Why Is It So Hard to Help Central City Schools?

William Duncombe
John Yinger

Abstract

Many states have implemented educational grant systems designed to provide more aid to school districts that are, by some standard, in greater need. Nevertheless, many if not most central city school systems continue to produce poor educational outcomes, as measured, for example, by test scores and dropout rates. Using data from New York State, this article asks why existing aid formulas fail to provide the assistance that central city school districts need to bring their educational outcomes up to reasonable standards. Two principal explanations are explored: the failure of existing aid programs to recognize the high cost of providing education in central cities and the possibility that aid simply makes central cities less efficient without raising educational outcomes. The article presents aid programs that account for costs, but shows that these revised programs will do little to help central cities without at least one politically unpopular provision, namely a large state budget or a high required local property tax rate. The article also estimates the extent to which increased aid to central cities leads to their less efficient operation, thereby undermining the objective of improved educational outcomes for central city students. The article concludes by listing the steps that a state can take to help central city schools and by discussing the yet unresolved problems that arise in helping these districts.

Despite decades of education reform efforts since the *Serrano* decision, school quality remains distressingly low in many central cities. In New York State, for example, educational outcomes in the three large upstate central cities, as measured by the test-score-based index we develop later in the article, are 60 percent below the state average. Advocates of more aid for central city schools argue that existing aid programs fail to recognize the unique features of these schools that make it expensive for them to provide education. Opponents argue that more aid will make central city schools even less efficient than they already are and will have little impact on educational outcomes. This article explores these two views. In particular, we estimate, for both central city and other

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districts, what would happen to some key educational outcomes and to the efficiency with which they are provided if a state shifts to an aid program in which educational outcomes, rather than expenditures, are the focus of equalization.

Our objectives are to design outcome-based state aid programs and simulate their effects. We discuss the conceptual issues that arise in any attempt to meet these objectives and describe the steps a state would have to take in designing outcome-based aid. Although we have an unusually extensive data set for school districts in New York State, we cannot fully resolve all the conceptual and statistical issues that arise in this process. Instead, we examine relatively straightforward aid programs and draw on the existing literature to illustrate their likely effects on educational outcomes.

The analysis in this article builds on three relationships. The first two, cost and demand equations for education, are well known. The cost equation describes the relationship between educational spending, outcomes, and costs. We focus on a particular set of educational outcomes, including test scores and the dropout rate. The demand equation explores the factors affecting a district's choice of these educational outcomes, such as its income, tax price, and state aid. Our key innovation in estimating these equations is to include a variable, described more fully later, that measures, among other things, the efficiency with which these educational outcomes are delivered. The third relationship concerns the determinants of this "efficiency" measure. This analysis of "efficiency" must be interpreted with care, but it allows us to estimate the extent to which higher state aid results in less efficient delivery of educational outcomes.

The article begins with a presentation of the behavioral foundations. We explain our cost, demand, and efficiency equations and describe our estimation results, which are based on school districts in New York in 1991. We then bring in state aid reform. We focus on foundation aid formulas, which are designed to bring all districts up to a minimum spending or outcome level. Because central city districts tend to have relatively poor outcomes, a foundation aid plan can focus attention on them without bringing in stronger, more controversial equity standards, such as wealth neutrality, that may involve the relative position of various high-outcome districts.[1] We describe the types of foundation aid and explain our methodology for simulating the impact of a new aid plan on educational outcomes. Next we present our simulation results. We show how various types of districts, including central city districts, are affected both by our preferred foundation plan and by other plans based on the incomplete information a state is likely to employ. Our conclusion summarizes the key lessons from our simulations and, to the extent possible, answers the question in our title.

BEHAVIORAL FOUNDATIONS: COSTS, OUTCOMES, AND EFFICIENCY

The Cost Equation

Any production process uses available technology to translate inputs into outputs. In cost terms, the amount a production unit spends depends on the

[1] Wealth neutrality is a situation in which educational outcomes are not correlated with district wealth per pupil. For more on alternative equality standards for school finance, see Berne and

output level it chooses and on the price of inputs.[2] Analysts have long recognized that this process is particularly complicated with public production because outputs are difficult to define.[3] The translation of inputs, such as teachers and classrooms, into units of governmental activity, such as hours of mathematics instruction, looks like a standard production problem; however, measures of this activity are difficult to develop and the output parents ultimately care about is learning, not instruction. Measures of learning, such as standard achievement test scores, are sometimes controversial, but they are widely available and, as we will see, can be selected using statistical procedures.

The production of learning or any other final outcome depends on the environment in which it is provided. For example, a given amount of instruction delivered in a district where most of the pupils come from poor, single-parent families will, all else equal, result in less learning than if it is delivered where most of the pupils come from stable, middle-class homes. This difference reflects the fact that poverty and single parenthood not only make it difficult for a family to provide resources, such as books and computers, to reinforce lessons learned in school, but also because poverty and family breakup often result in stresses that distract children from their schoolwork.

In short, spending in a school district depends not only on the educational outcomes the district provides and its input prices, but also on its cost environment. Thus, we estimate the cost equation with district spending per pupil as the dependent variable and educational outcomes (such as test scores), wages, and various environmental cost factors (such as district enrollment and poverty rate) as explanatory variables.[4]

This equation makes it possible to calculate two indexes that are crucial for the rest of our analysis. The first is a cost index, which indicates the amount each school district must spend to provide the same level of educational outcomes as the average district.[5] The second is an educational outcome index. As discussed later, outcome-based aid programs generally require state policymakers to select the educational outcomes on which school performance will be based.[6] This choice has a significant impact on the distribution of aid, largely because it affects the estimated cost index. Our outcome index is a weighted average of the outcome variables included in the regression, where

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Stiefel [1984], Monk [1990], and Duncombe and Yinger [1996]. For a recent discussion of the importance of adequacy, the standard behind a foundation plan, see Clune [1993].

[2] The literature on educational production and educational costs is reviewed in Hanushek [1986] and Cohn and Geske [1990]. For a comparison of production and cost analysis, see Duncombe, Ruggiero, and Yinger [1996], who point out that only the latter can provide a comprehensive picture of each district's relative costs, which, as we will see, is needed to design an outcome-based aid program.

[3] Discussions of the unique features of educational production can be found in Bridge, Judd, and Moock [1979], Hanushek [1986], Ratcliffe, Riddle, and Yinger [1990], Ferguson [1991], Downes and Pogue [1994], Duncombe, Ruggiero, and Yinger [1996], and Ferguson and Ladd [1996]. See also Ladd and Yinger [1991] and Duncombe and Yinger [1993].

[4] Teacher wages are set by a school district and are therefore endogenous in this equation. See footnote 16.

[5] A district's cost index equals its predicted spending per pupil, with all variables except the cost variables set at the state average, divided by average spending in the state (and with the predicted, not actual, value of the wage variable). For more on cost indexes, see the references in footnote 3.

[6] It is possible to design an outcome-based aid program without selecting specific outcomes, but the required cost equation is more abstract and less compelling than the one used here. See Downes and Pogue [1994] or Duncombe, Ruggiero, and Yinger [1996].

the weights, which are measured by the regression coefficients, indicate the value voters place on each outcome.[7] This approach provides an appealing replacement for an arbitrarily selected test score as a summary indicator of a district's performance because it is based on a variety of educational outcomes, which are selected and weighted based on statistical procedures.

Several scholars, particularly Hanushek [1986, 1996], argue that additional school spending has little impact on educational outcomes. Other scholars, including Ferguson [1991], Downes and Pogue [1994], and Ferguson and Ladd [1996], provide compelling evidence that spending matters. The approach used here makes it possible to estimate the relationship between spending and a set of educational outcomes selected on statistical grounds. Moreover, as explained later, we explicitly control for productive inefficiency, which is a common explanation for the lack of association between spending and outcomes.

The Demand Equation

Educational outcomes, measured by our index, reflect the decisions of voters and school officials in each school district. Following another long line of literature, educational outcomes are a function of a district's median income; its tax price, which is the amount of taxes the median household can expect to pay to raise educational outcomes by one unit; the aid it receives; and its preferences, as reflected by its demographic characteristic.[8] The tax price is the product of tax share and marginal cost. The tax share is the ratio of median house value to property value per pupil. It indicates how much the median voter must pay to raise one more dollar per pupil. The marginal cost indicates how much the district must spend to provide one more unit of educational

[7] See Duncombe and Yinger [1996]. Our form can be derived from a simple model in which a district tries to maximize a multiplicative outcome index, S, subject to a budget constraint in which each outcome, S_j, is produced at a constant cost c_j, (A cost-minimization version of this problem leads to the same result.) To be specific, a district with total spending, E, tries to select the set of outcomes, S_j, to:

$$\text{Maximize } S = \prod_j (S_j)^{\alpha_j}$$

$$\text{Subject to } E = \sum_j c_j S_j$$

The first-order conditions of this problem imply that:

$$E = (\alpha_1 + \alpha_2 + \alpha_3)S/\lambda$$

where λ is a Lagrangian multiplier to indicate the scale of spending. Moreover, the first-order conditions also can be used to express the coefficients from the output index, the α_i values in terms of the cost parameters. The result:

$$E = \frac{\sum_j c_j S_j}{S} S \equiv (\text{Average Cost})S$$

where average cost is constant. This is exactly the form we estimate. Without the assumption of constant costs per unit of S, the estimated coefficients of the outcome variables might reflect production and demand, not just demand as in this model. As discussed in Duncombe and Yinger [1993] however, this strong assumption is impossible to avoid without very complicated techniques.

[8] For reviews of this literature, see Inman [1979], Rubinfeld [1987], and Ladd and Yinger [1991]. A detailed derivation of the specification used here is in Duncombe and Yinger [1996].

outcomes. We estimate this demand relationship, therefore, by regressing our index of educational outcomes on district median income, tax price, state aid, and a few preference variables.

This demand equation also helps solve a problem in the cost equation, namely that the educational outcome variables are endogenous so that the estimated coefficients may be biased. The demand equation identifies exogenous instruments, such as income and tax share, that can be used in a simultaneous equations procedure for the cost equation.

Measuring District Efficiency

Costs and outcomes also are influenced by a district's productive efficiency, that is, by its ability to translate its resources into outcomes given its cost environment. The problem, of course, is that efficiency is difficult to measure. Although we cannot measure efficiency directly, we can use a technique called data envelopment analysis (DEA) to compare the spending in each district with that in other districts providing the same level of the educational outcomes selected for the cost equation.[9] A DEA variable takes the form of an index that reaches 1.0 in the districts that spend the least, holding measured outcomes constant. However, this DEA variable cannot be interpreted as a measure of efficiency; at a given level of the selected outcomes, for example, districts that spend a relatively high amount might be inefficient in all their activities or might direct their spending toward other outcomes. Moreover, a district's spending might be higher (and hence its DEA index lower) than other districts with the same outcomes if it faces high costs. Nevertheless, the DEA variable does reflect productive efficiency, along with other things, and we can use it to bring efficiency into our analysis.

To begin, we include the DEA variable in our cost and demand equations to control for productive inefficiency. In the cost equation, this type of inefficiency could lead to higher spending, controlling for outcomes and cost factors, and in the demand equation, it effectively raises the price of educational outcomes and could lead voters to substitute away from them, holding income, tax price, and other factors constant. Thus, in both equations, a failure to account for productive inefficiency could bias the coefficients of other variables, and therefore bias the outcome and cost indexes, among other things. Including the DEA variable minimizes this bias. Because the DEA variable reflects costs and omitted outcome variables as well as productive inefficiency, including it in these two equations also may reduce the precision with which the coefficients of cost and outcome variables can be estimated [see Duncombe, Ruggiero, and Yinger, 1996]. However, this loss of precision is a small price to pay for eliminating omitted variable bias.

[9] Data envelopment analysis (DEA) uses linear programming to determine a "best-practice frontier" for production. It was pioneered by Charnes, Cooper, and Rhodes [1978] and Fare and Lovell [1978]. It has become popular in evaluating productive efficiency in the public sector because it handles multiple outputs, is nonparametric, and can be applied to both production and cost functions. See Grosskopf and Yaisawarng [1990] for an application of DEA to cost efficiency. For more on the application of DEA to education, see Fare, Grosskopf, and Weber [1989], Duncombe, Ruggiero, and Yinger [1996], and Ruggiero [in press].

The Efficiency Equation

Our third equation explores the determinants of school district efficiency, with the DEA measure as the dependent variable. Although not relevant in the cost and demand equations, the distinction between productive inefficiency and spending on unobserved outcomes is crucial here. Our objective is to estimate the impact of state aid on a district's productive efficiency. Simply regressing the DEA variable on state aid would not suffice, however, because the DEA variable is influenced by educational outcomes other than those included in the outcome index, and the aid coefficient is likely to be biased if the other outcomes are excluded from the regression. To minimize this bias, we include in our regression measures of other educational outcomes. Because the DEA variable also reflects cost factors, we include the input and environmental cost factor from our cost equation, along with a few others. Thanks to these controls, we interpret the coefficients of the state aid variables, which are discussed later, as measures of the impact of state aid on a district's productive efficiency.

The efficiency equation also includes three broad categories of exogenous factors that, according to existing theories about the behavior of public and private managers, might affect the productive efficiency of school district personnel.[10] Public choice scholars emphasize that competition in the delivery of a public service is likely to put external pressure on managers to be more efficient. Although we have no measure of competition from private schools, we can identify city districts that do not face extra electoral competition in the form of a required school budget referendum. Second, jurisdiction size is hypothesized to affect efficiency because larger governments "will be associated with decreased responsibility of local officials and decreased participation by citizens" [Ostrom, 1972, p. 487]. Because potential economies of pupil scale are already controlled for through the cost variables, district population is used as a determinant of efficiency.

Finally, efficiency could be affected by external socioeconomic factors, such as the level of adults' education, that influence the ability and incentives of citizen/voters to monitor and put pressure on school officials. Leibenstein [1966] suggests a reverse relation between community wealth and the external pressure put on public officials: Residents of districts with higher property wealth or income may exert less pressure on school officials because inefficiency does not prevent high outcomes if enough resources are available.[11]

This discussion points to two ways in which state aid might influence efficiency. First, the Leibenstein hypothesis suggests that higher aid might lead to less efficiency as it loosens the constraints on school officials. Second, with interdistrict competition, districts that receive high aid relative to similar districts, with which they are likely to compare themselves, may face less pressure to improve their educational outcomes. School districts often compare themselves to other districts in the same property-value/enrollment class. As a result, we divide the school districts in New York into 16 such classes and define two basic aid variables: average aid in a district's class and the difference between

[10] See, for example, Leibenstein [1966], Niskanen [1971], Migué and Bélanger [1974], Wyckoff [1990], and Ruggiero, Duncombe, and Miner [1995]. Empirical work on efficiency is limited. Applications of DEA to education can be found in Bessent and Bessent [1980] and Fare, Grosskopf, and Weber [1989]. Tests of theories about efficiency can be found in Ruggiero, Duncombe, and Miner [1995], Duncombe, Miner, and Ruggiero [in press], and Borger et al. [1994].

[11] High-income residents also may have a relatively high opportunity cost for their time.

a district's aid and the average aid in its class. The first variable, which we call the between-class aid variable, tests our first hypothesis about aid, and the second, the within-class aid variable, tests our second hypothesis. Finally, because the impact of aid may depend on a district's circumstances, we interact both of these variables with district income and (to keep the functional form flexible) district income squared.

Estimation Results

The cost, demand, and efficiency equations are estimated for 631 school districts in New York State using data for 1991.[12] Table 1 presents the estimation results for the demand and cost equations.[13] The dependent variable for the cost equation is a district's approved operating expense per pupil.[14] The educational outcomes are the average share of students above a standard reference point on third and sixth grade math and English tests; the average share of students who pass several state-run standardized tests in high school; and the share of students who stay in school.[15] These three outcome variables all have the expected signs, two of the three are highly significant, and the third, the non-dropout rate, is significant at the one-tailed 5.3 percent level.[16] For these outputs, at least, higher spending and higher output go hand in hand. The DEA variable has the expected negative sign and is highly significant. The most significant cost coefficients indicate that per-pupil costs increase with poverty, single-parent households, and limited English proficiency, and are a U-shaped function of enrollment, with a minimum at about 3800 pupils. The wage elasticity, 0.65, is significant at the one-tailed 5.9 percent level.[17]

The cost index derived from these results indicates how much a district must spend, relative to the average district, to obtain services of a given quality, holding efficiency constant. It ranges from 0.74 to 2.61, although 75 percent

[12] For more information on these data, including sources, see Duncombe and Yinger [1996]. There were 695 school districts in New York in 1991; our sample was limited because of missing data.

[13] For more discussion of this cost model, including results for some alternative specifications, see Duncombe, Ruggiero, and Yinger [1996].

[14] Approved operating expense, defined by New York State, includes salaries and fringe benefits of teachers and other school staff, other instructional expenditures, and all other expenditures related to operation and maintenance of schools. We exclude transportation expenditures because we have no measures of the relevant environmental cost factors. The average value of this variable is $6212 per pupil.

[15] The elementary outcome is based on Pupil Evaluation Program (PEP) tests and the high school outcome on Regents exams. The process by which these variables were selected is described in Duncombe, Ruggiero, and Yinger [1996]. We limited our analysis to variables that had correlations of 0.1 or higher with demand factors, combined related variables into averages, and checked our results using factor analysis.

[16] The two equations are estimated with two-stage least squares. All the exogenous variables in the demand equation are used as instruments for outcomes in the cost equation. The cost equation also treats the DEA variable and the wage rate as endogenous. Instruments for the DEA variable, which come from the efficiency equation discussed later, are total district population and population density, percent of the private employees who are managers or professionals, and whether the district is a city district. County population and the county wage rate for manufacturing production workers are instruments for the wage variable. Finally, the DEA variable is treated as endogenous in the demand equation, using the same instruments.

[17] The wage variable is average salary for teachers with five or fewer years of experience, adjusted for experience, education, type or certification, and tenure. See Duncombe and Yinger [1996].

Table 1. Education cost and demand equations, New York school districts, 1991.

Variables	Coefficient		*t*-statistic
Cost equation[a]			
Intercept	−4.9550		−1.53
Third- and sixth-grade PEP scores (Average % above standard reference point)[b]	5.1106		2.50
Percent nondropouts[b]	4.4757		1.62
Percent receiving Regents diploma[b]	1.3449		3.19
Efficiency index (percent)[b]	−1.1670		−4.87
Log of teacher salaries[b]	0.6487		1.57
Log of enrollment	−0.5680		−3.54
Square of log of enrollment	0.0345		3.44
Percent of children in poverty	1.0109		3.93
Percent female-headed households	2.2260		3.85
Percent of students with severe handicaps	0.8584		1.29
Percent of students with limited English proficiency	4.0525		2.68
SSE		34.58	
Adj. R^2		0.32	
Number of observations		631	
Demand equation			
Intercept	−1.2428		−1.42
Log of median family income	0.8880		9.49
Ratio of operating aid to median income[c]	3.5723		2.55
Ratio of other lump-sum aid to median income[c]	3.0807		1.33
Ratio of matching aid to median income[c]	−8.2197		−1.58
Log of tax share	−0.3118		−6.39
Log of efficiency index[b]	0.4391		1.98
Percent owner-occupied housing	0.2322		1.51
Relative percent of adults with college education	0.1752		0.65
SSE		37.36	
Adj. R^2		0.47	
Number of observations		631	

[a] The cost and demand models are estimated with linear 2SLS regression. The dependent variables are the logarithm of per-pupil operating expenditures for the cost model and of the outcome index for the demand model.

[b] These variables are treated as endogenous. See footnote 6 for a discussion of the instruments.

[c] Aid variables are multipled by the tax share.

of districts fall below 1.05 and 75 percent are above 0.89. The cost equation also leads to our index of educational outcomes.

The demand equation implies an income elasticity of 0.89 and a price elasticity of −0.31, which are both in the range of previous estimates for education and are highly significant. State aid is divided into three types.[18] The key aid variable, operating aid, has a large and significant coefficient. The variable for other lump-sum aid has a similar coefficient but is not statistically significant. The matching aid variable, which is an amount, not a matching rate, has a negative sign but is not statistically significant. The

[18] Basic operating aid constitutes over 60 percent of the state aid budget. For details on the various aid programs, see Duncombe and Yinger [1996].

DEA variable has the expected sign and is significant, unlike the two preference variables.

Estimation results for the efficiency equation are presented in Table 2. As expected, district efficiency decreases with district property value, district income, the ratio of matching aid to income, and population density, and increases with the share of college educated parents. City districts and districts with large populations do not have significantly different efficiency from other districts, however. The DEA variable also does, as expected, reflect outcome and cost variables. The 14 outcome variables reflect the percentage of students taking specialized state examinations in various subjects and per-pupil levels of various types of special facilities and equipment. The nine cost variables include all those in the cost equation plus the weighted pupil measure used by New York to allocate its current aid and the percentage of students in high school.[19] Four outcome and four cost variables in Table 2 are statistically significant.

Table 2 also reveals the complexity of the link between aid and productive efficiency. As expected, the "within-class" coefficient, which is highly significant, indicates that districts with aid that is high relative to other districts in their value/enrollment class are less efficient, all else equal. Although not significant at conventional levels, the "between-class" coefficient suggests that districts in value/enrollment classes that receive a relatively high amount of aid are less efficient than districts in other classes.[20] Table 2 also reveals a nonlinear interaction between the impact of aid and district income. As discussed in more detail in the Appendix, the effect on efficiency of higher aid both relative to the average in a district's group and relative to other groups is at a minimum when district income is close to the statewide average and increases as income diverges from the average in either direction.

AID PROGRAMS AID SIMULATIONS

Because our focus is on central city schools, which have relatively low levels of educational outcomes, we restrict our attention to state aid programs, called foundation grants, that are designed to bring all districts up to some minimum quality level. About 80 percent of the states, including New York, currently use grants of this type.[21] This section describes foundation aid formulas and explains how we simulate their impacts.

[19] This measure gives extra weight to students with special needs or disabilities and to students in secondary school. The correlation between this measure and our cost index is only 0.14. See Duncombe, Ruggiero, and Yinger [1996]. The percent of students in high school is a significant cost factor in some states where some districts only teach elementary students. See Ratcliffe, Riddle, and Yinger [1990]. Although its coefficient is close to zero and statistically insignificant if it is included in our cost equation, we include percent in high school in the efficiency equation just in case it picks up some otherwise unexplained cost factor.

[20] Although none of the "between" coefficients is significant by itself, the set of three coefficients is significant at the one-tailed 6.2 percent level.

[21] See Gold et al. [1992]. New York actually calls its operating aid a "power-equalizing" grant, and this usage leads Gold et al. to misclassify the New York program. In fact, New York uses an expenditure-based foundation formula that we define later.

Table 2. Determinants of school district efficiency, New York school districts, 1991.[a]

Variables	Coefficient	*t*-statistic
Intercept	5.8247	5.84
Aid variables[b]		
Within-class variable	−1278.7540	−2.44
Between-class variable	−447.7361	−1.42
Within * log of income	243.4566	2.44
Within * log of income squared	−11.5955	−2.44
Between * log of income	84.2389	1.39
Between * log of income squared	−3.9711	−1.36
Other efficiency factors		
Log of per-pupil property value	−0.2786	−9.58
Log of median family income	−0.3245	−3.79
Ratio of matching aid to median income	−0.0719	−2.53
City district (1 = yes)	0.0005	0.02
Total district population (millions)	0.9210	1.16
Population density (thousands)	−0.0137	−2.77
Percent college educated parents	0.5071	3.28
Omitted outcome measures		
Percent of grade taking Regents exam in:		
English	0.0658	1.34
Earth science	0.1134	3.04
Global studies	−0.0312	−0.54
History	0.0144	0.23
Math I	−0.0073	−0.16
Math II	−0.0468	−0.66
Math III	0.3132	4.42
Biology	0.1999	3.49
Chemistry	0.0031	0.06
Physics	0.0374	0.61
Per-pupil art and music facilities	−5.2932	−4.35
Per-pupil video equipment	−0.0834	−0.61
Per-pupil personal computers	−0.5918	−1.36
Per-pupil network facilities	−11.3262	−1.36
Cost factors		
Log of teacher salaries	−0.1024	−1.44
Log of enrollment	0.3622	2.47
Square of log of enrollment	−0.0256	−2.42
Percent of children in poverty	−0.1286	−0.71
Percent female-headed households	0.1474	0.42
Percent of students with severe handicaps	−0.2215	−0.45
Percent of students with limited English	−1.5298	−2.24
Percent of students in high school	0.1125	0.56
Weighted pupil index	0.3443	4.53

Number of observations is 631.

[a] Estimated with a Tobit regression; OLS results are similar. The dependent variable is the logarithm of the efficiency index.

[b] Districts are divided into 16 classes based on per-pupil property value and enrollment; the aid variable is from the demand model (all lump-sum aid divided by income); "within-class" is the difference between a district's aid and the average aid in its class; "between-class" is the average aid in its class.

Foundation Aid Formulas

A standard foundation grant takes the following form:

$$A_i = E^* - t^* V_i \tag{1}$$

where the subscript indicates the school district, A is aid per pupil, E^* is the minimum spending per pupil set by the state, t^* is the minimum acceptable local property tax rate determined by the state, and V is property value per pupil. Intuitively, a foundation grant makes up the difference between the revenue a district can raise at a tax rate t^* and the revenue it needs to provide spending E^*.

Two policy questions arise in implementing equation (1). The first is that many low-wealth districts may not choose a tax rate as high as t^*, and therefore will not reach a spending level of E^* even with a foundation grant. Although New York is a notable exception, many states deal with this issue by requiring a minimum effort from every district, defined as a local tax rate of at least t^*.[22] This step enlists the districts in the program to ensure that all districts provide an adequate education, as defined by E^*. We examine foundation grants with and without this minimum-effort requirement. Second, a literal application of equation (1) requires negative aid in districts with high property values. To the best of our knowledge, no state collects negative aid of this type, so we do not examine formulas with negative aid here.[23] Instead, all of our aid plans have minimum aid equal to zero.

The standard foundation formula contains a major flaw because it does not recognize that some districts have higher costs than others. A high-cost district that spends E^* per pupil will not receive the same educational outcomes as a low-cost district that spends the same amount. As shown by Ladd and Yinger [1994], this problem can be solved by introducing a cost index into equation (1). In particular, let C be an index of educational costs, defined to equal unity in the average district and let S be an index of educational outcomes, scaled so that $E_i = S_i$ in a district with average costs and perfect efficiency.[24] Now

[22] Actually, there is a second choice here, too, namely whether to require all districts to levy the minimum tax rate, including those who already provide the minimum outcome. The plans evaluated in this article impose the minimum-tax-rate requirement on all districts (or on none).

[23] Some states use aid plans that are equivalent to negative aid. For example, Kansas sets the property tax rate for all districts, collects the revenue, and then returns the same grant per weighted pupil to each district, regardless of the amount a district contributed. See Reschovsky [1994]. For simulations of foundation (and other) plans with negative aid, see Duncombe and Yinger [1996].

[24] The state aid formula requires S^*C_i to be the amount a district must spend to obtain the outcome level S^*. Our conceptual framework implies that $E = S'C'f/e$, where S' is the product of the (unlogged) outcome variables, each raised to the power indicated by its estimated coefficients (as in footnote 7); C' is the product of the (unlogged) cost variables, each raised to the power indicated by its estimated coefficient; e is an unobserved index of productive efficiency; f is all other factors that influence spending; and the district subscript is implicit. Our cost index, C, is C' divided by its average value across districts. Because e cannot be observed, we estimate $E = S'C'd\mu$, where d is our DEA variable multiplied by its estimated coefficient and exponentiated and μ is the error term exponentiated. It follows that $f/e = d\mu$ or $f = ed\mu$. Using the estimate of e obtained from our efficiency equation, which, as explained later, holds the nonefficiency aspects of d constant, we can obtain an estimate of f. Thus:

$$E = \frac{S'C'f}{e} = \frac{S'\overline{C}'\frac{C'}{\overline{C}'}f}{e} = \frac{S'\overline{C}'Cf}{e}$$

Finally, holding f constant at its average value across districts, we define a scaling factor, γ, that state policymakers must select a minimum educational outcome, S^*, and the foundation formula becomes:

$$A_i = S^* C_i - t^* V_i \tag{2}$$

Equation (2) implicitly assumes that all districts are perfectly efficient. Expecting perfect efficiency is unrealistic, however, and a perfect-efficiency standard ensures that few if any districts will actually achieve the target outcome level, S^*. Thus, we add one more policy parameter to this equation, namely the efficiency standard that state policymakers expect school districts to meet. Let e be an index of district efficiency, with $e = 1$ in an efficient district, and let e^* be the standard state officials select. Now the foundation formula becomes:

$$A_i = \frac{S^* C_i}{e^*} - t^* V_i \tag{3}$$

This formula ensures that any district making at least the minimum effort, t^*, that is at least as efficient as the target level, e^*, will be able to provide the minimum outcome, S^*. Districts that levy lower tax rates (assuming they are allowed to do so) or that are less efficient will still fall short of the minimum outcome. Districts that are more efficient than the target are rewarded in the sense that they receive more money than necessary for them to reach S^* (at tax rate t^*).

The total aid a district receives equals its aid per pupil from equation (3) multiplied by its enrollment. The state aid budget, B, is the sum, across districts receiving aid, of this aid amount. Because district characteristics are fixed, setting S^*, e^*, and t^* therefore determines B. It follows that to hold B constant across aid formulas, one of the policy parameters must be made endogenous. Our strategy is to examine formulas with various values of S^*, holding e^* constant, and solving for the value of t^* that keeps B at its current level.

Simulation Strategy

The cost, demand, and efficiency equations make it possible to simulate the impact of alternative foundation plans on educational outcomes in New York State. The first step, of course, is to estimate the amount of aid each district would receive under each foundation plan. As noted earlier, all simulations hold total state spending at the 1991 level of actual state operating aid plus other lump-sum aid, namely \$3.65 billion or \$2427 per pupil.

The demand equation can then be used to simulate educational outcomes. Because state aid appears in this equation, any change in state aid has a direct effect on the educational outcomes a district selects. However, state aid also appears in the efficiency equation and the DEA variable appears in the demand equation, so state aid also has an indirect impact on educational outcomes through its impact on efficiency.

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transforms S' into our final outcome index, S, such that $S = E$ in a district with average costs ($C = 1$) and perfect efficiency ($e = 1$):

$$E = S = \gamma S' = \overline{C}'\bar{f}S'$$

To simulate the direct impact of aid on outcomes, we first subtract the effect of New York's existing aid programs, which, as explained earlier, fall into three categories: basic operating aid, other lump-sum aid, and matching aid. In particular, all our simulations start by calculating the decline in educational outcomes associated with eliminating current operating and other lump-sum aid, based on the coefficients of these two variables. However, because we lack information on matching rates and because matching programs are a very small part of the current state budget, our simulations assume that these programs remain untouched.

The next step is to calculate the impact of the new foundation plan on outcomes. We pool together all lump-sum aid to determine the available state aid budget, calculate the aid each district would receive under a new foundation plan, and then, using only the estimated coefficient of operating aid, determine the increase in educational outcomes that would occur if the district received this much aid.

The indirect impact of a new aid formula on outcomes is calculated in two steps. First, we use the coefficients in the efficiency equation to predict the efficiency level each district would achieve given the aid it would receive under each foundation plan. This procedure holds constant the nonefficiency determinants of the DEA measure, such as cost factors and educational outcomes other than those in the outcome index, so, as discussed earlier, it reveals the impact of aid on productive efficiency alone.[25] This step also leads to an estimated efficiency level in each district under each plan.[26] Second, we use the coefficient of the DEA variable in the demand equation to calculate the impact of the predicted change in efficiency on a district's educational outcome.

These calculations reveal the educational outcome in each district under each foundation formula. Once the educational outcome is known, we work backward, using the cost equation, to educational spending and, using district property value, to the tax rate levied to cover operating spending.[27] When the foundation plan imposes a minimum tax rate that exceeds a district's preferred rate, spending under the plan is set equal to state aid under the plan plus the property tax revenue at the required minimum tax rate, and the cost equation is used to estimate outcomes.[28]

[25] To be specific, we set the value of all nonefficiency variables at the state mean for every district.

[26] To eliminate the impact of nonefficiency variables, we rescale the predicted index so that it has a maximum value of 1. This approach, which is equivalent to assuming that under all aid programs at least one district is perfectly efficient, is similar to that of McCarty and Yaisawarng [1993] and Ray [1991]; in their method, a DEA efficiency measure is regressed on socioeconomic factors affecting outcomes with a rescaled version of the residual used as the new measure of efficiency. We also control for possible omitted outcomes and include exogenous factors likely to affect variation in efficiency across districts.

[27] To be specific, we use the equation:

$$E_i^n = E_i^x + c_i\left(\frac{S_i^n}{e_i^n} - \frac{S_i^x}{e_i^x}\right)$$

where the superscripts indicate new (n) and existing (x) aid formulas.

[28] To be specific, we use the equation:

$$S_i^n = \left(\frac{E_i^n - E_i^x}{c_i} + \frac{S_i^x}{e_i^x}\right)e_i^n$$

where the superscripts are defined in footnote 27.

Table 3. Average characteristics of school districts by region and type, New York school districts, 1991.

		Downstate		Upstate			
Characteristic	State average	Small cities	Suburbs	Large cities	Rural	Small cities	Suburbs
Per-pupil expenditure							
Total expenditure	$8399	$12,135	$11,874	$8245	$7472	$7345	$7402
Operating expenditure	$6054	$8741	$9016	$5186	$5145	$5184	$5333
Fiscal capacity							
Per-pupil property value	$196,204	$329,178	$394,556	$112,903	$138,974	$135,567	$146,751
Median family income	$40,426	$54,635	$61,635	$26,527	$30,474	$32,455	$39,029
Local school property tax rate[a]	2	1.8	1.9	2.2	2.0	2.1	2.1
Cost and other Factors							
Cost index	100.0	131.9	107.3	197.9	100.9	109.6	91.1
Teacher salaries	$24,727	$30,101	$28,333	$26,205	$23,713	$23,627	$23,676
Enrollment	2383	4492	3277	33,054	1060	4100	2273
Percent of children in poverty	11.6	10.9	5.2	36.5	16.0	19.3	9.2
Percent female-headed households	8.8	12.3	9.3	19.1	8.2	11.8	8.2
Percent students with severe handicaps	4.5	7.1	5.3	7.8	4.1	5.6	4.0
Percent students with limited English	1.0	4.3	2.2	2.1	0.6	1.0	0.6
Population density	1093.1	7053.9	3061.7	6268.3	64.8	1805.9	532.9

The same sample of 631 districts was used in these calculations and in the other tables.

[a] The local school tax rate equals local school revenue divided by full property value of a district; local revenue excludes state and federal aid.

SIMULATION RESULTS

Our simulations are designed to show how various foundation aid formulas influence educational outcomes, particularly in central cities. This section describes the districts in our sample and presents the simulation results for our preferred outcome-based foundation programs and for other foundation programs based on less complete information.

District Classes

To facilitate the presentation of our results, we divide the 631 school districts into six relatively homogeneous classes, which are described in Table 3. These classes distinguish between the New York City area, called downstate, and the rest of the state, called upstate, and within each broad region, between city, suburban, and rural districts. Moreover, the school districts for three large upstate central cities, Buffalo, Rochester, and Syracuse, are placed into a separate class. Unlike any other districts in the sample, these three school districts are part of a city government, instead of being independent. The sample does not include New York City itself, both because information on several key variables was missing, and because New York City is so unique that bringing it into the analysis would distract attention from general principles.

The three large upstate cities, which have the lowest property values and incomes and highest school tax rates of any class, are fairly typical of central city school districts throughout the Northeast and Midwest. They have very high costs, for example, reflecting their relatively high wages and high concentrations of poverty, female-headed households, and students with handicaps. To a lesser degree, small upstate cities also have incomes and property values that fall below, and school tax rates that fall above, the state average. However, school costs for these cities are not far above average. In contrast, the downstate small cities have relatively high incomes and house values and relatively low tax rates, but are second behind the upstate large cities in their school costs. These relatively high costs reflect both the relatively high wages in the New York City area and several other cost factors, such as a concentration of students with limited English proficiency. Although suburbs exhibit some of the same upstate–downstate differences, they tend not to be disadvantaged in resources or costs in either part of the state. Finally, rural districts fall between the upstate suburbs and small cities in both their resources and their costs.

Policy Simulations for Outcome-Based Foundation Plans

Our basic simulations cover six outcome-based foundation aid plans. These plans are defined by three different values of S^* (the 25th, 50th, and 75th percentiles of the current outcome distribution), with and without the requirement that districts set a minimum tax rate of t^*. All the plans also set e^* at the 75th percentile of the current efficiency distribution.

The second column of Table 4 presents the aid amounts under our preferred outcome-based plan for the three values of S^*. Imposing a minimum tax rate does not alter the aid a district receives, so this table applies to foundation plans both with and without the minimum-tax-rate requirement. A comparison of the first two columns of this table reveals that an outcome-based plan would lead to dramatic increases in aid to the three large upstate cities and modest increases in aid to small upstate cities, at the expense of all other types of districts. With the most generous outcome-based foundation plan, the aid to large cities is well over three and a half times as high as it is now, \$9635 per pupil compared with \$2736. Even the least generous outcome-based plan would increase these cities' aid by two and a half times.

The impact of these aid programs on educational outcomes is presented in the second columns of Tables 5 and 6. The first column indicates outcomes under the current aid system, which includes several small lump-sum programs plus a foundation plan with the minimum expenditure (not outcome) level set at approximately the 25th percentile of the current expenditure distribution and with various hold-harmless and minimum-aid provisions. A comparison of the first and second columns of Table 5 reveals that, regardless of the level of S^*, an outcome-based foundation plan would provide a substantial outcome boost to schools in the large upstate central cities. With the most generous plan, in the third panel, outcomes increase by about 45 percent. Even with S^* set at the 75th percentile, however, outcomes in these three cities still fall far short of even the current median outcome level of 4635. The shift to an outcome formula also would benefit small cities, both upstate and downstate, to a small degree. The losers, at least in terms of educational outcomes, would be suburbs, both downstate and upstate. Educational outcomes in rural areas would be largely unaffected by this shift, at least on average.

The second column of Table 6 presents results for an outcome-based foundation plan with a required minimum tax rate. This plan enlists the school districts in the efforts to bring districts up to S^*. Outcomes obviously are higher for all types of districts under this approach. As in Table 5, the most dramatic increases are for large, upstate central cities. The average outcome for these three cities with the most generous plan, 4588, is almost two and a half times

Table 4. Comparison of aid per pupil under different foundation formulas, New York school districts, 1991.[a]

Aid system	Present aid[c]	Outcome-based aid system: Correct cost index—Efficiency correction	Outcome-based aid system: Incorrect cost index—Efficiency correction	Outcome-based aid system: Incorrect cost index—No efficiency correction	Expenditure-based aid system
Aid: S^* = 25th percentile = 3628.2[b]					
Downstate					
Small cities	$2384.27	$1886.98	$2764.88	$3074.25	$947.12
Suburbs	1654.44	1037.88	1554.43	1934.01	922.24
Upstate					
Large cities	2736.18	7061.52	7686.14	6385.73	3181.01
Rural	2844.63	2594.74	2306.38	2237.49	2925.76
Small cities	2836.10	3087.84	2808.16	2596.32	3023.78
Suburbs	2847.44	2067.83	1803.36	1866.15	2798.34
Aid: S^* = 50th percentile = 4634.8[b]					
Downstate					
Small cities	2384.27	1558.23	2527.34	2762.11	880.70
Suburbs	1654.44	852.04	1365.71	1553.17	804.55
Upstate					
Large cities	2736.18	8375.10	9181.21	7660.25	3302.38
Rural	2844.63	2713.67	2359.43	2301.13	3022.54
Small cities	2836.10	3275.03	2933.71	2801.07	3116.74
Suburbs	2847.44	1971.26	1667.84	1800.47	2841.20
Aid: S^* = 75th percentile = 5719.2[b]					
Downstate					
Small cities	2384.27	1633.86	2384.77	2577.46	744.82
Suburbs	1654.44	789.45	1279.78	1381.42	657.91
Upstate					
Large cities	2736.18	9634.93	10,624.36	8940.12	3535.22
Rural	2844.63	2759.50	2331.99	2350.19	3234.07
Small cities	2836.10	3315.89	2902.81	2917.59	3288.27
Suburbs	2847.44	1823.29	1503.49	1687.93	2912.62

[a] All grants require approximately the same state budget to fund as the actual aid system in 1991: $3.65 billion.

[b] Percentiles refer to the current outcome distribution.

[c] Total current lump-sum aid per pupil.

as large as their current outcome, 1892. This new outcome level falls short of the target S^*, 5729 (and indeed is even a bit below the 50th percentile target of 4635), because the efficiency level in these districts falls below e^*.

Comparing Tables 5 and 6 reveals that a foundation plan with New York's current budget can do little to bring low-outcome districts up to a reasonable outcome target unless school districts are forced to contribute to the effort. This key point is examined further in Table 7, which describes the local tax rate devoted to school operating expenses (now called a local contribution rate to distinguish it from the overall school tax rate) when no minimum rate is imposed. The demand equation implies that an increase in operating aid results in both increased operating spending and a reduced local contribution to the operating budget. This result, which is well known from other studies [see,

Table 5. Comparison of predicted outcomes under different foundation formulas, New York school districts, 1991, no minimum tax rate.[a]

		Outcome-based aid system			
Aid system	Actual outcomes	Correct cost index—Efficiency correction	Incorrect cost index—Efficiency correction	Incorrect cost index—No efficiency correction	Expenditure-based aid system
Aid: S^* = 25th percentile = 3628.2[b]					
Average	4759.5	4686.4	4662.7	4654.5	4799.3
Downstate					
Small cities	3949.1	4058.2	4283.1	4287.7	3730.6
Suburbs	5.641.7	5509.6	5634.4	5672.6	5537.2
Upstate					
Large cities	1891.6	2365.6	2428.3	2262.5	1947.6
Rural	4256.6	4220.9	4152.6	4120.9	4310.9
Small cities	3912.0	3940.8	3877.4	3826.5	3989.0
Suburbs	4954.0	4846.6	4778.6	4776.1	5062.5
Aid: S^* = 50th percentile = 4634.8[b]					
Average	4759.5	4694.6	4667.3	4661.5	4815.5
Downstate					
Small cities	3949.1	4008.6	4280.8	4281.5	3712.7
Suburbs	5641.7	5471.1	5631.5	5633.6	5513.8
Upstate					
Large cities	1891.6	2546.6	2635.1	2424.9	1964.4
Rural	4256.6	4262.5	4176.7	4151.4	4342.7
Small cities	3912.0	3990.7	3913.2	3875.7	4016.4
Suburbs	4954.0	4841.8	4761.1	4777.7	5085.7
Aid: S^* = 75th percentile = 5729.2[b]					
Average	4759.5	4695.7	4667.9	4665.9	4852.9
Downstate					
Small cities	3949.1	4030.9	4299.4	4281.6	3678.8
Suburbs	5641.7	5465.7	5675.9	5627.8	5481.5
Upstate					
Large cities	1891.6	2735.1	2853.1	2600.5	1998.9
Rural	4256.6	4286.6	4180.6	4173.2	4412.5
Small cities	3912.0	4010.9	3917.4	3908.2	4070.7
Suburbs	4954.0	4818.6	4729.6	4764.0	5131.9

[a] All grants require approximately the same state budget to fund as the aid system in 1991: $3.65 billion.

[b] Percentiles refer to the current outcome distribution.

e.g., Inman, 1979], reflects the fact that aid allows a district to shift some of its own funds from operating spending to other school purposes, such as capital spending; to other public services, such as police; or to private consumption through tax cuts.[29] As shown in Table 7, this response is dramatic in large cities, which receive the largest increase in aid. In fact, without a required minimum tax rate (or, more literally, a minimum local contribution rate), the

[29] Because our measure of operating spending excludes transportation expenses, this effect also might indicate that general-purpose operating aid induces districts to shift funds to transportation. With the exception of the large city districts, school districts in New York are separate from municipal government, so increases in police or other spending require a cut in school taxes combined with an increase in municipal taxes.

Table 6. Comparison of predicted outcomes under different foundation formulas, New York school districts, 1991, required minimum tax rate.[a]

		Outcome-based aid system			
Aid system	Actual outcomes	Correct cost index—Efficiency correction	Incorrect cost index—Efficiency correction	Incorrect cost index—No efficiency correction	Expenditure-based aid system
Aid: S^* = 25th percentile = 3628.2[b]					
Average	4759.5	4884.1	4807.6	4747.8	4865.8
Downstate					
Small cities	3949.1	4058.2	4283.1	4287.7	3730.6
Suburbs	5641.7	5781.2	5898.1	5888.0	5656.3
Upstate					
Large cities	1891.6	3191.1	3307.8	2770.3	1947.6
Rural	4256.6	4464.1	4269.2	4206.7	4390.7
Small cities	3912.0	4201.8	4303.9	3912.3	4062.9
Suburbs	4954.0	4945.3	4840.5	4805.9	5088.3
Aid: S^* = 50th percentile = 4634.8[b]					
Average	4759.5	5407.5	5233.5	5211.7	5274.5
Downstate					
Small cities	3949.1	4177.3	4423.6	4477.1	3723.4
Suburbs	5641.7	6371.4	6518.4	6537.0	6032.2
Upstate					
Large cities	1891.6	3944.1	4067.2	3659.9	2085.0
Rural	4256.6	5105.2	4787.9	4712.8	4898.8
Small cities	3912.0	4882.2	4576.2	4479.6	4461.1
Suburbs	4954.0	5300.0	5085.2	5107.2	5443.1
Aid: S^* = 75th percentile = 5729.2[b]					
Average	4759.5	6251.7	6068.4	6136.3	6323.7
Downstate					
Small cities	3949.1	5223.7	5454.3	5572.1	4734.1
Suburbs	5641.7	7548.5	7830.4	7848.9	7122.5
Upstate					
Large cities	1891.6	4588.4	4729.2	4401.8	2643.9
Rural	4256.6	5940.6	5578.9	5601.7	5974.1
Small cities	3912.0	5635.6	5285.0	5336.4	5393.1
Suburbs	4954.0	5978.0	5711.2	5855.3	6476.7

[a] All grants require approximately the same state budget to fund as the aid system in 1991: $3.65 billion.

[b] Percentiles refer to the current outcome distribution.

local contribution to operating spending in large cities actually goes negative, which implies that some of the aid intended for operating purposes is used for other things, such as school capital spending.

This result does not, of course, imply that the school property tax rate in large cities is negative. In fact, Table 3 shows that these cities start out with the highest school property tax rates in the state. Moreover, we do not estimate the extent to which property taxes for capital spending increase when operating aid increases, so it is possible that large cities have higher overall tax rates than other types of districts even after the cuts described in Table 7. This result simply shows that large cities, which face the constraints imposed by high costs and low wealth in providing all public services, respond to a large increase

Table 7. Comparison of local contribution rate for operating expenditure under different foundation formulas, New York school districts, 1991, no minimum tax rate.[a]

		Outcome-based aid system			
Aid system	Actual rate	Correct cost index—Efficiency correction	Incorrect cost index—Efficiency correction	Incorrect cost index—No efficiency correction	Expenditure-based aid system
Aid: S^* = 25th percentile					
t^* = 1.19%[b]					
State average	1.93	1.55	1.78	1.98	1.77
Downstate					
Small cities	1.95	1.76	1.83	1.89	2.09
Suburbs	2.30	1.96	2.14	2.13	2.31
Upstate					
Large cities	2.15	−0.44	−0.62	1.41	1.84
Rural	1.65	1.25	1.52	1.82	1.48
Small cities	1.86	1.21	1.47	1.80	1.68
Suburbs	1.99	1.67	1.90	2.11	1.75
Aid: S^* = 50th percentile					
t^* = 1.89%[b]					
State average	1.93	1.49	1.81	1.78	1.70
Downstate					
Small cities	1.95	1.82	1.95	1.83	2.08
Suburbs	2.30	2.02	2.48	2.14	2.31
Upstate					
Large cities	2.15	−0.93	−1.12	−0.61	1.74
Rural	1.65	1.11	1.42	1.52	1.37
Small cities	1.86	1.06	1.37	1.48	1.59
Suburbs	1.99	1.65	1.92	1.91	1.67
Aid: S^* = 75th percentile					
t^* = 2.64%[b]					
Average	1.93	1.51	2.00	1.80	1.56
Downstate					
Small cities	1.95	1.84	2.11	1.93	2.07
Suburbs	2.30	2.11	3.20	2.41	2.30
Upstate					
Large cities	2.15	−1.22	−1.37	−1.05	1.55
Rural	1.65	1.07	1.43	1.43	1.15
Small cities	1.86	1.02	1.38	1.38	1.41
Suburbs	1.99	1.71	2.00	1.91	1.53

[a] All grants require approximately the same state budget to fund as the aid system in 1991: $3.65 billion. The local contribution rate is calculated by subtracting per-pupil lump-sum aid from operating expenditures and dividing by per-pupil property value. A negative local contribution rate is possible because some aid may be spent on capital expenditures or on transportation (which is not included in operating spending here).

[b] The value of t^* applies to column 2.

in state operating aid for education by shifting some of their own resources to other activities. This shift undercuts a state's efforts to ensure minimum educational outcomes.

Placing a minimum on the local contribution rate obviously raises local contributions. As shown in Table 7, the value of t^* for the most generous plan is above the average contribution rate that every type of district would choose without a required minimum rate. Even with the other two plans, which result in average local contribution rates above t^* for most types of districts, adding the requirement increases average local contribution rates because some districts of each type have rates below t^*.[30] In all cases, however, the increases are much larger in large cities than elsewhere. Local contribution rate increases of this magnitude help move large cities closer to the educational outcome targets, but they also pull local resources away from other things that cities must do, such as provide educational facilities or police protection.

The implications for productive efficiency of outcome-based foundation plans are presented in Table 8. The first column presents current efficiency levels and the second column presents efficiency levels for three different outcome targets. Efficiency is not affected by the local tax rate, so Table 8 applies to programs both with and without a minimum-tax-rate requirement. On average, the most generous outcome-based plan raises the average efficiency index in the state from 69.1 to 78.3 percent. Moreover, for all three outcome targets, these plans significantly raise efficiency in every type of district except the large upstate cities.

The decline in efficiency in large city districts is not surprising given their large boost in aid. With the most generous outcome-based plan, the efficiency index for these districts declines by about 15 percent, from 89.5 to 75.7. This decline works against the goals of the aid program; as aid goes up, the impact of each dollar of aid on outcomes goes down. However, the magnitude of this effect is moderate; without the decline in efficiency, the most generous plan would boost their educational outcomes by 45(1.15) = 52 percent, instead of 45 percent.

Policy Simulations for Simpler but Less Complete State Policies

Implementing our aid plans requires an understanding of cost indexes, an explicit decision about the acceptable level of inefficiency, and the estimation of cost indexes controlling for efficiency. Existing state plans do not meet any of these requirements, so we simulate three alternative foundation plans based on less complete information than our own.[31]

The simplest foundation plan follows equation (1), with no recognition of costs or efficiency. The results for such a plan are presented in the last (fifth) column of Tables 4 through 8. Because the implicit expenditure target in the current New York foundation plan is set at about the 25th percentile of the current expenditure distribution, a comparison of the first and last columns in the first panel of these tables largely reflects the impact of eliminating hold-harmless and minimum-aid provisions and pooling all lump-sum aid into a foundation formula. These steps would modestly increase aid (and outcomes) in upstate cities, both large and small, and decrease aid substantially (with little impact on outcomes) in downstate cities and suburbs. The average impact on rural districts and downstate suburbs would be minimal.

[30] A table comparable to Table 7 presenting average local contribution rates with a minimum rate requirement is available from the authors upon request. Under the most generous plan, 85 percent of districts are forced to impose the minimum t. This drops to 29 percent under the least generous plan.

[31] To hold constant the level of required local effort (as well as the state budget), we hold the minimum required tax rate, where relevant, at its level in column 2 for all the other plans (columns) with the same value of S^*.

Table 8. Comparison of predicted efficiency rates under different foundation formulas, New York school districts, 1991.[a]

		Outcome-based aid system			
Aid system	Existing aid programs[b]	Correct cost index—Efficiency correction	Incorrect cost index—Efficiency correction	Incorrect cost index—No efficiency correction	Expenditure-based aid system
Aid: S^* = 25th percentile = 3628.2[c]					
Average	69.05	78.26	77.46	73.74	70.40
Downstate					
Small cities	50.36	57.36	54.88	52.09	53.89
Suburbs	51.39	59.10	57.31	54.13	53.62
Upstate					
Large cities	89.52	83.67	80.54	80.80	89.93
Rural	75.77	85.65	84.97	81.41	77.06
Small cities	74.22	82.98	82.22	78.88	75.42
Suburbs	72.05	81.84	81.00	77.24	72.94
Aid: S^* = 50th percentile = 4634.8[c]					
Average	69.05	78.51	77.60	77.25	70.72
Downstate					
Small cities	50.36	58.18	55.53	54.87	54.22
Suburbs	51.39	59.50	57.77	57.31	54.05
Upstate					
Large cities	89.52	79.84	76.37	80.61	90.20
Rural	75.77	85.65	85.12	84.97	77.29
Small cities	74.22	82.94	82.31	82.22	75.72
Suburbs	72.05	82.34	81.57	81.00	73.30
Aid: S^* = 75th percentile = 5729.2[c]					
Average	69.05	78.29	77.44	77.55	71.40
Downstate					
Small cities	50.36	57.85	55.60	55.38	55.02
Suburbs	51.39	59.44	57.65	57.72	54.88
Upstate					
Large cities	89.52	75.74	71.99	77.04	90.84
Rural	75.77	85.18	84.81	85.10	77.77
Small cities	74.22	82.54	82.05	82.30	76.37
Suburbs	72.05	82.33	81.58	81.48	74.08

[a] All grants require approximately the same state budget to fund as the aid system in 1991: $3.65 billion. This table presents estimates of actual efficiency rates using the model presented in Table 2. All cost factors and additional outcomes are held constant at the mean and the aid and other efficiency factors are allowed to vary. Predicted efficiency is then divided by the maximum efficiency to scale the variable up to a maximum of 1.0 (most efficient).

[b] Based on the existing aid system. The same method is used for calculating efficiency as for the other aid programs, with all current lump-sum aid categories combined into one.

[c] Percentiles refer to the current outcome distribution.

Bringing in the results in the second column, we can see that an outcome-based foundation goes much farther than an expenditure-based foundation in shifting aid to large cities. It does not go nearly as far, however, in shifting aid away from downstate small cities and suburbs. Largely because they face very high labor costs, these downstate districts tend to have high costs, a fact that is missed by an expenditure-based plan. The current system of hold-harmless and minimum-aid provisions serves some of the same purpose as a cost correction by boosting aid to these districts, but it goes too far in this direction and does not ensure fair treatment either within these districts or between these districts and others.

These tables also reveal that even the most generous expenditure-based foundation plan leaves large cities far short of any outcome target, even with a required minimum tax rate. In fact, the most generous such plan, in the last panel of Table 6, helps large cities but still leaves them at an outcome level well below the 25th percentile of the current distribution! Moreover, Table 8 shows that these plans do little to increase efficiency in the average district.

The first step a state must take in moving toward a complete outcome-based foundation is to estimate a cost index. An aid program for municipal services, including education, based on an estimated cost index was implemented in Massachusetts [Bradbury et al., 1984], and school aid programs based on estimated cost indexes are presented in Ratcliffe, Riddle, and Yinger [1990], Downes and Pogue [1994], and Duncombe and Yinger [1996]. Thus, we now examine outcome-based foundation programs that, like these, incorporate a cost index estimated without controlling for efficiency and that implicitly assume, following equation (2), that all districts are efficient. A cost index estimated in this way is biased by the omission of an efficiency variable, but it takes a large step toward recognizing the role of input and environmental cost factors.[32]

Results for these programs, presented in the fourth column of Tables 4 through 8, reveal that in most cases adding a cost index closes a large share of the gap between the expenditure-based foundation in column 5 and the outcome-based foundation in column 2. Under the most generous plan, for example, adding a biased cost index raises aid to large cities from $3535 per pupil (column 5 of Table 4) to $8940 (column 4), compared to the complete-information amount (column 2) of $9635.

In constrast, the foundation plan based on a biased cost index leads to much higher aid and higher outcomes (with little impact on efficiency) for downstate small cities and suburbs than either the expenditure-based foundation or the complete-information foundation in column 2. This result mainly reflects the large, negative correlation between efficiency and wage rates; because of this correlation, leaving efficiency out of the cost equation biases upward the coefficient of the wage variable and hence biases upward the cost index in places with high labor costs, particularly downstate districts.[33] In fact, the wage elasticity goes from 0.649 to 2.08 when the efficiency variable is left out.[34] In effect, therefore, an aid program based on a biased cost index rewards the downstate districts for their inefficiency. This is, of course, an inappropriate outcome.

This result poses a serious challenge to policymakers and researchers. Aid formulas based on simple cost indexes of the type that have been presented in the literature appear to be a big step in the right direction, but this step has

[32] Some states use much more ad hoc methods for measuring costs. These are, of course, even more biased. See Duncombe, Ruggiero, and Yinger [1996].

[33] All cost coefficients are biased when efficiency is left out, but in our equation the bias in the wage variable is particularly dramatic.

[34] A value of 0.65, which implies that districts have some opportunities to substitute away from teachers when teacher salaries rise, appears reasonable. Any value above 1.0, let alone 2.08, is not reasonable, as it implies that a district cannot preserve its outcome level after a wage increase simply by hiring the same number of teachers at the new higher wage.

a price. To the extent that efficiency is correlated with cost factors, a standard cost index will reflect inefficiency as well as costs, and an aid formula based on it will favor inefficient districts as well as high-cost ones. In New York, this effect does not boost aid to big cities, which despite their reputation are relatively efficient, but instead boosts aid to downstate small cities and suburbs, which tend to be inefficient.

Obviously the relevant correlations could vary from state to state, so these results cannot determine whether this type of plan would reward the same types of districts for inefficiency in other states. Nevertheless, the possibility that the plan rewards inefficiency clearly undercuts its appeal.

One simple step a state can take to recognize the role of efficiency is to bring in the concept of e^* using equation (3). All this step requires is identifying an efficiency level that is regarded as acceptable. This approach recognizes that virtually no districts will be able to achieve perfect efficiency so that spending greater than $S^* C_i$ is needed to bring district i up to the S^* outcome target. Compared to the previous approach, therefore, this approach focuses more aid on higher need districts. The third column of Tables 4 through 8 show the impact of a foundation plan with a biased cost index but with a value of e^* set at the 75th percentile of the current efficiency distribution. This plan takes another small step toward the complete-information plan in column 2. In most cases, the entry in column 3 falls between the entry in column 2, which has no correction for e^*, and the entry in column 2, which is based on an unbiased cost index. Because this plan retains the biased cost index, however, it does little to eliminate the excess aid given to downstate districts. Moreover, it actually overcompensates central city districts to a small degree, compared to their aid with an outcome-based foundation, because they, too, face relatively high wages.

CONCLUSIONS

Our first conclusion, already expressed in previous studies, is that a state cannot ensure adequacy in educational outcomes without including a cost index in its foundation formula.[35] In New York, and, we suspect, in many other states, this lesson is particularly important for large cities, which tend to have relatively high costs. Even when minimum tax rates are imposed, an expenditure-based foundation plan set to bring districts up to the 75th percentile of the current expenditure distribution does not bring large cities in upstate New York up to even the 25th percentile of the current outcome distribution. This result provides a key part of the answer to the question in our title: The failure of existing state aid plans to accurately account for variation in educational costs across districts helps explain why educational outcomes in many central cities remain far below their state's average.

Estimating cost indexes also may help dispel the widespread and, by our calculations, incorrect perception that large cities are relatively inefficient, a perception that may constitute a political barrier to increases in their aid. In New York, and no doubt in many other places, the key reason why large cities have low outcomes despite their high spending is that, through no fault of

[35] See, especially, Bradbury et al. [1984], Ratcliffe, Riddle, and Yinger [1990], Downes and Pogue [1994], and Duncombe and Yinger [1996].

their own, they face high costs. By our estimates, their current efficiency is above the state average, but they must spend twice as much as the average district to obtain the same educational outcomes.

A second lesson, also present in previous literature, is that a state cannot help low-outcome districts in general and large cities in particular without some combination of a larger state budget and required local property tax rate increases. The current New York budget for educational aid would have relatively modest impact on educational outcomes in large cities even if it were funneled through a formula that accounted for costs and set a high outcome target. The reason, of course, is that a foundation grant only ensures the outcome target under the assumption that districts set a minimum tax rate, which must be a high tax rate if the target is high or the budget is low. Stressed as they are by school debt expenses, nonschool expenditure demands, and declining tax bases, many central city districts are reluctant to impose tax rates for school operating expenses that are close to the minimum tax rates implicit in these plans.

This result does not imply that large cities are unwilling to tax themselves; indeed, their current overall tax rate for schools is higher than that of any other type of district. It simply emphasizes that large cities are likely to respond to increased operating aid for schools by shifting some of their own resources to other activities that are also in need of support. A state that is serious about bringing all districts up to a reasonable performance standard therefore must come up with new broad-based sources of revenue or new forms of revenue sharing, perhaps combined with modest required local tax increases.

A third lesson is that states are right to be concerned about districts' productive efficiency. In particular, we find three main reasons why this concern is justified. First, estimating a cost index without controlling for efficiency inappropriately rewards some inefficient districts. In New York, this approach leads to severe upward bias in the impact of wages on the cost index and unfairly rewards the relatively inefficient downstate districts that face high wage rates—at the expense of other districts. In another state the bias might work in another direction.

The second reason is that the presence of inefficiency interferes with a state's ability to reach a performance target in every district. If an outcome-based foundation formula implicitly assumes that all districts are perfectly efficient, it will fail to bring the vast majority of low-performance districts up to its target outcome. Thus, states must explicitly decide what level of inefficiency is acceptable and incorporate this level into their aid formulas. The trick here is to find a balance between efforts to reward efficiency and efforts to achieve performance standards. This lesson provides part of the explanation for poor outcomes in large cities in New York; an aid program that brings districts up to an outcome target if they are at the 75th percentile of the current efficiency distribution provides significantly more aid to large cities than an otherwise comparable program that expects all districts to be perfectly efficient.

The third reason is that aid programs themselves have a direct impact on productive efficiency. We find, for example, that relatively high aid leads to relatively low efficiency, all else equal. The aid programs examined here all shift aid toward large cities and therefore reduce efficiency there. This result provides another part of the answer to the question in our title; programs to increase aid to central city schools undermine themselves to some degree by lowering the efficiency of these districts. The importance of this point should not be exaggerated, however; switching to the most generous of our plans would cut efficiently in the three large upstate cities by only 15 percent.

Efficiency is, of course, a complex topic. We believe that the approach offered here is a step in the right direction, but it does not, by any means, answer all questions about the topic. It may be too complex for consideration by state policymakers. Moreover, it does not fully resolve the question of whether efficiency can be separated from other factors that might influence our DEA variable, such as educational outcomes not in our main index or unobserved cost factors. Nevertheless, we believe that this approach shows how crucial accounting for efficiency can be.

What Can State Policymakers Do?

Some of these lessons suggest concrete steps that state policymakers could take to boost outcomes in central city schools: Phase out hold-harmless and minimum-aid provisions that steal aid from the neediest districts; estimate cost indexes and incorporate them into foundation aid formulas; make people aware of the importance of cost factors to combat the perception that central city schools are relatively inefficient and therefore undeserving of aid; and change the implicit efficiency target in foundation formulas to a realistic level, such as 0.75 or 0.8, instead of demanding perfect efficiency. These steps would, of course, increase the fairness of a foundation plan for other types of districts, as well.[36]

Other lessons presented here do not yet lead to clear policy actions. The method we propose to measure efficiency and control for it in a cost regression is both complicated and not yet widely known. Simpler methods that accomplish the same objectives have not been developed. Moreover, no one has yet designed an aid program that provides districts with clear incentives to be more efficient while at the same time bringing districts up to some outcome target or otherwise promoting equity. Solving this problem is beyond the scope of this article, but we hope to have provided a foundation that makes it possible for such an aid system to be designed by future research.

Despite these uncertainties, our main conclusion is that states could design aid programs that would dramatically boost educational outcomes in central city schools. The real reason that it is so hard to help central city schools may be that these programs lack political support.

APPENDIX

State Aid and District Inefficiency

The results in Table 2 concerning the relationship between aid and efficiency are summarized in Figure A.1, for the within-class effect, and Figure A.2, for the between-class effect. In both figures, e_i stands for efficiency in district i, $\overline{A}$ stands for the value/enrollment class average aid per pupil, $\overline{Y}$ stands for income in the average district, and σ stands for the standard deviation in the distribution of income per pupil across districts. Figure A.1 reveals that the within-class effect can be quite large. At the statewide average income, a district

[36] These steps also would help meet equity objectives other than the minimum-adequacy objective of a foundation plan. See Duncombe and Yinger [1996].

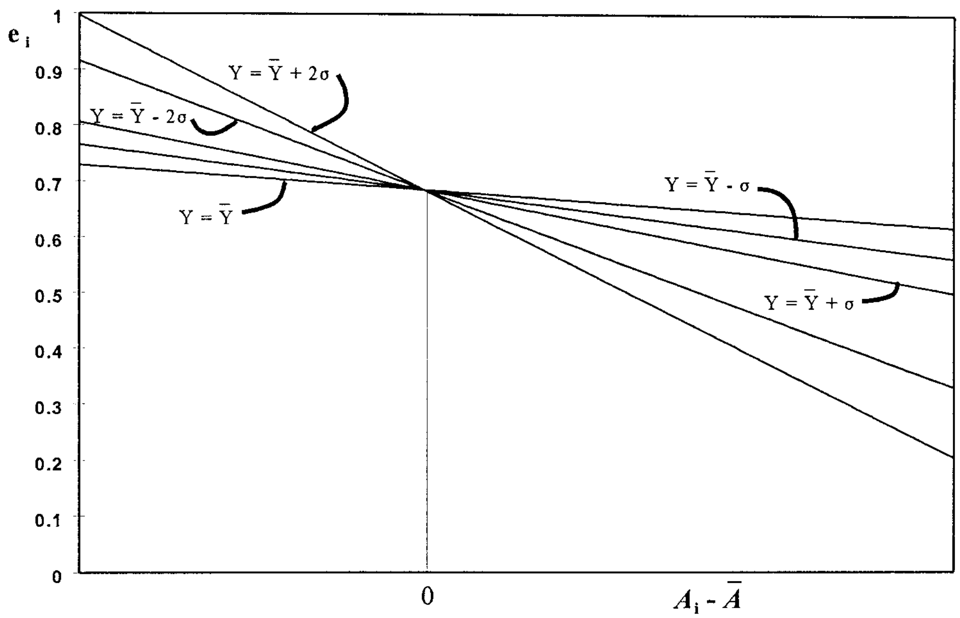

Figure A.1. Efficiency and deviation in aid from class average.

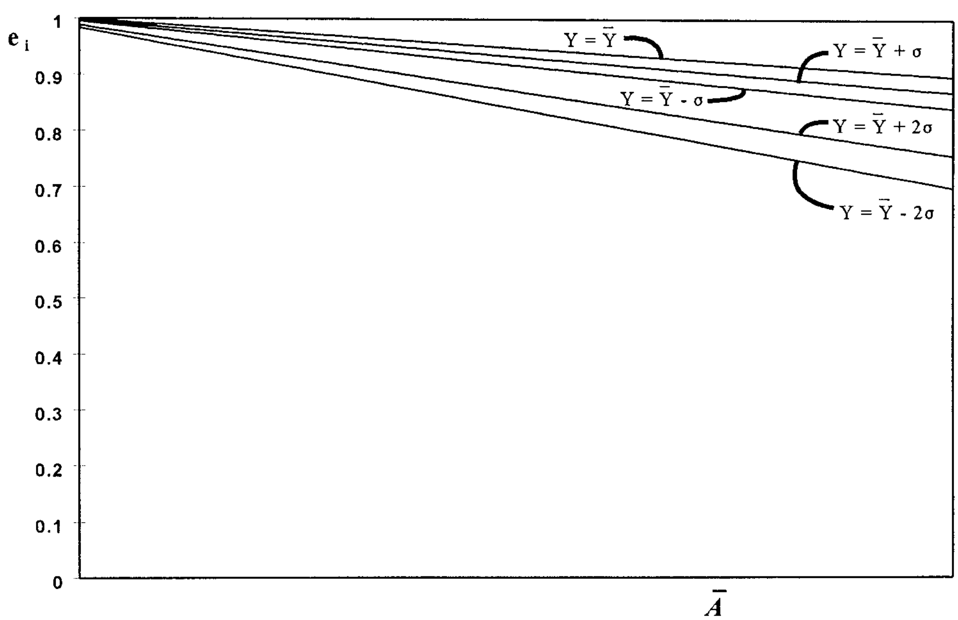

Figure A.2. Efficiency and average aid for district class.

with the maximum positive difference between its aid and the average aid for its class has an efficiency index of about 0.65, compared to an efficiency index of about 0.75 for the district with the maximum negative difference, all else equal. As the steepest lines in Figure A.1 indicate, this 10-point difference jumps to 60 points or more for districts with incomes far from the average. According to Figure A.2, an average-income district in the class that receives the most aid has an efficiency index that is also about 10 points below that of an average-income district in the class that receives the least aid. In this case, however, the gap increases only to about 25 points for districts with incomes at either tail of the distribution.

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WILLIAM DUNCOMBE is Associate Professor of Public Administration and Senior Research Associate at the Center for Policy Research, The Maxwell School, Syracuse University.

JOHN YINGER is Professor of Economics and Public Administration and Associate Director at the Center for Policy Research, The Maxwell School, Syracuse University.

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