Educational Evaluation and Policy Analysis
Spring 2000, Vol. 22, No. 1, pp. 27–39

High School Size: Effects on Budgets and Performance in New York City

Leanna Stiefel **Robert Berne** **Patrice Iatarola** **Norm Fruchter**
New York University

Given the large numbers of competing proposals for improving urban schools so that students perform better, policymakers need to know budget as well as performance implications of proposed reforms. One reform group with a large constituency suggests that high schools should enroll small numbers of students, but some policymakers worry that the costs of small schools are excessive. This paper contributes to the school size policy debate by using methods and data that combine budget and performance information, with the school as the unit of analysis. With data on budgets, graduates, and characteristics of students in New York City public high schools, we estimate 4-year budgets per graduate. We find that small academic and large high schools are similar in terms of budgets per graduate and that some vocational and "transfer" high schools have the highest budgets per graduate. Because the literature on school size indicates that small high schools are more effective for minority and poor students, the similarity in outcomes that small and large high schools produce suggests that policymakers might do well to support the creation of more small high schools.

Across the country, school reformers, parent groups, community organizations, business enterprises, and professionals are joining together to create new schools to meet children's learning needs. Practice and research repeatedly show that there is no single formula or recipe for creating effective schools. Yet, if there is a common theme running through many current *high school* reform strategies, it is that the large, factory model of schooling is not effective for teaching and learning, especially for disadvantaged students. A small student body is often identified by reformers, parents, and researchers as the key ingredient in the mix of factors necessary to create effective learning environments for high school students.

In order to choose among the large numbers of competing proposals to improve urban schools to increase student performance, policymakers need to know the budget as well as the performance implications of proposed reforms. This paper reports the results of a study that assessed the effect of school size on budgets and performance in New York City public high schools. The paper is unique in a number of important ways. It uses *school-level* budget data for New York City high schools, data that are just becoming available in a limited number of large districts.[1] It also measures high school performance using number of graduates, an indicator that represents one of several important "bottom-line" concerns for high school performance. Finally, it presents estimates of the impact of school size on both budget per student and budget per graduate, thus addressing traditional questions about costs versus size and newer questions about performance versus size while incorporating costs. The study is relevant not only to the national research and policy communities but more specifically to New York City school decision makers who are wrestling with the question of what size New York City high schools should be. The paper is divided into five sections: a discussion of policy initiatives on school size in New York and other large cities, a summary of the literature on school size, a description of data and methods used in the study, results, and conclusions.

Policy Initiatives on School Size

The first wave of new small school creation in New York City began in the late 1960s through the development of alternative high schools. Some of these new small schools were initiated outside the aegis of the Board of Education; others were started as experimental schools within the city system. These schools were labeled alternative because they were committed to serving students whom traditional schools, particularly high schools, had not served well and because they stressed nontraditional and often experimental methods of school and classroom organization, curriculum, and instruction to engage and educate students successfully. Eventually, those schools that survived the ensuing decades were integrated into the city system; by the early 1990s, some two dozen of them formed the core of the New York City Board of Education's Alternative High School Superintendency.

Many observers have cited the success of these alternative schools with students who had dropped out of or done poorly in traditional high schools. But a series of reports by the Public Education Association of New York in the early 1980s provided evidence, based on student outcomes, of these alternative schools' effectiveness with their second-chance students and pointed to the structural causes of success: smaller school and class size, teachers as advisors, curriculum and instruction tailored to student need, and strong student supports (e.g., see Foley & McConnaughly, 1982). Partly as a response to these studies, and partly as an attempt to meet the growing need for more diversified high school environments, a group of school reformers developed and funded a series of new small school interventions and secured the support of then Chancellor Joseph Fernandez and his administration. Two of these initiatives, the New Visions effort and the Coalition Campus project, together created some 40 new small schools, predominantly at the secondary school level, and launched the small school movement in New York City.

The New Visions project, initiated by New York City's public education foundation, sent out, in the early 1990s, requests for proposals to invited educators, advocates, activists, universities, hospitals, trade unions, museums, arts groups, and community organizations to submit designs for new small schools they wanted to create. Almost 400 organizations responded with proposals, some 30 groups survived the rigorous winnowing down process to become finalists, and 16 groups were selected and funded to start their own public schools, in collaboration with the Fernandez administration. Again, all of the schools stressed small size and scale, personalized supportive environments, theme-based curriculum and instruction tailored to student need, and significant student supports. By the mid-1990s, most of the 16 schools were operating, and in subsequent years New Visions has started another 15 schools.

The Coalition Campus schools, a very different model of school creation, were initiated by the Center for Collaborative Education (CCE), the New York City affiliate of the Coalition of Essential Schools. CCE's goal was to generate new, small schools to replace large, failing high schools. In collaboration with the Board of Education, CCE generated 10 new, small schools to serve students originally zoned for 2 large, failing high schools, 1 in Manhattan and 1 in the Bronx. From 1994–1998, the Board of Education phased out the 2 failing high schools, grade by grade, while CCE developed the 10 new schools, grade by grade, primarily in leased sites in the 2 failing schools' attendance areas. All of the new schools stressed small size and scale, personalized environments, instruction tailored to student need, and performance assessments.

In the mid-1990s, New Visions and CCE joined forces with two other reform groups to initiate the Annenberg Challenge project in New York City; one of the project's core principles stresses small, personal learning environments. The New York City Annenberg project started with 80 schools (most of them new, small secondary schools) and 25,000 students in 1995; by 1999, the project had grown to 140 schools and 50,000 students and was effectively promoting the initiation of new, small schools throughout the city. These and other efforts have made the New York City school system the epicenter for new small school creation, as well as a virtual laboratory in which the effectiveness of small school size can be assessed.

Similar efforts at new school creation are under way in other big city systems. Starting in the early 1990s, Philadelphia spurred the creation of what it called charters, actually small high school programs stressing theme-based curriculum and collaborative instruction, individualized teaching, and intensive student support. Some of the original charters have become small high schools, and Superintendent David Hornbeck subsequently encouraged all Philadelphia schools, and particularly high schools, to organize themselves into small learning communities. The Chicago school system has also developed several new small high schools, in part through the activities of the Small School Workshop at the University of Illinois and the Small Schools Coalition of Business and Professional People for the Public Interest.

All of these efforts, particularly the large scale of small school creation in New York City, have focused renewed interest on the issues of the efficacy and efficiency of small schools that this paper examines. While many of the New York City small high schools are still so new that they have not reached their full grade configuration and therefore could not be included in this study, there are now an adequate number of "maturing" small high schools. These fully developed new schools, combined with the small high schools created by previous reform efforts, provide an appropriate group with which to study the key issues of cost and performance.

Literature on School Size

The literature on school size, where size is measured by number of students, may be divided into those studies that focus on the outputs of schooling and those that focus on its costs.[2] There is theoretical work on the relationship of output to size as well as on the relationship of costs to size; there is also considerable empirical work on both topics.

Some have theorized that schools of approximately 1,500 students or more result in inferior *outputs*, where outputs are defined in many different ways, including test scores, attendance rates, graduation or dropout rates, and participation in extracurricular activities. In addition, many analysts postulate that small schools are particularly successful in educating minority and poor youth. The theoretical literature posits a variety of reasons why schools of small size might promote better student performance. Some of the reasons focus on the social aspects of the school as an intervening variable between small size and student performance. For example, the literature discusses an increased sense of student belonging, because teachers know students, as well as less violence, because everyone, students and staff, knows each other well.

The literature also posits high expectations for academic work because, in small schools, teachers and staff are able to nurture intellectual and other needs and can generate and support student-centered and inquiry-based learning and create more opportunities to participate in, and even lead, extracurricular activities. The literature also emphasizes more effective teacher self-assessment, greater accountability and interaction among teachers, and higher parent involvement. While a small school might "avoid" all of these attributes, the literature hypothesizes that avoidance will be rare and that large size will prevent the creation of most of these social aspects (see Fowler & Walberg, 1991; Fowler, 1992; and Howley, 1989, for good literature reviews of these studies).

The notion that *costs* are related to the size of the student body is grounded in the theory of economies of scale, according to which increasing all inputs (capital, labor, materials, and students) proportionately may lead to lower per pupil costs in some cases, higher costs in other cases, and level costs in yet other cases. Lower per pupil costs (increasing returns or economies of scale) might occur for larger schools for a number of reasons having to do with how inputs (resources) are used rather than which outputs are produced. These reasons include the following: (a) Some types of physical plant might be used more effectively at larger sizes (e.g., more intense use of common spaces such as gyms and cafeterias); (b) some inputs (such as administrators) may be indivisible, and their costs might be spread over more pupils; and (c) some specialization and division of labor might occur, for example, when teachers offer courses only in subjects in which they are certified. Generally, there is widespread popular belief that at some size higher per pupil costs (decreasing returns or diseconomies of scale) will set in owing to limits in managerial ability in regard to running a large school (see Case & Fair, 1999, p. 219, for a discussion of sources of decreasing returns to scale in general).

Empirical work on the relationship between *size* and *outputs* supports the theories. Students in small schools have been shown to do better than those in large schools, as measured in a variety of ways (see Fowler & Walberg, 1991, and Fowler, 1992). One recent study (Lee & Smith, 1997) showed that when output is measured as achievement in reading and math, the optimal school size is between 600 and 900 or 1,200, depending on the subject and type of student. The authors found that both very small and very large schools have worse outcomes.

Empirical work on the relationship between *costs* and *size* yields less definitive results than that on outputs and size, although such studies have been conducted since the 1960s. In an early paper, Cohn

(1968) estimated a long-run cost curve, incorporating short-run operating costs and long-run capital costs. Cohn found that the cost curve for high schools is U shaped, the least cost size of a school being 1,500 students. Using only operating expenditures at the middle and elementary school levels, Riew (1986) found declining expenditures in middle schools with enrollments as large as 1,024; at the elementary school level, however, the lowest expenditures he found were in schools with 200–400 students enrolled. An earlier study of operating expenditures in high schools concluded that, beyond an enrollment of 900, the existence of economies of scale is unclear (Riew, 1966).

Cost studies do not agree about the relationship between size and average costs (Bee & Dolton, 1985; Callan & Santerre, 1990; Chabotar, 1989; Kumar, 1983; Watt, 1980). But none of the studies found a direct (positive) relationship between size and average costs for high schools with enrollments under 900. There is no evidence from the body of cost studies we examined that small schools cost less per pupil than those with enrollments of around 900.

There are several common deficiencies in the studies of the effect of size on school outputs or costs. First, outputs and costs have not always been considered simultaneously in both theoretical and empirical studies. As the preceding review indicates, the theoretical and empirical literature on outputs almost never includes costs, and the literature on costs often does not include outputs. Clearly, costs are determined by how well students do in a school (output), as well as how many students are enrolled; outputs are likely to be higher, ceteris paribus, when expenditures are higher.

Second, estimated cost functions are predicated on the assumption that schools minimize the cost of producing given outputs, which is a dubious assumption for schools in public school districts where there is little incentive to do so. Use of budget instead of cost data in the present study helps avoid the need for this strong assumption.

Third, the school is the appropriate unit of analysis to use in empirical work on school outputs and costs; however, in the cost literature, the district is often used, largely owing to lack of school-level data. Of course, there are districtwide central administrative costs, such as the superintendent's office or the budget office, that will be lower per pupil in districts with larger student bodies and lower per school in districts with more schools. Studies that use data from many school districts must figure out ways to handle these central overhead costs. In this study, we used one district where central costs have been allocated on a per pupil basis. This allocation method means that while the per pupil costs will be less than they would be in a smaller district, the overhead will not affect our work on budgets and size of schools within the district because each student "receives" identical overhead cost allocations. In summary, our work improves on previous work by focusing on schools in one district, including output variables, and being careful to consider the distinction between budgets and costs.

Data and Method

New York City has more than 1,000 school buildings and more than 1.1 million students. The number of students has been increasing throughout the 1990s, with 5,000 to 20,000 net new entrants each year. There were approximately 180 high school buildings in 1995–1996 (and more "programs") with just under 300,000 high school students.[3] Overall, approximately 50% of the city's high school students graduate in 4 years and 70% in 7 years (Board of Education of the City of New York, 1998). Among the many issues facing those involved with city high schools, how to increase graduation rates (and decrease dropout rates) at the same time the state is requiring higher graduation standards is of prime importance.[4] Whether smaller high schools would contribute to higher graduation rates, and at what cost, is a specific and critical issue for the system at this time. But such critical issues are not unique to New York City. While the city's system is very large (it exceeds 41 states in terms of expenditures and 38 states in terms of enrolled students),[5] the review of policy initiatives at the beginning of this paper makes clear that many of the nation's largest cities are grappling with similar issues of high school size and in similar urban contexts.

Data

We used data for 121 New York City high schools for the 1995–1996 school year. These data included school-based budgets, cohort graduates per high school, and high school report cards (Board of Education of the City of New York, 1996a, 1996b). Budget data were published for the first time in a comprehensive manner in November 1996 (for the 1995–1996 school year). The cohort graduation data were derived from analyses that the New York City Board of Education produces to track students for 4 years from the point they enter the ninth grade, accounting for dropouts, withdrawals, and transfers in and out of the system.[6] Report card data that include school-level performance indicators and characteristics of students are produced annually by the Board of Education.

Choosing the Sample

The budget database originally contained 201 entries, consisting of high school programs as well as full schools. We eliminated all 24 programs because they often do not serve all grades or they serve very specialized populations, such as students who go to night school. Of the remaining 177 observations, 35 did not include all grades between 9 and 12. Because most of these non-9–12 schools are new, it is not yet clear what their enrollment will be when they are fully operational in all grades. Therefore, they provide inappropriate data for this study. There are 142 high schools fully serving Grades 9–12. Three of the variables necessary for our statistical analyses were not available for 21 of these schools: a measure of test scores, a measure of poverty, and number of graduates. Thus, our analysis focuses on the 121 high schools for which these data were available. These schools enrolled 85% of the 288,379 high school students in 1995–1996.

Model of Budget per Pupil

We estimated equations with per pupil budget as the dependent variable using ordinary least squares regression (OLS).[7] The centerpiece of the empirical work is the following model: BUDPUP = *f*(SIZE, TYPE, POV, LEP, PTSE, RCT), where BUDPUP is budget per student, SIZE is the number of students in the school, TYPE is a dummy variable (taking on a value of 0 or 1) representing the mission of the school (e.g., vocational education school), POV is the percentage of students in poverty, LEP is the percentage of students with limited English proficiency, PTSE is the percentage of students who are receiving part-time special education services, and RCT is the percentage of students who pass a state math test. SIZE was our key variable of interest. We expect the coefficients on all of the other variables to be positive because they reflect the likely impact on costs, which we think will then be reflected in budgets. Table 1 defines in more detail all variables used in the analyses described here.

Model of Budget per Graduate

As described earlier, the Board of Education has an excellent measure of number of graduates based on pupils who enter into the ninth grade. Graduates are a very important measure of high school performance, although other measures such as the amount of student learning that occurs, college-going rates, employment rates, and subsequent earnings profiles of students are also important. In approximately 5 years, one measure of learning will become available for New York City high schools because all students will then be required to pass a series of high-level content examinations (Regents examinations) in order to graduate from high school. At present, our only reliable performance measure is 4-year graduation rate, which we think is a sufficiently important indicator to warrant the emphasis we place on it here.

As a second dependent variable, we used a 4-year budget per graduate for each school in order to cover the entire career of a typical high school student and to combine budgets and graduates. The idea behind the 4-year budget per graduate variable can be conveyed through a simplified example of "Fantasy High School" versus "Troubled High School." Suppose Fantasy High has an entering ninth-grade class of 10 students, all of whom remain at Fantasy for 4 years and then graduate. No student drops out or transfers out, and no new student transfers in. Also suppose that the budget per student is $5,000 each year. Each student then incurs $20,000 in budgets over the 4 years (4 years multiplied by $5,000), and the total class of 10 students has a 4-year budget of $200,000 (10 students multiplied by $20,000). Since all 10 students graduate, the budget per graduate is $20,000 ($200,000 divided by 10 graduates).

Now suppose Fantasy High becomes Troubled High. Again 10 students enter ninth grade, and again budgets are $5,000 per student per year. But now all 10 students stay through March of their senior year, and then 5 students drop out, leaving 5 to graduate. Our measure then "counts" budgets at the same $200,000 (once a student begins a grade, the budget money is counted), but the budget per graduate now doubles to $40,000 ($200,000 divided by 5 graduates).

Our budget per graduate measure is unforgiving in regard to dropouts, because it assumes no value for high school attendance unless graduation is achieved. While this assumption is not correct, it is

TABLE 1
Definitions of Key Variables Used in Analyses

Variable name	Definition of variable
Budget per student (BUDPUP)	Budget: 1995–1996 total general education plus part-time special education budget Students: number of 1995–1996 registered general education students (part-time special education students are a subset)
Budget per graduate (BUDGRD)	Budgets: 1995–1996 total budget per student multiplied by 4, adjusted Graduate: from cohort of the ninth graders, number who graduate from school in 4 years (transfers in attributed to last school attended; transfers out of New York City system removed from cohort)
Size of school (SIZE)	Number of 1995–1996 registered general education students
Small school	School with 0–600 students Either academic mission (academic articulated) or "last resort" mission (transfer alternative)
Medium-sized school	School with greater than 600–2,000 students, subdivided into greater than 600 to 1,200 and greater than 1,200 to 2,000 Either academic mission (academic) or vocational or "last resort" mission (vocational and transfer alternative)
Large school	School with greater than 2,000 students
Poverty (POV)	Percentage of students eligible for free lunch in 1994–1995
Limited English proficiency (LEP)	Percentage of students classified in New York City with limited English proficiency in 1995–1996
Part-time special education (PTSE)	Percentage of students who receive resource room or related services in 1995–1996
RCT math test (RCT)	Percentage of students who passed a Regents competency math test (may take test multiple times) in 1995–1996

also not totally unrealistic. Many students drop out early in high school, at which point the value of their learning is unclear. Many remain enrolled but participate little. We do not have a reliable, valid way to use our data to estimate value of dropouts, but we think the measure we use is defensible given the dearth of measures and studies that focus on outcomes.

The real world of American high schools is more complicated than that of Fantasy or Troubled High. Students transfer in and out of high schools and out of the New York City system; they drop out before 12th grade; budgets change from year to year. Our data and methods can integrate and resolve many of these situations. Students who transfer out of the New York City system and into another are removed from the city's cohort database and thus are not counted for any New York City school. Students who transfer between New York City high schools are counted in the cohort of the final school in which they register. New York City keeps track of the percentage of students who drop out after each grade, but not by each school. Thus, we used systemwide numbers for dropouts per year per school. Budget numbers are specific to each school but are not available over 4 years, so we used the budget per student per school for 1995–1996 for all years.

Specifically, the 4-year budget per graduate is constructed as follows: BUDGRD = (BUDPUP/GRADUATES) × (ADJUSTED PUPIL COUNT), where BUDPUP is the school's budget per pupil per year, GRADUATES is the number of pupils who graduate from the school by the fourth year, and ADJUSTED PUPIL COUNT is the total number of pupils, of those who enter ninth grade, who are educated by a school in Grades 9 through 12. The pupil count needs to be adjusted because a portion of the ninth-grade entering class drops out each year.

Specifically, the adjusted pupil count is calculated as the sum of the pupils in the school in Grades 9 through 12 as we follow the group of entering students through 4 years. The calculation begins with the entire ninth-grade entering class and is adjusted for the proportion of all pupils who drop out in each grade. It is the sum of the following four terms: (a) 9th-grade pupils: ENTER; (b) 10th-grade pupils: ENTER − (%9) × (DROPOUTS); (c) 11th-grade pupils: ENTER − (%9 + %10) × (DROPOUTS); and 12th-grade pupils: ENTER − (%9 + %10 + %11) × (DROPOUTS), where ENTER is the number of pupils who enter ninth grade,[8] DROPOUTS is the total number of entering pupils who drop out at any time over the 4 years, and %9, %10, and %11 are the percentages of total DROPOUTS who leave during each of the grades.[9]

After obtaining a 4-year budget per graduate by school, we estimated the following model: BUDGRD = *g*(SIZE, TYPE, POV, LEP, PTSE, RCT). The variables in the equation are identical to those in the budget per pupil equation. Again, we are primarily interested in the effect of size on budget per graduate; the other variables were entered as controls.[10]

We summarize our results by aggregating schools into three size groups and several types.[11] First, we divide schools by size: small (0 to 600 students), medium (more than 600 to 2,000 students), or large (more than 2,000 students). We also subdivide small and medium-sized schools according to their types, and we subdivide medium schools into two size groups. High schools are distinguished by type because they have different missions or provide different kinds of programs. Small schools are either "alternative articulated" or "alternative transfer." Both types are labeled alternative because they were originally established as alternatives to the large traditional high schools.

Articulated schools enroll students directly from middle school and intend to graduate those students in 4 years. Transfer schools enroll students who may have dropped out or been suspended from another high school; they are "schools of last chance." The three other types of high schools are vocational, academic, and specialized.[12] Vocational schools offer a vocational curriculum; academic schools are comprehensive neighborhood high schools; and specialized schools, of which there are only three in our data, require that students pass a test or an audition to enter.

Results

Budget per Pupil and Budget per Graduate Regressions

Description of variables. Our objective was to estimate models with budget per pupil and budget per graduate as the dependent variables. The data provided us with many alternative dependent variables for budgets, but an aggregate number was most appropriate for our calculation of total 4-year budget per graduate. The dependent variable was, thus, general education plus part-time special education budget per registered general education student. Part-time special education students are a subset of general education students. The part-time students receive resource room or related services. The number excludes full-time special education budgets and students because special education students have individual education plans that often do not include a 4-year high school graduation goal and do include other goals, depending on the severity of the handicap.

Exclusion of full-time special education students does not affect the relationship of size, budget, and graduates because of the way in which the financial data are generated. Virtually all budgets associated with full-time special education students are segregated from the other budget data. Instructional budgets are separate, but, more important, most administrative budgets are as well. That is, full-time special education students "generate" budgets for administering their programs, and these are separated from the budgets for the general education and part-time education students. The debt service on the capital budget, which is aggregated to a system level, and other system overhead budgets are allocated to all students (including full-time special education students). Thus, when full-time special education students are removed, so are these parts of their budgets. The general administration of the high school (e.g., principal, secretaries) is also allocated to all students. For principals, at least, this allocation practice may understate budgets in schools with larger than average percentages of full-time special education students, since the principal would remain even if the students did not. The budgets involved, however, are a very small percentage of the total.

The model is estimated via the natural logarithm of the dependent variable, the natural logarithm of size and of the interaction between size and type of high school, and natural units for other variables.

Table 2 presents the descriptive statistics for the variables in the models. On average, the total per pupil budget for general education and part-time special education students was $6,790, and the mean budget per graduate was $65,559. Of the 121 schools, 3% were alternative articulated, 11% were alternative transfer, 15% were vocational, and 72% were comprehensive and specialized. While the average school served 2,030 students, the size of the student body varied widely, from a minimum of 185 to a maximum of 4,957 students. Whereas 45.4% of the students were eligible for free lunch, the variation was high, as indicated by a standard deviation of 21.8. The percentages of limited English proficiency and part-time special education students were 13.4% and 5.4%, respectively. These are numbers one would expect to find in high schools in a large urban district. The math test pass rate was 52.5%, with a high standard deviation of 14.2.

Estimated equations. The regression results are reported in Table 3 for the general education and part-time special education budget per general education student (BUDPUP) and the budget per graduate (BUDGRD).[13] Both equations had significant and high R^2 values of .60 and .70, respectively, and most of the coefficients were statistically significant at the 5% or better level with the expected signs. Because both the dependent variable and the size variables (size by itself and interacted with type of school) were measured in logarithms, the coefficients for the size variables are elasticities. For example, the BUDGRD equation indicates that, given similar student bodies with respect to poverty, limited English proficiency, and so forth, a transfer school that increases its enrollment by 100% will, on average, increase its budget per graduate by 0.7% more than will an academic/specialized high school. This is quite an inelastic (unresponsive) relationship; however, given the large range in size of student bodies in New York City high schools (185 to 4,957), it can result in sizable differences in budgets per graduate.

Analyses of Budget per Graduate

Table 4 shows a breakdown of schools by size and type with the mean values of the independent variables in order to highlight the major differences in types of students across schools. Small schools had considerably lower percentages of LEP students and somewhat higher percentages of part-time special education and poor students than medium-sized and large schools. These statistics indicate that, at an aggregate level, the types of schools are serving more or less equally costly students, with more LEP students in large schools balanced by more students receiving part-time special education services or more students in poverty in small schools.

TABLE 2
Descriptive Statistics on Budget Data Variables Used in Regression Equations (N = *121*)

Variable name and abbreviation	*M*	*SD*
Total general education plus part-time special education budget per general education student (BUDPUP) ($)	6,790	940.3
Budget per graduate (BUDGRD) ($)	65,559	43,621
General education register (SIZE)	2,030	1,191.5
Alternative articulated school—categorical (T2A)	0.03	0.18
Alternative transfer school—categorical (T2B)	0.11	0.31
Vocational school—categorical (T3)	0.15	0.36
Academic and specialized school—categorical (T1)	0.72	0.45
Percentage passing RCT math test (RCT)	52.5	14.2
Percentage eligible for free lunch in 1994–1995 (POV)	45.4	21.8
Percentage of general education register with limited English proficiency (LEP)	13.4	11.6
Percentage of general education register in part-time special education (PTSE)	5.4	4.8

TABLE 3
OLS Regression Results: BUDPUP and BUDGRD

Independent variable	BUDPUP[a] coefficient (*SE*)	BUDGRD[a] coefficient (*SE*)
Constant	9.476 (0.120)***	12.000 (0.400)***
LnSIZE	–.096 (.015)***	–.140 (.048)**
T2A × LnSIZE (interaction of articulated and size)	–.005 (.008)	–.018 (.026)
T2B× LnSIZE (interaction of transfer and size)	.012 (.006)**	.147 (.019)***
T3× LnSIZE (interaction of vocational and size)	.005 (.003)	.001 (.011)
LEP	.002 (.001)*	.009 (.003)**
PTSE	.004 (.002)**	.010 (.006)**
POV	.0003 (0.001)	.004 (.001)**
RCT	–.0004 (.001)	–.009 (.002)***
R^2	.60	.70
F	20.82**	32.28**
N	121	121

[a]Dependent variables measured via natural logarithms.
* $p < .10$. ** $p < .05$. *** $p < .01$.

Table 5 displays budgets per graduate, using actual budget per graduate numbers as well as regressions to predict budgets. Predicted budgets per graduate were derived from the regression equation by setting all variables except size and its interactions equal to the sample average. The purpose of the predictions was to isolate the effect of size, in essence assuming that all high schools are the same in other respects. Using actual budget per graduate numbers, large schools have the lowest budget per graduate, followed closely by small academic and articulated alternative schools. Using the predicted regression results, we find the same results as with actual budget numbers, except large schools and small academic schools had even more similar budgets per graduate. On the other hand, small alternative transfers had by far the highest budgets per graduate, whether we used actual or predicted budget numbers. It is the small medium group (600 to 1,200 students) that raises the budget per graduate in the medium-sized group, in particular the smaller medium-sized vocational and alternative transfer schools. Whether we use actual or predicted numbers, our results are similar. Large high schools and small academic and alternative articulated high schools had approximately the same budget per graduate.[14]

TABLE 4
Mean Values of Independent Variables in Regression by Size and Type of High School

	N	General education students	% LEP	% part-time special education	% poverty 1994–1995	RCT math: % passing
All schools	121	2,030	13.37	5.37	45.38	52.46
Small schools (0–600)	19	369	5.60	8.30	53.47	55.70
Academic and articulated alternative	8	394	3.83	8.73	51.05	56.89
Transfer alternative	11	351	6.88	7.98	55.23	54.83
Medium-sized schools (600–2,000)	42	1,330	11.55	5.92	51.12	48.00
Group 1: 600–1,200	17	864	12.74	6.41	57.53	49.86
Academic	10	845	18.18	4.71	65.44	52.92
Vocational and transfer alternative	7	890	4.97	8.84	46.23	45.48
Group 2: 1,200–2,000	25	1,649	10.73	5.58	46.76	46.74
Academic	14	1,748	12.92	4.99	40.44	49.20
Vocational and transfer alternative	11	1,518	7.96	6.34	54.82	43.61
Large schools (>2,000)	60	3,045	16.85	4.05	38.79	54.55

TABLE 5
Budget per Graduate

	N	Actual budget per graduate ($)	Predicted budget per graduate ($)
All schools	121	65,559	65,387
Small schools (0–600)	19	115,531	117,490
Academic and articulated alternative	8	51,876	51,778
Transfer alternative	11	161,826	165,281
Medium-sized schools (600–2,000)	42	65,227	63,485
Group 1: 600–1,200	17	74,989	72,922
Academic	10	63,950	64,706
Vocational and transfer alternative	7	90,758	84,659
Group 2: 1,200–2,000	25	58,588	57,069
Academic	14	59,385	56,539
Vocational and transfer alternative	11	57,574	57,743
Large schools (>2,000)	60	49,967	50,219

Note. Predictions were made with actual observations for LnSIZE and interactions and average for 121 regression observations for LEP, PTSE, POV, and RCT.

Conclusions

The literature on the relationship between high school outputs and the size of a school's student body generally shows that smaller schools evidence better outputs than larger schools. The literature on the relationship between school costs and the size of a school's student body does not have clear-cut findings, although no studies show that high schools smaller than 900 students cost less per pupil than larger ones.

In this study, we found that a combined output and cost measure, budget per graduate, shows that small academic high schools have budgets per graduate similar to those of large schools (greater than 2,000 students). For small academic high schools, this result is due to their vastly lower dropout rates. Smaller medium-sized vocational schools (600 to 1,200 students) and small transfer alternative high schools have the highest budgets per graduate.

These are interesting findings because they seem to support the arguments of both advocates of small schools and advocates of large schools. Our results indicate that small schools are cost-effective, but so are large schools in New York City. Why might we find these results? Because of the long-standing high school choice policy in New York City, many students may choose their school because of its size. Just as large schools may be the right places for many students, especially those who seek a rich variety of both curricular and extracurricular offerings, small schools may be right for other students, especially for disadvantaged and minority youth. Our data were not sufficiently disaggregated for us to know how individual students select or are assigned to their high schools; however, if a preeminent system goal is to graduate students, the present findings, combined with the existing literature, suggest that spending more on some students may pay off in higher graduation rates for those students.

Policymakers can also make critical choices, because budgets are not costs but instead are driven by policy decisions about how to allocate funding to schools. In this sense, changing allocation formulas to high schools could reverse the relationships we found, if policymakers wanted to change them. But the real question for policymakers involves the trade-offs between budgets and outputs. To the extent that small schools are better places for disadvantaged and minority youth (as suggested by the literature), the additional budgets per student shown to be produced by small articulated academic high schools may be well worth the improved student outcomes these schools generate.

As more small schools achieve full status with Grades 9–12, the New York City Board of Education should make sure that there are numerous, comparable output measures that can complement budget data so that studies can demonstrate the trade-offs between better outputs and budgets in the city's high schools. For now, using graduates as outcomes, this study suggests that the city might do well to continue to encourage the formation and continuing support of small high schools.

Notes

We wish to acknowledge funding for the study from the Bruner Foundation, the New York Community Trust, and the Robert Sterling Clark Foundation. Our use of the New York City School Based Budget Report database was supported by the Robin Hood Foundation. Amy Ellen Schwartz, Sheila Murray, Carolyn Jarvis, Ross Rubenstein, and two anonymous reviewers provided helpful comments and/or assistance on earlier versions. All statements are ours alone.

[1]Financial data measured in dollars and representing inputs such as labor and supplies are referred to as budgets, expenditures, and/or costs. These terms are conceptually different. Budgets are projected or planned expenditures as of a point in time before the end of a fiscal period. Expenditures are observed actual spending, often audited, usually at the end of a fiscal period such as a school year. Costs are the lowest value of resources necessary to achieve a given level of output. Costs are difficult to measure from available financial data. Expenditures are often preferred to budgets because they represent actual dollars and are audited. In this study, only budget data were available. They are, however, very nearly equivalent to expenditures because they were budgets as of June, 1996. Expenditures would be recorded as of June 30, 1996, the end of the fiscal year. Newer data on budgets and expenditures confirm the latter point by showing only a 0.54% difference between budgets and expenditures in New York City schools for 1996–1997. These newer expenditure data were not used for this study because we had not been able to match them to output and school characteristic data (see Iatarola & Stiefel, 1999, for a study of the difference between the budget and expenditure data).

[2]As stated in Footnote 1, the paper uses budget data in its empirical section. While most empirical work uses either budget or expenditure data, theoretical work uses the cost term, and thus so do we when discussing the literature.

[3]Programs are usually newer high schools, often do not have their own building, and often serve specialized populations. They may also share other resources with established high schools.

[4]Shortly after 2001, students will be required to pass a full set of state Regents examinations in order to obtain a high school diploma. Currently, students may satisfy graduation requirements by passing an easier set of state exams called the Regents Competency Examinations.

[5]The 1995–1996 school year is the most recent for which comparative data are available on the state level. New York City's 1995–1996 $8.2 billion public schools budget and 981,221 general education students are compared with states via the National Center for Education Statistics' (1998) recent compendium.

[6]Cohort data allowed us to follow students for 4 years from the point they enter 9th grade and to account for new entrants and dropouts. Our data covered 4 years for the class entering 9th grade in 1992–1993; in the future, 7 years of data will become available for this cohort of students. Cohort graduation rates are different from 1-year graduation rates. The latter divide the number of graduates in any one year by the number of students in 12th grade (or eligible for graduation). The 1-year rates are higher than the cohort rates because the denominator of 12th graders is reduced by all of the students who dropped out before 12th grade.

[7]Some simultaneity may exist in the model of per pupil budget between per pupil budget and the output variable. That is, budgets may depend upon the level of output, and output may, at the same time, depend upon the size of the budget. Instrumental variable estimation (IV), which is one way to correct for simultaneity, is used to estimate the equation, with the result that coefficient values and the coefficient of determination remain very similar to the OLS results, but the significance levels of the coefficients decrease. Budget per pupil and math score are endogenous. We report the OLS estimations because of the similarity to the IV results and the greater ease in understanding the OLS results.

[8]Pupils who transfer schools or withdraw from the New York City school system to enter another system are not counted in a school's entering class.

[9]BUDGRD counts students for a given grade if they are in a school for any part of the grade. Thus, 9th grade dropouts are only subtracted in the 10th grade, and so on. All values of variables in BUDGRD are specific to each school except %9, %10, and %11, which are available only as systemwide averages. Their values are 2.75%, 12.46%, and 30.93%, respectively. While 53.86% of the dropouts leave in the 12th grade, they are not subtracted because they are in a school for part of 12th grade.

Two numerical examples of the calculation of budget per graduate using the formula just described may aid readers. First, take the example of Troubled High School, described earlier in the text. Here, BUDPUP = 5,000, GRADUATES = 5, ENTER = 10, DROPOUTS = 5, and %9, %10, and %11 all equal zero because all dropouts are in 12th grade. Thus, using the formula for BUDGRD, we obtain (5000/5)[(10) + (10) + (10) + (10)] = 40,000, the same number as in the text.

Now suppose that these five dropouts drop out in 11th grade instead of 12th grade. Then all of the variables remain the same, except now %11 = 1.0. The formula for BUDGRD yields (5000/5)[(10) +(10) + (10) + (10 − 1 × 5)] = 35,000. Essentially, the budget per graduate declines because some of the cost of education is foregone, specifically the last year for each dropout.

[10]The BUDPUP and BUDGRD equations are related to one another since they both use BUDPUP in their dependent variable. We estimate the equations using the natural logarithm of the dependent variables. Thus, ln BUDGRD = ln BUDPUP − ln GRADUATES + ln (ADJUSTED PUPIL COUNT), and the estimated BUDPUP equation will differ from the estimated BUDGRD equation as a result of the way the control variables interact with GRADUATES and ADJUSTED PUPIL COUNT. We estimate the equations separately because the literature and the policy community have focused traditionally on BUDPUP but we wish to show effects with graduates included in the dependent variable as well.

[11]Size groups slightly different than these do not change results, and, since these are policy relevant groups in New York City, they are used here.

[12]Academic and specialized high schools are combined into one group in the analyses because there are only three specialized high schools in the sample.

[13]Dependent variables are measured in logarithms. Other functional forms, including a levels version, yielded qualitatively similar results.

[14]If we consider these schools a sample and not the universe of New York City high schools, then statistical significance testing is appropriate. Such tests show that the groups of small transfer and medium small transfer and vocational schools have significantly higher budgets per graduate than other schools. One of the main purposes of this study was to determine whether small academic high schools are more expensive per graduate than large high schools. The finding of no significant difference between these two types is the most policy-relevant result in the study. We also performed an analysis of variance across all group means and found a significant *F* value. This indicates, in general, that the within-group variance is less than the between-group variance across sizes and types of high schools. Finally, when we look at the specific values of the budget per graduate variable in each size category, we do not find that any group has one or two outliers that move the mean up or down.

References

Bee, M., & Dolton, P. J. (1985). Costs and economies of scale in UK private schools. *Applied Economics, 17,* 281–290.

Board of Education of the City of New York. (1996a). *Fiscal Year 1995–96: School based budget reports. Systemwide summary.* New York: Author.

Board of Education of the City of New York. (1996b). *1995–96 Annual school report.* New York: Author.

Board of Education of the City of New York. (1998). *The class of 1994: Final longitudinal report—A three-year follow-up study.* New York: Author.

Callan, S. J., & Santerre, R. E. (1990). The production characteristics of local public education: A multiple product and input analysis. *Southern Economic Journal, 57,* 468–480.

Case, K. E., & Fair, R. C. (1999). *Principles of microeconomics.* Englewood Cliffs, NJ: Prentice Hall.

Chabotar, K. J. (1989). Measuring the costs of magnet schools. *Economics of Education Review, 8,* 169–183.

Cohn, E. (1968). Economies of scale in Iowa high school operations. *Journal of Human Resources, 3,* 422–434.

Cohn, E., & Riew, J. (1974). Cost functions in public schools. *Journal of Human Resources, 9,* 408–414.

Foley, E., & McConnaughy, S. (1982). *Towards school improvement: Lessons from alternative high schools.* New York: Public Education Association.

Fowler, W. J., Jr. (1992, April). *What do we know about school size? What should we know?* Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Fowler, W. J., Jr., & Walberg, H. J. (1991). School size, characteristics and outcomes. *Educational Evaluation and Policy Analysis, 13,* 189–202.

Howley, C. (1989). Synthesis of effects of school and district size: What research says about achievement in small schools and school districts. *Journal of Rural and Small Schools, 4,* 2–12.

Iatarola, P., & Stiefel, L. (1999). *Executive summary: New York City school-level financial data: Do budget data differ from expenditure data?* New York: Institute for Education and Social Policy, New York University.

Kumar, R. C. (1983). Economies of scale in school operation: Evidence from Canada. *Applied Economics, 15,* 323–340.

Lee, V. E., & Smith, J. B. (1997). High school size: Which works best and for whom? *Educational Evaluation and Policy Analysis, 19,* 205–227.

National Center for Education Statistics. (1998). *State comparisons of education statistics: 1969–70 to 1996–97.* Washington DC: U.S. Department of Education.

Riew, J. (1966). Economies of scale in high school operation. *Review of Economics and Statistics, 48,* 280–287.

Riew, J. (1986). Scale economies, capacity utilization and school cost: A comparative analysis of secondary and elementary schools. *Journal of Education Finance, 11,* 433–440.

Watt, P. A. (1980). Economies of scale in schools: Some evidence from the private sector. *Applied Economics, 12,* 235–242.

Authors

LEANNA STIEFEL is a professor of economics and director of the Public and Nonprofit Management and Policy Program, Robert F. Wagner Graduate School of Public Service, New York University, 4 Washington Square, New York, NY 10003. She specializes in education finance and policy and applied statistics.

ROBERT BERNE is vice president for academic development, New York University.

PATRICE IATAROLA is a research associate, Institute for Education and Social Policy, New York University.

NORM FRUCHTER is director of the Institute for Education and Social Policy, New York University.

Manuscript received October 14, 1998
Revision received June 24, 1999
Accepted September 14, 1999