evidence," Journal of Economic Development, June, 1993 (also Chapter 3 in Education in Brazil, Washington, D.C., Inter-American Development Bank, 1996)

OTHER PUBLICATIONS

Munich, Daniel and Steven Rivkin, "Can incentives effectively raise the quality of instruction?," policy brief for the European Expert Network on the Economics of Education, European Education Commission, (No 2, 2016)

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Hanushek, Eric A. and Steven Rivkin, "The Distribution of Teacher Quality and Implications for Policy," Annual Reviews in Economics, (2012)

Meghir, Costas and Steven G. Rivkin, "Econometric Methods for Research in Education," Handbook of the Economics of Education Volume III, (2011)

Hanushek, Eric A. and Steven G. Rivkin, "Using Value Added Measures of Teacher Quality," Calder Brief #9, May 2010

Rivkin, Steven G., "Desegregation, Academic Achievement and Earnings," in International Encyclopedia of Education 3rd Edition. Edited by Eva Baker, Penelope Peterson and Barry McGaw, Elsevier, May 2010

Hanushek, Eric A. and Steven G. Rivkin, "Do Disadvantaged Schools Lose Their Best Teachers?" Calder Brief #7, May 2010

Rivkin, Steven G., "Stricter Regulations or Additional Incentives? The Teacher Quality Policy Dilemma," Measurement and Research in the Accountability Era, Educational Testing Service, 2005

Hanushek, Eric A. and Steven G. Rivkin, "Pay, Working Conditions, and Teacher Quality," Future of Children, 2007

Rivkin, Steven G., "Value Added Analysis and Education Policy," Calder Brief #1, November 2007

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Hanushek, Eric and Steve Rivkin, "Teacher Quality," Handbook on the Economics of Education, 2006

Hanushek, Eric, John Kain, and Steven Rivkin, "The Revolving Door: Factors Affecting Teacher Turnover," in Education Next (Winter 2004) and Developments in School Finance: 2003, edited by William Fowler, Jr., August, 2004

Cullen, Julie Berry and Steven Rivkin, "The Role of Special Education in School Choice," in The Economic Analysis of School Choice, ed. by Caroline Hoxby, University of Chicago Press, 2003

Hanushek, Eric and Steven Rivkin, "Does Public School Competition Affect Teacher Quality?," in The Economic Analysis of School Choice, ed. by Caroline Hoxby, University of Chicago Press, 2003

Rivkin, Steven, "Book Review: *A Notion at Risk*," Economics of Education Review, 2003

Rivkin, Steven, "Public Investment in Education: Lessons for Child Care Policy," in The Economic Rationale For Investing in Children: A Focus on Child Care, Department of Health and Human Services, 2001

Hanushek, Eric and Steven Rivkin, "Rising Expenditure, Falling Performance," Chapter 3 in Making Schools Work, Washington D.C., The Brookings Institution, 1994

Hanushek, Eric, Steven Rivkin and Dean Jamison, "Investing in American Education: Improving Outcomes and Controlling Costs," Carnegie-Rochester Conference Proceedings, December, 1992 Conference on Longitudinal Studies in Education, 2007

PROFESSIONAL ACTIVITIES

Member of Chicago Public School District VAM and Teacher Evaluation TAC, 2015-present
Member of Journal of Human Resources Board of Associate Editors, 2014-present
Member of Technical Advisory Committee for Evaluation of Teacher Preparation, 2012-present
Member of Institute of Education Sciences Peer Review Panel, 2008, 2011-present
Member of Mass Dept. of Education Task Force on Teacher and Principal Evaluation 2010-2011
Member of Technical Advisory Panel for Baccalaureate and Beyond Longitudinal Study, 2011 present
Member of Missouri Dept. of Ed Tech Advisory Committee on the MO Growth Model 2010-present
Member of Amherst School Committee 2009-2011
Editorial Board of Education Finance and Policy 2007-present
Member of Advisory Board - Center for Research on Education Outcomes, 1999 to present
Member of Society of Labor Economists Nominating Committee, 2004-2006
Member of Technical Advisory Panel for US Dept. of Education Teacher Cert Study 2005-2007
Member of American Education Research Association panel that prepared an amicus brief for the Supreme Court case involving race in school assignment decisions in Seattle and Louisville, 2007
Member of Research and Evaluation Advisory Group for the Mass Dept. of Education, 2007-2009
Member of Technical Advisory Panel for the New York City Value-Added Data for Teachers initiative
Member of Technical Review Panel for Baccalaureate and Beyond Longitudinal Study, 2014-present

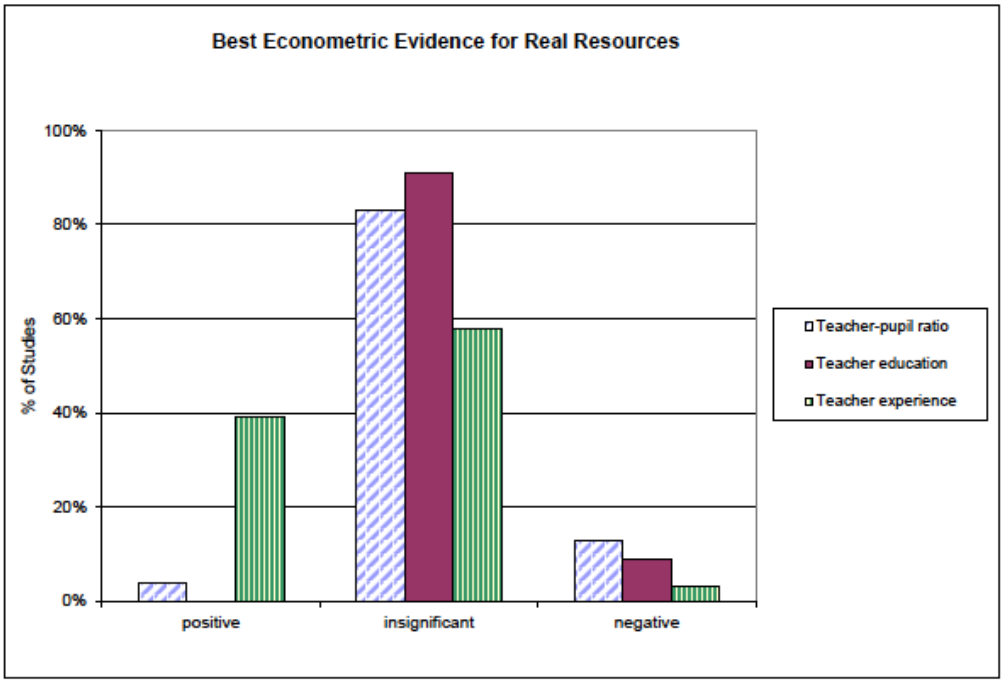
PROFESSIONAL ASSOCIATIONS

American Economic Association; Association for Education Finance and Policy; Association for Public Policy Management and Analysis; Society of Labor Economists
Research Fellow, CES-IFO Research Institute, Munich, Germany
Research Associate, National Bureau of Economic Research – Economics of Education

FOREIGN LANGUAGE Spanish

Appendix A

Figure A1.



Source: Hanushek, Eric A. 2003. "The failure of input-based schooling policies." *Economic Journal* 113, no. 485

Table A1.

TABLE 4 —PERCENTAGE DISTRIBUTION OF ESTIMATED EFFECT OF TEACHER–PUPIL RATIO AND EXPENDITURE PER PUPIL BY STATE SAMPLING SCHEME AND AGGREGATION

State Sampling Scheme and Aggregation of Resource Measures	Number of Estimates	Statistically Significant		Statistically Insignificant		Insignificant Unknown Sign
		+	−	+	−	
A. Teacher–Pupil Ratio						
Total	277	15%	13%	27%	25%	20%
Single state samples[a]	157	12	18	31	31	8
Multiple state samples[b]	120	18	8	21	18	35
With within-state variation[c]	109	14	8	20	19	39
Without within-state variation[d]	11	64	0	27	9	0
B. Expenditure per Pupil						
Total	163	27	7	34	19	13
Single state samples[a]	89	20	11	30	26	12
Multiple state samples[b]	74	35	1	39	11	14
With within-state variation[c]	46	17	0	43	18	22
Without within-state variation[d]	28	64	4	32	0	0

Notes Rows may not add to 100 because of rounding
[a] Estimates from samples drawn within single states
[b] Estimates from samples drawn across multiple states
[c] Resource measures at level of classroom, school, district, or county, allowing for variation within each state
[d] Resource measures aggregated to state level with no variation within each state

Source: Hanushek, Rivkin and Taylor. 1996. "Aggregation and the Estimated Effects of School Resources." Review of Economics and Statistics, : 611-627.

Appendix B[11]

Table B1. Unweighted and Enrollment Weighted Slope Coefficients from Regressions of Traditional Public School District Performance Outcomes on District Per-student Expenditure, by Adjustments for Differences in Student Income and Program Characteristics: 2017-2018 (standard errors in parentheses)

		Unweighted		Enrollment Weighted	
Controls for shares classified as low income, EL, SWD, and grade distribution.		No	yes	no	yes
Outcome	**Metric**				
SBAC - ELA	Percent Proficient	-0.0012	-0.0011	-0.0026**	-0.0016
		(0.0012)	(0.0014)	(0.0011)	(0.0013)
SBAC - ELA	Mean Scale Score	-0.0049**	-0.0024	-0.0070***	-0.0033
		(0.0025)	(0.0032)	(0.0023)	(0.0028)
SBAC - MATH	Percent Proficient	-0.00098	-0.0015	-0.0021*	-0.0018
		(0.0011)	(0.0019)	(0.0011)	(0.0017)
SBAC - MATH	Mean Scale Score	-0.0048*	-0.0036	-0.0060**	-0.0044
		(0.0026)	(0.0040)	(0.0025)	(0.0036)
SAT - ELA	Percent Proficient	-0.00007	0.0015	-0.0012	0.00064
		(0.0016)	(0.0010)	(0.0017)	(0.00093)
SAT - ELA	Mean Scale Score	-0.00002	0.0037	-0.0030	0.0013
		(0.0038)	(0.0027)	(0.0041)	(0.0024)
SAT - MATH	Percent Proficient	-0.00012	0.0013	-0.00061	0.00093
		(0.0015)	(0.00080)	(0.0014)	(0.00079)
SAT - MATH	Mean Scale Score	-0.0013	0.0026	-0.0036	0.00087
		(0.0040)	(0.0023)	(0.0040)	(0.0022)

Notes: Each cell comes from a separate regression. There is one observation per district in the samples, and the sample size is 16 for all regressions. Charter school districts are not included in the samples.

[11] Asterisks indicate statistical significance at the following levels: * ten percent; ** five percent; *** one percent.

Table B2. Unweighted and Enrollment Weighted Slope Coefficients from Regressions of Traditional Public and Charter School Performance Outcomes on School Per-student Expenditure, by Adjustments for Differences in Student Income and Program Characteristics: 2017-2018 (standard errors in parentheses)

		Unweighted		Enrollment Weighted	
Controls for shares classified as low income, EL, SWD, and grade distribution.		no	yes	no	yes
Outcome	**Metric**				
SBAC - ELA	Percent Proficient	-0.0028***	-0.00039	-0.0023***	-0.00034
		(0.00037)	(0.00027)	(0.00044)	(0.00029)
SBAC - ELA	Mean Scale Score	-0.0065***	-0.0011*	-0.0060***	-0.00083
		(0.0011)	(0.00063)	(0.0014)	(0.00068)
SBAC - MATH	Percent Proficient	-0.0024***	-0.00026	-0.0022***	-0.00031
		(0.00040)	(0.00033)	(0.00048)	(0.00035)
SBAC - MATH	Mean Scale Score	-0.0066***	-0.00114	-0.0060***	-0.00087
		(0.0011)	(0.00073)	(0.0013)	(0.00080)
SAT - ELA	Percent Proficient	-0.0034***	0.00020	-0.0039***	0.00004
		(0.00089)	(0.00066)	(0.0011)	(0.00068)
SAT - ELA	Mean Scale Score	-0.0083***	0.00105	-0.0098***	0.00062
		(0.0024)	(0.00182)	(0.0028)	(0.00190)
SAT - MATH	Percent Proficient	-0.0027***	0.00065	-0.0032***	0.00055
		(0.00086)	(0.00065)	(0.0010)	(0.00067)
SAT - MATH	Mean Scale Score	-0.0092***	0.00055	-0.010***	0.00008
		(0.0024)	(0.00172)	(0.0028)	(0.00178)

Notes: Each cell comes from a separate regression. There is one observation per school and there are 156 schools in the SBAC samples and 37 schools in the SAT samples. Charter school districts are included in the samples.

Table B3. Unweighted and Enrollment Weighted Slope Coefficients from Regressions of Traditional Public School Performance Outcomes on School Per-student Expenditure, by Adjustments for Differences in Student Income and Program Characteristics: 2017-2018 (standard errors in parentheses)

		Unweighted		Enrollment Weighted	
Controls for shares classified as low income, EL, SWD, and grade distribution.		no	yes	No	yes
Outcome	**Metric**				
SBAC - ELA	Percent Proficient	-0.0026***	-0.00047*	-0.0018***	-0.00043
		(0.00040)	(0.00027)	(0.00045)	(0.00029)
SBAC - ELA	Mean Scale Score	-0.0064***	-0.0013**	-0.0048***	-0.0011*
		(0.0013)	(0.00062)	(0.0015)	(0.00065)
SBAC - MATH	Percent Proficient	-0.0022***	-0.00030	-0.0017***	-0.00035
		(0.00043)	(0.00033)	(0.00049)	(0.00035)
SBAC - MATH	Mean Scale Score	-0.0062***	-0.0013*	-0.0045***	-0.00096
		(0.0011)	(0.00072)	(0.0013)	(0.00076)
SBAC - ELA	average percent of growth target met	-0.00078**	-0.00041	-0.00074**	-0.00047*
		(0.00031)	(0.00026)	(0.00034)	(0.00027)
SBAC - MATH	average percent of growth target met	-0.00059	-0.00016	-0.00037	-0.00010
		(0.00041)	(0.00035)	(0.00045)	(0.00035)
SAT - ELA	Percent Proficient	-0.0019*	0.00004	-0.0020*	0.00020
		(0.0011)	(0.00066)	(0.0012)	(0.00069)
SAT - ELA	Mean Scale Score	-0.0043	0.00069	-0.0046	0.00090
		(0.0027)	(0.00162)	(0.0029)	(0.00165)
SAT - MATH	Percent Proficient	-0.0015	0.00037	-0.0016	0.00047
		(0.00096)	(0.00047)	(0.0010)	(0.00051)
SAT - MATH	Mean Scale Score	-0.0053**	-0.00033	-0.0057**	-0.00019
		(0.0026)	(0.00123)	(0.0027)	(0.00130)
High School Graduation Rate		-0.0018***	-0.0013***	-0.0019***	-0.0014***
		(0.00040)	(0.00031)	(0.00045)	(0.00034)

Notes: Each cell comes from a separate regression. There is one observation per school and there are 138 schools in the SBAC samples, 134 schools in the growth samples, and 26 schools in the SAT and high school graduation samples. Charter school districts are not included in the samples.

Table B4. Unweighted and Enrollment Weighted Slope Coefficients from Regressions of Traditional Public School Class Size or Teacher Experience on the School Share of Students Classified as Low Income: 2017-2018 (standard errors in parentheses; each cell comes from a separate regression)

	Unweighted	Enrollment Weighted
1. Class Size		
Percent of school classes <21 students	0.48***	0.44***
	(0.039)	(0.039)
Percent of school classes <26 students	0.25***	0.24***
	(0.030)	(0.033)
2. Teacher Experience		
Percent of school teachers with <2 years of experience	0.11***	0.083**
	(0.037)	(0.038)
Percent of school teachers with 2 to 15 years of experience	0.074	0.083
	(0.053)	(0.056)
Percent of school teachers with >15 years of experience	-0.18***	-0.17**
	(0.061)	(0.066)

Note: Each cell reports the regression coefficient and standard error from a regression of the class size or experience share for that row regressed on the share of students classified as low income. Charter school districts are not included in the samples.

Appendix C[12]

Table C1. Unweighted and Enrollment Weighted Slope Coefficients from Regressions of Traditional Public School District Performance Outcomes on District Per-student Expenditure, by Adjustments for Differences in Student Income and Program Characteristics: 2018-2019 (standard errors in parentheses)

		Unweighted		Enrollment Weighted	
Controls for shares classified as low income, EL, SWD, and grade distribution.		no	yes	no	yes
Outcome	**Metric**				
SBAC - ELA	Percent Proficient	-0.0018*	-0.0012	-0.0029***	-0.0012
		(0.0011)	(0.0012)	(0.00094)	(0.0011)
SBAC - ELA	Mean Scale Score	-0.0059**	-0.0028	-0.0074***	-0.0029
		(0.0023)	(0.0026)	(0.0020)	(0.0025)
SBAC - MATH	Percent Proficient	-0.0016	-0.0020	-0.0023**	-0.0017
		(0.0011)	(0.0017)	(0.0010)	(0.0015)
SBAC - MATH	Mean Scale Score	-0.0063**	-0.0047	-0.0066***	-0.0042
		(0.0025)	(0.0036)	(0.0023)	(0.0034)
SAT - ELA	Percent Proficient	-0.00057	0.0011	-0.0018	0.00076
		(0.0018)	(0.00079)	(0.0017)	(0.00074)
SAT - ELA	Mean Scale Score	-0.0012	0.0025	-0.0034	0.0022
		(0.0038)	(0.00206)	(0.0039)	(0.00205)
SAT - MATH	Percent Proficient	-0.00057	0.00098*	-0.0011	0.00081
		(0.0014)	(0.00058)	(0.0014)	(0.00058)
SAT - MATH	Mean Scale Score	-0.0025	0.0015	-0.0044	0.00087
		(0.0036)	(0.00184)	(0.0037)	(0.00205)

Notes: Each cell comes from a separate regression. There is one observation per district in the samples, and the sample size is 16 for all regressions. Charter school districts are not included in the samples.

[12] Asterisks indicate statistical significance at the following levels: * ten percent; ** five percent; *** one percent.

Table C2. Unweighted and Enrollment Weighted Slope Coefficients from Regressions of Traditional Public and Charter School Performance Outcomes on School Per-student Expenditure, by Adjustments for Differences in Student Income and Program Characteristics: 2018-2019 (standard errors in parentheses)

		Unweighted		Enrollment Weighted	
Controls for shares classified as low income, EL, SWD, and grade distribution.		no	yes	no	yes
Outcome	**Metric**				
SBAC - ELA	Percent Proficient	-0.0024***	-0.00029	-0.0025***	-0.00044
		(0.00036)	(0.00027)	(0.00044)	(0.00030)
SBAC - ELA	Mean Scale Score	-0.0062***	-0.00076	-0.0077***	-0.0011
		(0.0011)	(0.00063)	(0.0014)	(0.00070)
SBAC - MATH	Percent Proficient	-0.0021***	0.00001	-0.0021***	-0.00012
		(0.00041)	(0.00033)	(0.00050)	(0.00038)
SBAC - MATH	Mean Scale Score	-0.0062***	-0.00037	-0.0071***	-0.00057
		(0.0010)	(0.00073)	(0.0013)	(0.00084)
SAT - ELA	Percent Proficient	-0.0034***	-0.00091*	-0.0042***	0.00003
		(0.00066)	(0.00050)	(0.00097)	(0.00053)
SAT - ELA	Mean Scale Score	-0.0076***	-0.0019	-0.0098***	0.00064
		(0.0016)	(0.00146)	(0.0025)	(0.00165)
SAT - MATH	Percent Proficient	-0.0024***	-0.00022	-0.0033***	0.00058
		(0.00063)	(0.00055)	(0.00094)	(0.00065)
SAT - MATH	Mean Scale Score	-0.0089***	-0.0033*	-0.010***	-0.00021
		(0.0017)	(0.00167)	(0.0025)	(0.00186)

Notes: Each cell comes from a separate regression. There is one observation per school in each regression. The samples sizes are 37 for the SAT regressions and 153 for the SBAC regressions. Charter school districts are included in the samples.

Table C3. Unweighted and Enrollment Weighted Slope Coefficients from Regressions of Traditional Public School Performance Outcomes on School Per-student Expenditure, by Adjustments for Differences in Student Income and Program Characteristics: 2018-2019 (standard errors in parentheses)

		Unweighted		Enrollment Weighted	
Controls for shares classified as low income, EL, SWD, and grade distribution.		no	yes	no	yes
Outcome	**Metric**				
SBAC - ELA	Percent Proficient	-0.0023***	-0.00049*	-0.0021***	-0.00074**
		(0.00038)	(0.00029)	(0.00043)	(0.00031)
SBAC - ELA	Mean Scale Score	-0.0063***	-0.0013**	-0.0067***	-0.0018***
		(0.0012)	(0.00065)	(0.0014)	(0.00070)
SBAC - MATH	Percent Proficient	-0.0020***	-0.00029	-0.0017***	-0.00055
		(0.00043)	(0.00035)	(0.00050)	(0.00038)
SBAC - MATH	Mean Scale Score	-0.0061***	-0.0011	-0.0060***	-0.0014*
		(0.0011)	(0.00075)	(0.0013)	(0.00084)
SBAC - ELA	average percent of growth target met	-0.00031	0.00015	-0.00022	0.00003
		(0.00028)	(0.00025)	(0.00031)	(0.00027)
SBAC - MATH	average percent of growth target met	-0.00027	0.00007	-0.00012	0.00004
		(0.00037)	(0.00031)	(0.00042)	(0.00033)
SAT - ELA	Percent Proficient	-0.0026***	0.00014	-0.0027**	0.00019
		(0.00078)	(0.00054)	(0.0011)	(0.00052)
SAT - ELA	Mean Scale Score	-0.0055***	0.00086	-0.0056**	0.00101
		(0.0018)	(0.00126)	(0.0026)	(0.00128)
SAT - MATH	Percent Proficient	-0.0017***	0.00056	-0.0018**	0.00056
		(0.00062)	(0.00038)	(0.00087)	(0.00038)
SAT - MATH	Mean Scale Score	-0.0073***	-0.00079	-0.0064***	-0.0004
		(0.0016)	(0.00112)	(0.0023)	(0.00113)

Notes: Each cell comes from a separate regression. There is one observation per school and there are 136 schools in the SBAC sample, 27 schools in the SAT sample, and 132 schools in the growth sample. Charter school districts are not included in the samples.

Table C4. Unweighted and Enrollment Weighted Slope Coefficients from Regressions of Traditional Public School Class Size or Teacher Experience on the School Share of Students Classified as Low Income: 2018-2019 (standard errors in parentheses; each cell comes from a separate regression)

	Unweighted	Enrollment Weighted
1. Class Size		
Percent of classes with <21 Students	0.57***	0.51***
	(0.15)	(0.16)
Percent of classes with <26 Students	0.46***	0.50***
	(0.17)	(0.19)
2. Teacher Experience		
Percent of teachers with <2 years of experience	0.15***	0.099**
	(0.039)	(0.041)
Percent of teachers with 2 to 15 years of experience	0.080	0.098
	(0.057)	(0.061)
Percent of teachers with >15 years of experience	-0.23***	-0.20***
	(0.067)	(0.072)

Note: Each cell reports the regression coefficient and standard error from a regression of the class size or experience share for that row regressed on the share of students classified as low income. Charter school districts are not included in the samples. Class size distributions are approximated from Delaware Report Card bar graphs in 2019. Because there was no information by grade, Delmar District, which only has 5th grade in the middle school, was excluded from the sample. Laurel District was also excluded due to a lack of data for 2019.

Appendix D

Data Files

Year	File Description	File Name
Raw Files		
2017-18		
	Class Size	SD_0012446.csv
	District Expenditures	SD_0103547_CONFIDENTIAL.csv
	School Expenditures	SD_0012447.csv
	Graduation Rates (unredacted)	SD_0079865_UR.csv
	Student Growth (Delaware Portal)	student_growth.csv
2018-19		
	Class Size (Delaware Report Cards)	schl_class_size_2019_edited.csv district_class_size_2019_edited.csv
	District Expenditures (Delaware Report Cards)	district_expend_2019.csv
	School Expenditures (Delaware Report Cards)	school_expend_2019.csv
	Student Growth (Delaware Portal)	Student_Growth_2019.csv
2017-18 & 2018-19		
	Enrollment (unredacted)	SD_0079834_UR.csv-SD_0079863_UR.csv
	Teacher Experience	SD_0012441.csv
	Student Achievement (SAT & SBAC) (unredacted)	SD_0079781_UR.csv-SD_0079795_UR.csv
	School and District names (Delaware Portal)	Student_Assessment_Performance.csv
Working Files		
2017-18		
	Achievement (SAT & SBAC)	SBAC_expend_UR_2018.dta SAT_expend_UR_2018.dta
	Growth	growth_expend_clean.dta
	Graduation	grad_spend_UR_clean.dta
	Class Size	class_size_expend_clean_T3.dta
	Teacher Experience	teacher_exp_expend.dta
2018-19		
	Achievement (SAT & SBAC)	SBAC_expend_UR_2019.dta SAT_expend_UR_2019.dta
	Growth	growth_expend_clean_2019.dta
	Class Size	class_size_expend_clean_2019.dta
	Teacher Experience	teacher_exp_expend_2019.dta