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AUTHOR Stiefel, Leanna; Iatarola, Patrice; Fruchter, Norm; Berne, Robert

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ABSTRACT

Small size is often cited by reformers and parents as the key ingredient necessary to create an effective learning environment. In New York City, the new public secondary schools have consistently smaller numbers of students than most existing high schools. The literature is unambiguous that smaller schools show better outputs than schools of other sizes, but is less clear about the relationship of school size and costs. This report analyzes the relationship between size of student body and school costs and performance in New York City public high schools, using Board of Education school-level data (1995-96) on budgeted expenditures, student characteristics, and performance. Of 201 secondary schools and programs in the Board's database, 133 were included in the analysis; excluded entries did not serve all grades 9-12, served very specialized populations, or lacked information on necessary variables. The schools were categorized as small (less than 600 students), smaller medium (600-1,200), larger medium (1,200-2,000), and large (over 2,000). Results indicate that the size of the student body was an important factor in relation to costs and outputs. Although small academic schools had somewhat higher costs per student, their much higher graduation rates and lower dropout rates produced among the lowest cost per graduate in the New York City system. Contains 36 references, 8 data tables and figures, and a glossary. (Author/SV)

The Effects of Size of Student Body on School Costs and Performance in New York City High Schools

Leanna Stiefel, Ph.D.
Professor of Economics
Director, Public and Nonprofit Management and Policy Program
Robert F. Wagner Graduate School of Public Service

Patrice Iatarola
Ph.D. Candidate, Robert F. Wagner Graduate School of Public Service
Data Analyst, Institute for Education and Social Policy

Norm Fruchter
Director, Institute for Education and Social Policy

Robert Berne, Ph.D.
Vice President for Academic Development, New York University

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INSTITUTE FOR Education and Social Policy

Robert F. Wagner Graduate School of Public Service

New York University

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All statements are ours alone.

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INSTITUTE FOR
Education and Social Policy
New York University
285 Mercer Street, NYC 10003
(212) 998-5880 • FAX: (212) 995-4564
email: iesp@nyu.edu

Robert F. Wagner
Graduate School of Public Service
New York University
Washington Square
New York, New York 10003

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Executive Summary

Introduction

Across the country, school reformers, parents, educators, community organizations and businesses are joining together to create new schools to better meet children's learning needs. But in too many settings, schools continue to fail our children. Practice and research repeatedly show that many different factors combine to create effective schools; there is no single formula or recipe for success.

Yet one common theme across many current school reform strategies is that the large factory model of schooling is not effective for teaching and learning, especially for disadvantaged students. Small size is often cited by reformers and parents as the key ingredient necessary to create an effective learning environment, particularly for high school students. Smaller student bodies seem to be better. The new public secondary schools in New York City, such as those begun as New Visions Schools, as well as those Campus High Schools formed by the Center for Collaborative Education, or other schools created by community, parent and business groups, all have consistently smaller numbers of students than most existing high schools.

Relationship Between School Size, School Cost, and Student Outputs[1]

This paper reports the results of work of the Institute for Education and Social Policy and the Robert F. Wagner Graduate School of Public Service at New York University to assess the effect of school size on costs in New York City public high schools.

The literature on the relationship between the size of a school's student body and school outputs is unambiguous – smaller schools show better outputs than schools of other sizes. The literature on the relationship between the size of a school's student body and school costs is less clear, although no studies show that schools with fewer than 900 students have lower per pupil costs than larger schools. A significant shortcoming of previous research is that studies of outputs almost never include school costs and studies of costs only occasionally include outputs.

It is clear that school costs should be looked at in conjunction with outputs and school size in both theoretical analyses and empirical studies. How well students do in school, and not simply the size of the student body, obviously affects the cost of educating students. Students who take more than four years to graduate, for example, will cost more than those taking only four years to graduate. A greater number of students taking more than four years to graduate raises a school's cost per graduate.

[1] We use outputs to mean what educators commonly refer to as outcomes — attendance rates, test scores, number of graduates, for example.

Data and Methods

This report analyzes the relationship between size of student body and school costs and performance in New York City high schools, using Board of Education school-level data on budgeted expenditures, student characteristics and performance. For this study we use data from the *School Based Budget Reports*, published by the New York City Board of Education for the first time in a comprehensive manner in 1995-96, as measures of budgeted expenditures. Student characteristics are obtained from a variety of sources, including the Board of Education's Annual School Report Cards and High School Overviews. The graduate data are from the Board of Education's cohort report, *The Class of 1996: Four-Year Longitudinal Report and 1995-96 Event Dropout Rates*, that follows 9th grade students through their high school careers and reports on their status four years later, when they should be graduating.

Summary of Findings

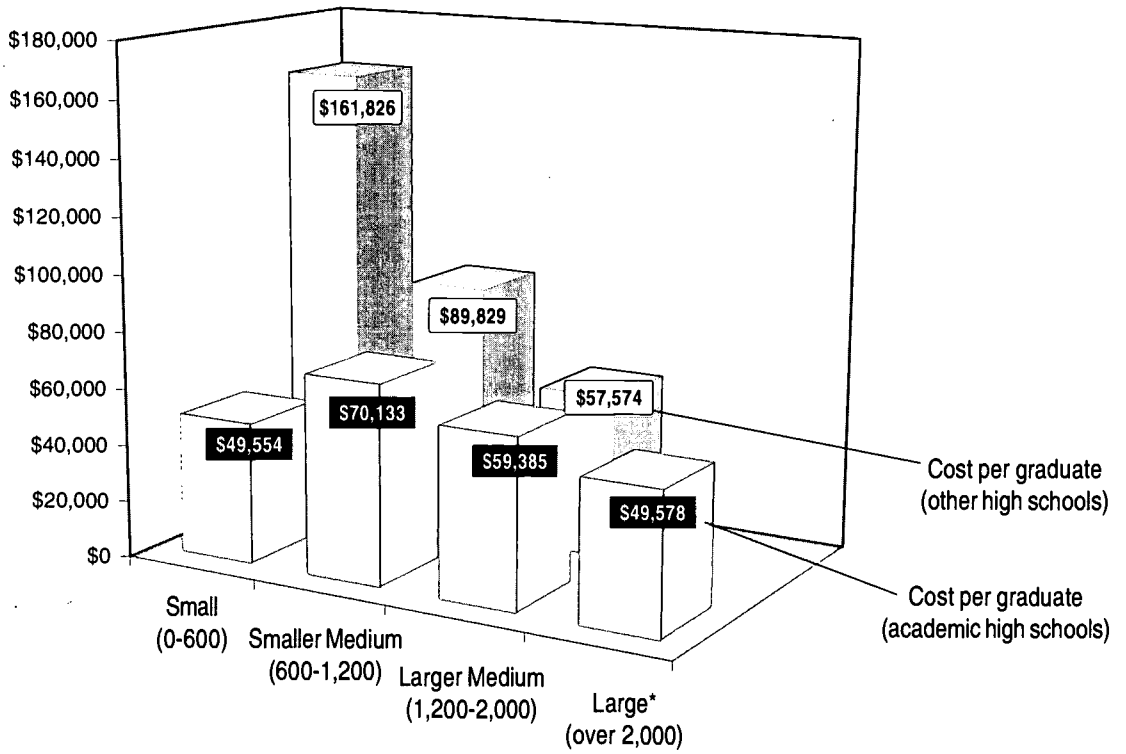
Our study successfully integrates resource inputs and school-level outputs. *We find that size of the student body is an important factor in relation to costs and outputs and that small academic and articulated alternative high schools cost among the least per graduate of all New York City high schools.* Though these smaller schools have somewhat higher costs per student, their much higher graduation rates and lower dropout rates produce among the lowest cost per graduate in the entire New York City system.

Implications for Policy and Future Research

Budgets are not simply based on costs, but rather are the result of policy decisions about how to allocate funding to schools. Therefore, the relationships we find could be altered by changing allocation formulas. But the real questions for policymakers involves the tradeoffs between budgets and outputs. *The research literature indicates that small schools are better places for disadvantaged youth, particularly poor students of color in urban districts. The small additional budgeted amounts per student this study finds invested in small schools seem well worth the improved outputs, particularly the low costs per graduate, that these small schools demonstrate.*

Within the next five years, when an additional 50 or more small schools will have graduating classes, it will be possible to calculate the cost per graduate for these small schools. As more small schools achieve full status encompassing grades 9-12, the New York City Board of Education would be wise to ensure that there are numerous, comparable outcome measures that can be integrated with budget and unit data to better explicate the tradeoffs between outputs and costs in the city's high schools. In the future, more data will be available to assess many more of the newer small schools. There will be additional output measures such as scores on Regent's examinations and six- and seven-year cohort graduation results, and actual expenditure data. We are confident of our current findings and eagerly anticipate the results of future studies using more comprehensive data.

What is the cost of educating a student who graduates in four years from a New York City high school?

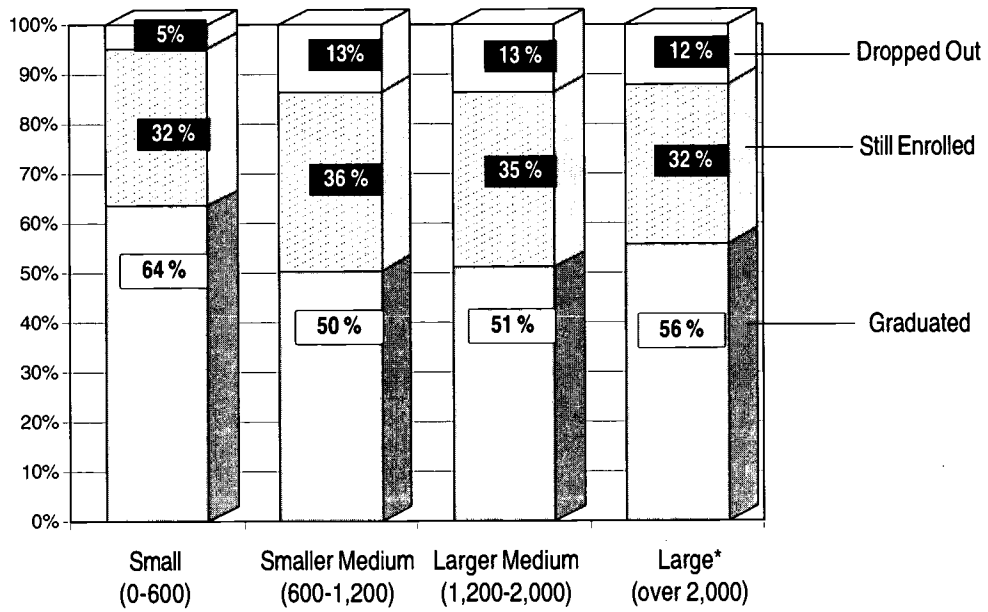


Notes: See Table 3. "Other" includes only transfer alternative high schools in the small school category, transfer alternative and vocational high schools in the smaller mediumcategory, and only vocational high schools in the larger medium category.

*includes one vocational school

After four years of schooling,
what happened to those students
who entered New York City's
high schools in 1992?

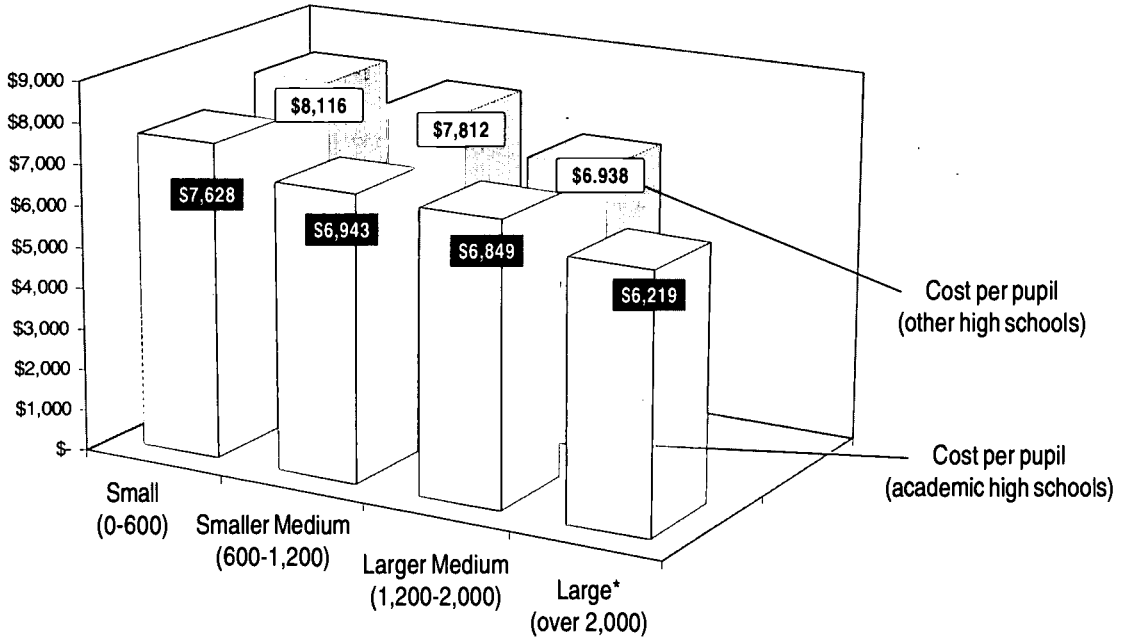
Outcomes for Students at Academic High Schools



Notes: See Table 4. Percentages may not add to 100% due to rounding error.

*includes one vocational school

What is the average annual cost of educating students in New York City high schools?



Notes: See Table 5. "Other" includes only transfer alternative high schools in the small school category, transfer alternative and vocational high schools in the smaller mediumcategory, and only vocational high schools in the larger medium category.

*includes one vocational school

INTRODUCTION

Across the country, school reformers, parent groups, community organizations, business enterprises and professionals are joining together to create new schools that meet children's learning needs. But in too many settings, schools continue to fail our children. Practice and research repeatedly show that many different factors combine to create effective schools; there is no single formula or recipe for success.

Yet one common theme across many current reform strategies holds that the large factory model of schooling is not effective for teaching and learning, especially for disadvantaged students. Smaller student bodies seem to be better, particularly for high school students. The new public secondary schools in New York City, such as those begun as New Visions Schools, as well as those Campus High Schools formed by the Center for Collaborative Education, or other schools created by community, parent and business groups, all have consistently smaller numbers of students than most existing high schools. This does not mean that it is impossible to restructure and improve high schools with large numbers of students. But even when this is accomplished, such as at Andrew Jackson High School or South Shore High School in New York City, reducing the effects of large size is part of the restructuring remedy. A small size student body is often defined by reformers and parents as the key ingredient necessary to create effective learning environments for high school students.

Given current constrained fiscal conditions for public education, particularly in urban districts that often contain large high schools, it is essential to know the cost implications of school reforms that aim to reduce school size. This paper reports results of work the Institute for Education and Social Policy and the Robert F. Wagner Graduate School of Public Service at New York University has undertaken to assess the effect of school size on costs in New York City public high schools. The difficulties of such a study were apparent from its conceptualization; therefore the results reflect attempts to resolve a host of predictable thorny problems. Despite these problems, we have come to several clear conclusions: small schools in New York city do cost somewhat more per pupil than larger schools, but when cost per graduate is used as the cost/output ratio, a set of small high schools cost among the least per graduate of all New York City high schools. In what follows, we summarize the literature on small schools, review the methods we used to carry out our study, discuss our results and state the conclusions we draw from our findings.

LITERATURE ON SCHOOL SIZE

The literature on school size, in which size refers to number of students, may be divided into those studies that focus on outputs of schooling (such as test scores and graduation or dropout rates, or on intermediary contributors to outputs such attendance rates and participation in extracurricular activities)

and those that focus on inputs of schooling, such as resources and costs. (Note that in what follows, we use the economic term, outputs, for what educators usually define as outcomes, indicators of some form of academic achievement such as test scores, credit accumulation or graduation.) There are some *hypotheses* about the relationship of outputs to size and of costs to size and there is considerable *empirical work* on both topics.

The hypotheses on the relationship between outputs and size state that large factory type schools of approximately 1,500 or more students produce inferior outputs. In addition, many analysts postulate that large size schools are particularly harmful for disadvantaged youth.

The relationship between costs and size is grounded in the concept of economies of scale, whereby increasing all inputs (capital, labor, materials and students) proportionately should lead to decreasing per-pupil costs up to a point of maximal effective size, where costs are minimized, beyond which costs per pupil rise. Economies might occur for larger schools for several reasons: 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); varied curricula might be offered more cheaply; some inputs (such as administrators) may be indivisible and their costs might get spread over more pupils; and some specialization and division of labor might occur, for example when teachers offer more advanced courses in their subjects. Generally, at some point, diseconomies of scale (higher per-pupil costs) will set in due to limits in managerial ability.

Economies of scale is what economists call a "long-run" concept, whereby all inputs are increased proportionately. Short-run per pupil costs, with capital inputs fixed, will almost always show some decreasing cost per pupil for a while, due to spreading of fixed costs such as a principal, basic energy usage, or a base level of custodial service. But these types of decreases in per pupil costs in the short-run are less significant than the potential source of decreases in per-pupil costs in the long-run, when whole capital (long term investment) expenditures such as school buildings and more specialized labor, such as guidance counselors or language teachers, are spread over more pupils.

Empirical work on the relationship between size and outputs confirms the theory. Small schools have been shown to do better as measured in many different ways when compared to very large schools. (See Fowler, 1992 for a good literature review of these studies.) One recent study (Lee and Smith, 1997) finds 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 find that both very small and very large schools have worse outputs.

Empirical work on the relationship between costs and size yields less definitive results than that on outputs and size. Such studies have been conducted for the past 30 years. In an early paper, Cohn (1968) found that in the long run, the cost curve for high schools is U-shaped, the optimal size of a school being 1,500 students. Cohn's research came amidst the movement to consolidate rural school districts that began in the 1960s and continued through the 1970s; the main impetus was James B. Conant's work that advocated school district consolidation to take advantage of economies of scale through larger comprehensive high schools (Conant 1959, 1967). The intradistrict equalization litigation that began in the 1970s, as well as the movements to close schools as enrollments declined in the 1980s, has kept the spotlight on economies of scale arguments for maintaining larger high schools.

The implication of the U-shaped curve is that long-run average costs decrease as size increases until average costs are minimized at a certain size (1,500 in Cohn's research) and then begin to rise as size increases. Cohn estimated a long-run cost curve, incorporating short-run operating costs and long-run capital cost. Using only operating expenditures at the middle and elementary school level, Riew (1986) found economies in middle schools with enrollments as large as 1,024, but at the elementary school level the greatest economies he found were in schools of 200-400 students. An earlier study of operating expenditures in high schools concluded that beyond an enrollment of 900, the existence of economies is questionable (Riew 1966).

Cohn and Riew did not directly include measures of constant quality outputs in their models. Rather, both related expenditures to size while controlling for quality of outputs. Cohn developed an index that incorporated school-level changes in test scores, teachers salaries, class size and other variables to serve as a proxy for quality of output. Similarly, Riew used teachers' education and experience, the school's environment and utilization, and other variables to capture differences in quality of outputs while relating school size to operating expenditures.

In 1992, the Public Education Association (PEA) of New York issued two reports on the benefits and effectiveness of small schools, in terms of both operating and capital costs. The PEA report argued that economies of scale associated with larger schools using traditional administrative designs can be overcome by smaller schools that take advantage of flexible administrative arrangements, such as when teachers assume administrative responsibilities. PEA could not find any study that supported economies of scale beyond a school size of 1,800 (PEA 1992A). Additionally, PEA argued that it is conceivable that economies related to the nature of capital (buildings) may be surmounted if cost-effective approaches such as competitive bidding, shared and multiple-use space, and renovation are used in developing new small schools (PEA 1992B).

The more recent cost studies we examined do not reveal consistent findings. These studies reach different conclusions, including that there are negative, constant, U-shaped, or no relationships between size and average costs (Chabotar 1989, Watt 1980, Callan and Santerre 1990, Kumar 1983, Bee and Dolton 1985). Not one of the studies, however, found a direct (positive) relationship between size and average costs for schools with enrollments under 900. there is no evidence from the body of cost studies we examined that small schools cost less or that medium-size schools, those with enrollments between 400 and 900, cost more.

There are several common deficiencies in the studies of the effect of size on outputs or costs. One is the that the school is the appropriate unit of analysis to use in such empirical work, but in the cost literature the district is often used (due to lack of school-level data). Second, outputs and costs should be considered together in both theory and in empirical studies. Clearly how well students do in a school, and not simply the size of the student body, will affect the costs per pupil; for example those students who take longer to graduate will raise the cost per graduate in any high school. Yet, the literature on outputs almost never includes costs and the literature on costs only occasionally includes outputs. In our work, we attempt to include costs, outputs, control variables and size in one model by estimating per pupil budgeted costs as a function of size, limited English proficiency, poverty, percent special education and percent passing a state competency exam in math.

METHODOLOGY AND DATA ISSUES

Because of problems in obtaining data to accurately measure or identify school outputs, school costs, or even to identify schools (as opposed to programs within schools), we used several different methods and types of data to help us reach conclusions about the relationship of school size, cost and output as measured by graduation from school. These are briefly described here, with more detail in the appendices.

Allocation Formulas for High Schools

New York City high schools receive their funding in the form of units. These units are the "currency" in which high schools get funds and translate them into personnel resources such as teachers, aides, administrators and also supplies. Although these formulas are described in great detail in the *Comparative Analysis of the Organization of High Schools* (Board of Education of the City of New York 1995-96), the exact mathematical representation of each part of the formula cannot currently be obtained from the report. Therefore, we devoted considerable resources to working backwards from the actual allocations to each high school to derive the formula that drives the allocations for all high schools. We used these "derived formulas" to analyze the way units are related to the size of the student body.

Interviews

We conducted interviews in eight schools – four small, two medium and two large – during the 1996-97 academic year to illuminate the conceptual issues and the data quality as well as to provide a fuller context for non-quantifiable differences between schools. The interviews were used for three purposes. First, they helped clarify the conceptual issues involved in developing a measure of costs for a school and understanding how costs are related to a school's organizational setting, its programmatic offerings and the needs of its students. Second, the interviews helped supplement and assess the quality of the quantitative data used in the study. Lastly, the interviews helped identify areas for further research.

Statistical Models of Units per Pupil and Budgets per Pupil

We used two data bases in this study. The first is the *School Based Budget Reports*, published by the Board of Education for the first time in a comprehensive manner in 1995-96. (Board of Education of the City of New York, November 1996). The second is the actual unit allocations provided by the Division of High Schools to each high school. The unit data base was obtained from the hard copy of computer printouts documenting what each high school received in 1995-96.

Each data base originally contained 201 entries, the official tally of the Board of Education's (BOE) secondary schools and programs in 1995-96. This number includes programs as well as full schools. We eliminated all 24 programs from the data bases because these programs often do not serve all grades or they serve very specialized populations (such as students who attend night school). Of the remaining 177 schools (201 minus 24), 35 do not include all grades 9 through 12. Most of these non 9^{th} -12^{th} grade schools are new and it is not clear what their enrollment will be when they are fully operational with all grades included. Therefore they provide inappropriate data for this study. After eliminating current non 9^{th} -12^{th} grade schools, we were left with 142 high schools. Two of the variables necessary for our statistical analyses were not available for all these 142 schools: a measure of output such as Regents Competency Tests in reading or math and a measure of poverty such as percent of students eligible for free lunch. After eliminating schools without these variables, we ended with 133 high schools in the data base that we could use to statistically analyze the relationship of size and budget per student.[1]

[1] When the budget data are combined with the performance data on graduation rates, the number of schools declines somewhat more due to missing cohort data. See later in this summary.

We estimated per pupil budget or per pupil unit allocations as the dependent variable, using ordinary least square regression (OLS). The equations assess the relationship of budgets to size, controlling for other factors, and are also used to calculate costs per graduate. We are not estimating pure economic cost functions; instead we are postulating a behavioral model in which resources per pupil are related to size of student bodies (our main variable of interest) as well as to other conditions. We expected size to have some effect on resources and that resources would be higher in schools with students who are more expensive to educate (such as in schools with high percentages of students with limited English proficiency), in schools where outputs are higher, and in some types of schools with specialized programs, such as vocational high schools. Based on the wide body of literature on performance and costs, we chose these particular variables to include in the equations.

Estimates of Budgets per Graduate

Originally we hoped to compare costs to several different outputs or intermediary measures such as accumulated credits, test scores of various kinds, graduates and attendance rates. But only two measures of outputs ultimately proved viable, given the need to have a reliable measure of performance and to maximize the number of schools included in our sample: 1) Percent passing Regents Competency Test (RCT) in Mathematics and 2) graduates. We used the percent passing the RCT in Math in our regression estimates as a control variable for output. While we would be able to calculate a cost per student passing the RCT exam, such a measure is a narrow indicator of a school's performance at only one point in time and in only one subject area. In addition, the measure is a less accurate indicator of performance than is graduates. For example, we cannot identify students that may have passed the exam but have dropped out of school or failed to graduate. Therefore, we related costs only to graduates.

The Board of Education has a good measure of the numbers of graduates of each high school, based on cohorts that begin in the 9th grade and the status of the cohort four years later. These data are published every year; for our work we used *The Class of 1996: Four-Year Longitudinal Report and 1995-96 Event Dropout Rates.* (Board of Education of the City of New York) From these data, we calculated a four year cost (traditional high school career) per graduate for various sizes and types of schools. To do so, we multiplied the budget per student *times* the number of students in a cohort *times* those who have not dropped out each year, for four years, to give us a four-year cohort budget. We then divided this aggregate four-year cohort budget by the number of cohort graduates to obtain the four-year cohort budget per cohort graduate for each school.

We used two different combinations of numbers for these calculations and thus obtained two different results. First we used the raw budget per student numbers (*School Based Budget Reports, 1995-96*)

published by the Board of Education; second we predicted budget per student numbers using our estimated regression equations, which control for types of students and test scores in the school.

Finally, for both methods, we averaged the budget per graduate numbers for small (0 to 600 students), medium (over 600 to 2000 students) and large (over 2000 students) schools. We also subdivided small high schools into academic and articulated versus transfer alternative;[2] we divided medium-size high schools into academic versus vocational and transfer alternative, and within each of these, into smaller medium (over 600 to 1,200 students) and larger medium (over 1,200 to 2,000 students). The category of large high schools (over 2,000 students) was not subdivided.

The number of schools used to calculate the budget per graduate is either 128 or 121, depending whether the budget number used is the actual or predicted one. These numbers differ from the 133 used in the regressions because of lack of cohort data for some high schools. (Another way to understand the number of high schools is to begin again with the 201 entries in the Board of Education's data base for high schools. Of these, 57 schools do not have cohort data, bringing the total usable schools from 201 to 144. Of the 144 schools, 16 are non 9^{th} -12^{th} grades, or very new schools, or special retrieval programs; eliminating these brings the total from 144 to 128. We used the 128 schools with the actual, unadjusted, budget data to obtain one measure of cost per graduate. In order to use the regression results, we eliminated another 7 schools due to missing values for variables in the regression.)

FINDINGS

Allocation Formulas

Our work with the allocation formulas involved both the general education and the special education parts of the formula. We derived these formulas by working backwards from the actual allocations to the schools.

General Education

The general education formulas, which are composed of basic, instructional and discretionary support components, show the effect of student size most clearly for the basic support component of the formula.[3] In the *basic support component* of the formula, the units are based totally on groupings of schools by size of the student body and the number

[2]Articulated alternative high schools enroll a majority of their students from junior high/intermediate schools at the ninth grade and expect that those students will graduate within four years. Transfer alternative schools only enroll students who are transferring from other educational settings from which they may have dropped out or have been suspended. These are "last chance" schools.

[3]The basic support allocation provides resources for administrative and support services such as principals, assistant principals, and secretaries. The instructional support allocation provides resources for costs associated with direct instruction, primarily teachers' time. Discretionary support is provided for special programs or essential needs which are not being met by the formula allocations.

of units declines with size. In the *instructional support component* of the formula, units are less directly related to the size of the student body; they also depend on the curriculum index.[4] In the *discrete support component* of the formula, unit allocations are left to the borough high school superintendents to allocate on the basis of their perception of various school-level needs. There is no formula for these discrete allocations.

Special Education

The special education formulas also have components for basic, instructional and discretionary support.[5] While the basic support component is based on size of the special education student body, providing schools with a per capita amount for each special education student, the amount provided relates to the type of special education student – that is, the student's particular classification of disability. The instructional components maintain the distinction by type of special education student, but also incorporate differences in school-level approaches to educational settings, such as mainstream and self-contained. Therefore the instructional formulas for special education may not be as closely related to size as the general education component. Other components, such as educational paraprofessionals and resource room funding support, are related to ranges in the size of the special education student populations, not on per capita bases.

Interviews

The interviews confirmed what we had already conceptualized or suspected in terms of measuring costs and outputs. Due to the limitations of the data, we could not identify differences in costs associated with programmatic offerings, such as internships, that might vary across schools. The schools we interviewed identified various programs associated with the schools, but were unable to identify any additional costs associated with those programs. The budget data we used in the quantitative analyses did not identify programmatic costs within schools. Furthermore, we were unable to conclusively assess the relationship between the size of the school's student body and the flow of alternative sources of funding to schools. Therefore, budget allocations of tax levy and reimbursable funds, the major sources of funding for all schools, were our only proxy for costs.[6]

[4] This index is essentially a weight within the formula to account for differences between academic and vocational schools in required subject areas and maximum class sizes of the subject areas.

[5] The primary basic support for a school is allocated through the general education formula. The special education basic support allocation is supplemental, providing only a per capita allocation rather than a base in addition to the per capita.

[6] Although data on private grants are included in the *School Based Budget Reports,* all other alternative sources of funding are not reported in this database.

The schools did not have a common standard for measuring a course credit based on time spent in class. The medium and large high schools in the sample tended to have similar, but not identical, standards and requirements. One small school in our sample had an alternative assessment waiver. Other problems with the data on course credits, in addition to the ones identified through the interviews, limited the use of these data as a measure of output.

The interviews were very useful for identifying future areas of research and conceptualizations to supplement available quantitative data to assess the relationship between size of student body and costs and performance. First, how are progressive educational settings for special education students, including mainstreaming, being used by schools and is there a relationship to the size of the entire student body? Furthermore, what are the funding implications of providing different educational settings for full-time special education students? Second, knowing which schools in the system are applying for and receiving waivers for alternative assessments will aid in controlling for these variations in the systemic quantitative analyses using the entire population of New York high schools and might even allow us to construct a measure of output for these schools. Third, although private sources of public school funding may be minimal on a systemic level, such funding may be significant at a school level. Additionally, there may be significant variation between schools in funds raised from private sources.

Results of Statistical Models

Regression analysis identifies the independent effect of variables (or factors) on a dependent variable, such as budget per pupil. In our regressions with budget per pupil as the dependent variable, we found a small, negative effect of student size on budget per pupil. For example, a 10% increase in the number of students is associated with a 0.7% decrease in budget per pupil; thus these regressions indicate that larger size does generate a slight decrease in costs. When units per pupil are used as the dependent variable, the size of the student body is statistically significant for basic support. For basic support, there is a medium sized effect of size on units; for example, a 10% increase in the number of students is associated with a 3.8% decrease in units per pupil. For instructional support, there is no statistically significant effect of size on units except for vocational high schools where there is a very small positive effect. (A 10% increase in students is associated with an 0.12% increase in instructional units per pupil for vocational high schools.) Thus, the larger the size of the student body, the fractionally lower the per pupil cost of both basic and instructional costs.

The budget data show declining budgets with increasing size, but the effect is small. Units show a decline for the basic support part of the formula, but not much effect at all for the instructional support part. Thus, when the budget data, rather than the unit data, is used for analysis, school size has a statistically significant, yet small, effect on costs.

Budgets per Graduate

We obtained two different budget per cohort graduate numbers, averaged by the size and type of school. Results are presented in Tables 1 through 5. The number of high schools reported in these tables is either 121 or 128.[7]

Table 1 shows a breakdown of schools by size and type with the mean value of the independent variables in the regression equations. This table is useful for identifying differences in types of students across schools. Small schools have considerably lower percentages of LEP students and somewhat higher percentages of part-time special education and poor students than medium and large size schools.

Table 2 displays costs per cohort graduate, using regressions to predict cost. Small academic and articulated alternative schools have the lowest cost per graduate, with large schools a close second.[8] Small transfer alternative schools, however, have by far the highest costs per graduate. The smaller range schools (over 600 to 1,200 students), particularly the vocational and transfer alternative schools, are primarily responsible for raising the cost per graduate in the medium-size group. Results in Table 3 are similar to those in Table 2, but Table 3 shows actual rather than predicted budget numbers.

Tables 4 and 5 break out results into cohort graduates and costs per student to show why we obtain the results in Tables 2 and 3. Table 4 shows that the small articulated and academic high schools have very low dropout rates, while small transfer alternative schools have very high dropout rates. Medium size vocational schools have dropout rates only a little higher than average. Table 5 reveals that small transfer alternative schools have considerably higher than average costs per student and medium vocational schools have somewhat higher costs per student. Thus with both vastly higher dropout rates and much higher costs per student, small transfer alternatives are bound to cost very much more per graduate. The smaller medium vocational schools have a similar problem, without such extremes in costs or dropouts, and thus they have high but not exorbitant costs per graduates. The small academic schools have higher costs per student than the large schools, but these schools' lower dropout rates and higher graduation rates make their costs per cohort graduate very slightly lower than those for the large schools.

[7] See previous section for an explanation of which schools are included and why.

[8] Given the small sample size for small academic and articulated alternative schools (10) and the very similar cost per graduate number for large schools. These two groups can be thought of as similar in costs.

CONCLUSIONS

The literature on the relationship between high school outputs and the size of a school's student body is unambiguous – schools with between 600 and 1,200 students show better outputs than other size schools. The literature on the relationship between school costs and the size of a school's student body is less clear cut, although no studies show that schools smaller than 900 students cost less per pupil than larger ones.

Using New York City *budget* data, we find that smaller schools have higher budgets per pupil, but the magnitude of this relationship is very small. Using New York City *unit* data, we find that smaller schools have higher *basic support* units per pupil. (The magnitude of this relationship is moderate.) Since the basic support part of the general education unit allocation accounts for a small percentage of that total allocation, smaller schools have only slightly higher total general education units per pupil.

Our measures of budgets per cohort graduate show that small academic and articulated schools have among the lowest costs per cohort graduate. This is due to their vastly lower dropout rates and higher graduation rates. We also find that the large high schools (greater than 2,000 students) have the second lowest cost per graduate and a cost per cohort graduate quite close to that of the small high schools. Smaller medium size vocational schools (over 600 to 1,200 students) and small transfer alternative high schools have the highest costs per cohort graduate.

Units and budgets are not costs, but the results of policy decisions about how to allocate funding to schools. Therefore the relationships we found could be altered by changing formulas. But the real question for policy makers involves the tradeoffs between budgets, units and outputs. *To the extent that small schools are better places for disadvantaged youth, particularly poor students of color in urban districts, as the research literature indicates, the small additional budgets and units per student this study found invested in small New York city high schools seem well worth the improved outputs, particularly the low costs per graduate, that these small schools demonstrate.*

Within the next five years, an additional 50 or more small schools will have graduating classes that can be used in the cohort analysis to calculate cost per graduate. 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 outcome measures that can be integrated with budget and unit data to better explicate the tradeoffs between outputs and costs in the city's high schools. In the future, data will be available to assess the newer small schools, to use additional output measures such as scores on Regent's examinations and six and seven year cohort graduation results, and to use actual expenditures in addition to budget data. We are confident of our current findings, and eagerly anticipate the results of future studies using more comprehensive data.

TABLE 1

MEAN VALUE OF INDEPENDENT VARIABLES IN REGRESSION BY SIZE AND TYPE OF HIGH SCHOOL

	N	GEN ED STUDENTS	% LEP	% PART-TIME SPECIAL ED	% POVERTY 1994-95	RCT MATH % PASSING
ALL	121	2,030	13.4	5.4	45.4	52.5
SMALL (0-600)	19	369	5.6	8.3	53.5	55.7
Academic & Articulated Alternative	8	394	3.9	8.7	51.1	56.9
Transfer Alternative	11	351	6.9	8.0	55.2	54.8
MEDIUM (600-2,000)	42	1,330	11.8	5.9	51.1	48.0
Smaller Medium (600-1,200)	17	864	13.2	6.4	57.5	49.9
Academic	10	845	19.0	4.7	65.4	52.9
Vocational & Transfer Alternative	7	890	5.0	8.8	46.2	45.5
Larger Medium (1,200-2,000)	25	1,649	10.8	5.6	46.8	46.7
Academic	14	1,748	13.0	5.0	40.4	49.2
Vocational	11	1,518	8.0	6.3	54.8	43.6
LARGE (>2,000)	60	3,045	17.0	4.1	38.8	54.6

Sources: Board of Education of the City of New York: *Fiscal Year 1995-96: School Based Budget Reports*; *Annual School Reports 1994-95 and 1995-96*; and *High School Overviews*.

TABLE 2

COSTS PER COHORT GRADUATE
USING REGRESSION EQUATIONS TO PREDICT COSTS
BY SIZE AND TYPE OF HIGH SCHOOL

	N	COST PER GRADUATE[1]
ALL	121	$63,444
SMALL (0-600)	19	$108,363
Academic & Articulated Alternative	8	$46,657
Transfer Alternative	11	$160,654
MEDIUM (600-2,000)	42	$61,405
Smaller Medium (600-1,200)	17	$70,138
Academic	10	$60,464
Vocational & Transfer Alternative	7	$83,958
Larger Medium (1,200-2,000)	25	$55,466
Academic	14	$54,076
Vocational	11	$57,235
LARGE (>2,000)	60	$49,289

Sources: Board of Education of the City of New York: *Fiscal Year 1995-96: School Based Budget Reports*; *Annual School Reports 1994-95 and 1995-96*; *High School Overviews*; and *The Class of 1996: Four-Year Longitudinal Report and 1995-96 Event Dropout Rates.*

Note: Predicted using 1) actual observations for LNGE and TYPE and 2) average of 133 regression observations: PLEP, PPTSE, RCTMTPCT

[1] Systemwide percent of dropouts for each year of the cohort class used to adjust cost per graduate calculation, e.g. 2.75% of all dropouts do so during the first year of school.

Cost Per Grad = (2.75% of Dropouts)(1)(Budget) + (12.46% of Dropouts)(2)(Budget) + (30.93% of Dropouts)(3)(Budget) + (53.86% of Dropouts)(4)(Budget) + (Cohort -Dropouts) (4)(Budget) divided by Graduates

TABLE 3

COSTS PER COHORT GRADUATE
USING ACTUAL BUDGETS TO OBTAIN COSTS
BY SIZE AND TYPE OF HIGH SCHOOL

	N	COST PER GRADUATE[1]
ALL	128	$65,586
SMALL (0-600)	21	108,363
Academic & Articulated Alternative	10	49,554
Transfer Alternative	11	161,826
MEDIUM (600-2,000)	46	67,284
Smaller Medium (600-1,200)	21	77,637
Academic	13	70,133
Vocational & Transfer Alternative	8	89.829
Larger Medium (1,200-2,000)	25	58,588
Academic	14	59,385
Vocational	11	57,574
LARGE (>2,000)	61	49,578

Sources: Board of Education of the City of New York: *Fiscal Year 1995-96: School Based Budget Reports* and *The Class of 1996: Four-Year Longitudinal Report and 1995-96 Event Dropout Rates.*

[1] Systemwide percent of dropouts for each year of the cohort class used to adjust cost per graduate calculation, e.g. 2.75% of all dropouts do so during the first year of school.

Cost Per Grad = (2.75% of Dropouts)(1)(Budget) + (12.46% of Dropouts)(2)(Budget) + (30.93% of Dropouts)(3)(Budget) + (53.86% of Dropouts)(4)(Budget) + (Cohort -Dropouts)(4)(Budget) divided by Graduates

TABLE 4

COHORT OUTCOME VARIABLES
BY SIZE AND TYPE OF HIGH SCHOOL

	N	% STILL ENROLLED	% GRADUATED	% DROPPED OUT
ALL	128	36.1	51.1	12.8
SMALL (0-600)	21	44.7	42.6	12.8
Academic & Articulated Alternative	10	31.6	63.6	4.8
Transfer Alternative	11	56.6	23.4	20.0
MEDIUM (600-2,000)	46	37.2	48.6	14.2
Smaller Medium (600-1,200)	21	40.2	46.4	13.4
Academic	13	36.1	50.4	13.5
Vocational & Transfer Alternative	8	46.9	39.7	13.4
Larger Medium (1,200-2,000)	25	34.7	50.6	14.8
Academic	14	35.4	51.2	13.5
Vocational	11	33.9	49.7	16.4
LARGE (>2,000)	61	32.3	55.9	11.9

Sources: Board of Education of the City of New York: *Fiscal Year 1995-96: School Based Budget Reports* and *The Class of 1996: Four-Year Longitudinal Report and 1995-96 Event Dropout Rates.*

TABLE 5

COST PER STUDENT

BY SIZE AND TYPE OF HIGH SCHOOL
(General Ed & Part-time Special Ed)

	N	BUDGET	N	PREDICTED
ALL	128	$6,796	121	$6,603
SMALL (0-600)	21	7,884	19	7,586
Academic & Articulated Alternative	10	7,628	8	6,827
Transfer Alternative	11	8,116	11	8,138
MEDIUM (600-2,000)	46	7,064	42	6,737
Smaller Medium (600-1,200)	21	7,274	17	6,937
Academic	13	6,943	10	6,665
Vocational & Transfer Alternative	8	7,812	7	7,326
Larger Medium (1,200-2,000)	25	6,888	25	6,601
Academic	14	6,849	14	6,348
Vocational	11	6,938	11	6,924
LARGE (>2,000)	61	6,219	60	6,199

Sources: Board of Education of the City of New York: *Fiscal Year 1995-96: School Based Budget Reports*; *Annual School Reports 1994-95 and 1995-96*; *High School Overviews*; and *The Class of 1996: Four-Year Longitudinal Report and 1995-96 Event Dropout Rates.*

Note: Predicted using 1) actual observations for LNGE and TYPE and 2) average of 133 regression observations: PLEP, PPTSE, RCTMTPCT

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Glossary

Academic high schools include: 1) zoned academic/comprehensive high schools, which accept all students within the school's zone; 2) total educational options high schools, which admit students based on previous academic performance; and 3) specialized high schools, which admit students through entrance examinations.

Articulated alternative high schools, included in the academic high school category, enroll a majority of their students from junior high/intermediate schools at the ninth grade and expect that those students will graduate within four years.

The **size** of the student body is determined by the number of general education students in the school. The following ranges were used in our study:

Small	0 to 600
Medium	600 to 2,000
Smaller Medium	600 to 1,200
Larger Medium	1,200 to 2,000
Large	Over 2,000

Transfer alternative high schools only enroll students who are transferring from other educational settings from which they may have dropped out or been suspended. These are "last chance" schools.

Vocational high schools offer programs for students primarily interested in job training in vocational and technical areas or interested in college.

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