THE IMPACT OF SCHOOL EXPENDITURES AND OTHER RESOURCES ON ACADEMIC ACHIEVEMENT IN NEW YORK

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PURPOSE AND SCOPE

This report was prepared at the request of the Office of the Attorney General of the State of New York as part of its case in *Maisto v. New York State*. The plaintiffs in this case are parents from eight school districts who allege that their schools do not have sufficient educational resources to provide an opportunity for a sound basic education to their children as required by the New York State Constitution.

Specifically, these parents argue that the educational inputs for their schools--meaning funds and resources to provide for sufficient numbers of qualified and experienced teachers, well maintained facilities, instrumentalities of learning, etc.--are inadequate and lead to low educational outputs as measured by such indicators as standardized achievement tests and high school graduation and dropout rates. Plaintiffs believe that increasing the amount of state funding for their school districts will improve their teachers and other conditions, and therefore their educational outcomes will be make them more comparable to other New York school districts.

The purpose of this report is to assess the relationship between educational inputs and outputs for all school districts in New York.[1] Using detailed data on educational inputs and outputs maintained by the New York Department of Education, the report will show that the relationships between educational inputs and outputs are very weak, and that substantial increases in funds and other school resources will have either no impact or only very small impacts on student academic outcomes.

SUMMARY OF MAJOR FINDINGS AND OPINIONS

- The best way to know what will happen to student achievement in New York if spending is increased is to analyze the relationship between educational inputs and outputs using New York's own education data. After controlling for socioeconomic factors, these data show a very small but statistically significant relationship between test scores and per capita expenditures for general education, class sizes, and teacher salaries. There is no statistically significant relationship between total expenditures and test scores.[2]

- If very large increases in funding were devoted primarily to reducing class sizes and raising teacher salary in New York school districts, an analysis of New York data reveals that math and ELA proficiency would be raised only slightly for elementary students. For middle school students, teacher salaries do not have a statistically significant effect, and class size has a statistically significant but even smaller effect. Therefore, large reductions in middle school class sizes would result in even smaller increases in proficiency (than for elementary students).

- Teacher experience, the percentage with Masters degrees, the percentage without valid teaching certificates, and the percentage of classes taught by instructors who are outside their certified field have no statistically significant effects on math or ELA skills for either elementary or middle school students after controlling for socioeconomic factors. It is worth noting that in 2012 five of the plaintiff districts had no teachers without valid certificates, and six had less than .5 percent of classes taught by out of field teachers.

- Nearly 90 percent of the variation in English and Language Arts (ELA) test scores occurs within school districts, and 85 percent occurs within schools. Similarly, 80 percent or more of the variation in math scores

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[1] For reasons explained below, unless otherwise noted New York City is excluded from these analyses.

[2] The statistical significance of a relationship is not the same thing as the strength of a relationship. A statistically significant relationship means it has not occurred by chance, but that does not mean it is a strong relationship. Given the very large number of students and schools in New York, statistical significance can occur even when the relationship is very weak.

lies within schools and districts. This is clear evidence that individual student differences rather than district policies and school inputs are the primary reasons why school districts have differing achievement test proficiency.

- While student socioeconomic characteristics have a major influence on achievement test scores, this does not mean that disadvantaged students cannot learn. There is a large skill gap between lower and higher socioeconomic status (SES) students when they begin schooling. Given the weak effects of spending and other school resources, research shows that both groups learn at about the same rates and thus the achievement gap continues as students move from Kindergarten through 12th grade. In New York, for example, the gap in math scores between poverty and non-poverty students in 3rd grade is about the same as it is in 8th grade.[3]

- Like test scores, high school graduation and dropout rates are strongly influenced by student socioeconomic characteristics, and they are also strongly influenced by earlier academic achievement. After controlling for these characteristics, only one school or teacher resource has a statistically significant but very small effect on 5 year graduation or dropout rates, which is teacher turnover. Per capita expenditures, teacher salaries, average class size, teacher experience, and teacher education do not have statistically significant impacts on graduation or dropout rates.

DATA AND INFORMATION RELIED UPON

Most of the data for this report comes from various databases maintained by the New York State Education Department (SED), including the Basic Educational Data System (BEDS) and the Student Information Repository System (SIRS). These official databases are used to produce the school report cards and other regular and special reports on student academic progress and school characteristics.

Specifically, this report uses several categories of individual student, school, and school district data for the school years 2010, 2011, and 2012. Individual student data includes outputs of math and English Language Arts (ELA) test results (scale scores and proficiency levels) for grades 3 through 8, and socioeconomic input characteristics such as free/reduced price lunch, race, ethnicity, and limited English proficiency. School characteristics include output indicators of high school graduation and dropout rates, and the school inputs of average class sizes, teacher turnover rate, average teacher salary, and several indicators of teacher quality including experience, education, percentage of certified teachers, and percentage of classes taught by teachers without certification in the fields taught. School district characteristics include enrollment, total per capita expenditures and per capita expenditures for general education students.

Other information relied upon includes the author's education, training, research, and professional work experience; his knowledge of scientific studies of schools and student achievement; his review of records and documents pertaining to this litigation, including pleadings, discovery responses, plaintiffs' expert reports and exhibits; his general experience in educational research and writings including *Maximizing Intelligence* and "Can NCLB Close Achievement Gaps," and his studies in other educational adequacy cases including New York City, the State of South Dakota, and the State of Washington.

OVERVIEW AND APPROACH

The State of New York operates one of the largest systems of elementary and secondary education in the nation. In the 2011-12 school year it enrolled 2.6 million students in grades K through 12 organized into nearly

[3] There may be factors, other than school resources, that would benefit academic achievement for some disadvantaged students, but this is beyond the scope of the present report.

700 separate school districts (counting New York City as a single district). Approximately 200,000 students are enrolled at each grade level, meaning that test scores are available for approximately 1.2 million students in grades 3 to 8 each year. About 460,000 of these elementary and middle school students are enrolled in New York City schools, while 740,000 are enrolled in all other New York school districts.

For several reasons, New York City is not included in the main assessment reported here. First, its schools are administered and organized differently than most school districts in the state, with 32 separate community school districts for elementary and middle schools (grades K to 8) and five high school districts at the borough level.[4] Second, its total enrollment comprises more than a third of total public school enrollment in the state, thereby having a potential disproportionate impact on relationships between school inputs and educational outcomes. Finally, and most important, no information is available for per pupil expenditures for the 32 community school districts, which is a critical school input in this assessment.

The report will be divided into two sections. The first section looks at academic outcomes for elementary and middle school using the New York state testing program for grades 3 to 8. This analysis is conducted at the individual student level, which has major advantages when estimating the effects of student background factors on test scores. The second section examines academic outcomes for high school students using extensive information on graduation and dropout rates developed by the New York SED. This information is compiled at the school level.

For each section, the report first presents some general descriptive statistics for New York school and student characteristics. The report then discusses results from analyses that explain the relationship between school inputs and outputs. In the social sciences, it is well-established that student academic outcomes are strongly influenced by student socioeconomic characteristics, and these factors must be taken into account in order to isolate the impact of increases in funding and other school resources.[5] These analyses rely upon the statistical technique of longitudinal multiple regression, which allows estimation of school resource effects over time, controlling for differences in student backgrounds. More detailed explanation of this technique is found in Appendix A.

ACADEMIC OUTCOMES FOR ELEMENTARY & MIDDLE SCHOOLS

When reporting achievement test results, the SED uses proficiency rates determined by standards that it sets for various grades. Many of the statistical analyses in this section rely on scale scores, which are scores corresponding to a particular number of questions answered correctly. Proficiency levels correspond to particular scale scores for each grade.

To help the reader interpret school district proficiency levels when reporting average scale scores, Table 1 shows the percentage of elementary students who are proficient for a school or school district whose average scale scores range from 660 to 700 (in five point increments).[6] An average scale score of 675 corresponds to 53 percent proficiency; an average scale score of 685 corresponds to 67 percent proficiency, and so forth. Generally, an increase of one scale score point corresponds to an increase of about one and a half points in the

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[4] Community and high school districts have separate superintendents and elected community advisory committees, but the Mayor of New York City has overall policy making responsibility for all schools and school districts.

[5] Classic studies include James Coleman, et al, (1968) *Equality of Educational Opportunity*, U.S. Government Printing Office, Wash. DC, and Frederick Mosteller & Daniel P. Moynihan (1972), *On Equality of Educational Opportunity*, Vintage Books.
More recent authorities include Duncan, G. J., & Brooks-Gunn, J. (1997a). *Consequences of Growing up Poor*. New York: Russell Sage Foundation; Rothstein, R. (2004). *Class and Schools: Using Social, Economic, and Educational Reform to Close the Black-White Achievement Gap*. Washington, DC: Economic Policy Institute; and David J. Armor (2003), *Maximizing Intelligence*, Transaction Publishers

[6] The SED reports proficiency rates by grade level, but to provide an elementary school comparison, scores for grades 3 to 5 are combined in this table. In the regression analysis, individual grade and year are entered as controls.

proficiency rate. These data are generated by test scores for all New York students in grades 3 to 5 with the indicated scale scores.

Table 1 Percent Proficient by Average Math Scale Score for Grades 3-5

Scale	Year			
Score	2010	2011	2012	All
660	30	31	31	31
665		40	33	38
670	46	45	44	45
675	53	54	53	54
680	59	62	61	61
685	65	68	67	66
690	72	72	73	72
695	79	81	79	79
700	84	85	85	84
(N)	(122,129)	(94,407)	(125,706)	(342,242)

Descriptive information for Student and School Characteristics

Table 2 shows math scale scores averaged over students in each grade and year. Scale scores are developed separately for each year and grade, so they cannot be used to show growth or to directly compare one grade to another. They do range from roughly the high 400s to the high 700s, depending on year and grade, and for that reason average scale scores are quite similar within grade across the three years. Scale scores in grades 3 to 5 average about 10 points higher than those in grades 7 and 8. The statistical analyses to evaluate the effects of school resources take these grade and year differences into account.

Table 2 New York State Math Scores by Grade and Year [a]

	Year			All
Grade	2010	2011	2012	years
3	694	688	689	690
4	689	689	691	690
5	687	687	688	687
6	683	685	685	684
7	681	682	681	681
8	680	680	682	681
All grades	686	685	686	686

a These tabulations exclude NYC

The New York state databases include numerous measures of both socioeconomic factors and school resources at various levels: students, schools, and school districts. Table 3 shows a list of the measures used in this report to evaluate various inputs and outputs for elementary and middle school students, along with summary statistics showing their average levels or percentage distributions. More detailed descriptive statistics are found in Appendix A.

The first measure is the New York state "needs" index, which is a combined SES and demographic classification of a school district and the geographic area in which it is located. The needs index has six categories, the first corresponding to New York City, and a second for the next four largest city school districts which are Buffalo, Rochester, Syracuse, and Yonkers. The remaining four categories are determined by an index that combines measures of district poverty, community wealth, density, and community size. The third category is "high need urban/suburban," the fourth is "high need rural," and the last two are average need and low need, respectively.

Socioeconomic measures available at the student level include free/reduced price lunch (which is based on family poverty as defined by the U.S. Census), race and ethnic categories, and limited English capability. There is one other student measure that has a strong impact on student outcomes, which is special education status. This is not a socioeconomic variable, but school districts with higher percentages of special education students will have lower average test scores, everything else being equal, so it is important to take it into account when evaluating the impact of school resources on test scores.

The last section in Table 3 shows the school and teacher resource variables that are available in the New York databases. The first six of these are measured at the school level: the percentage of teachers not certified, the percentage of teachers with less than three years of teaching experience, the percentage with Masters degrees, the percentage of classes taught by teachers not certified in that field, the teacher turnover rate, and the average class size. The last three measures are available only at the school district level: average teacher salary, total per pupil expenditures, and per pupil expenditures for general education students (excludes spending for special education students).

Table 3 Student and School Characteristics for Grades 3-8, 2012

Characteristic	All Districts except NYC
DISTRICT SES	
Large City	6%
High Need Urban/Sub	12%
High Need Rural	9%
Average Need	48%
Low Need	24%
STUDENT SES	
Free/red Lunch	37%
Black	11%
Hispanic	13%
Asian	4%
White	71%
Limited English	4%
OTHER STUDENT	
Special Ed	13%
SCHOOL/TEACHER	
Teachers Not Cert.	3%
Less than 3 yrs exp.	2%
Masters degree	36%
Out of Field	0.5%
Teacher turnover	13%
Class size	21.7
Teacher salary	$76,318
Per pupil $, Total	$20,449
Per pupil $, Gen Ed	$11,262

According to federal reports, New York has the highest average teacher salaries for public elementary and secondary schools.[7] As shown in Table 3, in 2012 the average salary for teachers in all schools districts other than New York City is over $76,318. In some New York school districts, average teacher salary is well above $100,000. The national average for teacher salaries that year was $56,600. New York also has the highest average per pupil expenditures in the nation, just over $20,000 per student. This compares to a national average of $10,600 in 2012.[8] Some portion of total expenditures are for special education students and for non-instructional cost such as debt service and transportation. Per pupil *instructional* expenditures for general education students alone is approximately $11,300--which is higher than the national average for total expenditures.

Relationship between Inputs and Outputs

There are several ways to assess the relationship between school inputs (or resources) and educational outcomes. First, the variation in student outcomes, in this case test scores, can be partitioned into two components, a component that lies within a school district and a component which lies between school districts. Variability of student test scores within a school district cannot be attributable to school district policies, programs, or practices, such as per pupil expenditures and teacher salaries. Variation in student outcomes can also be partitioned into a component that is between individual schools and within schools, and variability within schools cannot be attributed to school-level variables such as average class size, percentage of teachers with Masters degrees, and other school-level resources.

Second, correlations can be computed showing the relationship between each student characteristic or school resource and test scores. Correlations range from -1 to +1, with 0 indicating no relationship, +1 indicating a perfect positive relationship between two variables and -1 indicating a perfect negative relationship. Finally, a multiple regression analysis can show how school resources relate to student test scores, taking into account differences in socioeconomic factors.

Within vs. Between District Variation

Figure 1 shows the percentage of variation in test scores that are due to differences between school districts versus differences within school districts. The differences within a school district are due to student characteristics, or possibly school characteristics that differ within districts. Only 13 percent of variation in ELA scores lies between districts, which might be caused by differences in school district policies and practices such as per capita spending. The district impact on elementary math scores is only slightly higher (14 percent), and the potential district impact is highest for middle school math scores at 18 percent. Some of the within-district variation could be due to specific school resources or programs that differ from one school to another within a district.

[7] National Center for Education Statistics, Digest of Education Statistics, 2013, Table 91.

[8] U.S Census Bureau, Public Education Finances: 2012 (Issued May 2014). The Census report lists total per pupil expenditures for the State of New York at $19,500 (that figure is still highest in the nation); the figure in Table 3 comes from the SED data base.

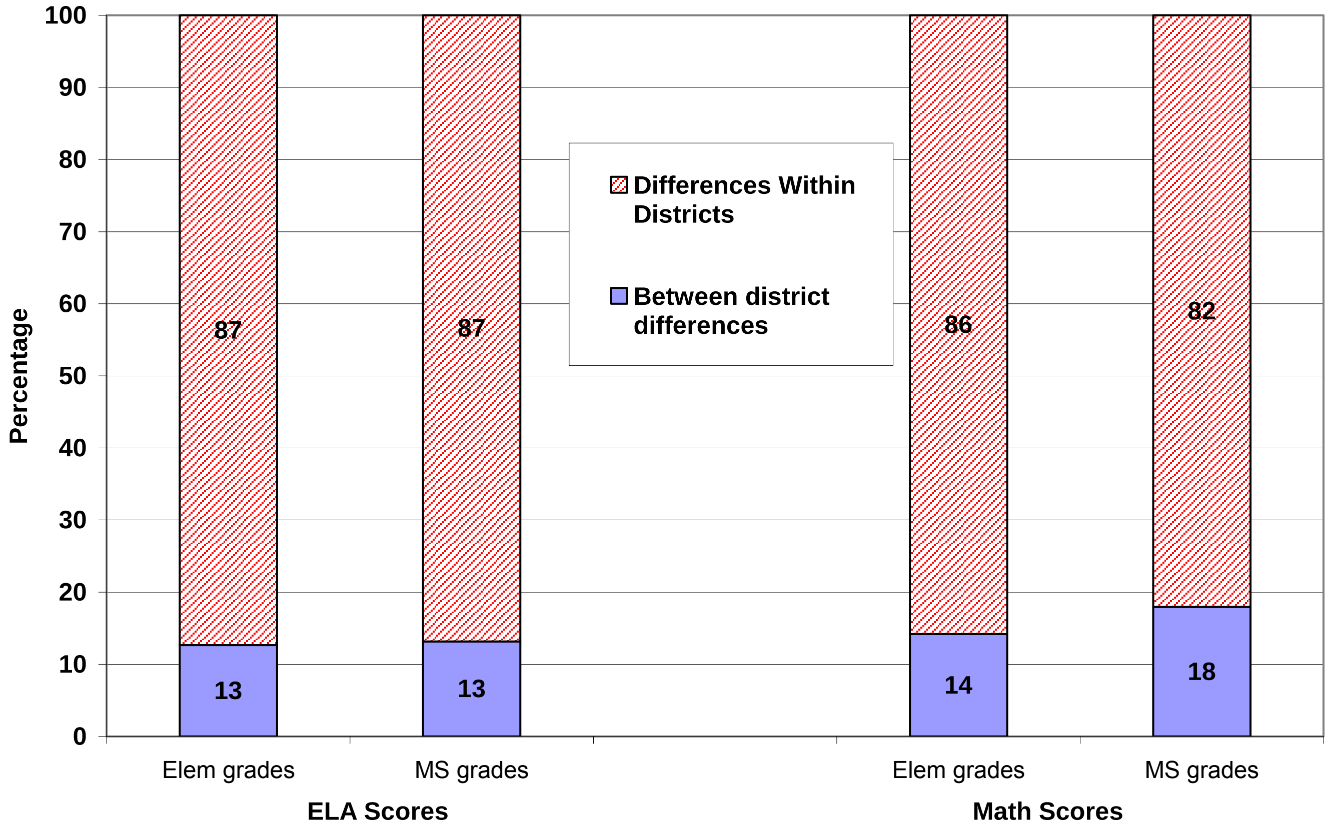

Figure 1 Variation in Achievement Test Sores between and within New York School Districts (Percentage)

Figure 2 shows the percentage of variation in test scores that are due to differences from one school to another, which is the upper limit, so to speak, of the impact of specific school resources that can differ from one school to another within a district (or between districts). This is only 15 percent for ELA scores at elementary and middle school grades, and it is 17 percent for elementary math scores. The highest between school variation is middle school math, although even here only 20 percent of the total variation in middle school math scores lies between schools.

These within-between analyses demonstrate that most variation in test scores is not due to variation in school resources and district policies; rather, it is attributable to variations in individual student characteristics.

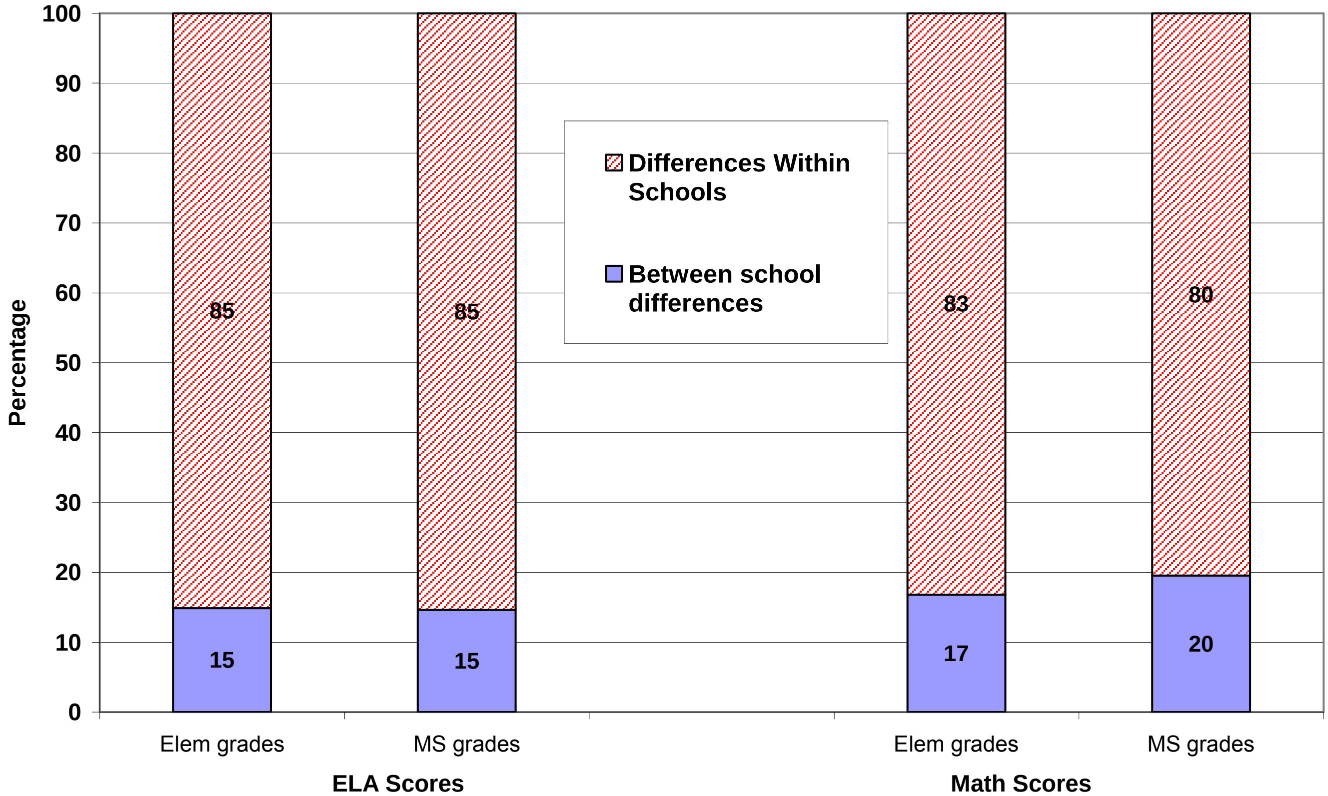

Figure 2 Variation in Achievement Test Scores between and within New York Schools (Percentage)

Correlations between Student & School Characteristics & Test Scores

The evidence shown in Figs. 1 and 2 demonstrates that individual student characteristics are the primary reasons for differences in achievement test scores. This conclusion is reinforced by the correlation analysis. Figure 3 shows the simple correlations between each of the student, school, and school district characteristics listed in Table 3 and elementary grade math scores. The correlations are shown separately for each year. The pattern and magnitude of the correlations are quite similar from one year to the next.

In the case of school resource inputs, with two exceptions, all of the correlations are weaker than +/- .1 in all three years. The two exceptions are the percentage of teachers with Masters degrees, which is .11 in all three years, and per pupil expenditures for general education students, which is .10 in 2011 and .12 in 2012. These are very low correlations. A correlation of .10 means that the variation in one characteristic explains only one percentage point of the variation in the other characteristic.

Most of the correlations between math scores and student and school district SES factors are much larger. The strongest correlation is for special education status, which is not a SES factor, which approaches -.4 in 2012. The strongest SES measure is free/reduced lunch, which is about -.35 in 2011 and 2012. With the exception of rural and average need districts, all of the remaining SES measures have correlations that are stronger than +/- .1

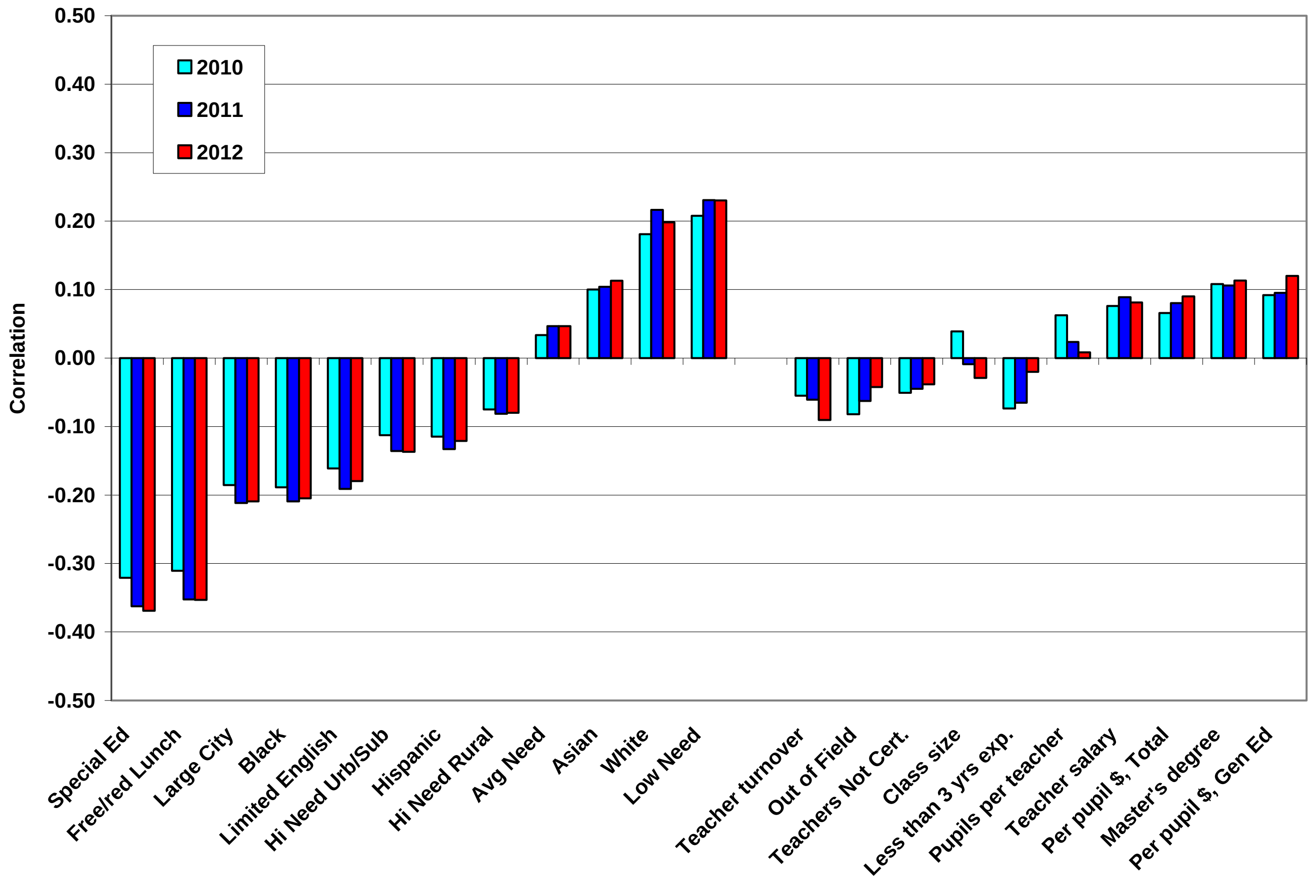

Figure 3 Correlations between Student & School Characteristics and Math Scores, Grades 3 to 5

Estimating the Effects of School Inputs on Test Scores

The correlations between test scores and school inputs shown in Figure 3 cannot be used by themselves to estimate the expected effects of increases in these resources, such as increased salaries, reduced class sizes, and so forth, as recommended by plaintiffs' experts. The reason is that there are even higher correlations between socioeconomic characteristics and test scores, which are also shown in Figure 3, and as noted earlier it is well-established in social science research that these factors have a strong influence on test score differences among students, and these influences occur before students enter kindergarten. In order to estimate the effect of school resources, one must control for these socioeconomic factors using multiple regression analysis, where the potential effect of a given variable can be estimated by controlling for (or removing the effect of) socioeconomic characteristics.

Briefly, the regression analysis uses test scale scores for three years (2010 to 2012) and all New York students in grades 3 to 8 except for New York City. It uses all of the student and school variables listed in Table 3. The regression model is longitudinal, which captures changes in test scores over time as well as effects of resource changes over time. The nature of the regression models used here is explained in Appendix A along with more detailed results.

The regression analysis was done separately for elementary grades (3 to 5) and middle school grades (6 to 8) because they yielded different results. Generally, the potential effects of school inputs were stronger for the elementary grades. The results are discussed in order.

Elementary Grades 3-5

Because of the very large number of schools and school districts in New York, there is a higher likelihood that statistical significance will be found for school inputs even though their effect on test scores is very small, at least when compared to the socioeconomic factors. Despite this condition, most school inputs did not have a statistically significant effect on math or ELA scores for elementary schools. There is no statistically significant impact on either math or ELA scores for total per pupil expenditures, number of students per instructional staff, percentage of teachers with Masters degrees, years of teacher experience, percentage of teachers with valid certificates, and the percentage of classes taught by teachers not certified in that field.

Table 4 shows the estimated effects of the four school inputs found to be statistically significant in the regression analysis: class size, teacher salary, teacher turnover rate, and per pupil expenditures for general education. To estimate the size of an effect, it is assumed that the school input would be increased or decreased by one standard deviation. This is a very substantial change; about two thirds of all schools are found between plus one and minus one standard deviation for a given characteristic. This means a reduction in average class size of 2.5 students, an increase of $9,000 in average teacher salary, or an increase of $2,500 in per capita expenditures for general education students.[9]

Even if these resources were changed to this degree, the expected improvement in either math or ELA test scores in the elementary grades is less than a single test score point for all resource changes.[10] Since a change of one full point in a test score corresponds to about two weeks of learning during an elementary school year, a half point is about one week of learning. So reducing class sizes or increasing teacher salaries by substantial amounts would have only very small estimated effects on math scores, according to a regression analysis based on data collected and maintained by the New York SED. Note that class size does not have a statistically significant effect for ELA scores.

Table 4 Estimated Effect of Changes in School Inputs on Elementary Test Scores

Resource	Test Score Change	Resource Change [a]
MATH SCORES		
Class size	.54	-2.5 students
Teacher Salary	.35	$9,000
Teacher Turnover	.36	-7%
Per pupil expend (gen ed)[b]	.56	$2,500
ELA SCORES		
Teacher Salary	.33	$9,000
Teacher Turnover	.25	-7%
Per pupil expend (gen ed)[b]	.42	$2,500

a Approximately one standard deviation
b Estimated in separate model; not additive with other resources

According to New York's own data, if large increases in general education expenditures were given to a particular district--on the order of $2,500 per elementary student, and those expenditures were used to reduce elementary class size and raise salaries of elementary school teachers, the expected increase in math scale

[9] Because teachers in downstate New York districts average about $40,000 more than teachers from upstate districts, due to cost of living considerations, their salary distributions are virtually non-overlapping. The standard deviations for teacher salaries are computed separately for upstate and downstate districts and averaged. See Appendix A for details.

[10] To explain the magnitude of effects, gains in test scores can be related to fractions of a school year in expected growth. During the elementary grades, a typical student gains about 20 points in math or ELA scale scores over a school year, which can be rounded to about 10 months of growth. So if some factor has an estimated impact of 2 scale score points, that would mean about 1 month of growth in a school year; 1 point means two weeks of growth.

scores would amount to less than one point, or about one week of learning. The expected increase in ELA scores would be only about a third of a point.

Another interpretation can be offered for the teacher salary effect. Given the difference between upstate and downstate salaries, an alternative model was tested that assumed salary effects could differ within these regions. In this model teacher salary had no statistically significant effect on math scores in upstate districts, but it had a larger positive effect for downstate districts, such that a $10,000 increase in teacher salary was associated with an increase of one point in math scores. This result suggests that teacher salary may be a surrogate for income or wealth, such that higher-salary districts reflect communities with higher incomes, and higher family income--not teacher salary--is responsible for the higher test scores.

A caution is offered concerning teacher turnover effects. While a school board can apply additional funds directly to increase teacher salary and reduce class sizes, it is unclear whether additional funding alone will reduce turnover. Turnover involves teachers' personal decisions to leave a school, which may be for a variety of reasons, including travel time and housing availability. Many of these factors are outside the control of a school board.

As expected, the regression analysis showed very large effects of socioeconomic status (SES) factors on both math and ELA scale scores. The strongest SES effects on math scores are as follows (controlling for all other factors): a large city school district scores 10 points less than a low needs district; a limited English proficient student scores 7 points lower than a student proficient in English; and a free or reduced lunch student scores 6 points lower than a student who pays for lunch. Other SES effects are being black vs white, high needs urban/suburban district vs low needs, and being Asian vs white (Asian students score higher). The effects of SES factors on ELA scores are only slightly weaker.

It needs to be emphasized that these estimated effects for socioeconomic characteristics are net of any particular set of school resources. That is, they assume that all resources have been held constant (or are otherwise equal) for the students being compared.

Illustrating the Relationship between School Inputs and Test Scores

The weak relationship between school inputs and test scores can be illustrated by plotting school input characteristics against SES-adjusted test scores for individual school districts. Since there are nearly 700 school districts, it would be impractical to do this for all districts. It is possible, however, to define a subgroup of districts that resemble plaintiff districts in size and needs.

All but one plaintiff district is in upstate New York, all have grade 3-8 enrollments between 1000 and 5000 students, and all have average or high needs-to-resource ratios. There are approximately 100 school districts that fit this description, and this broadly comparable group of districts is used to plot school inputs against SES-adjusted test scores. The Mt. Vernon district is added to the group so that all plaintiff districts are included in the plot.

An SES-adjusted test score is one in which the effects of the student socioeconomic characteristics (poverty, race/ethnicity, and LEP status) have been removed, so that students are made equivalent in terms of their background characteristics. In this way one can examine the relationship between a given school input and test scores without being concerned that it might reflect known student SES differences between districts.

Figure 4 shows the plot between average class size and SES-adjusted math scores for the 104 school districts that meet the criteria stated above, which includes all plaintiff districts. School districts are ranked from lowest to highest on their adjusted math scores in order to assess its relationship with class size. It is clear from the plot that there is great variability in class sizes, so that class size is not visibly related to test scores in this group of districts. There are districts with low class sizes and lower test scores (e.g., Olean) and districts with higher class sizes and higher test scores (e.g., Cornwall). This high variability is the reason that the effect of class size on test scores is so small.

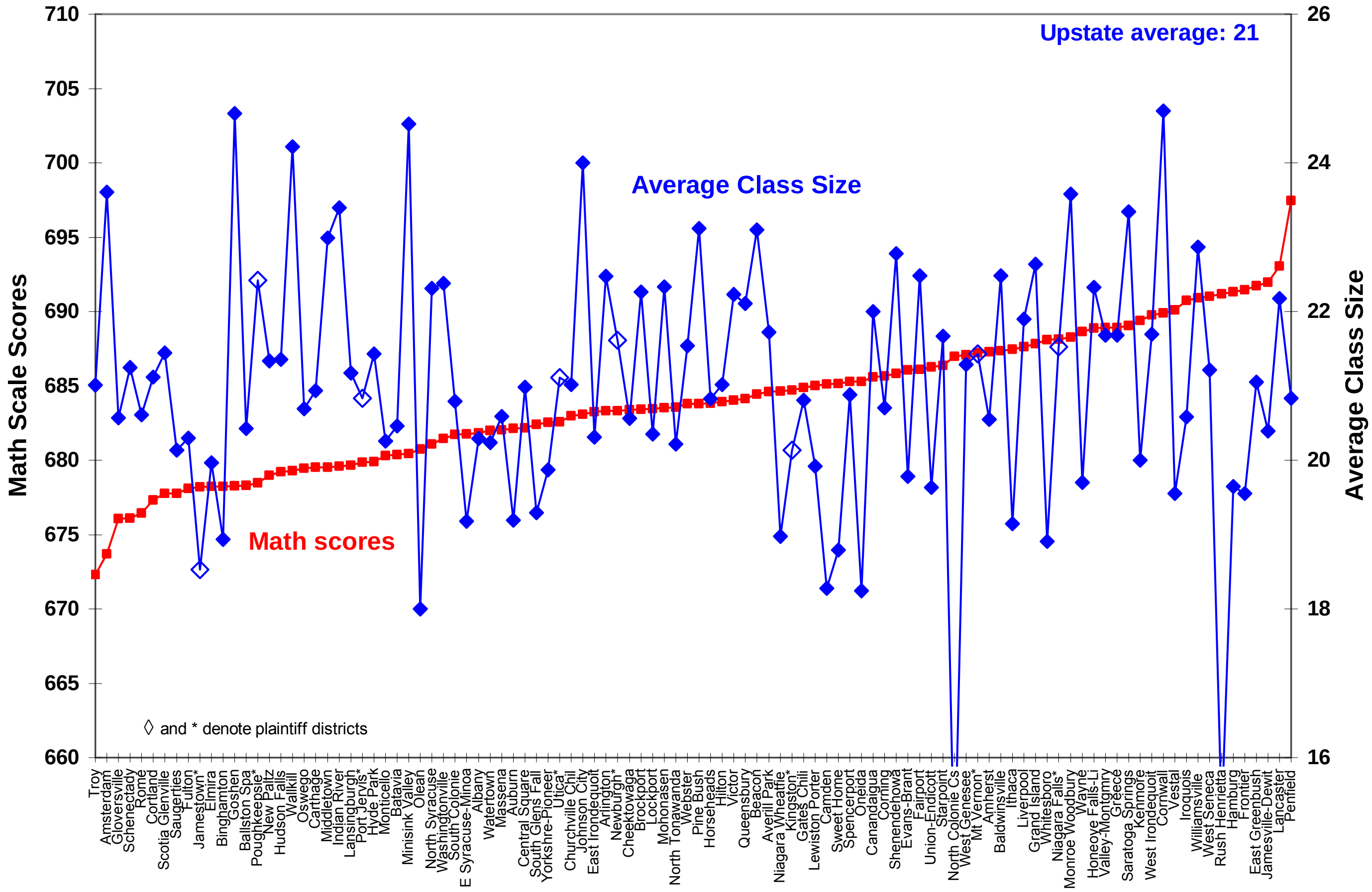

Figure 4 Plot of Average Class Size and Elementary Math Scores for Upstate School Districts
(All Medium-sized High and Average Needs Districts; Math Scores Adjusted for Socioeconomic Status)

Figure 5 shows the relationship between average teacher salaries and math scores for the same districts. Again, there is great variability in salaries, with many districts with very high salaries having relatively low math scores, and many districts with low salaries with relatively high math scores, so there is no visible relationship. The teacher salary for Mt. Vernon is not shown on the chart because it is a downstate district with a much higher average salary. The average teacher salary for Mt. Vernon is $102,000, which is very close to average teacher salary for all downstate districts ($100,000).

It is worth noting that 4 of the 7 upstate plaintiff districts have among the highest salaries in these upstate districts, and yet their SES-adjusted math scores are average or below. This further illustrates the weak relationship between teacher salaries and student achievement.

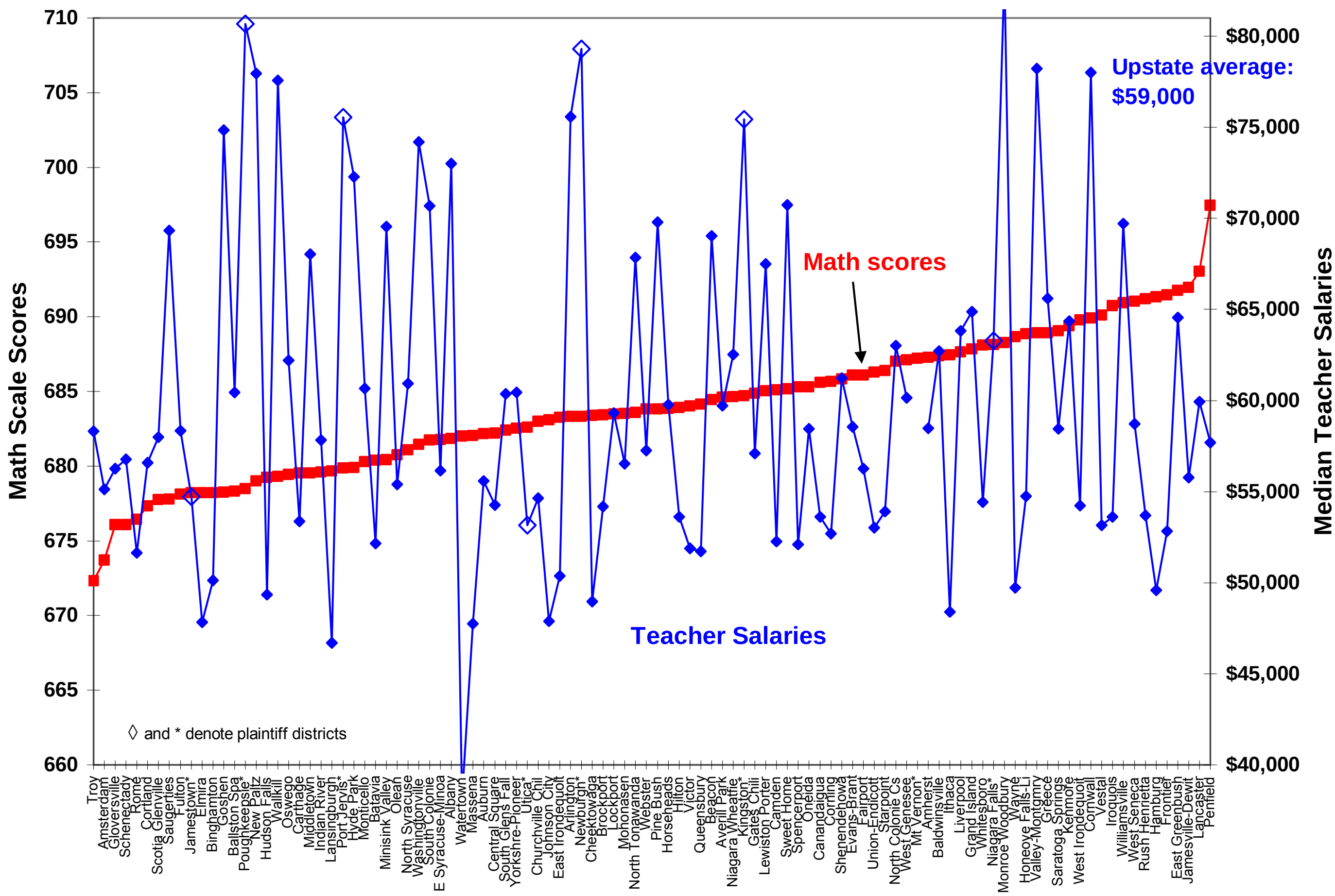

Figure 5 Average Teacher Salaries and Elementary Math Scores for Upstate School Districts
(All Medium-sized High and Average Needs Districts; Math Scores Adjusted for Socioeconomic Status)

Finally, Figure 6 shows the relationship for per pupil general education expenditures.[11] This plot actually shows a slight negative relationship, in that about a half-dozen districts with much higher-than-average expenditures have math scores at or below the mid-point for math, while only two of the districts with math scores above the midpoint (Newburgh and Mt. Vernon) have expenditures above the upstate average of about $10,000. However, this plot captures only about one-sixth of the school districts in New York, and the full sample used for the regression analysis produces a small positive relationship as shown in Figure 2 and Table 5.

As a further illustration of the weak relationship between expenditures and test scores, Poughkeepsie, Kingston, and Newburgh have relatively high per pupil expenditures for upstate districts (likely due to higher teacher salaries) yet their SES-adjusted test scores are average or below. Conversely, Niagara Falls has lower expenditures but higher than average math scores.

[11] The SES-adjusted math scores used for general education expenditures exclude special ed students, so they differ somewhat from SES-adjusted scores for all students. The ranking of the plaintiff districts is very similar on the two adjusted math scores.

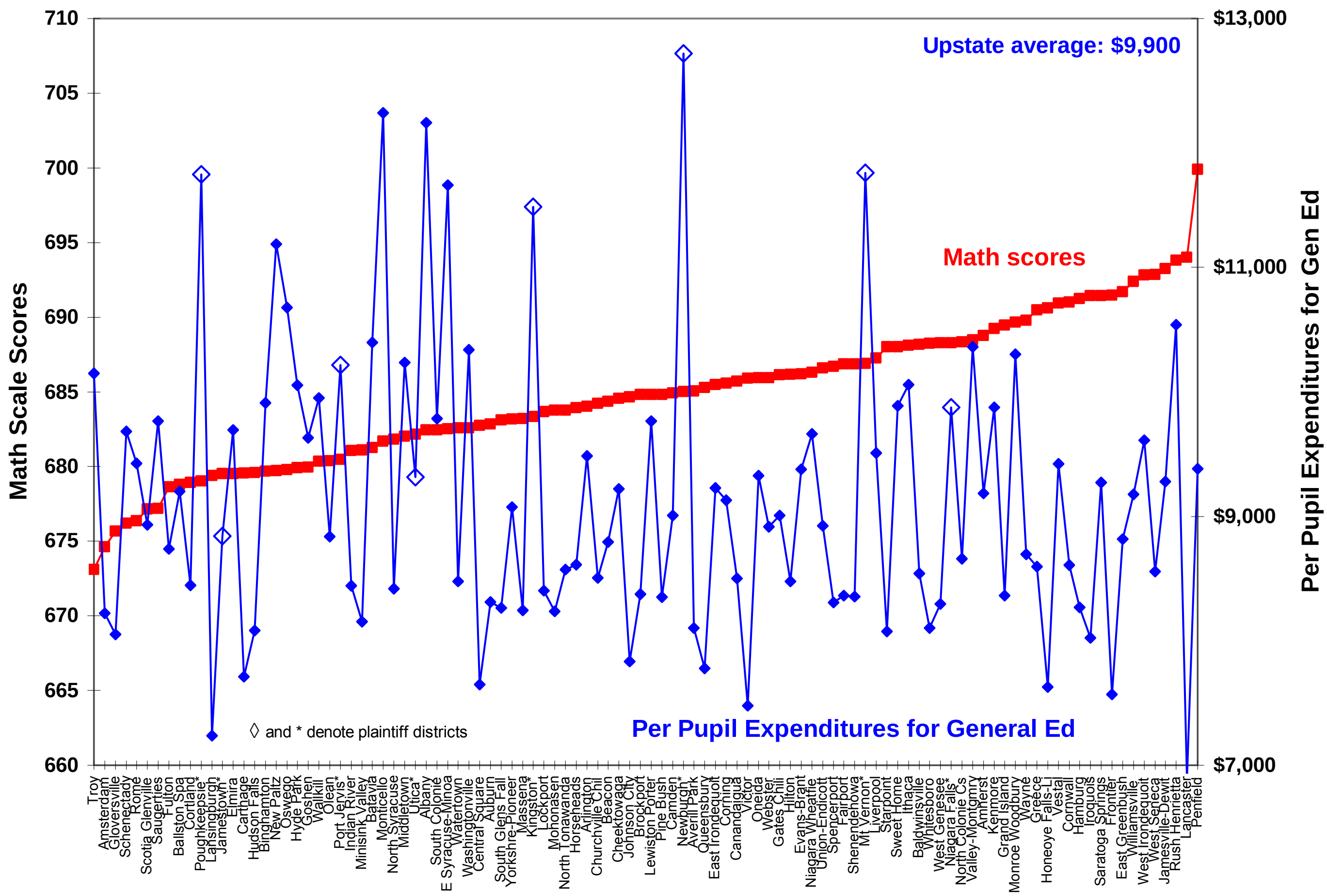

Figure 6 Per Pupil Expenditures for General Education and Elementary Math Scores for Upstate School Districts
(All Medium-sized High and Average Needs Districts; Math Scores Adjusted for Socioeconomic Status)

Results for Middle School Grades 6 to 8

The estimated effects of school inputs were uniformly weaker for middle school students, and only a few inputs reach statistical significance. There is no significant effect on math or ELA scores for total per pupil expenditures, teacher salaries, number of students per instructional staff, percentage of teachers with Masters degrees, years of teacher experience, percentage of teachers with valid certificates, and the percentage of classes taught by teachers not certified in that field. Teacher turnover had a small but statistically significant effect for both math and ELA scores, class size had a small effect on math but not ELA scores, and general education expenditures had a small effect on ELA but not math.

The magnitudes of these estimated effects for school inputs are very small. Substantial reductions in class size and teacher turnover rates would increase math scores only by one fourth of a point, and substantial increases in per capita expenditures for general education would increase ELA scores by about one fourth of a point. Reducing teacher turnover rates by 7 percentage points would not significantly affect math scores and would increase ELA scores by less than a half point.

For the middle school grades, the relationship between test scores and socioeconomic factors are strong and statistically significant, just as they are for the elementary grades. The effect sizes were slightly larger for district needs categories and slightly smaller for student SES. Being in a large city district reduces middle school math scores by 12 points and being free/reduced lunch or limited English reduces math scores by 4 and 3 points, respectively.

ACADEMIC OUTCOMES FOR HIGH SCHOOL STUDENTS

Achievement tests are the best way to judge educational outcomes for New York elementary and middle school students, because they are administered to all students in grades 3 to 8. For high school students, however, achievement test scores cannot be used to evaluate all high school students. The reason is that there is no test which is administered uniformly to all high school students.

Although Regents Exams are offered to all students, and starting in 2012 passing scores on selected tests are required to receive a diploma, students who leave or drop out of school after the 10th grade usually do not have test score results. Many school districts, including two of the plaintiff districts, have high school dropout rates of 20 percent or more. For this reason, the best educational outcomes which can be used to evaluate all high school students are graduation and dropout rates.

Given that graduation and dropout rates are the academic output measures, high schools are the unit of analysis for the high school evaluation. Accordingly, nearly all measures are averages or percentages calculated for each individual high school. Like the elementary and middle school analysis, New York City high schools were not included in the main analysis. Graduation and dropout rates were analyzed for approximately 650 high schools in 2011 and 2012.

Basic student and school characteristics for the 2011-12 school year are tabulated in Table 5. The overall 5 year graduation rate is quite high at 90 percent, and the 5 year dropout rate is 7 percent. Small numbers of students who are still enrolled in high school or in a high school equivalency program make up the remaining 3 percentage points. It should be noted that the graduation and dropout rates for the plaintiff districts are 76 and 17 percent, respectively (not shown in the table).

Regarding student socioeconomic characteristics, about 34 percent of high school students are on the free/reduced lunch program, 11 percent are black, 11 percent are Hispanic, and only 2 percent are limited English. The LEP percentage is about half that for grades 3 to 8, which is understandable given that by high school it would be expected that some students initially classified as non-English speaking would have developed better English skills.

School characteristics are similar in most respects to that shown for elementary and middle schools, although there is a somewhat higher rate of teachers with Masters degrees and a somewhat higher rate of teachers without certification. Average class size, teacher experience, teacher turnover rates, and teacher salaries are about the same.

Table 5 Student and School Characteristics for New York High Schools, 2012

Characteristic	All Districts except NYC
OUTCOME	
% Graduating, 5 yrs	90
% Dropping out, 5 yrs	7
DISTRICT SES	
Large City	6%
High Needs Urban/Sub	11%
High Needs Rural	10%
Average Needs	49%
Low Needs	24%
STUDENT SES	

% Free/reduce Lunch	31
% Black	11
% Hispanic	11
% Asian	4
% Limited English	2
OTHER STUDENT	
8th grade math score	681
SCHOOL/TEACHER	
% Teachers not cert.	8
% Less than 3 yrs exp.	3
% Master's degree	37
% Out of field	.5
% Teacher turnover	11.5
Class size (10th Gr Eng)	22
Teacher salary	$75,660
Per pupil $, Total	$20,368
Per pupil $, Gen Ed	$11,219
(Number of High Schools)	(657)

Multiple regression analyses were undertaken for the variables in Table 6 using graduation rates and dropout rates as the outcomes and the other characteristics as inputs. The regressions were weighted by school enrollment, and two years of data were included, the 2010-11 and the 2011-12 school years. The details of the regression analyses are shown in Appendix B.

The regression analyses revealed that neither total nor general education expenditures had statistically significant effects on graduation or dropout rates. Teacher turnover was the only school resource or teacher characteristic that had a statistically significant, but very weak, effect on the 5 year graduation rate and the 5 year dropout rate. A large reduction of teacher turnover of 6 percentage points would change graduation and dropout rates by less than a percentage point (+.6 and -.5, respectively). Teacher education, teacher experience, certification, and average class size had no statistically significant effect on either graduation or dropout rates. Teacher salary had a small effect that was statistically significant, but it was in the wrong direction (an increase of $10,000 in teacher salary was associated with a reduction in the graduation rate of one-half of a percentage point).

Many socioeconomic factors had statistically significant impact on both graduation and dropout rates. However, school percent Asian, school percent black, high needs districts, average needs districts, and rural districts did not have statistically significant effects in most models. Controlling for all other inputs, each additional 10 percentage points of free/reduced lunch students at a high school decreases graduation rates and increases dropout rates by about one and one-half percentage points. An increase of 10 points in the average 8th grade math scores leads to an increase of one and one-half percentage points in the graduation rate and a one percentage point decrease in the dropout rate. Large effects are also found for large city districts and the percentage of students with limited English proficiency.

CONCLUSION

The evidence provided by these New York analyses is clear. Difference in test scores, graduation rates, and dropout rates between one New York district and another has little to do with their particular spending or other school resource levels.

The only school resource with a statistically significant--but very small--impact on both test scores and high school outcomes is teacher turnover. However, the difference between plaintiff schools and statewide turnover rates is also very small, so that if plaintiff turnover rates were made equal to statewide rates, it would translate into virtually no impact on their educational outcomes.

If plaintiff districts' expenditures on general education were increased by $2,500 per student, both math and ELA scores would increase by less than one point, and high school graduation and dropout rates are unlikely to change at all.

Signed:

David J. Armor, Ph.D.

11/11/14
Date

APPENDIX A MULTIPLE REGRESSIONS FOR GRADE 3-8 TEST SCORES

Table A1 shows basic statistics for the 2011-12 school year for all variables used in the elementary Grade 3 to 5 test score analyses, including the regression analyses. School enrollment was highly skewed, so a square root transformation was used to make the distribution approximately normal. A dummy variable for "downstate" was added, corresponding to school districts in Long Island and the three counties closest to New York City (Westchester, Rockland, and Putnam).

The downstate counties have higher housing costs (and possibly higher costs of living generally) than the counties in "upstate" New York, which may reflect a socioeconomic income or wealth effect. In addition, the distinction also impacts teacher salaries. Although the overall mean teacher salary shown in Table A1 is about $76,000, the average upstate teacher salary is about $60,000 compared to about $100,000 in downstate districts.[12] The standard deviation in each group is about $9,000. The within-group standard deviation was used to illustrate estimated teacher salary effects in Table 5.

Table A1 Descriptive Statistics for Grades 3-5 Analyses, 2012

Variable	N	Mean	SD	Min	Max
Math Scale Score	362900	689.5	30	470	800
ELA Scale Score	362301	671.4	24	430	79
Large District	362900	0.067	0.250	0	1
High needs sub/urb	362900	0.127	0.333	0	1
High needs rural	362900	0.091	0.288	0	1
Average Needs	362900	0.480	0.500	0	1
Free/Reduced Lunch	362900	0.387	0.487	0	1
Black	362900	0.110	0.313	0	1
Hispanic	362900	0.135	0.342	0	1
Asian	362900	0.045	0.206	0	1
Limited English	362900	0.046	0.209	0	1
Special Ed	362900	0.128	0.334	0	1
1+ Uncert. Teacher	362878	0.029	0.167	0	1
% < 3 yrs experience	362878	2.1	3.0	0	20
% with MA degree	362878	36	29	0	100
% Out of Field	362878	0.3	1.2	0	10
% Teacher turnover	362878	12.9	7.2	0	40
Avg class size	357285	21.6	2.5	4	40
Pupil teacher ratio	362878	13.2	2.2	1.5	30.1
Teacher salary	362716	$76,274	$21,743	$37,840	$131,239
Per pupil $, total	362900	$20,451	$4,049	$12,158	$123,726
Per pupil $, gen ed	362900	$11,256	$2,404	$6,617	$52,463
Sqrt of Enrollment	362900	121	59	7.8	305.7
Downstate (vs. Upstate)	362900	.401	.49	0	1

Table A2 shows the same statistics for the middle grades. There are very few differences of note. The socioeconomic characteristics are very similar, which is expected. Middle schools have about 1% higher rate of uncertified teachers but their rate is still only 4%. Most remaining differences are less than one percentage point.

[12] There some missing data in teacher salaries, particularly for 2012 with about 20% of districts missing. Estimates were made for missing values on a district basis by assuming cost of living increases of about 3%, which is the average change for all districts without missing data.

Table A2 Descriptive Statistics for Grades 6-8 Analyses, 2012

Variable	N	Mean	SD	Min	Max
Math	375566	682.7	31	480	800
ELA	378016	664.5	19	430	790
Large District	375566	0.059	0.236	0	1
High needs sub/urb	375566	0.117	0.322	0	1
High needs rural	375566	0.091	0.287	0	1
Average Needs	375566	0.482	0.500	0	1
Free/Reduced Lunch	375566	0.358	0.479	0	1
Black	375566	0.111	0.314	0	1
Hispanic	375566	0.122	0.327	0	1
Asian	375566	0.044	0.204	0	1
Limited English	375566	0.028	0.164	0	1
Special Ed	375566	0.132	0.338	0	1
1+ Uncert. Teacher	375537	0.040	0.196	0	1
% < 3 yrs experience	375537	2.8	2.8	0	20
% with MA degree	375537	37	26	0	100
% Out of Field	375537	0.8	1.6	0	10
% Teacher turnover	375537	13.1	7.5	0	40
Gr 10 Eng class size	331816	21.5	3.7	1	38
Pupil Teacher Ratio	375537	12.7	2.2	3.6	40.3
Teacher Salary	375379	$76,360	$21,719	$37,840	$131,239
Per pupil $, Total	375566	$20,446	$4,028	$12,158	$58,199
Per pupil $, Gen Ed[a]	375566	$11,268	$2,405	$6,617	$38,233
Sqrt of Enrollment	375566	120	57	11.9	305.7
Downstate (vs. Upstate)	375566	,402	.49	0	1

Estimating Effects of Student and School Characteristics

The effects of student and school characteristics were estimated by means of a longitudinal regression analysis. The longitudinal linear regression model takes the form

$$A_t = b_0 + b_A A_{(t-1)} + \Sigma_j \, b_j S_{jt} + \Sigma_k b_k R_{kt} + g^*t + e$$

where A stands for a student test score; t represents year (for 2010, 2011, and 2012); the S_{jt} represent j district and student socioeconomic characteristics and special education status at time t; the R_{kt} represent k school and teacher resource characteristics at time t; g*t are grade by year interaction terms; and e represents random error and other unmeasured characteristics. Thus the longitudinal model posits that student achievement in year t is a function of the students' prior achievement (the year before), plus current year socioeconomic characteristics, plus current year school resource and teacher characteristics, plus controls for test differences (if any) by year and grade level.

The regressions were run separately by grade level (elementary and middle schools) because of differing results for the two levels. Within each grade level three models were run: one including class size and teacher salaries but excluding per capita expenditures, one including total per pupil expenditures but excluding class size and teacher salaries, and one like the former but excluding special ed students and replacing total expenditures with per pupil general education expenditures. Expenditures cannot be included with class size and teacher salaries because of multicollinearity. Expenditures are largely a function of salaries and class size.

Table A3 has the regression results for math scores excluding expenditures. All of the district and student socioeconomic and demographic characteristics are statistically significant, despite controlling for a students prior-year test scores, and many of the effects are quite large. In addition, 4th and 5th grade scores are substantially lower than 3rd grade scores, undoubtedly due to test differences between 3rd and the higher grades.

It is emphasized that because of the very large number of observations, both students and schools, even small relationships can be statistically significant. So in addition to evaluating whether a school resource has a statistically significant effect on test scores, the size of the effect also must be examined.

Table A3 Longitudinal Regressions for Math Scores, excluding expenditures

	ELEMENTARY GRADES 3-5				MIDDLE SCHOOL GRADES 6-8		
	Coefficient	Robust SE	p	Beta	Coefficient	Robust SE	p
Prior year math	**0.630**	**0.003**	**0.000**	**0.594**	**0.671**	**0.003**	**0.000**
Large District	**-9.685**	**0.913**	**0.000**	**-0.076**	**-11.929**	**1.131**	**0.000**
High needs sub/urb	**-4.109**	**0.511**	**0.000**	**-0.043**	**-6.410**	**0.633**	**0.000**
High needs rural	**-4.692**	**0.489**	**0.000**	**-0.043**	**-4.481**	**0.510**	**0.000**
Average Needs	**-1.865**	**0.330**	**0.000**	**-0.030**	**-2.587**	**0.370**	**0.000**
Free/Reduced Lunch	**-5.548**	**0.121**	**0.000**	**-0.085**	**-3.644**	**0.105**	**0.000**
Black	**-5.294**	**0.241**	**0.000**	**-0.053**	**-3.493**	**0.259**	**0.000**
Hispanic	**-1.522**	**0.199**	**0.000**	**-0.016**	**-1.377**	**0.208**	**0.000**
Asian	**5.507**	**0.249**	**0.000**	**0.035**	**5.070**	**0.241**	**0.000**
Limited English	**-6.902**	**0.346**	**0.000**	**-0.042**	**-2.552**	**0.404**	**0.000**
Special Ed	**-15.264**	**0.198**	**0.000**	**-0.164**	**-10.199**	**0.177**	**0.000**
1+ Uncert. Teacher	0.599	0.551	0.277	0.003	0.052	0.596	0.930
% < 3 yrs experience	0.035	0.032	0.270	0.004	-0.002	0.035	0.961
% with MA degree	**-0.025**	**0.009**	**0.003**	-0.022	0.004	0.011	0.707
% Out of Field	0.050	0.090	0.579	0.002	-0.026	0.071	0.712
% Teacher turnover	**-0.051**	**0.015**	**0.001**	**-0.012**	**-0.039**	**0.016**	**0.018**
Avg class size	**-0.215**	**0.056**	**0.000**	**-0.017**	**-0.103**	**0.036**	**0.004**
Teacher salary	**0.000039**	**0.000**	**0.004**	0.026	0.000001	0.000	0.969
Sqrt of Enrollment	**0.014**	**0.003**	**0.000**	**0.026**	**0.018**	**0.004**	**0.000**
Downstate	**2.588**	**0.644**	**0.000**	0.040	0.436	0.782	0.577
Grade by year							
3 or 6, 2012	0.140	1.302	0.914	0.000	-0.287	0.256	0.264
4 or 7, 2011	**-17.065**	**1.049**	**0.000**	-0.236	-0.198	0.365	0.588
4 or 7, 2012	**-11.439**	**1.062**	**0.000**	-0.157	**-1.456**	**0.394**	**0.000**
5 or 8, 2011	**-15.999**	**1.041**	**0.000**	-0.220	-0.489	0.327	0.136
5 or 8, 2012	**-15.216**	**1.069**	**0.000**	-0.208	0.406	0.343	0.237
Constant	276.827	2.704	0.000		229.860	2.302	0.000
R-squared	0.579				0.6419		

N = 464259, SE adjusted for 1675 schools N= 642485, SE adj. for 803 schools

Characteristics in bold sig. at p<.05; shaded entries significant at p<.05 but wrong direction

Teacher turnover, average class size, and teacher salary are the only school resource characteristics that are statistically significant in the expected direction. Their effects on elementary math scores are very small. A 5 percentage point reduction in the turnover rate corresponds to an increase of just (5 x .05) = one fourth of a point in math; a reduction of one student in average class size corresponds to an increase in math of two-tenths of a point; and an increase of $5000 in teacher salary corresponds to an increase of just (5000 x .00004) = two-tenths of a point in math. These are quite small compared to the effect of being a free/reduced lunch student, which lowers math achievement by 5.5 points compared to a paid lunch student.

The percentage of teachers with an MA degree is also statistically significant but the effect is negative, which is not the expected direction. The effect is very small, however; an increase of 10 percentage points in the MA rate corresponds to a reduction in math scores of about a quarter of a point.

For middle school students, only teacher turnover and class size effects are statistically significant, but their effects on math scores are even smaller. A 5 percentage point reduction in teacher turnover corresponds to an increase of just two-tenths of a point, and a reduction of one student in class size corresponds to an increase of just one-tenth of a point.

An alternative model was constructed with an interaction term between the downstate dummy and teacher salary. In this model, teacher salary had no statistically significant effect on math scores in upstate districts, but it had a larger positive effect for downstate districts. Basically, a $1000 increase in teacher salary was associated with an increase of about one-tenth of a point in math scores for downstate districts. It is possible that teacher salary is a surrogate for income or wealth. That is, higher-salary districts reflect communities with more high income families, and the higher family income--not teacher salary--is responsible for the higher test scores.

Table A4 shows regression results for the models that include expenditures. Total per pupil expenditures is not statistically significant, but per pupil spending for general education is statistically significant. The effect on math scores is quite small, however; an increase of $1000 in additional spending per student is associated with an increase of only two-tenths of a point. Neither total nor general education expenditures have statistically significant effects on math for middle school students in grades 6-8.

Table A4 Longitudinal Regressions for Math Scores, including expenditures [a]

	ELEMENTARY GRADES 3-5				MIDDLE SCHOOL GRADES 6-8		
	Coefficient	Robust SE	p	Beta	Coefficient	Robust SE	p
Prior year math	**0.632**	**0.003**	**0.000**	**0.596**	**0.672**	**0.003**	**0.000**
Large District	**-10.086**	**0.910**	**0.000**	**-0.079**	**-10.637**	**0.970**	**0.000**
High needs sub/urb	**-4.425**	**0.516**	**0.000**	**-0.046**	**-5.963**	**0.565**	**0.000**
High needs rural	**-5.246**	**0.482**	**0.000**	**-0.048**	**-4.480**	**0.460**	**0.000**
Average Needs	**-2.212**	**0.333**	**0.000**	**-0.035**	**-2.525**	**0.353**	**0.000**
Free/Reduced Lunch	**-5.556**	**0.123**	**0.000**	**-0.085**	**-3.635**	**0.100**	**0.000**
Black	**-5.174**	**0.238**	**0.000**	**-0.052**	**-3.287**	**0.238**	**0.000**
Hispanic	**-1.514**	**0.206**	**0.000**	**-0.016**	**-1.464**	**0.198**	**0.000**
Asian	**5.540**	**0.245**	**0.000**	**0.035**	**5.123**	**0.229**	**0.000**
Limited English	**-6.847**	**0.340**	**0.000**	**-0.042**	**-2.985**	**0.369**	**0.000**
Special Ed	**-15.170**	**0.197**	**0.000**	**-0.163**	**-10.309**	**0.163**	**0.000**
1+ Uncert. Teacher	0.366	0.596	0.539	0.002	0.302	0.557	0.589
% < 3 yrs experience	0.041	0.032	0.193	0.004	0.014	0.031	0.647
% with MA degree	-0.025	0.009	0.003	-0.022	0.000	0.009	0.971
% Out of Field	0.038	0.088	0.666	0.001	-0.029	0.067	0.662
% Teacher turnover	**-0.061**	**0.015**	**0.000**	**-0.014**	**-0.062**	**0.015**	**0.000**
Per pupil $, total	0.000056	0.000	0.145	0.007	0.000038	0.000	0.283
From separate regression:							
Per pupil $, gen ed	**0.000222**	**0.000**	**0.003**	**0.019**	0.000056	0.000	0.422
Sqrt of Enrollment	**0.013**	**0.003**	**0.000**	**0.024**	**0.013**	**0.004**	**0.000**
Downstate	**3.323**	**0.561**	**0.000**	**0.052**	**0.473**	**0.583**	**0.417**
Grade by year							
3 or 6, 2012	**0.135**	**1.298**	**0.917**	**0.000**	-0.378	0.209	0.071
4 or 7, 2011	**-17.084**	**1.042**	**0.000**	**-0.234**	**-0.681**	**0.318**	**0.032**
4 or 7, 2012	**-11.452**	**1.056**	**0.000**	**-0.156**	**-1.977**	**0.342**	**0.000**
5 or 8, 2011	**-16.106**	**1.036**	**0.000**	**-0.223**	**-0.890**	**0.280**	**0.002**
5 or 8, 2012	-15.418	1.064	0.000	-0.212	-0.108	0.295	0.715
Constant	273	2.408	0.000		228	1.994	0.000
R-squared	0.580				0.639		

N = 474619, SE adjusted for 1717 schools   N = 727817, SE adj. for 1271 schools

Characteristics in bold sig. at p<.05; shaded entries significant at p<.05 but wrong direction

a All coefficients except Per Pupil $, gen ed are from the regression with Per Pupil $, total

Tables A5 and A6 contain the parallel longitudinal regressions for ELA scores. Generally, the effects for school and teacher resources are weaker than for math scores. Although teacher turnover remains statistically significant, class size does not. Teacher salary is statistically significant for grades 3-5 at about the same magnitude as for math scores. General ed expenditures is significant for both grade levels, but again the effects are small. An increase of $1000 in per capita spending for general education corresponds to an ELA increase of less than two-tenths of a point for grades 3-5 and about one-tenth of a point for grades 6-8.

Table A5 Longitudinal Regressions for ELA Scores, excluding expenditures

	ELEMENTARY GRADES 3-5			MIDDLE SCHOOL GRADES 6-8		
	Coefficient	Robust SE	p	Coefficient	Robust SE	p
Prior year ELA	**0.420**	**0.003**	**0.000**	**0.367**	**0.004**	**0.000**
Large District	**-6.916**	**0.648**	**0.000**	**-6.473**	**0.740**	**0.000**
High needs sub/urb	**-3.835**	**0.329**	**0.000**	**-4.227**	**0.395**	**0.000**
High needs rural	**-3.875**	**0.330**	**0.000**	**-3.763**	**0.317**	**0.000**
Average Needs	**-1.766**	**0.241**	**0.000**	**-1.974**	**0.251**	**0.000**
Free/Reduced Lunch	**-5.026**	**0.095**	**0.000**	**-4.165**	**0.098**	**0.000**
Black	**-3.279**	**0.170**	**0.000**	**-3.329**	**0.164**	**0.000**
Hispanic	**-1.034**	**0.137**	**0.000**	**-1.643**	**0.141**	**0.000**
Asian	**3.446**	**0.185**	**0.000**	**2.246**	**0.185**	**0.000**
Limited English	**-7.915**	**0.302**	**0.000**	**-9.206**	**0.309**	**0.000**
Special Ed	**-15.295**	**0.165**	**0.000**	**-13.221**	**0.126**	**0.000**
1+ Uncert. Teacher	0.338	0.437	0.439	0.174	0.434	0.689
% < 3 yrs experience	-0.002	0.020	0.918	0.009	0.026	0.747
% with MA degree	**-0.017**	**0.006**	**0.002**	-0.002	0.006	0.760
% Out of Field	0.072	0.072	0.321	0.016	0.057	0.776
% Teacher turnover	**-0.036**	**0.010**	**0.000**	**-0.058**	**0.011**	**0.000**
Avg class size	-0.065	0.035	0.066	-0.029	0.024	0.239
Teacher salary	**0.000041**	**0.000**	**0.000**	0.000008	0.000	0.357
Sqrt of Enrollment	**0.009**	**0.002**	**0.000**	**0.008**	**0.002**	**0.001**
Downstate	**1.685**	**0.409**	**0.000**	0.372	0.411	0.365
Grade by year						
3 or 6, 2012	0.040	1.038	0.969	**2.080**	**0.114**	**0.000**
4 or 7, 2011	1.296	0.799	0.105	**3.697**	**0.150**	**0.000**
4 or 7, 2012	**6.244**	**0.807**	**0.000**	**5.735**	**0.156**	**0.000**
5 or 8, 2011	**-6.554**	**0.787**	**0.000**	**-5.596**	**0.153**	**0.000**
5 or 8, 2012	**-3.071**	**0.792**	**0.000**	**-1.182**	**0.159**	**0.000**
Constant	396	2.201	0.000	423	2.755	0.000
R-squared	0.508			0.526		

N = 461350, SE adjusted for 1675 schools N = 638035, SE adj. for 802 schools

Characteristics in bold sig. at p<.05; shaded entries significant at p<.05 but wrong direction

Table A6 Longitudinal Regressions for ELA Scores, including expenditures [a]

	ELEMENTARY GRADES 3-5			MIDDLE SCHOOL GRADES 6-8		
	Coefficient	Robust SE	p	Coefficient	Robust SE	p
Prior year ELA	**0.420**	**0.003**	**0.000**	**0.362**	**0.004**	**0.000**
Large District	**-7.500**	**0.645**	**0.000**	**-6.200**	**0.624**	**0.000**
High needs sub/urb	**-4.093**	**0.326**	**0.000**	**-4.033**	**0.351**	**0.000**
High needs rural	**-4.222**	**0.313**	**0.000**	**-3.767**	**0.276**	**0.000**
Average Needs	**-1.967**	**0.243**	**0.000**	**-1.949**	**0.232**	**0.000**
Free/Reduced Lunch	**-5.023**	**0.095**	**0.000**	**-4.139**	**0.091**	**0.000**
Black	**-3.172**	**0.169**	**0.000**	**-3.196**	**0.148**	**0.000**

Hispanic	**-0.934**	**0.137**	**0.000**	**-1.664**	**0.132**	**0.000**
Asian	**3.487**	**0.185**	**0.000**	**2.125**	**0.169**	**0.000**
Limited English	**-7.831**	**0.298**	**0.000**	**-8.968**	**0.272**	**0.000**
Special Ed	**-15.166**	**0.164**	**0.000**	**-13.008**	**0.115**	**0.000**
1+ Uncert. Teacher	0.398	0.420	0.343	0.323	0.411	0.432
% < 3 yrs experience	-0.010	0.020	0.612	0.008	0.023	0.725
% with MA degree	-0.015	0.006	0.008	-0.001	0.005	0.923
% Out of Field	0.047	0.069	0.503	0.013	0.054	0.809
% Teacher turnover	**-0.039**	**0.010**	**0.000**	**-0.058**	**0.009**	**0.000**
Per pupil $, total	0.000031	0.0000256	0.223	0.00002	0.0000213	0.277
From separate regression:						
Per pupil $, gen ed	**0.0001673**	**0.0000462**	**0**	**0.00009**	**0.0000387**	**0.018**
Sqrt of Enrollment	**0.010**	**0.002**	**0.000**	**0.007**	**0.002**	**0.002**
Downstate	**2.705**	**0.365**	**0.000**	**0.489**	**0.342**	**0.153**
Grade by year						
3 or 6, 2012	0.088	1.034	0.932	**1.972**	**0.096**	**0.000**
4 or 7, 2011	1.342	0.795	0.092	**3.456**	**0.132**	**0.000**
4 or 7, 2012	**6.336**	**0.804**	**0.000**	**5.429**	**0.143**	**0.000**
5 or 8, 2011	**-6.597**	**0.784**	**0.000**	**-5.838**	**0.141**	**0.000**
5 or 8, 2012	**-3.009**	**0.788**	**0.000**	**-1.460**	**0.149**	**0.000**
Constant	396	2.037	0.000	427	2.506	0.000
R-squared	0.509			0.525		

N = 471598, SE adj. for 1717 school N = 722595, SE adj. for 1267 schools

Characteristics in bold sig. at p<.05; shaded entries significant at p<.05 but wrong direction

a All coefficients except Per Pupil $, gen ed are from the regression with Per Pupil $, total

Explaining Plaintiff Test Scores

There is a sizeable gap between plaintiffs' test scores and those for the state as a whole., particularly for math. For example, the state average scale score for math is 690 in grades 3-5 (Table A1), compared to the plaintiff average of 678 shown in Table A7, for a difference of 12 points. The gap is 17 points for grades 6-8.

The question is how much of these gaps is explained by socioeconomic and demographic differences alone. Special regressions were run using just the socioeconomic and demographic characteristics shown in tables A1 and A2. Predicted scores were calculated for all districts using just the variables in those regressions, and then actual and predicted scores were calculated for plaintiffs. The regressions results are shown in Tables A8 and A9; actual and predicted scores are summarized in Table A7.

Plaintiffs' actual math scores in grades 3-5 are only six-tenths of a point less than scores predicted using socioeconomic and demographic factors only, and they are about 3 points less for grades 6-8 (statewide scores are 683). Plaintiffs' predicted ELA scores in grades 3-5 are identical to their actual scores, and in grades 6-8 the actual and predicted scores differ by less than a half point. With the exception of middle school math scores, where about 80 percent of the gap is explained, virtually all of the other three gaps are explained by socioeconomic and demographic factors.

Table A7 Actual and Predicted Test Scores for Plaintiff Districts [a]

	ELEMENTARY GRADES 3-5			MIDDLE SCHOOL GRADES 6-8		
	N	Mean	SD	N	Mean	SD
Actual Math Scores	12408	677.9	29.2	11959	666.4	32.2
Predicted Math Scores	12408	678.5	14.4	11959	669.1	16.2
Actual ELA Scores	12288	661.9	24.1	11832	655.8	18.4
Predicted ELA Scores	12408	661.9	13.7	11959	655.4	11.8

a Predicted using only SES & demographic characteristics

Table A8 Regression for Predicting Plaintiff Math Scores

	ELEMENTARY GRADES 3-5			MIDDLE SCHOOL GRADES 6-8		
	Coefficient	Robust SE	p	Coefficient	Robust SE	p
Large District	-17.981	1.238	0.000	-24.391	1.779	0.000
High needs sub/urb	-7.529	0.665	0.000	-12.764	0.952	0.000
High needs rural	-8.771	0.581	0.000	-11.465	0.787	0.000
Average Needs	-4.561	0.437	0.000	-6.159	0.637	0.000
Free/Reduced Lunch	-10.348	0.163	0.000	-10.319	0.215	0.000
Black	-10.302	0.298	0.000	-10.976	0.413	0.000
Hispanic	-3.585	0.270	0.000	-5.168	0.358	0.000
Asian	9.721	0.420	0.000	11.602	0.575	0.000
Limited English	-17.615	0.516	0.000	-22.785	0.812	0.000
Special Ed	-27.694	0.244	0.000	-31.037	0.258	0.000
Sqrt of Enrollment	0.025	0.004	0.000	0.028	0.006	0.000
Downstate	4.566	0.405	0.000	2.465	0.592	0.000
Grade by year						
3 or 6, 2011	-6.318	0.171	0.000	1.477	0.209	0.000
3 or 6, 2012	-5.190	0.182	0.000	1.667	0.270	0.000
4 or 7, 2010	-5.658	0.242	0.000	-3.227	0.318	0.000
4 or 7, 2011	-4.690	0.228	0.000	-1.779	0.276	0.000
4 or 7, 2012	-3.007	0.252	0.000	-1.955	0.307	0.000
5 or 8, 2010	-8.133	0.254	0.000	-3.718	0.327	0.000
5 or 8, 2011	-7.231	0.256	0.000	-3.925	0.326	0.000
5 or 8, 2012	-5.993	0.305	0.000	-2.018	0.306	0.000
Constant	704	0.573	0.000	696	0.833	0.000
R-squared	0.274			0.3307		

N = 1104078, SE adjusted for 1797 schools — N = 1139135, SE adjusted for 1291 schools

Table A9 Regression for Predicting Plaintiff ELA Scores

	ELEMENTARY GRADES 3-5			MIDDLE SCHOOL GRADES 6-8		
	Coefficient	Robust SE	p	Coefficient	Robust SE	p
Large District	-10.867	0.911	0.000	-10.567	1.000	0.000
High needs sub/urb	-5.792	0.472	0.000	-7.580	0.524	0.000
High needs rural	-6.646	0.431	0.000	-7.415	0.436	0.000
Average Needs	-3.298	0.322	0.000	-4.163	0.376	0.000
Free/Reduced Lunch	-8.952	0.125	0.000	-7.773	0.147	0.000
Black	-6.788	0.221	0.000	-5.796	0.221	0.000
Hispanic	-2.297	0.192	0.000	-3.132	0.212	0.000
Asian	4.887	0.300	0.000	4.865	0.351	0.000
Limited English	-17.172	0.398	0.000	-19.716	0.544	0.000
Special Ed	-26.439	0.188	0.000	-22.198	0.150	0.000
Sqrt of Enrollment	0.008	0.003	0.008	0.005	0.003	0.152
Downstate	3.520	0.291	0.000	1.445	0.348	0.000
Grade by year						
3 or 6, 2011	-5.089	0.161	0.000	-2.754	0.160	0.000
3 or 6, 2012	-4.505	0.168	0.000	-2.692	0.174	0.000
4 or 7, 2010	5.955	0.196	0.000	3.365	0.224	0.000
4 or 7, 2011	3.371	0.189	0.000	-1.782	0.183	0.000
4 or 7, 2012	6.281	0.222	0.000	-0.736	0.198	0.000
5 or 8, 2010	3.339	0.217	0.000	-4.551	0.237	0.000
5 or 8, 2011	-1.949	0.194	0.000	-9.875	0.199	0.000

5 or 8, 2012	0.564	0.181	0.002	-7.338	0.192	0.000
Constant	680	0.440	0.000	678	0.468	0.000
R-squared	0.275			0.273		

N = 1096478, , SE adjusted for 1797 schools

N = 1130480, SE adjusted for 1290 schools

APPENDIX B MULTIPLE REGRESSIONS FOR HIGH SCHOOL ANALYSES

Table B1 has basic statistics for the variables in the high school graduation and dropout rate analyses. Five year outcomes were chosen for the main dependent variables in the regression analyses, because they allow students and schools an additional year to graduate or to determine dropout status. They are about a point and a half higher than the four year rates. Sensitivity analyses were run for four year outcomes, and there were no major differences. Graduation and dropout rates for general education students were used instead of all students, because special ed students had lower graduation and higher dropout rates than regular students.

All other variables in the table were used as independent variables in the regression analyses except percent with Masters and size of 10th grade math class. Because the distribution of percent with MA was skewed, the log was used in the regression analyses. Average 10th grade English class size was chosen instead of 10th grade math due to fewer missing observations. The statistics in this table and in all regressions are weighted by the size (enrollment) of the cohort used for calculating the graduation and dropout rates.

Table B1 Descriptive Statistics for High School Outcome Analyses, 2012 (Weighted)

Variable	N	Weight	Mean	SD	Min	Max
% 5 yr Grads, gen ed	657	118117	90.3	10.13	0	100
% 5 yr Dropouts, gen ed	657	118117	6.9	7.90	0	100
% 4 yr Grads, gen ed	649	117696	88.8	11.96	0	100
% 4 yr Dropouts, gen ed	649	117696	5.4	6.87	0	60
Average 8th Grade Math	725	120435	680.8	13.2	647	710
Large City District	727	120443	0.06	0.24	0	1
High needs sub/urb	727	120443	0.11	0.32	0	1
High needs rural	727	120443	0.10	0.29	0	1
Average Needs	727	120443	0.49	0.50	0	1
Low Needs	727	120443	0.24	0.43	0	1
% Free/Reduced Lunch	726	120436	30.7	20.97	0	93
% Black Students	726	120436	11.3	17.04	0	88
% Hispanic Students	726	120436	11.1	14.05	0	72
% Asian Students	726	120436	4.3	5.98	0	52
% Limited English	726	120436	2.3	4.76	0	58
1+ Uncert. Teacher	725	120423	0.08	0.27	0	1
% < 3 yrs experience	725	120423	2.83	2.64	0	20
% with MA degree	725	120423	36.6	24.57	0	98
Log of % MA degree	725	120423	3.31	0.85	0	4.6
% Out of Field	725	120423	0.46	1.08	0	10
% Teacher turnover	725	120423	11.5	6.34	0	40
Gr 10 Eng class size	685	118438	22.3	3.28	4	38
Gr 10 Math class size	608	110294	21.0	4.23	4	38
Teacher Salary	726	120375	$75,660	$21,539	$38,059	$131,239
Per pupil $, Total	727	120443	$20,368	$3,972	$12,772	$58,199
Per pupil $, Gen Ed[a]	727	120443	$11,219	$2,362	$7,298	$38,233
Log of Enrollment	726	120436	7.0	0.6	3.3	8.2
Downstate (vs. Upstate)	727	120443	0.38	0.49	0	1

Graduation Rate Analysis

Table B2 shows the results for the first regression model for 5 year graduation rates, which includes teacher salary and class size but excludes per pupil expenditures. Because operational expenditures are largely determined by teacher salaries and class sizes, expenditures cannot be included in the same model due to multicollinearity. Expenditure effects are estimated in a separate model (see Table B3). The regression includes two years of data, 2011 and 2012, and so there is a dummy variable for year which has a very small effect that is not significant. A very high proportion of the variation in graduation rates, 77 percent, is explained by these variables.

Table B2 Regression Results for 5 yr Graduation Rate excluding Expenditures

Characteristic	Coefficient	Robust SE	p	Beta
Average 8th Grade Math	**0.146**	**0.029**	**0.000**	**0.192**
Large city district (vs low)	**-6.579**	**2.733**	**0.016**	**-0.151**
High needs sub/urb "	-2.651	1.508	0.079	-0.083
High needs rural "	-0.780	1.159	0.501	-0.021
Average Needs "	0.301	0.600	0.616	0.015
% Free/Reduced Lunch	**-0.166**	**0.029**	**0.000**	**-0.337**
% Black Students	-0.054	0.031	0.081	-0.091
% Hispanic Students	**0.111**	**0.032**	**0.001**	**0.153**
% Asian Students	0.037	0.037	0.320	0.021
% Limited English	**-0.572**	**0.115**	**0.000**	**-0.271**
1+ Uncert. Teacher	0.987	1.024	0.335	0.026
% < 3 yrs experience	-0.016	0.066	0.804	-0.004
Log of % MA degree	-0.056	0.345	0.872	-0.005
% Out of Field	-0.362	0.268	0.177	-0.044
% Teacher turnover	**-0.092**	**0.047**	**0.050**	**-0.053**
Teacher Salary	-0.00005	0.00002	0.014	-0.106
Gr 10 Eng class size	-0.030	0.069	0.668	-0.009
Log of Enrollment	**-1.265**	**0.476**	**0.008**	**-0.069**
Downstate (vs. Upstate)	**4.377**	**0.908**	**0.000**	**0.209**
Year				
2012	**0.705**	**0.205**	**0.001**	**0.035**
Constant	9.407	19.825	0.635	.
R-squared	0.775			

(N=1219; SE adjusted for 663 schools)

Characteristics in bold sig. at p<.05; shaded entries sig. at p<.05 but wrong direction

Only one school or teacher characteristic, teacher turnover, is statistically significant in the expected direction, but the size of the effect is very small. The coefficient shows that a one point reduction in teacher turnover increases graduation rates by only 9 hundredths of a percentage point. Even a sizeable reduction of turnover rates (say, by one standard deviation or 6 points) would only raise graduation rates by just over one half of a percentage point (.58). Teacher salary has a small, statistically significant effect but it is in the wrong direction (a small negative effect).

In terms of student characteristics, average 8th grade math is highly significant (p<.001), and the student socioeconomic (SES) factors of % free/reduced lunch, % Hispanic, and & LEP are also statistically significant at p<.05. The two strongest student SES characteristics are LEP status and free/reduced lunch. For every 10 percentage point increase in a high school's free/reduced lunch rate, the graduation rate decreases by more than one and a half percentage points.

Interestingly, after controlling for other SES characteristics, the percentage black does not have a statistically significant effect on graduation rates. The only district SES characteristic to have a statistically significant effect is large city district, and the effect is to reduce graduation rates by 6.7 percentage points.

The standardized effects (betas) for the significant socioeconomic characteristics are .15 or higher (in absolute value), with % free/reduced lunch, % LEP, and 8th grade math being strongest at -.34, -.27, and .19, respectively. All school characteristics have very weak standardized effects, and teacher turnover is only .05

Regression results for the model containing total per capita expenditures are in Table B3. Total per capita expenditures does not have a statistically significant effect on graduation rates, nor does instructional expenditures for gen ed students (shown in note a).

The student test scores and socioeconomic variables have coefficients similar to the results shown in Table B2, which is expected. In this model, however, the % of black students is now significant, although the effect is weaker than the other SES characteristics. The most likely reason for % black being statistically significant is that this model is based on 23 additional schools (686 vs. 663) because of missing data in the class size variable, which is not included in this regression (see Table B1)

Table B3 Regression Results for 5 yr Graduation Rate including Expenditures
(N=1300; SE adjusted for 686 schools)

Characteristic	Coefficient	Robust SE	p	Beta
Average 8th Grade Math	**0.138**	**0.029**	**0.000**	**0.178**
Large city district	**-6.714**	**2.754**	**0.015**	**-0.153**
High needs sub/urb	-2.803	1.498	0.062	-0.085
High needs rural	-0.742	1.125	0.510	-0.020
Average Needs	0.280	0.596	0.639	0.013
% Free/Reduced Lunch	**-0.150**	**0.029**	**0.000**	**-0.300**
% Black Students	**-0.066**	**0.030**	**0.030**	**-0.111**
% Hispanic Students	**0.101**	**0.030**	**0.001**	**0.135**
% Asian Students	0.031	0.037	0.392	0.018
% Limited English	**-0.585**	**0.107**	**0.000**	**-0.276**
1+ Uncert. Teacher	0.962	1.004	0.338	0.025
% < 3 yrs experience	-0.011	0.067	0.867	-0.003
Log of % MA degree	-0.183	0.334	0.583	-0.015
% Out of Field	-0.325	0.250	0.194	-0.039
% Teacher turnover	**-0.103**	**0.045**	**0.023**	**-0.061**
Per pupil $, Total[a]	-0.00006	0.00006	0.350	-0.021
Log of Enrollment	**-1.475**	**0.458**	**0.001**	**-0.082**
Downstate (vs. Upstate)	**3.308**	**0.801**	**0.000**	**0.154**
Year				
2012	**0.560**	**0.204**	**0.006**	**0.027**
Constant	14.172	19.724	0.473	
R-squared	0.766			

Characteristics in bold sig. at p<.05
a For Gen Ed $, coefficient= -.0002, p=.05, not significant (p=.13)

Dropout Rate Analysis

Table B4 contain regression results for 5 year dropout rates, excluding expenditures. The pattern of results is very similar to that for graduation rates. The effect of teacher turnover is about the same as for graduation rates. A one point reduction in teacher turnover is associated with a reduction of .08 percentage points in the dropout rate. As in the case of graduation rates, there is also a small significant effect for teacher salary but in the wrong direction.

Average 8th grade math scores and many socioeconomic factors have strong and statistically significant effects on dropout rates (p<.05). The largest effects are for percent free/reduced lunch, percent limited English, and percent Hispanic, with standardized effects of -.38, -.25, and -.20, respectively. An increase of 10 percentage points in free/reduced lunch rate increases the dropout rate by nearly one and one half points. It is interesting that, as for graduation rates, % black does not have a statistically significant effect after controlling for free/reduced lunch and the other SES factors.

Table B4 Regression Results for 5 yr Dropout Rate excluding Expenditures

Characteristic	Coefficient	Robust SE	p	Beta
Average 8th Grade Math	**-0.102**	**0.026**	**0.000**	**-0.171**
Large city district	**5.578**	**2.271**	**0.014**	**0.164**
High needs sub/urb	1.316	1.217	0.280	0.053
High needs rural	0.528	0.989	0.594	0.018
Average Needs	-0.569	0.510	0.265	-0.036
% Free/Reduced Lunch	**0.145**	**0.025**	**0.000**	**0.376**
% Black Students	0.032	0.027	0.234	0.070
% Hispanic Students	**-0.114**	**0.030**	**0.000**	**-0.200**
% Asian Students	-0.019	0.029	0.521	-0.014
% Limited English	**0.418**	**0.108**	**0.000**	**0.252**
1+ Uncert. Teacher	-0.282	0.929	0.761	-0.009
% < 3 yrs experience	0.097	0.056	0.086	0.034
Log of % MA degree	0.041	0.343	0.905	0.004
% Out of Field	0.301	0.247	0.223	0.046
% Teacher turnover	**0.077**	**0.035**	**0.029**	**0.057**
Teacher Salary	**0.00007**	**0.00002**	**0.001**	**0.179**
Gr 10 Eng class size	0.065	0.068	0.337	0.026
Log of Enrollment	**0.862**	**0.403**	**0.033**	**0.060**
Downstate (vs. Upstate)	**-4.227**	**0.933**	**0.000**	**-0.258**
Year				
2012	-0.509	0.189	0.007	-0.032
Constant	59.428	17.614	0.001	.
R-squared	0.730			

(N=1219; SE adjusted for 663 schools)

Characteristics in bold sig. at p<.05; shaded entries sig. at p<.05 but wrong direction

Table B5 shows results for dropout rates with expenditures included. As for graduation rates, neither total nor general ed expenditures have statistically significant impacts on dropout rates. Like the other models, teacher turnover has a small but statistically significant effect; the magnitude is about the same. A 6 percentage point reduction in teacher turnover rate (a very large change considering the mean is only 10 percent) would reduce the dropout rate by just over one-half of a percentage point.

The SES characteristics have similar effects, with % free/reduced lunch having the strongest effect. In this case, despite the slightly larger number of high schools in the analysis, the % black is still not statistically significant.

Table B5 Regression Results for 5 yr Dropout Rate including Expenditures

Characteristic	Coefficient	Robust SE	p	Beta
Average 8th Grade Math	**-0.095**	**0.027**	**0.000**	**-0.155**
Large city district	**5.563**	**2.345**	**0.018**	**0.160**
High needs sub/urb	1.288	1.234	0.297	0.050
High needs rural	0.407	0.979	0.678	0.014
Average Needs	-0.612	0.512	0.233	-0.037

% Free/Reduced Lunch	**0.127**	**0.026**	**0.000**	**0.321**
% Black Students	0.048	0.027	0.081	0.102
% Hispanic Students	**-0.102**	**0.029**	**0.000**	**-0.173**
% Asian Students	-0.009	0.029	0.749	-0.007
% Limited English	**0.437**	**0.102**	**0.000**	**0.261**
1+ Uncert. Teacher	-0.288	0.915	0.753	-0.009
% < 3 yrs experience	0.076	0.059	0.194	0.027
Log of % MA degree	0.221	0.334	0.509	0.022
% Out of Field	0.248	0.229	0.279	0.038
% Teacher turnover	**0.089**	**0.035**	**0.012**	**0.067**
Per pupil $, Total[a]	0.00004	0.00006	0.478	0.019
Log of Enrollment	**1.171**	**0.389**	**0.003**	**0.082**
Downstate (vs. Upstate)	**-2.618**	**0.783**	**0.001**	**-0.155**
Year				
2012	-0.335	0.182	0.066	-0.020
Constant	57.026	17.826	0.001	
R-squared	0.716			

(N=1300; SE adjusted for 686 schools)
Characteristics in bold sig. at p<.05
a For Gen Ed $, coefficient=.00014, not significant (p=.22)

Explaining Plaintiffs' Graduation and Dropout Rates

State-wide graduation rates are 90.3 percent and dropout rates are 6.9 percent, as shown in Table B1. These are considerably higher/lower than the averages for plaintiffs districts, which are 78.1 and 16.1 percent, respectively, as shown in Table B6. Given that the available school resource measures have very small effects which are not statistically significant (with the sole exception of teacher turnover), the question becomes whether these differences might be explained by unmeasured school resources or by socioeconomic differences. It turns out that nearly all of the large differences between plaintiff and statewide rates can be explained by the SES, math scores, and demographic characteristics of plaintiff districts.

To demonstrate this, special regressions were run for both graduation and dropout rates using only these characteristics; all New York high schools (excepting NYC) are used for these regressions.[13] Predicted scores were then calculated for the plaintiff districts as a group using the coefficients generated by these regressions, also shown in Table B6. The regression coefficients are displayed in Tables B7 and B8. Most factors are statistically significant for graduation rates except for high needs sub/urb, rural, and average needs districts (vs. low) and percent Asian students.

The predicted graduation rate is 78.5, just four-tenths of point higher than the actual rate. The predicted dropout rate is 15.4, seven-tenths of a point lower than the actual rate. This demonstrates that the large difference between plaintiffs and state averages for graduation and dropout rates is due to socioeconomic and demographic factors, and that school funding and other school resources, measured or unmeasured, do not play an important role.

[13] The regressions and the statistics are weighted by size of the high school cohort used to calculate graduation and dropout rates.

Table B6 Actual and Predicted Graduation & Dropout Rates for Plaintiff High Schools

	N	Mean	SD	Min	Max
Actual 5 yr Grad Rate	10	78.1	8.4	41.2	94.5
Predicted 5 yr Grad Rate	10	78.5	5.9	68.8	86.6
Actual 5 yr Dropout Rate	10	16.1	5.6	4.9	27.5
Predicted 5 yr Dropout Rate	10	15.4	4.5	9.7	23.1

Table B7 Grad Rate Regressions on SES, Test Scores, and Demographics

Characteristic	Coefficient	Robust SE	p
Average 8th Grade Math	0.141	0.030	0.000
Large city district	-7.599	2.670	0.005
High needs sub/urb	-2.616	1.505	0.083
High needs rural	-0.642	1.152	0.578
Average Needs	0.377	0.604	0.532
% Free/Reduced Lunch	-0.154	0.030	0.000
% Black Students	-0.071	0.031	0.023
% Hispanic Students	0.103	0.031	0.001
% Asian Students	0.032	0.039	0.405
% Limited English	-0.610	0.110	0.000
Log of Enrollment	-1.105	0.428	0.010
Downstate (vs. Upstate)	2.782	0.601	0.000
Year			
2012	0.656	0.197	0.001
Constant	6.631	20.538	0.747
R-squared	0.762		

(N=1301; SE adjusted for 687 schools)

Table B8 Dropout Rate Regressions on SES, Test Scores, and Demographics

Characteristic	Coefficient	Robust SE	p
Average 8th Grade Math	-0.098	0.027	0.000
Large city district	6.223	2.339	0.008
High needs sub/urb	1.016	1.242	0.414
High needs rural	0.234	1.012	0.817
Average Needs	-0.783	0.525	0.136
% Free/Reduced Lunch	0.131	0.026	0.000
% Black Students	0.053	0.028	0.059
% Hispanic Students	-0.104	0.030	0.000
% Asian Students	-0.007	0.030	0.812
% Limited English	0.458	0.104	0.000
Log of Enrollment	0.859	0.373	0.021
Downstate (vs. Upstate)	-2.200	0.539	0.000
Year			
2012	-0.480	0.174	0.006
Constant	64.348	18.616	0.001
R-squared	0.711		

(N=1301; SE adjusted for 687 schools)