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Financing an adequate education: A case study of New York

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Introduction

The New York State Board of Regents and Commissioner of Education have identified a set of clear performance standards for students in New York State. These standards represent the knowledge and skills students are expected to need in order to function successfully as productive citizens in the 21st century. These standards will be implemented through new "high-stakes" Regents examinations, which all students will be required to pass to graduate from high school, and supported by new examinations in the fourth and eighth grades, which will serve as important intermediate checkpoints in assessing student progress.

New York is not alone in setting higher standards for its students. Over the last decade, many states have implemented higher standards, and by 2004, almost half the states will require passage of exit exams for high school graduation (Meyer et al. 2002). Although this movement toward higher standards is driven primarily by state education departments and state elected officials, it has other roots as well. State courts often interpret the education clauses in their state constitutions as obligating the state to ensure that all children have the opportunity to reach an adequate level of content knowledge and skill (Lukemeyer 2003). New York's school finance system, for example, has been challenged in state court as unconstitutional because it does not provide a "sound basic education."[1]

[1] New York's highest court, the Court of Appeals, has interpreted article XI, section 1, of the state constitution as requiring the legislature to "ensure the availability of a sound basic education to all the children of the State." *Campaign for Fiscal Equity,* 655 N.E.2d 661 [*"CFE1"*] at 665; *Board of Education v. Nyquist* (1982). The two most recent decisions in the ongoing litigation include *Campaign for Fiscal Equity*, 719 N.Y.S.2d 475 (2001) (*"CFE2"*), and *Campaign for Fiscal Equity*, 744 N.Y.S.2d 130 (2002) (*"CFE3"*). In *CFE2*, the trial court found the system unconstitutional, but New York's intermediate appellate court reversed the trial court's decision in *CFE3*. The case has been appealed to New York's highest court, the Court of Appeals.

Moreover, the federal No Child Left Behind Act of 2001 requires states to implement annual testing from third through eighth grade as part of a broader accountability system that includes school report cards and state-set minimum performance standards (Robelen 2002).

Despite the clear trend toward higher standards in education, states have been slow to implement funding systems designed specifically to help students (and schools) reach new standards (Boser 2001). The objective of this paper is to provide state governments with tools to help them develop a school finance system that supports students and school districts trying to reach higher performance standards. The paper focuses on a well-known problem, namely, that schools with disadvantaged students must spend more than other schools to meet any given standard. This paper shows how to estimate each district's cost for achieving an adequacy standard and develops a foundation aid formula that adjusts for the higher costs in some districts.

The objective of this paper is to provide state governments with tools to help them develop a school finance system that supports students and school districts trying to reach higher performance standards.

The development of any adequacy-based school finance system involves three components, which correspond to the three substantive sections of this paper:

First, a state must select measures of adequacy, either in terms of resources or student performance. Such measures are necessary to identify school districts below the standard. Although these measures can be controversial and difficult to develop, this choice is unavoidable.

Second, a state must estimate the cost of reaching a given performance standard in each district. The cost function approach presented in this study relies on statistical methods to extract from actual data the impact of student needs, resource prices, and enrollment size on the spending required to reach a particular standard.

Third, a state must develop a school aid formula. This formula should provide all school districts the resources they need to reach the adequacy standard selected by the state.

This paper explains how each of these steps can be implemented, with illustrations based on data from New York State.[2] Our objective is to provide guidance for any state that wants to design an adequacy-based finance system.

Developing an Adequacy Standard

In setting an adequacy standard, a state must first decide whether the standard is intended to guarantee each district some minimum level of resources or to give all students the opportunity to reach a minimum level of student performance. A resource standard is typically represented in terms of a bundle of resources and course requirements that represent an opportunity for an adequate education. In contrast, a performance standard usually is expressed as a level of student performance on standardized exams. One set of examinations is unlikely to capture all dimensions of an adequate education, as defined by the courts or the general public; nevertheless, many states are setting adequacy standards by making the passage of specific tests either an objective or a graduation requirement.

In New York State, the debate over performance standards has not yet been resolved. Both the Board of Regents and Commissioner of Education have identified a clear set of performance requirements for students to graduate from high school. However, the courts have not yet identified the standards required by the New York State Constitution.

In a 1995 decision, New York's highest court defined the constitutional requirement that the state provide a "sound basic education" in terms of both student performance (knowledge and skills necessary to vote and serve on a jury) and resources (minimally adequate

[2] A more detailed discussion of data and methods used in this paper is available in Duncombe (2002), particularly appendix A (data sources and measures) and appendix B (statistical models and methods).

facilities, material, and teaching).[3] In later decisions, however, lower courts have differed as to the level of student performance that this definition requires. In January 2001, the trial court ruled that "a capable and productive citizen . . . is capable of serving impartially on trials that may require learning unfamiliar facts and concepts and . . . decid[ing] complex matters that require . . . verbal, reasoning, math, science, and socialization skills. . . ." (*CFE2* at 485) This implies that high school graduation from a reasonably demanding program is a requirement for productive citizenship. In contrast, in June 2002, an intermediate appellate court ruled that "The State submitted evidence that jury charges are generally at a grade level of 8.3, and newspaper articles on campaign and ballot issues range from grade level 6.5 to 11.7. . . . Thus, the evidence at trial established that the skills required to enable a person to obtain employment, vote, and serve on a jury, are imparted between grades 8 and 9, a level of skills which the plaintiffs do not dispute is being provided." (*CFE3* at 138) In other words, this court ruled that high school graduation is not mandatory for meeting the constitutional standard.

While translating these court decisions into specific performance measures is beyond the scope of this paper, it is clear that the level of student performance associated with "productive citizenship" as defined by the courts will have a large impact on the school finance system. In selecting a measure of performance to use in estimating the cost of adequacy, we have drawn from the measures developed by the New York State Education Department (SED). First, we average math and English exam scores in fourth grade, eighth grade, and high school. The measure used in this study is based on a weighted average of fourth- and eighth-grade exam scores, and high school Regents exam scores. Regents exam scores were weighted twice as heavily as fourth- and eighth-grade exam scores to reflect the fact that students are now required to pass these exams for high school graduation.[4] The resulting composite test scores can range from 0 to 200.

For comparison purposes, we are going to look at the costs associated with two standards, 130 and 160. A standard of 130 might be consistent with the third CFE decision (*CFE3*), because it implies adequate performance for all fourth- and eighth-grade students, but

[3] The Court of Appeals stated:

> Such an education should consist of the basic literacy, calculating, and verbal skills necessary to enable children to eventually function productively as civic participants capable of voting and serving on a jury. If the physical facilities and pedagogical services and resources made available under the present system are adequate to provide children with the opportunity to obtain these essential skills, the State will have satisfied its constitutional obligation. As we stated in *Levittown,*
>
>> The Legislature has made prescriptions (or in some instances provided means by which prescriptions may be made) with reference to the minimum number of days of school attendance, required courses, textbooks, qualifications of teachers and of certain nonteaching personnel, pupil transportation, and other matters. If what is made available by this system (which is what is to be maintained and supported) may properly be said to constitute an education, the constitutional mandate is satisfied. (57 N.Y.2d, at 48.)
>
> The State must assure that some essentials are provided. Children are entitled to minimally adequate physical facilities and classrooms which provide enough light, space, heat, and air to permit children to learn. Children should have access to minimally adequate instrumentalities of learning such as desks, chairs, pencils, and reasonably current textbooks. Children are also entitled to minimally adequate teaching of reasonably up-to-date basic curricula such as reading, writing, mathematics, science, and social studies, by sufficient personnel adequately trained to teach those subject areas.

(*CFE1* at 666 [footnote omitted])

[4] Newly developed examinations in mathematics and English language arts are required of all fourth- and eighth-grade students. SED has divided test results into four levels and reports the counts (and percent) of students reaching a given level. The levels are selected to reflect students with "serious academic deficiencies" (level 1), students needing "extra help to meet the standards and pass the Regents examinations" (level 2), students meeting "the standards and with continued steady growth, should pass the Regents examinations" (level 3), and students exceeding "the standards and are moving toward high performance on the Regents examination" (level 4). The percent of students reaching each level is first identified, and then a weighted average of these percents is calculated with a weight of 1 for level 2 and a weight of 2 for levels 3 and 4. With relatively few exceptions (e.g., severe disabilities), all students will have to pass a series of Regents examinations to receive a regular high school diploma. A similar process is used to aggregate results for the Regents examinations. The percent of students receiving between 55 and 64 on the Regents exams in math and English are given a weight of 1, and the percent of students receiving above a 64 are weighted at 2. Performance in high school is a more accurate reflection of the accumulated knowledge and skills of students than performance in earlier grades. Thus, a weight of 50 percent is applied to the Regents exams, 25 percent to fourth-grade exams, and 25 percent to eighth-grade exams in constructing an overall performance measure. Sensitivity analysis was also performed using equal weights on exams from all three grade levels. The results of the analysis are not highly sensitive to these weights. See Duncombe (2002), appendix A, for a more detailed discussion of these measures.

only basic competency for most students on the high school exams. Taken literally, the new Regents standards imply a score close to 200, because students are required to pass the Regents exams to receive a high school diploma. Very few districts would presently meet a standard of 200. A more realistic standard that still might be consistent with the second CFE decision (*CFE2*) would be the present state average of 160. Most districts in New York already meet this standard, but a standard of 160 would be a very ambitious standard for many urban districts.

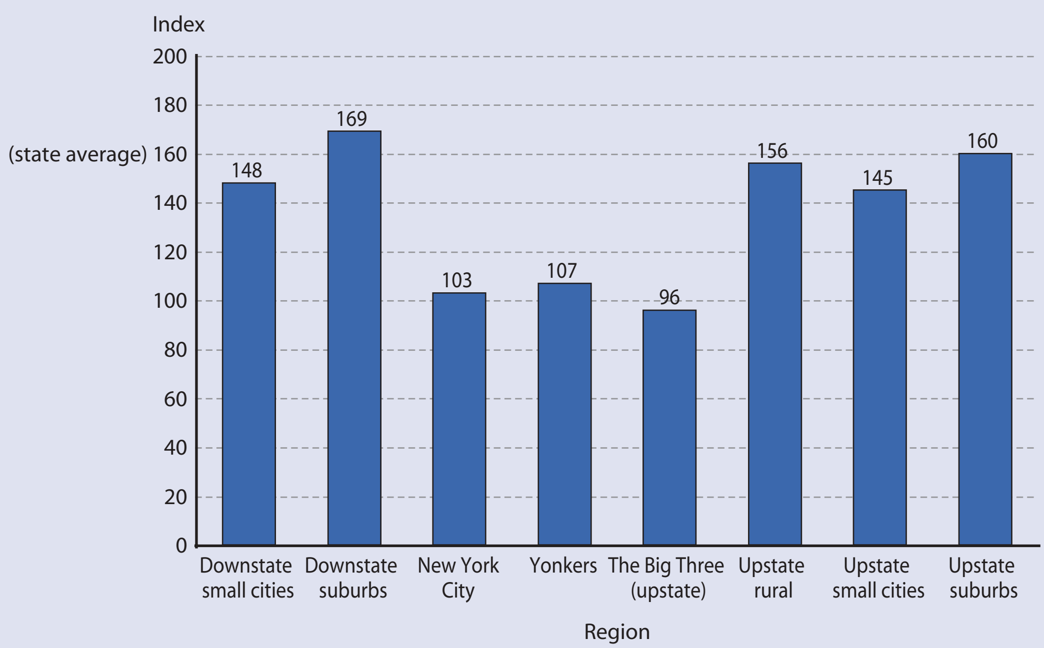
As indicated in figure 1, there are wide disparities in student achievement across districts in New York State, and these disparities are tied closely to school district size and urbanization. The five large city school districts have performance levels of approximately 100, which is well below both the current state average and our more modest standard of 130. Only 5 percent of the districts don't reach a standard of 130, but these districts serve close to half the students in the state. Most of the suburban districts and many rural districts exceed the state average of 160.

Estimating the Cost of Adequacy

The heart of any adequacy-based finance system is an estimate of the costs or spending required for each district to reach a particular resource or performance standard. This cost cannot be directly observed for a low-performing district, so this step requires a method to estimate the extent to which some districts must pay more than others for the same performance because of characteristics, such as student poverty, that are outside their control. This calculation leads to a cost index, which can then be used to determine how much money each district needs to boost its student performance. This approach is analogous to estimating and applying a cost-of-living index. If one location has a cost of living that is higher than average, then people living in that location must receive a higher income than people in the average location in order to achieve the same standard of living. Estimating a cost index is complicated, however, and several different approaches have been developed.[5] In this paper, we focus on one method, which is called the "cost function approach."

[5] For a review of these methods, see Guthrie and Rothstein (1999) and Duncombe and Yinger (1999).

Figure 1. Comparison of student performance index by New York region: 2000



SOURCE: New York State Education Department.

The cost function approach uses statistical methods to relate data on actual spending in school districts to student performance, resource prices, student needs, and other relevant district characteristics.[6] The resulting estimates are used to construct an education cost index, which measures how factors outside a district's control affect the spending required to reach a given resource or student performance level. The cost function approach is well suited to developing estimates of the cost of adequacy in individual districts, and the results can be used directly in aid formulas.

These benefits are contingent, however, on the quality of the data used in statistical analysis and the accuracy of the statistical results. Any researcher estimating an education cost function must make a number of choices. Each of these choices may affect the statistical results, in some cases significantly, and some of these choices are not "transparent" to policymakers and educators.[7] The onus is on a researcher using the cost function approach to explain the method in an intuitive fashion and to convince policymakers and other policy analysts that reasonable choices were made. In this section, we discuss the choices we made in applying the cost function approach to New York.

Because the primary resources used by school districts are teachers and other professional staff, adjusting for differences in the cost of hiring teachers is particularly important.

The first step in the cost function approach is to estimate a teacher cost index. As discussed below, a teacher cost index is sometimes used on its own as a measure of resource cost differences across school districts. In addition, however, a teacher cost index plays a critical role in an analysis of total educational costs, which must consider not only resource costs differences, but also differences in costs that arise because of district size or the presence of many disadvantaged students (also known as "at-risk" students). We begin this section, therefore, by explaining how to estimate a teacher cost index and by presenting teacher cost index results for New York. We then turn to our method for estimating a full education cost index, that is, for determining the resources each district needs to provide a given quality education given its resource costs, its enrollment, and its concentration of at-risk students. The section ends with a presentation of cost index results for New York school districts.

Estimating a Teacher Wage Model and a Teacher Cost Index

If a state's adequacy standard requires that all districts receive a minimum level of resources, then a state aid program needs to make some adjustment for the higher cost of purchasing educational resources in some school districts than others. Because the primary resources used by school districts are teachers and other professional staff, adjusting for differences in the cost of hiring teachers is particularly important.[8] Such differences could arise for several reasons. Specifically, some districts may have to pay significantly more than others to recruit teachers of equal quality because of a higher cost of living in the area, strong competition from the private sector for similar service-sector occupations, or more difficult working conditions facing teachers. Not all teachers consider the same factors in evaluating working conditions, but classroom discipline problems, violence in schools, and a general lack of student motivation are likely to make a teaching job less attractive to most teachers.

In developing a teacher cost index, it is important to distinguish between discretionary factors that a district can influence, and labor market or working con-

[6] For other examples of this approach, see Downes and Pogue (1994), Reschovsky and Imazeki (1997), and Duncombe and Yinger (2000).

[7] The cost function approach has been criticized and ultimately rejected by some researchers, because its technical complexity makes it difficult to explain to "reasonably well-educated policymakers" (Guthrie and Rothstein 1999, p. 223). In our view, this is an inappropriate criterion for selecting a method for estimating the cost of adequacy, because simpler approaches, even if they are easier to explain, may be grossly inaccurate. The main criteria in selecting a method should be accuracy, not transparency.

[8] In principle, cost differences can also be calculated for other inputs, such as transportation, energy, and facilities, but this step is rarely included in practice. For a good introduction to methods for calculating input cost differences, see Fowler and Monk (2001).

dition factors that are outside a district's control.[9] Factors a district can influence include the experience and education of its teaching force, the certification level of its staff, the size of schools and classes, average student performance, and the general level of efficiency in the district. Factors outside a district's control include labor market factors, such as private sector salaries and unemployment rates, and factors related to working conditions, such as a concentration of at-risk students, juvenile crime rates, and pupil density. A teacher cost index that is used to help compensate high-need districts as part of a state aid system obviously should only reflect factors that a district cannot control. As a result, a teacher wage model accounts for factors influenced by a district but does not consider them in calculating the teacher cost index.

A teacher cost index that is used to help compensate high-need districts as part of a state aid system obviously should only reflect factors that a district cannot control.

Using information on individual teacher salaries and characteristics in 2000, along with school and district characteristics, we estimate a teacher wage model for New York State. The sample size is over 120,000 full-time classroom teachers, representing almost all the state's districts. The dependent variable is the teacher's salary, without fringe benefits or compensation for extracurricular activities.[10] The model is estimated with standard linear regression techniques.[11] The explanatory variables include a wide range of teacher, school, and district characteristics. The 2-year average share of K–6 students eligible for a free lunch, for example, is used as a measure of student poverty.[12] A complete list of the variables in the model is provided in appendix table A-1.

The results for the teacher wage model are reported in table 1. Looking first at teacher characteristics, most of the variables are statistically significant and have the expected sign. There is a positive relationship, for example, between teacher salaries and total teaching experience, whether the teacher has a graduate degree, whether she teaches math or science, and the percentage of assignments in which she is certified to teach. The two variables representing the quality of the college the teacher attended (as rated by *U.S. News & World Report*) have the expected positive sign, but they are not statistically significant.

Among the other discretionary factors, we found that working in a larger school and having larger classes are associated with higher wages, holding other factors constant, but the class-size effect is not statistically significant. Not surprisingly, we found that the more resources that a district has relative to its peer groups, the higher the wages are.[13] One unusual result is the positive coefficient for the student outcome measure, which implies that teachers require additional pay to work with high-performing students. Another possi-

[9] For a detailed discussion of the process of developing a teacher cost index and a cost of education index, see Chambers (1997).

[10] Following many other studies, the teacher salary variable is specified as the natural logarithm of the observed salary.

[11] Because the equation is estimated at the individual teacher level, it is reasonable to assume that teachers are price takers, that is, that they cannot influence the salary schedule they face or the underlying personnel policies of the school district. Thus, endogeneity of some of the independent variables is not likely to be a problem. However, the variables used in the model are from at least two different levels of aggregation, the individual teacher and the school district. This implies that the standard errors from an ordinary least squares regression (OLS) are biased, because the error terms are not independent across observations. In particular, the estimated standard errors on district-level variables may significantly understate the actual standard errors. We use a well-known method to correct for this problem. See Huber (1967) and White (1980). These corrections were made using the software package STATA, and clustering was assumed only at the district level. There are three variables at the county level—professional wage, unemployment, and crime rate. It is possible that the standard errors for these variables are underestimated. Finally, the model was initially estimated with a measure of high-cost special needs students, but the coefficient was not found to be statistically significant. The final model was estimated without this variable.

[12] One of the difficulties of estimating a "reduced form" teacher wage model is that variables, such as poverty, can pick up both working condition differences and fiscal capacity differences across districts. The coefficient on the percent of free-lunch students was consistently negative, suggesting that this variable is picking up fiscal capacity differences. To separate these two effects, we regressed the percent free-lunch students on the natural log of per pupil income and property values, and used the residual in the regression as the measure of poverty. This variable had the expected positive relationship with wages, holding other factors constant.

[13] This is one of the so-called efficiency variables, which are discussed later in the paper.

Table 1. Results of the teacher wage model: 2000[1]

Variables	Coefficient	t-statistics
Constant	7.84418	26.40
Teacher characteristics		
Total experience[2]	0.21596	10.13
Master's or higher	0.06403	2.51
Teacher of math/science	0.01261	6.00
Percent of assignments certified	0.03318	7.78
M.A. from top-rated school	0.00932	0.97
B.A. from top-rated school	0.00215	0.88
Factors under district control		
School enrollment[2]	0.01827	4.50
Class size	0.00006	1.39
Aid efficiency variable[3]	0.59311	2.55
Income efficiency variable[3]	0.00000	5.00
Full value efficiency variable[3]	0.00000	0.45
Average student performance	0.00348	7.50
Factors outside district control		
Labor market factors		
Average unemployment rate (1997–99)	–0.01626	–3.95
Pupil density[2]	0.03074	5.58
Professional wage[2]	0.14947	5.22
Share of county's teachers	–0.16798	–3.00
Working condition factors		
Average percent LEP[4] students	0.43459	2.03
Adjusted free lunch student rate[5]	0.23406	5.38
Juvenile violent crime rate	–45.71180	–3.72
District enrollment[2]	0.02708	2.50
Adjusted R-square	0.71400	

[1]Estimated with ordinary least-squares regression, with standard errors adjusted for nonindependence using Huber (White) method. Dependent variable is the natural logarithm of teacher salaries. Sample size is 121,203.

[2]Expressed as natural logarithm.

[3]Calculated as the difference between district level and average level in peer group. See Duncombe (2002), appendix B.

[4]"LEP" means limited English proficient.

[5]Residual from a regression of the average (1999–2000) share of free lunch students in elementary school regressed on the log of per pupil income and per pupil property values.

SOURCE: Calculations by authors.

bility is that this variable is picking up fiscal capacity differences across districts associated with unobserved teacher quality.

Turning to the factors outside of district control, we find that most of the variables fit expectations. More urbanized districts pay higher wages, for example, as do districts with higher private sector wages. The coefficient on the unemployment rate variable has the expected negative sign; lower unemployment rates lead to tighter labor markets and higher salaries. Salaries are negatively related to the share of a county's teachers in a district, indicating that districts with relatively large numbers of teachers may be more attractive to teachers because they provide more options.[14]

We also find, as expected, that salaries are affected by the working conditions in a district. To be specific,

[14] Another interpretation for this variable is that it measures the ability of the district to exercise market power over wages. If the variable is interpreted as a monopsony measure, then it would be a discretionary variable and would be held constant in constructing the teacher wage index.

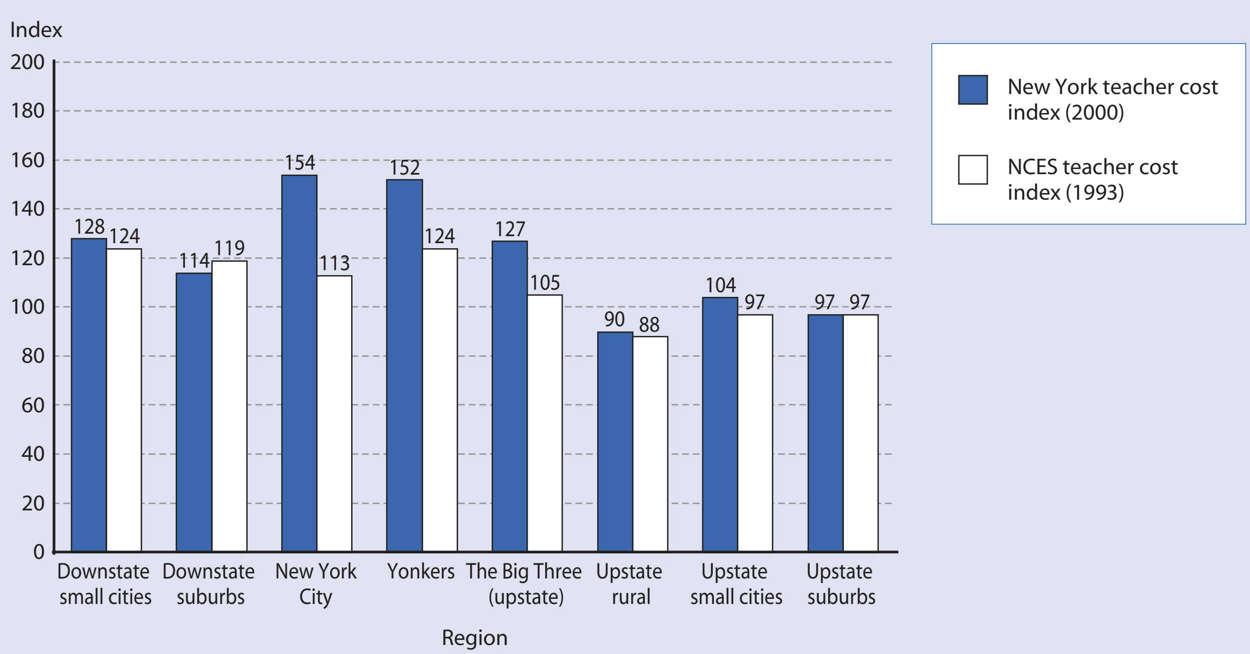
districts with higher shares of students with limited English proficiency or receiving free lunch pay higher salaries, holding other factors constant. Larger districts (in terms of enrollment) are associated with higher salaries, even controlling for school size and pupil density, suggesting that large district size may negatively affect working conditions. One of the variables included to measure working conditions, juvenile violent crime rate, is negatively related to wages. Possible explanations for this counterintuitive result include (1) teacher quality has not been adequately controlled for, so that this variable is picking up both working conditions and lower teacher quality, and (2) the crime rate is capturing omitted urbanization and fiscal capacity variables, and its coefficient reflects the fact that poorer urban areas tend to have lower fiscal capacity. In either case, the crime rate variable does not appear to be reflecting differences in working conditions.

This teacher wage model can be used to develop a measure of the underlying wage that a school district must pay to attract teachers with a given set of characteristics to a school district. As noted earlier, this predicted wage should only measure variation in factors outside a school district's control. Constructing the predicted wage involves three steps: (1) multiplying the regression coefficient associated with each discretionary variable by the state average for that variable, (2) multiplying the regression coefficient associated with each variable outside a district's control by the actual value for that variable in each district, and (3) summing for each district the results from the first two steps to obtain the predicted wage.[15] The teacher wage index is then defined as the ratio of the predicted wage for each district divided by the state average wage and multiplied by 100.

Our teacher cost index for New York is reported in figure 2. This index reveals a distinct difference in resource costs between upstate and downstate districts. Most of the downstate districts have above-average costs, and most of the upstate districts have below-average costs. New York City and Yonkers, for example, would have to pay over 50 percent more than the av-

[15] Because the wage is expressed as a logarithm, the expected wage is the antilog of this sum.

Figure 2. Comparison of teacher cost indexes for New York regions: 1993, 2000



SOURCE: Chambers, J. (1997). *A Technical Report on the Measurement of Geographic and Inflationary Differences in Public School Costs*; and calculations by authors.

erage district to attract similar teachers. These high index values reflect both the high cost of living in downstate New York and the challenging working environment in these two cities. Even though the other large cities, commonly called the Big Three, are located in upstate New York, where the cost of living is below average, their working conditions are so difficult that they still would have to pay salaries 25 percent higher than those in the average district to be able to recruit teachers with similar characteristics.

Figure 2 also presents results for the 1993 teacher cost index developed by Chambers (1997) for NCES.[16] This index shows the same general pattern as our index, but its values for large cities are significantly smaller. The NCES index values for New York City and Yonkers, for example, are only 10 to 25 percent higher than the state average, and only 5 percent higher than the state average for the upstate large cities (the Big Three). Because it is based on more detailed and more recent data and is specific to New York State, we believe that our index provides more credible results than the NCES index. To put it another way, the significant differences between our teacher cost index and the NCES index highlights the importance of careful state-by-state analysis of factors affecting resource costs.

A state adequacy standard that requires all districts to raise their students to a given level of student performance cannot be achieved with a standard foundation aid formula.

Estimating Cost Functions and Full Cost Indexes

A standard foundation aid formula brings all districts up to a minimum level of spending per pupil, but does not ensure a minimum level of student performance. A state adequacy standard that requires all districts to raise their students to a given level of student performance cannot be achieved, therefore, with a standard foundation aid formula. Instead, the only way to ensure that all districts have the resources they need to meet this standard is to implement a foundation aid formula that includes adjustments both for resource cost differences across districts and for the higher level of resources required in some districts because of a concentration of at-risk students and other factors outside their control. The necessary adjustments can be determined by estimating an education cost function and using the results to calculate an overall education cost index.

An education cost function relates per pupil spending in a school district both to factors outside a district's control and to factors a district can influence. Only the former factors are considered, however, in calculating an education cost index. The logic behind a cost function begins with the observation that spending levels in a district are clearly affected by the level of student performance that school officials, and ultimately taxpayers, want to support, a key factor inside the district's control. The cost function we estimate, therefore, includes as an explanatory variable the student performance measure described earlier. Because additional resources are generally required to raise student performance, we expect a positive relationship between student performance and spending, holding other factors constant.

The relationship between spending and performance has to be tempered by the possibility of inefficiency in the use of resources, another factor within a district's control. Some school districts may have high spending relative to their level of student achievement not because of higher costs, but because of inefficient use of resources. Moreover, a cost model requires careful accounting for efficiency differences across districts, because the results may depend on which set of efficiency factors is included.

The literature on managerial efficiency and public bureaucracies suggests three broad factors that might be related to productive inefficiency: fiscal capacity, competition, and factors affecting voter involvement in monitoring government (Leibenstein 1966; Niskanen 1971; Wyckoff 1990; Duncombe, Miner, and Ruggiero 1997). Research on New York school districts suggests incentives for efficient use of resources may be lower in

[16] The NCES index developed by Chambers (1997) is based on a regression model fit to national data on teachers, schools, and districts from several NCES data sources, and other national data sources. While the basic structure of the teacher wage equation is similar, the measures of teacher salary, teacher characteristics, and school district characteristics differ substantially from those used in this study.

wealthier or higher income districts, or those receiving more state aid, because looser financial constraints diminish the incentive for taxpayers to put pressure on their school districts (Duncombe and Yinger 2000). Moreover, school officials have an incentive to compare their school's performance to that of similar districts and will work hard to keep from falling behind other districts at the same level of income or wealth. To measure the relative affluence of a district, we include the difference between a district and the average in its peer group for per pupil income, per pupil property values, and state aid as a percent of district income. In this context, a peer group is defined as one of the need/resource-capacity categories defined by SED, with the five large cities treated as one peer group.[17] We expect that the higher a district's resources relative to its peer group, the less efficient the district will be and thus the more it will spend, all else being equal.

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The other variables in a cost function are factors that are outside a district's control. These cost factors can be divided into three categories, resource prices, student needs, and the physical characteristics of the district. As discussed above, some districts may have to pay significantly more to recruit teachers of equal quality. The average salary for full-time teachers with a graduate degree and 1 to 5 years of experience is used as the teacher salary measure.[18] Factors affecting students' school readiness, motivation, and behavior influence not only the working conditions facing a teacher, and hence competitive salaries, but also the quantity of resources required to reach any given student performance standard. We expect, for example, that students whose native language is not English will require additional resources in the form of bilingual education classes and other support to help them obtain mastery of English and to stay on track in the curriculum. The cost function in this study includes two student need factors: the share of district enrollment that consists of limited English proficient (LEP) students, and the percentage of the district's children between 5 and 17 years old living below the poverty line. Finally, education costs may be affected by certain physical characteristics of a district, including enrollment size and physical terrain. Our cost model includes a set of variables indicating the enrollment level in the district to reflect the fact that costs are likely to be higher in very small school districts (Duncombe and Yinger 2001b).

The dependent variable in the cost model is per pupil operating expenditure for fiscal year 2000.[19] The sample size is 678 school districts. Descriptive statistics for the variables in the cost model are provided in appendix table A-2. One technical complexity arises in estimating this model. Budget decisions involve tradeoffs between desired student performance levels, constraints on local property tax rates, and decisions over teacher salaries. In other words, spending levels, performance targets, and teacher salaries are set simultaneously in the budget process, which implies that the performance measure and teacher salaries are likely to be endogenous and standard regression techniques are likely to yield biased results. Consequently, we estimate the cost model with the appropriate simultaneous-equations procedure.[20]

[17] The categories include New York City, other large cities, high-need urban/suburban, high-need rural, average need, and low need. These districts are classified based on a comparison of fiscal capacity (property values and income) and student needs (students receiving reduced-price lunch, limited English proficient [LEP] students, and students in sparsely populated districts). New York City and the other large cities were combined as one category. See New York State Education Department (2001), appendix, for a description of this classification.

[18] As before, this variable is expressed as a natural logarithm.

[19] Expressed as a natural logarithm.

[20] The cost model was estimated with two-stage least squares regression (2SLS), with instruments selected from characteristics of adjacent school districts. We calculated the average, minimum, and maximum values of adjacent districts for a set of student characteristics, performance levels, physical characteristics, and fiscal capacity measures. These potential instruments are then tested, and those that meet the requirements of an instrument are used in the cost model. Instruments include the log of the pupil density, the average of LEP students in adjacent districts, the maximum for income and performance on the grade 8 exams, and the minimum of performance on grade 8 exams for adjacent districts. See Duncombe (2002), appendix B, for a detailed discussion of the process of selecting instruments.

The cost model results are reported in table 2. In general, the coefficients in the regression models have the expected signs. The student performance variable has a positive coefficient and is statistically significant, indicating that higher performance requires more resources. The precision of this coefficient is important, because it is used in the adequacy calculations discussed below. As anticipated based on our analysis of district inefficiency, the more resources a district has relative to its peers, the higher its spending. Teacher salaries are positively related to per pupil spending and the salary coefficient is sensible; a 1 percent increase in predicted salaries is associated with a 1 percent increase in per pupil spending.

The results for student characteristics also follow expectations. As the proportion of poor students or LEP students increases, the level of spending also increases, controlling for performance. Both of these coefficients are statistically significant at conventional levels. The coefficient on the child poverty variable (LEP variable) indicates that a 1 percentage point increase in the child poverty rate (share of LEP students) is associated with a 0.98 (1.075) percent increase in per pupil spending, all else being equal. Finally, the coefficients for the enrollment class variables indicate that, relative to very small districts (under 1000 students), costs per pupil are generally lower for most enrollment categories except the largest (over 15,000 students). The coefficient on the 1000-to-2000-student variable, for example, indicates that these districts spend, on average, 9.3 percent less than districts with fewer than 1000 students, holding other variables constant. In other words, the smallest districts have the highest costs.

Once an education cost function has been estimated, an education cost index can be calculated in simple steps. For each variable that a district can influence,

Table 2. Results of the education cost models: 2000[1]

Variables	Coefficient	t-statistics
Constant	–2.58360	–2.29
Performance index	0.00752	3.57
Efficiency variables[2]		
Full value	0.00000	10.55
Aid	1.12073	3.83
Income	0.00000	0.61
Average teacher salary[3]	0.99296	7.65
Percent child poverty (1997)[4]	0.97819	5.46
2-year average LEP[5] students[4]	1.07514	2.30
Enrollment classes[6]		
1,000–2,000 students	–0.09342	–4.20
2,000–3,000 students	–0.07956	–2.72
3,000–5,000 students	–0.09500	–2.68
5,000–7,000 students	–0.07944	–2.01
7,000–15,000 students	–0.09579	–2.08
Over 15,000 students	0.05404	0.51
Adjusted R-square		0.493

[1]Estimated with linear two-stage least squares regression, with the student performance and teacher salaries treated as endogenous. See Duncombe (2002), appendix B for discussion of instruments.

[2]Calculated as the difference between district value and the average in peer group. (See Duncombe 2002, appendix B.)

[3]For full-time teachers with 1 to 5 years of experience. Expressed as natural logarithm.

[4]Variables expressed as percent of enrollment.

[5]"LEP" means limited English proficient.

[6]The base enrollment is 0 to 1,000 students. The coefficients can be interpreted as the percent change in costs from being in this enrollment class compared to the base enrollment class.

SOURCE: Calculations by authors.

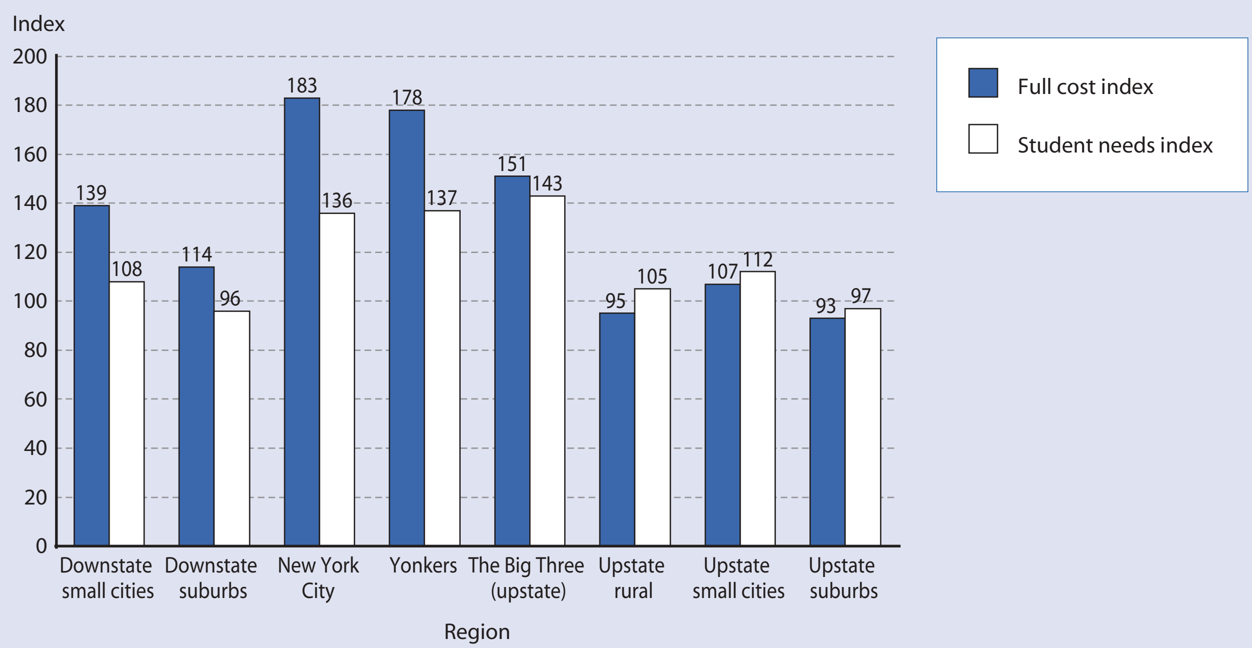
the estimated coefficient from the cost model is multiplied by some constant value for the variable, usually the state average, and these products are summed across all such variables. This approach holds these variables constant across school districts; that is, it does not allow factors inside a district's control to influence its relative educational costs. For each variable outside a district's control, the estimated coefficient from the cost model is multiplied by the actual value for the variable in each district. These products are then summed across all such variables. The variation in these variables across districts is, of course, the source of the variation in the cost index. These two sums (based on factors inside and outside a district's control, respectively) are then added, resulting in a prediction of the amount each district must spend per pupil to obtain an average performance level, assuming that it has the efficiency level in the average district.

The final step is to transform this predicted spending into an index. This step involves dividing predicted spending in each district by predicted spending in a district with average characteristics (including those inside a district's control) and then multiplying the result by 100. This index reveals how much more or less than the average district each district must spend to achieve any given performance standard. An index value of 200 indicates, for example, that a district must spend twice as much as the average district to obtain any given performance standard, whereas an index value of 50 indicates that a district needs to spend only half as much.

We also calculate a student need index, which has the same form as the overall education cost index except that it holds all factors at the state average except for the poverty and LEP variables. A value of 150 for this index, for example, indicates that a district must spend 50 percent more than the average district to achieve any given performance standard simply because of the high needs among its students (as measured by poverty and LEP).

Figure 3 presents our education cost index and student need index. The full cost index, which reflects variation in both resource costs and student needs, has a value of 183 for New York City, which indicates that even if operating at an average efficiency level, New York City would have to spend 83 percent more than a district with average cost characteristics to reach the

Figure 3. Cost and student needs indexes for New York regions: 2000



SOURCE: Calculations by authors.

same level of student performance. In addition, child poverty and LEP levels in New York City raise the costs of achieving any adequacy target by 36 percent compared to a district with average poverty and LEP rates. This index also indicates that to reach the same student performance level as the average district, Yonkers would have to spend almost 80 percent more per pupil, and the upstate Big Three would have to spend 51 percent more per pupil. Moreover, student needs alone have about the same impact on required spending for Yonkers and for the Big Three as they do for New York City. The only other districts with costs significantly above average are the "downstate small cities," which have to pay above-average teacher salaries but do not have above-average student needs.

The typical approach for including student-need adjustment in aid formulas is to weight some students more heavily than others in the distribution of aid. If aid is distributed on a per pupil basis, then counting some types of students twice, for example, will assure that districts with these types of students receive more resources. While most states use the weighted-pupil approach to adjust for student needs, the origins of most of these weights remain obscure. At best, some are based on professional judgments about the extra costs associated with certain types of students; others appear to be ad hoc political compromises. Rarely are pupil weights determined through careful analysis of the actual relationship between student characteristics and costs. This is unfortunate, because an education cost model, such as the one estimated for this paper, can be used to calculate these weights.

We now illustrate this principle by using our cost model to calculate cost weights for both students in poverty and LEP students. The first and third columns of table 3 provide estimates of the extra costs associated with a student with certain characteristics in different types of districts. We find that each student in poverty requires a district to spend between $7,000 and $9,000 in additional resources to maintain the average performance level in the state. For LEP students, the extra costs are even higher, namely, in excess of $10,000 per student.

Pupil weights are calculated by dividing these additional costs by the spending required to bring non-LEP and poverty students up to average student performance. The resulting weights are presented in the second and fourth columns of table 3.[21] For both types of students the weights are approximately equal to 1. A weight of 1 can be interpreted as indicating that it is twice as expensive to bring a student of this type up to any given performance level as it is to bring other types of students up to that performance level. While there exists no definitive list of the pupil weights used by various states, the available evidence suggests that weights of 0.5 or below for at-risk students are the norm (Alexander and Salmon 1995, table 9.2). Our results indicate that the typical weight is far too low for New York State.

[21] See Duncombe (2002), appendix B, for a discussion of the methodology used to calculate pupil weights from cost function results.

Table 3. Cost impact of student needs: 1999–2000*

Regions	Extra cost per child in poverty (in dollars)	Child poverty weight	Extra cost per LEP student (in dollars)	LEP student weight
Downstate small cities	8,002	0.98	10,571	1.13
Downstate suburbs	7,941	0.98	10,343	1.10
New York City	7,945	0.98	10,762	1.15
Yonkers	7,606	0.94	11,008	1.18
The Big Three (upstate)	8,985	1.10	10,440	1.12
Upstate rural	8,086	0.99	10,170	1.09
Upstate small cities	7,715	0.95	10,260	1.10
Upstate suburbs	7,951	0.98	10,129	1.08

*Pupil weight is defined as the percent increase in costs associated with a student of a certain type. For example, the limited English proficient (LEP) student weight in New York City is 1.15. This indicates that bringing a typical LEP student in NYC up to an average performance level (160) will cost 115 percent more than a non-LEP student with otherwise similar characteristics.

SOURCE: Calculations by authors.

Estimating the Cost of Adequacy

The bottom line in developing a school finance system to support adequacy is determining what it will cost in each school district to reach the adequacy standard (assuming average efficiency). As explained earlier, we consider student performance standards of 130 and 160 to illustrate the effects of different adequacy standards on costs. For each performance standard, we first use our cost model to calculate the per pupil spending required to reach the standard in a district with average characteristics. This required per pupil spending in the average district is then multiplied by the cost index (divided by 100) to estimate the cost of adequacy in other districts.

To estimate the cost of adequacy with a resource standard, one must select a minimum bundle of resources and then estimate its cost. One technique for carrying out these steps is commonly called the "resource cost model" (RCM), which is a "bottom-up" approach to estimating the cost of adequacy (Chambers and Parish 1982; Management Analysis 1997). The RCM method involves designing prototypical classrooms, schools, and districts by asking professional educators what resources are required for a school to meet a particular standard. These resources are multiplied by resource prices to estimate the cost of resource adequacy in a prototypical district. The cost in the prototypical district is then multiplied by the resource cost index to estimate adequacy costs for other districts. For simplicity, we use the cost of adequacy in a district with average characteristics to identify a prototypical district's cost, instead of identifying a bundle of resources and determining its cost. We then multiply the spending required in this district by different resource cost indexes rather than by the full cost index.

Table 4 provides estimates of the per pupil spending required to reach different adequacy standards using different cost indexes for New York school districts. Comparisons are made to actual per pupil expenditures in the 1999–2000 fiscal year. As expected, we find that estimated required spending levels depend heavily on which standard and which cost index are used. With a standard of 130 and the teacher cost index produced for this study (New York teacher cost index), achieving adequacy requires significant increases over actual spending only in New York City and the large upstate cities (top panel of table 4).[22] Using the NCES teacher cost index, actual spending in New York City is estimated to already be adequate to reach a standard of 130. Using the 130 standard and a full cost index, which adjusts for resource prices and student needs, adequacy cannot be achieved without significant spending increases in all the large cities. We estimate, for example, that per pupil spending in New York City would have to increase by 56 percent, from $8,823 to $13,758.

With a standard of 130 and the teacher cost index produced for this study (New York teacher cost index), achieving adequacy requires significant increases over actual spending only in New York City and the large upstate cities.

If the more ambitious 160 standard is selected, then spending increases would be required in New York City and the upstate Big Three using any cost index. Using the NCES index, modest spending increases would have to occur in all the large cities except Yonkers and in the downstate small cities. When either the teacher cost index or the full cost index developed for this study is used, however, achieving adequacy would require sizeable spending increases in all the large cities and downstate small cities. Using the full cost index, for example, we estimate that spending would have to double in New York City, increase by 35 percent in Yonkers, and increase by 53 percent in the large upstate cities (the Big Three). Clearly, the level of the standard and the type of adjustment for cost differences across districts can have a large impact on the estimated costs of reaching an adequacy standard.

State Aid Formulas to Fund Adequacy

Basic operating aid formulas should be designed primarily to assist state governments in accomplishing their educational equity objectives. In most states, school districts differ widely in property wealth, income, resource prices, and student needs, and these

[22] Because regional averages are presented, the results in table 4 obscure the fact that some districts in other regions are estimated to require significant spending increases to reach the adequacy standard.

Table 4. Required spending per pupil for adequacy for different cost indexes*

Regions	1999–2000 per pupil expenditure	Standard of 130: New York teacher cost index (2000)	Standard of 130: NCES teacher cost index (1993)	Standard of 130: New York full cost index (2000) (all cost factors)
	In dollars			
State average (per pupil)	9,781	7,606	7,606	7,606
Downstate small cities	10,400	9,765	9,458	10,502
Downstate suburbs	11,723	8,642	9,038	8,573
New York City	8,823	11,701	8,597	13,758
Yonkers	12,437	11,569	9,430	13,384
The Big Three (upstate)	9,289	9,627	7,990	11,372
Upstate rural	9,509	6,842	6,693	7,181
Upstate small cities	9,335	7,902	7,357	8,054
Upstate suburbs	8,307	7,361	7,348	7,028
	2000 average performance index	**Standard of 160: New York teacher cost index (2000)**	**Standard of 160: NCES teacher cost index (1993)**	**Standard of 160: New York full cost index (2000) (all cost factors)**
		In dollars		
State average (per pupil)	160	9,532	9,532	9,532
Downstate small cities	148	12,236	11,852	13,161
Downstate suburbs	169	10,829	11,326	10,774
New York City	103	14,663	10,773	17,241
Yonkers	107	14,497	11,817	16,772
The Big Three (upstate)	96	12,036	10,012	14,251
Upstate rural	156	8,574	8,387	8,999
Upstate small cities	145	9,903	9,220	10,093
Upstate suburbs	160	9,224	9,208	8,808

*Calculated by estimating the cost in district with average cost to reach the given standard multiplied by the cost index (divided by 100).

NOTE: Large city districts are shaded.

SOURCE: Calculations by authors.

differences can lead to equally large differences in student performance. Most states have long recognized that variation in fiscal capacity can play an important role in creating large disparities in spending and student performance across districts. The equally significant impact on student performance of variation in resource costs and student needs has received far less attention. Educational cost indexes are important largely because they make it possible to design school aid formulas that effectively target resources to districts with the highest costs and greatest student needs. This section will illustrate how a cost index can be used in conjunction with fiscal capacity measures to develop simple but effective operating aid formulas for funding adequacy standards.[23]

Designing a Cost-Adjusted Foundation Formula

The majority of states use some form of a foundation grant system, which is designed to ensure that all districts meet some minimal standard.[24] For the most part, however, these systems express their standard in terms of spending, not student performance, so they do not bring the most disadvantaged districts up to a reasonable performance standard. In other words, these sys-

[23] This section draws heavily from Ladd and Yinger (1994), and Duncombe and Yinger (1998, 2000).

[24] For the most recent compilation of school finance systems, see U.S. Department of Education (2001).

tems are not consistent with the current focus on minimum adequacy standards for student performance.

In designing a *traditional foundation formula*, a state government needs to set a statewide minimum level of spending (E^*) and the minimum amount of local effort. The latter is often defined in terms of a state-determined minimum local property tax rate (t^*) . The amount of revenue raised at this rate depends on the actual property values per pupil in a school district (V_i). Once these are defined, the per pupil aid (A_i) received by a district is simply the difference between the minimum spending level and the sum of the revenue raised by the district at the minimum local effort.[25] In short,

$$A_i = E^* - t^* V_i .$$

While the minimum spending level is constant statewide, the amount raised at the minimum level of local effort will vary across districts in direct proportion to their fiscal capacity. Thus, a foundation formula expects wealthier districts to contribute more taxes per pupil than poorer districts. If the traditional foundation formula is to successfully bring districts up to the minimum spending level, then a minimum level of local effort must be enforced; that is, no district should be allowed to levy a tax rate below t^*. Taken literally, this formula also could lead to "negative aid" or "recapture" of local property taxes in wealthy districts. In practice, however, the minimum aid amount is usually set to zero, and we use this aid design in the rest of our analysis.[26]

A traditional foundation formula with a minimum-tax-rate requirement should be successful in bringing spending in all districts up to the desired minimum level. However, the same minimum spending will be much more successful in raising student performance in some districts than in other districts, due in part to factors outside a district's control. Thus, a traditional foundation formula will generally not be successful in raising student performance in all districts up to an adequate performance level unless the minimum spending level is set very high, and the performance adequacy standard is set very low.

A traditional foundation formula will generally not raise student performance in all districts up to an adequate level unless the minimum spending level is very high and the performance adequacy standard is very low.

To convert a traditional foundation formula into a *cost-adjusted foundation formula* requires the basic tools that have been developed in this study.[27] First, the state must select an adequacy standard defined as a minimum level either of resources or of student performance, not simply of spending. Second, the adequacy standard must be converted into the spending required to meet the adequacy standard, an amount that obviously varies across districts because of variations in costs. One approach to these two steps is, of course, developed in this paper. Specifically, we estimate the cost of adequacy by multiplying the spending required in the district with average cost characteristics by a cost index. For a resource adequacy standard, the cost index reflects differences in the resource costs across the state that arise because higher salaries must be paid to attract teachers in some districts than in others. For a performance adequacy standard, the cost index captures both variation in resource prices and the greater quantity of inputs required in some districts because of higher student needs.

These steps make it possible to define cost-adjusted foundation aid per pupil, which is the difference between the spending per pupil necessary to reach the

[25] Some states consider other local revenue sources or certain types of federal aid as part of the local contribution. To minimize the required state aid, we counted all federal aid as part of the local effort.

[26] A few states have turned the local property tax into a state tax, which is an indirect way to include recapture in a foundation formula.

[27] This could also be called a performance-based foundation when the cost adjustment is for resource costs, sparsity, and student needs (our full cost index). The aid formula with full cost adjustment is designed to provide adequate resources for a district to have the opportunity to reach a particular performance standard (Duncombe and Yinger 2000). We have used the more general term, cost-adjusted foundation, to reflect either resource cost adjustment or full cost adjustment.

adequacy standard in a given district and the amount raised in the district by the minimum local tax effort and federal aid:

$$A_i = E^*c_i - t^*V_i ,$$

where E^* is required spending in the district with average characteristics, and c_i is an education cost index (centered on the district with average characteristics). The cost of adequacy calculated previously is represented by E^*c_i .

This cost-adjusted foundation formula is simple enough to be transparent to most school personnel and to the average voter; the logic of adjusting for costs is compelling and easy to understand. Moreover, the available evidence indicates that it would be effective. Duncombe and Yinger (1998) tested a number of aid formulas using New York data to determine which ones are the most effective in accomplishing specific educational equity objectives. They conclude:

> Our simulations of the impacts of . . . outcome-based [foundation] plans indicate that such plans can be an effective tool for promoting educational adequacy, at least when they include a required minimum tax rate. Indeed, by requiring contributions from local taxpayers, these plans can bring the vast majority of districts up to any standard policymakers select. The districts that remain below the standard are relatively inefficient. (p. 258)

As with a traditional foundation formula, the success of a cost-adjusted foundation aid formula in significantly raising resources and student performance depends on enforcing a minimum-local-tax-rate provision and on the efficiency with which needy school districts use the additional resources.

Such a cost-adjusted foundation aid program would result in an increase of $6 billion, substantial aid increases in the larger cities, and significant aid cuts in many downstate districts and rural districts.

Example of Aid Distribution With a Cost-Adjusted Foundation System

To illustrate a cost-adjusted foundation formula, we use the estimates of spending required to reach particular adequacy standards in table 4. In addition, we impose a minimum local effort equivalent to a property tax rate of $15 per $1,000 of market value, which is equal to the 1999–2000 state average.[28]

By design, a cost-adjusted foundation focuses aid on districts that face the most severe constraints in reaching the performance standard. However, table 5 makes it clear that the distribution of aid across districts depends significantly on the standard chosen and the type of cost adjustment made. This table compares the current aid distribution with aid that is distributed entirely through a cost-adjusted foundation formula. With a standard of 130 and the NCES teacher cost index, switching to a cost-adjusted foundation program would actually cut aid by over $2 billion, and even the large cities would receive little, if any, aid increases. In contrast, using the teacher cost index developed in this study would raise aid by $3 billion, and would result in large aid increases in the large cities. A cost-adjusted foundation aid program based on the full cost index developed in this study would result in an increase in the overall aid budget of $6 billion, substantial aid increases in the large cities, and significant aid cuts in many downstate districts and in rural districts.

Not surprisingly, the results for a performance standard at the current state average of 160 are more dramatic. In this case, switching to a cost-adjusted foundation aid program would result in substantial aid increases for the large cities using any cost index. Aid increases in New York City would range from about $2,000 per pupil (a 52 percent increase) with the NCES teacher cost index, to $8,500 per pupil (a 215

[28] Although this minimum effort is expressed as a property tax rate, the revenue could be raised through some other source, such as a local income tax. In this case, the local property tax rate would not have to be this high.

Table 5. Distribution of cost-adjusted foundation aid for different cost indexes[1]

Regions	2000–2001 per pupil school aid [2]	Standard of 130: New York teacher cost index (2000)	Standard of 130: NCES teacher cost index (1993)	Standard of 130: New York full cost index (2000) (all cost factors)
Total aid budget (in millions of dollars)	11,145	13,332	9,702	15,458
	In dollars			
State average (per pupil)	4,053	2,856	2,784	2,836
Downstate small cities	3,205	2,291	1,971	2,828
Downstate suburbs	2,419	1,312	1,531	1,204
New York City	3,949	6,922	3,817	8,979
Yonkers	3,112	5,837	3,697	7,652
The Big Three (upstate)	5,835	6,516	4,879	8,261
Upstate rural	5,203	3,099	2,877	3,397
Upstate small cities	4,937	4,321	3,800	4,496
Upstate suburbs	4,031	3,365	3,358	3,039

Regions	Standard of 160: New York teacher cost index (2000)	Standard of 160: NCES teacher cost index (1993)	Standard of 160: New York full cost index (2000) (all cost factors)
Total aid budget (in millions of dollars)	19,762	15,223	22,395
	In dollars		
State average (per pupil)	4,448	4,440	4,397
Downstate small cities	4,340	3,887	5,145
Downstate suburbs	2,505	2,834	2,334
New York City	9,884	5,993	12,462
Yonkers	8,765	6,084	11,040
The Big Three (upstate)	8,953	6,901	11,140
Upstate rural	4,680	4,351	5,066
Upstate small cities	6,289	5,626	6,497
Upstate suburbs	5,133	5,108	4,716

[1]Cost-adjusted foundation aid is calculated by taking the estimated per pupil spending to reach the standard, and subtracting from it the required minimum local tax contribution (1.5 percent of property values) and federal aid. If the calculated aid is negative, it is set equal to 0.

[2]Includes all formula aid except Building Aid, Transportation Aid, and Reorganization Building Aid. Based on estimates of aid distribution in May 2001.

NOTE: Large city districts are shaded.

SOURCE: Calculations by authors.

percent increase) with the full cost index developed for this study. Aid increases would be even higher in Yonkers and would range from 18 percent to 91 percent in the other large cities. If one of the cost indexes developed in this study is used, aid increases would also occur in many small city districts. The significant aid increases in large urban districts would be financed from two sources: aid reductions, particularly in some rural and suburban districts, and large increases in state aid budgets (assuming minimum local effort is kept at the current state average of $15 per $1,000). For a standard of 160, the aid budget would increase between $4.1 billion (37 percent) and $11 billion (101 percent), depending on the cost index used.

Policy Choices in Financing an Adequate Education

Our estimates of the cost of achieving adequacy imply that adequacy cannot be achieved in New York without dramatic changes in the state's school finance system. In particular, spending levels in the high-need urban districts would have to rise significantly to provide the resources these districts need to bring their students up to any reasonable standard. Part of that required spending increase would cover higher teacher salaries so that these districts could compete with their suburbs for the best teachers. In addition, this required spending increase could fund class-size reductions, additional staff to support intense instruction in reading and math, and programs to address the social and health needs of at-risk children. When interpreting these large required spending increases, it is important to keep in mind that reaching the current statewide student average performance (160) in New York would require raising student performance in New York's large cities to levels that have seldom been achieved in large cities anywhere in the nation.

This study has presented estimates of the spending required for a district to have the opportunity to reach an adequacy standard. Another central policy question is how this spending should be financed. To answer this question, that is, to design a school finance system, state policymakers must address two key issues: the relative contributions of state and local governments and the impact of aid changes on school district efficiency.

The minimum local tax effort must be a legal requirement for receiving state aid. Otherwise, financially strapped districts, such as the large cities, will be tempted to cut local school tax rates and siphon state school aid into other services or tax cuts.

State Versus Local Contribution to School Funding

The amount of state aid required to support an adequacy objective is directly related to two key policy decisions: how high to set the standard and how high to set the minimum local contribution. The advantage of a simple aid formula, such as the cost-adjusted foundation, is that it makes clear the impact of these two decisions on the required state aid budget. With any reasonable minimum local tax effort, the state aid budget would have to increase significantly to finance the adequacy standards presented in this report, and the only way to lower the required state aid budget for a given standard is to raise the required local tax effort.

This analysis requires the state to enforce the minimum local tax effort as a legal requirement for receiving state aid. Otherwise, financially strapped districts, such as the large cities, will be tempted to cut local school tax rates and siphon state school aid into other services or tax cuts.[29] This type of behavior obviously undermines an adequacy standard.

Before making a decision about the required minimum local tax effort, a state needs to consider several issues. The first issue is that there are some good arguments for keeping local property taxes low. While a well-administered property tax is not as regressive as is commonly believed, it can impose a significant burden on some low-income households. Moreover, a substantial property tax increase may undermine the competitiveness of a community, particularly a large city, in attracting or retaining residents and business. In our simulations, some of the largest required local tax increases would be in Buffalo and Syracuse and other upstate cities, which have experienced little economic growth in the last decade.

Some states have tried to minimize the burden of local property taxes without increasing state education aid by passing a property tax relief program, such as a homestead exemption. These programs help to ease the property tax burden on homeowners, but they often do not help renters or businesses. Moreover, these programs do not focus tax relief (and the state funds that support it) on homeowners in the school districts that need help the most. If a state is concerned about school finance equity, it should keep local property taxes low by increasing state aid to education, not by implementing direct property tax relief programs (Duncombe and Yinger 2001a).

An alternative to enforcing a minimum-tax-effort requirement is to use matching grants for operating aid.

[29] For a good review of the evidence on local tax effort in New York, where no minimum local effort is required, see New York State Education Department (2000). The study shows that several of the large upstate cities, Buffalo and Syracuse, used most of the school aid increases in the 1990s to lower school taxes rather than improve education.

A matching grant can be adjusted for fiscal capacity and educational costs, so that the state matching rate will be much higher in large cities and other high-need districts. These high matching rates are designed to encourage local spending on schools without requiring any particular local contribution. There is no guarantee, however, that high-need districts will significantly increase local tax effort in response to such a grant, let alone that they will increase local effort enough to achieve an adequate performance, however defined. In fact, a recent analysis using New York data shows that for any given state aid budget, even well-designed matching grants will not be as effective as cost-adjusted foundation grants in reaching an adequacy standard (Duncombe and Yinger 1998). While enforcing a minimum-local-effort provision may be politically unpopular with some local officials, it is a more cost-effective strategy than a matching grant for assuring adequate educational performance.

A substantial increase in state aid to high-need districts could increase inefficiency.

A final issue that arises in deciding on the state's share of education spending is that any increase in this share may lower productive efficiency in school districts. Indeed, some recent research based on New York data finds evidence supporting this possibility (Duncombe and Yinger 2000). This effect could arise, for example, because citizens are more apt to put pressure on school boards and superintendents, and thereby keep school districts efficient, when they must finance education through local taxes than when money for education is provided from state aid. A substantial increase in state aid to high-need districts could increase inefficiency by (1) putting pressure on already strained teacher labor markets; (2) encouraging rapid expansion of teacher salaries without accountability; (3) raising local construction costs through a large building program; and (4) straining the capability of district personnel to efficiently manage finances, to monitor private contracts, and to evaluate the success of existing or new programs.

These efficiency effects are not so large that they eliminate the benefits of higher state aid to school districts, but they do indicate that some of the benefits of state aid "leak out" in the form of higher inefficiency. As a result, states should be leery of setting the required minimum local tax effort too low.

Improve School Efficiency

An alternative approach to the issue of school district efficiency is to devise policies that boost school district efficiency directly, and thereby offset to some degree the efficiency-lowering effects of increased state aid. This approach is appealing, because it allows a state to minimize the required local tax effort for any given state aid budget (or to minimize state aid at any given required local tax effort), but it is also risky, because the impacts of direct policies to boost school district efficiency appear to be modest but are not well understood. Indeed, it is highly unlikely that any policies currently known could generate efficiency improvements sufficient to raise low-performing districts up to a reasonable adequacy standard. Nevertheless, these policies have the potential to make a significant positive contribution to a state education finance system, and in particular, to help high-need districts cope with large aid increases, and they are clearly worthy of more investigation.

Among the policies that appear most promising is technical assistance provided by a state education department on a variety of topics, including

- personnel functions, such as planning and forecasting future staffing needs, teacher recruitment and retention policies, and teacher evaluation methods, etc.;
- the use of program evaluation methods and student performance data to help guide program decisions made by school districts;
- the development of long-range capital plans, and evaluation of alternative capital financing options; and
- financial management practices, such as the use of cost accounting techniques, and school-based budgeting.

Another set of promising policies concerns the training of school district administrators. The recent selection of superintendents from noneducation backgrounds by some large-city districts may reflect in part the lack of training in basic management functions in many educational administration programs. State education departments can help shape the training that education administrators receive through both certification requirements and promoting innovative education management programs. While state governments may be loath to expand state education departments, particularly during an era of declining revenues, assisting districts to improve their management capacity may require an expanded staff and a diversification of specializations within these departments. In some cases, investing in increased capacity in state education departments to provide technical assistance in school management and improved administrator training programs may do as much to promote an adequacy standard as investing in higher state aid.

Conclusions

The trend toward higher student performance standards, which is backed by elected officials, education departments, and courts in many states, is clearly here to stay. It is time for state education finance systems to catch up, and in particular, to implement state aid systems that explicitly recognize that some districts must spend more than others to achieve any given performance standard.

The objective of this study is to assist state governments in developing this type of education finance system. In particular, we explain that an adequacy-based finance system involves three components. First, states must clearly define the type and level of the adequacy standard. They must decide, for example, whether to focus on resource adequacy or performance adequacy. As illustrated in the *CFE* decisions in New York, the distinction between these two types of standards is not always clarified by the courts; nevertheless, this distinction is crucial because it determines whether the state aid system must make adjustments for cross-district differences in student needs.

Second, a state government must estimate the spending required to reach adequacy in each district. This step is consistent with the court decisions in most states, which focus on resource or performance standards, not spending. This estimated cost of adequacy varies across districts in line with education costs. We illustrate the use of two statistical models, namely, a teacher wage equation and an education cost function, to develop education cost indexes. These indexes play a crucial role in estimating the cost of adequacy by measuring differences in resource costs and student needs across school districts. Using New York as a case study, we illustrate how the estimated cost of adequacy, particularly in large cities, is affected by choices about the stringency of the adequacy standard and the cost index. Given the importance of cost adjustments to estimating the cost of adequacy, all state governments would be well advised to support research on educational costs in their state and how these costs vary across districts.

Third, a state must develop a state aid formula that focuses aid on the districts with the highest costs and the lowest fiscal capacities. In New York, these districts include the large cities, which also have some of the lowest levels of student performance in the state. A simple modification of a traditional foundation formula to incorporate the estimated cost of adequacy provides a simple, but powerful aid system for reaching an adequacy standard. The simplicity of this formula helps to focus attention on the key questions in designing a school finance system: What is the adequacy standard? How should costs be accounted for? What should be the state share of educational spending?

Table A-1. Variables in a teacher wage equation

Variable name	Variable description	Source	Level	Mean[1]	Standard deviation[1]
Dependent variable:					
Lnsalary	Natural log of basic salary (no fringes or extra pay)	PMF	teacher	10.82305	0.30820
Discretionary factors					
Teacher quality measures:					
Lexper	Log of total teaching experience	PMF	teacher	2.38441	0.97610
Gradsch	1 if have Ph.D. or M.A.	PMF	teacher	0.74533	0.43568
Mathsci	1 if major assignment is in math or science	PMF	teacher	0.14258	0.34108
Sumcert	Share of assignments teacher has permanent certification.	PMF	teacher	0.88374	0.30213
MA_USN	1 if M.A. college is in *U.S. News* 1st tier	TCERT/*U.S. News*	teacher	0.03037	0.17161
BA_USN	1 if B.A. college is in *U.S. News* 1st tier	TCERT/*U.S. News*	teacher	0.04543	0.20824
Working condition measures:					
Lschenr	Log of enrollment in school where teacher teaches	IMF	school	6.61511	0.63250
Clsize	Average class size for teacher's assignments	PMF	teacher	23.75623	19.49249
Outcomes	Average district student performance	SED	district	141.52944	30.97875
Efficiency measures:[2]					
Aiddif	Difference in aid per dollar of income in this district and average district in similar need-capacity category	State aid	district	–0.01208	0.02283
Fvdif	Difference in per pupil property value in this district and average district in similar need-capacity category	State aid	district	13845	65578
Incdif	Difference in per pupil income in this district and average district in similar need-capacity category	State aid	district	–49726	251518
Factors outside district control					
Labor market variables:					
Lprofwage	Log of average county payroll for professional, scientific and technical sector (1997)	Census	county	10.59301	0.35579
Avgunemp	Average unemployment rate (1997–1999)	BLS	county	4.63639	1.44679
Tchshare	District share of county's full-time teachers	IMF	district	0.41629	0.34830
Working condition variables:					
Lpupden	Log of enrollment per square mile	IMF	district	5.83664	1.96455
Ldisenr	Log of district enrollment (average enrollment)	IMF	district	9.85490	2.65105
Flunres[3]	Adjusted 2-year average of percent K–6 enrollment receiving free lunch (1999–2000)	SED	district	–0.03499	0.26970
Avglep	2-year average of percent LEP[4] students (1999–2000)	SED	district	0.05142	0.05515
Crrate2	Violent crime rate for juveniles (under 18 years old) per 100,000 people (1998)	FBI	county	0.00275	0.00199

[1]Average of values associated with individual teachers. Sample size is 121,203. For county- or district-level variables, this is equivalent to a weighted average, weighted by the relative number of teachers. All data are for 2000 (or the 1999–2000 school year or fiscal year) unless otherwise noted.

[2]Need-capacity categories are defined by the New York State Education Department based on property, wealth, and student characteristics in the district.

[3]Residual from a regression of the average (1999–2000) share of free lunch students in elementary school regressed on the log of per pupil income and per pupil property values.

[4]"LEP" means limited English proficient.

SOURCE: PMF = New York State Education Department Personnel Master File; TCERT = New York State Education Department teacher certification data base; IMF = New York State Education Department Institutional Master File; State aid = New York State Education Department state aid files; Census = U.S. Bureau of the Census, 1997 Economic Census for Service Industries; BLS = U.S. Bureau of Labor Statistics, Local Area Unemployment Statistics; *U.S. News* = *U.S. News & World Report* rankings of undergraduate colleges; FBI = U.S. Department of Justice, FBI Uniform Crime Reporting system; and SED = Provided directly by New York State Education Department staff.

Table A-2. Descriptive statistics for variables in cost model: 1999–2000

Variables	Mean	Standard deviation
Per pupil spending[1]	9.106	0.231
Performance index	159.43	17.58
Efficiency variables[2]		
Full value	0.00000	623613
Aid	0.00000	0.02723
Income	0.00000	73010
Average teacher salary[3]	10.5137	0.1342
Percent child poverty (1997)[4]	0.1580	0.0978
2-year average LEP[5] students[4]	0.0129	0.0307
Enrollment classes[6]		
1,000–2,000 students	0.3201	0.4668
2,000–3,000 students	0.1608	0.3676
3,000–5,000 students	0.1431	0.3504
5,000–7,000 students	0.0605	0.2385
7,000–15,000 students	0.0516	0.2214
Over 15,000 students	0.0103	0.1012
Downstate small city or suburb	0.2589	0.4383

[1]Total spending without transportation, debt services, or tuition payments for students in private placements. Sample size is 678 school districts.

[2]Calculated as the difference between district value and the average in peer group. See text for discussion of peer group.

[3]For full-time teachers with 1 to 5 years of experience. Expressed as natural logarithm.

[4]Variables expressed as a percent of enrollment.

[5]"LEP" means limited English proficient.

[6]The base enrollment is 0 to 1,000 students. Variable equals 1 if district is this size, or else it equals 0.

SOURCE: Calculations by authors.

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