Estimating the Cost of Educational Adequacy:

A Comparison of Approaches

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Abstract

States have moved aggressively in the last decade to implement higher standards, and almost half the states will require passage of exit exams for student graduation by 2004. State courts also often interpret education clauses in their state constitutions as requiring the state to provide an opportunity for all children to reach an adequate level of content knowledge and skills. Despite the clear trend toward adequacy standards in education, states have been much less successful in implementing funding systems designed specifically to assist students (and schools) to reach these standards.

The objective of this study is to examine several of the common approaches of estimating the cost of adequacy—empirical identification approach, resource cost model, and cost function approach. Estimating the cost of adequacy involves three steps: 1) selecting measures of student performance (or bundles of resources) that can be used to identify adequate and inadequate performance; 2) estimating required spending for adequacy in at least one "benchmark" school district; and 3) adjusting this benchmark spending level to reflect different characteristics in other school districts.

To highlight these differences we develop adequacy costs for school districts in New York. The results of this analysis indicate that the three methods produce similar estimates of the cost of adequacy in benchmark districts (step 2). The largest variation in the estimated cost of adequacy emerges in the third step in the process, when benchmark spending is adjusted for differences in resource costs and student needs. The choice of cost adjustment is by far the most important decision that a state has to make in deciding how to finance an adequate education. The cost function approach is particularly well suited for the third stage of the process, because one of the outputs of this method can be education cost indices that measure the additional costs required because of geographic cost differences and student needs.

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The recent passage of the "No Child Left Behind Act" will require 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). Schools will be expected to make adequate progress towards bringing their students up to these standards or face increasing pressure, including reconstituting schools as charter schools. The Act is formalizing a process that is already taking place in most states. States have moved aggressively in the last decade to implement higher standards, and by 2004 the majority will require passage of exit exams for student graduation, and will have in place some form of school accountability system (Boser, 2001). The focus on adequacy standards has also emerged in the judicial branch, and courts often interpret education clauses in their state constitutions as requiring the state to provide an opportunity for all children to reach an adequate level of content knowledge and skills.[1]

Despite the clear trend toward adequacy standards in education, states have been much less successful in implementing funding systems designed specifically to assist students (and schools) to reach these standards. One of the key tasks in designing an appropriate finance system is determining the spending in each district required to reach the standard. The development of estimates of the cost of adequacy involves three steps. First, measures of student performance (or bundles of resources) must be selected that can be used to identify adequate and inadequate performance. Despite the fact that these measures can be controversial, this choice is unavoidable in the development of an adequacy-based finance system. The second step is identification of the required spending for adequacy in at least one "benchmark" school district. Third, adjustment of this adequate spending level is required to

reflect different characteristics in other school districts. The objective of this study is to examine several of the common approaches to estimating the cost of adequacy, and to illustrate how these adequacy cost estimates can be used in developing aid formulas.

The comparison of approaches will be made in the context of New York school districts. New York is an appropriate example, for several reasons. 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, which are reflected in new high stakes 4^{th}, 8^{th}, and high school examinations. In addition, New York's education finance system is presently under a legal challenge, because it does not provide adequate financing for a "sound basic education." In a recent decision (*Campaign for Fiscal Equity, Inc. v. State*, 2001), the trial court declared the present system unconstitutional, providing a detailed discussion of the appropriate adequacy standard and the required cost adjustment in a new school finance formula. We will draw from both the new Regents standards, and the *Campaign for Fiscal Equity* (*CFE*) decision to develop several possible adequacy standards for New York.[2]

In the next section, we will briefly review the role of state supreme courts in framing the adequacy standards facing states, and will focus in particular on the *CFE* decision. We then turn to discussing the key steps in estimating the cost of adequacy and the strengths and weaknesses of three common methodologies. The process of developing a cost of adequacy will be presented for New York, and the factors most apt to drive differences in costs will be highlighted. Finally, we will illustrate how these adequacy costs can be used in a modified foundation formula to fund adequacy.

Adequacy and the Courts

Disparities in funding across school districts have resulted in numerous court challenges to school funding structures, and the courts have played a significant role in the search for school finance reform. Legal scholars (Levine, 1991; Thro, 1994) have identified three "waves" of school finance reform litigation. The first wave occurred in the early 1970s, and involved primarily claims that school funding systems violated the equal protection clause of the fourteenth amendment to the United States Constitution. Despite early success in California with the *Serrano v. Priest* decision (1971), the U.S. Supreme Court effectively closed the door on federal equal protection claims in *San Antonio Independent School District v. Rodriguez* (1973). After *Rodriguez*, plaintiffs in the second wave concentrated on state constitutional claims, relying on both education and equal protection clauses in state constitutions. Wave II lasted from 1973 to 1989 and resulted in few victories for reformers. Most victories were based, at least in part, on equal protection claims (Levine 1991, Thro 1994).

Adequacy cases

In 1989, three state supreme courts (Montana, Kentucky, and Texas) held that their state's school finance systems violated their state's constitutional provisions concerning education. These plaintiffs' victories marked the beginning of a new wave of court cases. Wave III courts overturning school finance systems have relied primarily on state education rather than equal protection clauses (Levine 1991, Thro 1994).[3] Equally significant, the cases inaugurating Wave III, particularly the Kentucky case *Rose v. Council for Better Education, Inc*. (1989), were widely characterized as heralding a switch in focus from relative equity standards to adequacy standards (Enrich 1995, Minorini and Sugarman, 2000). Courts

accepting an adequacy standard typically interpret their state's constitution to require the state to provide all students with access to an education or an opportunity for an education meeting some minimum standard of adequacy. For instance, in two-thirds of 33 cases in which courts addressed education clause claims (Table 1), they interpreted that clause as imposing an adequacy standard, either alone (42%) or in combination with other standards (24.3%).

<Table 1 about here>

While a majority of state supreme courts have been willing to consider adequacy as the educational standard associated with the education clause, this does not guarantee the success of the plaintiffs in overturning the finance system. The level of education or educational opportunity that the courts consider necessary to meet the constitutional obligation also plays a role. If the courts define the obligation as requiring only a very basic level of education, proving that the education system fails to provide it can be difficult.

In addition to setting the level of adequacy that the constitution requires, defining an adequacy standard also requires identifying the object of that standard. With regard to this issue, Lukemeyer (2001b) found that in the majority of court decisions, judges considered some combination of resource and outcome standards.[4] While resource and outcome standards imply that the finance system should adjust for differences in input costs and student needs across districts, relatively few courts have explicitly discussed these adjustments. Most courts have said with little elaboration that the state may adjust funding for cost differences or student need differences, but have not required such adjustments as part of the remedy (Lukemeyer 2001a).[5]

CFE decision

As is typical of many states, the Education Article of the New York Constitution

provides a very general description of what is required:

> The legislature shall provide for the maintenance and support of a system of free common schools, wherein all the children of this state may be educated. (NY Const art XI, 1)

After a substantial legal history including several cases before the New York Court of Appeals (New York's highest court), the Court of Appeals has interpreted the education clause of the New York Constitution to require the provision of "a sound basic education." (*Levittown*, 57 N.Y.2d at 48) The task facing the trial court is threefold.

> First, this court must define what constitutes a sound basic education. Second, the court must determine whether New York City School children are provided with the opportunity to obtain a sound basic education in the City's public schools. Third, if New York City public school children do not have the opportunity to obtain a sound basic education, the court must determine whether there is a "causal link" between this failure and the State's system for funding public schools (*CFE*, 187 Misc. 2d at 10, 13)

Judge DeGrasse presiding over the Supreme Court of the County of New York concluded in *Campaign for Fiscal Equity v. New York* that, "[T]he court holds that the education provided New York City students is so deficient that it falls below the constitutional floor set by the Education Article of the New York Constitution. The court also finds that the State's actions are a substantial cause of this constitutional violation." (187 Misc. 2d at 4)[6] As discussed more fully below, the trial court uses both references to skills and knowledge, and minimally adequate physical facilities and resources in describing what constitute a sound basic education.

With regard to the state's responsibility the court indicates that, "the State is ultimately responsible for the provision of a sound basic education…" (187 Misc. 2d at 114) The trial court is following a very common interpretation of state constitutions that the school finance

system is ultimately the responsibility of the state government including administration of local taxes to support schools (Lukemeyer, 1999). Judge DeGrasse goes on to say, "In the course of reforming the school finance system, a threshold task that must be performed by defendants is ascertaining, to the extent possible, the actual costs of providing a sound basic education in districts around the state. Once this is done, reforms to the current system of financing school funding should address the shortcomings of the current system." (187 Misc. 2d at 115) Any remedy to the deficiencies in the New York school finance system will involve first determining the cost of an adequate education, and second, developing a school aid system to provide the opportunity for adequacy.

Approaches to Estimating the Cost of Adequacy

The heart of any adequacy-based finance system is estimates for individual school districts of the spending required for them to reach a particular resource or performance standard. If the courts identify a resource standard, then the costs of adequacy involve costing out a particular bundle of resources in different parts of the state. When a performance standard is used, estimating the cost of adequacy is a forecast about what could happen to student performance when additional resources are provided to school districts. For either standard, estimating the cost of adequacy requires three steps.

First, the object and level of the standard needs to be defined. Defining a standard, particularly in terms of student performance, can be difficult and controversial. It is highly unlikely that one set of examinations will adequately capture all dimensions of what courts and the general public would consider an adequate education. However, it is clear that most states are implementing high-stakes student accountability systems, and this process could be

accelerated by recent passage of the "No Child Left Behind Act." Even if this step is ignored, because of poor data or political controversy, a choice is implicitly being made in selecting the bundle of resources and course requirements that represent adequacy.

The second step in the process is linking spending to the adequacy standard in at least one benchmark district. If adequacy cost estimates are going to have any validity, an empirical link must be established between a certain level of spending and a given bundle of resources or student performance level. Spending, per se, is often a poor measure of resource availability, because of input price differences, particularly for teacher salaries, that may exist across a state. If resources are the standard, then this step could involve an exercise in costing out a particular bundle of resources in a particular district. If student performance is the basis of adequacy, then establishing a spending-performance link is much more difficult, but unavoidable step. Ideally, this link should be established using empirical evidence on the historical relationships between resource use and student performance, holding constant all the non-school factors that affect student performance. Education production and cost functions have often been used to establish these relationships.

The final step in the process is the adjustment of the cost of adequacy in the benchmark district to reflect different characteristics in other school districts. If a resource adequacy standard is used, this adjustment involves determining differences in the prices that will have to be paid to purchase equal quality resources across the state. With regard to employee compensation, usually the largest share of a schools district's operating budget, adjustments need to be made for both differences in cost-of-living across a state, and the working conditions for the staff. A district with an above average cost-of-living may be able to pay teachers below average salaries if the working conditions are particularly favorable. If a performance standard

is used, then adjustments must also be made for the non-school factors that affect student performance in estimating the cost of adequacy, such as student needs and sparsity. While estimating the cost implications of geographic cost differences and student needs can be challenging, this is an essential step in the process. As will be illustrated below for New York, the choice made in this third step results in the largest variation in adequacy cost estimates.

Not surprisingly given the recent interest in adequacy standards, several methods have been developed to estimate the cost of adequacy. In the remainder of this section, we will briefly compare these approaches, and discuss their strengths and weaknesses with regard to different adequacy standards. [7]

Empirical Identification Approach

One obvious approach to estimating the cost of adequacy is to find districts that are presently meeting the standard, and to measure how much they are spending. This method involves four steps (Augenblick, 1993, and 1997). First, select the performance standard. Second, identify all districts reaching this standard. Third, select the spending categories included in the analysis, and calculate the average per pupil spending in these districts. Trim off districts with particularly high per pupil property values or income. Finally, adjust this estimate for differences in cost of doing business or higher need students.

The strength of this approach is clearly in the second step of the process—linking spending and a benchmark set of districts that are achieving a given student performance standard. Once a student performance standard has been selected and spending data collected, this approach is simple to implement and easy to explain. The underlying concept behind this method is intuitively appealing—simply find school districts meeting the standard and determine what they spend. One obvious implication of this approach is that as the standards increase, the

number of districts meeting the standard decrease. Simple spending comparisons should not be made across standards without suitable cost adjustment.

Unfortunately, almost by definition these districts are not "typical" districts especially if a high standard is selected. The empirical identification approach provides very little guidance on the third step--how to adjust the cost of adequacy in benchmark districts to reflect the characteristics of districts not meeting the standard. In application, a regional cost adjustment is usually made and a set of pupil cost weights is used to reflect student need differences.[8] The higher the adequacy standard gets, the more serious the lack of careful cost adjustment becomes. With high student performance standards, the set of successful districts will include primarily wealthy and higher income districts with relatively few high need students. A fair question is what relevance the spending in these districts has for understanding the required spending in poor districts with large numbers of at-risk students, which is the key challenge facing a school finance system? With crude cost adjustments, the empirical identification approach is likely to be particularly inaccurate in states with large urban areas, and where the adequacy standard is set significantly above the performance levels in these central cities.

Resource Cost Model Approach

Another intuitive approach to estimating adequacy is to go out and ask professional educators what resources they think are required for districts to achieve an adequacy standard. Commonly called the "resource cost model" (RCM) or "professional judgment method", this is a "bottom-up" approach to estimating the cost of adequacy.[9] 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. While this method can be time consuming and expensive to implement, the resulting estimates include a wealth of details

on the types and numbers of classrooms, teachers, other staff, and non-personnel resources that educators feel are necessary for a school to be successful.

This method is designed primarily to address the second step in the process—estimating the cost of adequacy in a benchmark district—when the benchmark is defined in terms of bundles of resources. If a state supreme court lays out a series of resource requirements and curricular offerings required for an adequate education, then the RCM method provides a systematic method for costing out these resource bundles. However, if the adequacy standard is expressed at least partially in terms of student performance, then the RCM method is on shakier ground, because the link between performance and resources is less clearly established. One way around this problem maybe to combine both the empirical identification and RCM approaches, by examining the bundles of resources required in districts already achieving the performance standard.

With regard to the third step in the process, the estimates of required spending in the prototypical school district are typically adjusted for input cost differences, to determine the required resource costs for adequacy. The RCM approach is often accompanied by estimates of geographic cost differences for resources, such as teacher salaries, energy prices, and capital construction costs. Professional salary cost indices can reflect both cost-of-living differences and working condition differences.

Much less attention is paid under the RCM approach to additional resources required to address different student needs. While it is possible to ask educators what additional resources will be required to help at-risk students reach the adequacy standards, these are just educated guesses, because of the paucity of actual examples of "successful" high-need urban schools. Simplistic methods of adjusting for needs, such as pricing the extra costs associated

with all high need schools adopting a whole school reform, are particularly questionable. What limited evaluation research exists on these programs suggests the need for investing in more qualified teachers, and more support staff than recommended by program sponsors.[10] The farther the characteristics of students in the prototype district diverge from high-need districts in a state, the more important accurate cost adjustment becomes.

Cost Function Approach

The third approach to estimating the cost of adequacy concentrates on the third step in the process—developing accurate adjustments for student needs and resource price differences. As discussed more fully below the approach involves estimating "cost functions" using statistical methods. A cost function relates data on actual spending in a district to student performance, resources prices, student needs, and other relevant characteristics of districts.[11] The resulting estimates are used to construct education cost indices, which measure how factors outside a district's control affect the spending required to reach a given student performance level. For the second stage of the process—estimating required spending to reach adequacy in a benchmark district—the cost function approach relies on the statistical results for the student performance measure(s).

The strengths of the cost function approach include: 1) concentration on the third step in the process by estimating the variation in required spending across districts, which is particularly important in states with large urban areas; and 2) the use of actual data on factors affecting spending to develop estimates of the costs of adequacy. However, these benefits are contingent on the quality of the data used in statistical analysis, and the accuracy of the statistical results. If the data does not capture well the underlying cost characteristics of a district, then as the saying goes, "garbage in, garbage out."

A number of choices confront a researcher attempting to estimate an education cost model. 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. 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, 223) In our view, this is an inappropriate criterion for selecting a method for estimating the cost of adequacy, because simple approaches, which are easy to explain, may be grossly inaccurate. The main criteria in selecting a method should be accuracy, not transparency. However, the onus is on the researcher using the cost function approach to explain the method in an intuitive fashion, and to convince policymakers and other policy analysts that the statistical decisions he or she made are reasonable.

Another criticism of the cost function approach is that it is a "black box," which reveals little about how the resources given a school district should be spent. The results from this method provide an estimate of how many resources will be required by a district to reach a given standard using present technology, and given some level of efficiency. The cost function approach does not prescribe what districts should do to reach adequacy, but instead predicts required spending based on historical relationships. While the emphasis on performance standards, not input or process standards, is consistent with the increasing focus on performance management (school accountability), it may not satisfy courts that have defined adequacy partially in terms of specific resources. In such cases, it is possible to combine the RCM and cost function approaches. The cost function approach can be used to link overall spending to a particular student performance standard. The RCM method can then be employed to identify specific sets of inputs that can be funded at these spending levels. Finally

the cost indices developed from the cost function approach can be used to estimate the required resources in other districts. If the court focuses exclusively on resources and not on performance as the measure of adequacy, then the RCM approach with geographic cost adjustment is probably preferable to the cost function method.

Estimating the Cost of Adequacy in New York

The bottom line in developing a school finance system to support adequacy is determining what it will cost in each school district to reach these standards. To compare these three approaches, we will use New York as an example. New York is an appropriate example because the New York State Board of Regents and Commissioner of Education have identified a set of clear performance standards required for high school graduation, and the *CFE* decision (2001) challenges the constitutionality of New York's school finance system on adequacy grounds. New York also provides a challenging environment to test these methods, because it is a very diverse state in terms of the enrollment size, student performance levels, demographic composition, and spending patterns of its districts.

The estimates provided in this paper are based on a number of data sources and assumptions about what data to use, how to aggregate the data, and what measures should be used to represent key underlying concepts. Most of the data comes from published sources produced by the New York State Education Department (SED). Because one of the objectives of the project was to develop estimates that could be replicated in the future by government staff in New York, we tried to rely on SED data sources as much as possible. While the data were generally provided by SED, ultimately we am responsible for the decisions about how to use the data, and thus, are responsible for any errors, omissions, and

misrepresentations that may exist.[12] As discussed earlier, estimating the cost of adequacy is a three-step process, and we will illustrate this process for New York.

Student Performance Measure

In setting an adequacy standard, the first step is determining whether the standard applies to guaranteeing some minimum level of resources, or the opportunity to reach a minimum level of student performance. In New York, the Board of Regents and Commissioner of Education have identified a clear set of performance standards for students to graduate from high school. In other words, education officials have selected performance adequacy as the equity standard in New York.

The trial court definition's of a sound basic education in the *CFE* decision (2001) is based on several passages in the 1995 Court of Appeals decision that suggest both performance and resource standards apply.

> The trial court will have to evaluate whether the children in the plaintiff's districts are in fact being provided with the opportunity to acquire the basic literacy, calculating and verbal skills necessary to enable them to function as civic participants capable of voting and serving as jurors. (86 N.Y. 2d at 318)

> Children are entitled to minimally adequate physical facilities and classrooms…minimally adequate instrumentalities of learning…minimally adequate teaching of reasonably up-to-date basic curricula…by sufficient personnel adequately trained to teach those subject areas. (86 N.Y.2d at 317)

The trial court interprets a sound basic education as "instill[ing] the skills students need to become productive citizens." (187 Misc.2d at 14). Students must be able to vote or serve as a juror "capably and knowledgeably." Voters must "evaluate complex issues such as campaign finance reform, tax policy, and global warming." Jurors must be "capable of serving impartially on trials that may require learning unfamiliar facts and concepts and new ways to

communicate and reach decisions with . . . fellow jurors. . . . [J]urors may be called on to decide complex matters that require the verbal, reasoning, math, science, and socialization skills that should be imparted in public schools. Jurors today must determine questions of fact concerning DNA evidence, statistical analyses, and convoluted financial fraud, to name only three topics." (187 Misc.2d at 14)

The trial court also goes beyond the strict language of the court of appeals decision to include an "economic competitiveness" aspect to the definition.

> Beyond voting and jury service, productive citizenship implies engagement and contribution in the economy as well as in public life. . . . public schools' duty to give students the foundational skills they need to obtain productive employment or pursue higher education . . . is inherent in the Court of Appeals' admonition that students must be prepared to become productive citizens." (187 Misc. 2d at 15)

While a sound basic education does not require that "most of the City's public school graduates be accepted into elite four-year colleges and universities in preparation for lucrative careers," it does provide students the opportunity to move beyond low-level service jobs that pay only the minimum wage.

While translating the court's decisions into specific performance measures is beyond the scope of this study, it is clear that the trial court is considering student performance measure as key indicators of a sound basic education. In selecting a measure of performance to use in estimating the cost of adequacy, we have drawn from the measures developed by SED in their proposed school accountability system. Specifically, the measure used in this study is based on a weighted average of 4^{th} and 8^{th} grade math and English tests, and high school Regents exams in math and English. Regents Exams were weighted twice as heavily as 4^{th} and 8^{th} grade exams to reflect the fact that students are now required to pass these exams for high school

graduation.[13]

<Figure 1 around here>

As indicated in Figure 4, there are wide disparities presently in student achievement, and they are related closely to the region and student needs in school districts. The five large city school districts (New York City, Yonkers, and the Big Three) have performance levels of approximately 100 (out of 200), which is well below the state average (159.5), and the performance level reached in any other region of the state. Even the rural districts and small city districts, which include many districts with high poverty rates, perform much better on average than the large cities. The target performance standard in 2000-01 in the school accountability system was 140, forty percent higher than the level of performance in these large cities. Besides estimating the cost of reaching the 140 standard, we will estimate the required spending to reach standards of 150 and 160.

Estimating the Cost of Adequacy in Benchmark Districts

The second step in developing estimates of the cost of adequacy is to determine the required spending level to reach a performance standard in one or several benchmark school districts. The three methods for estimating adequacy, discussed previously, take very different approaches to determining a benchmark district. The cost function approach estimates the spending required by a district to reach a particular performance standard assuming the district has average student needs, average predicted teacher salaries, average enrollment, and average efficiency (to be defined in the next section). The estimated per pupil spending levels to reach different adequacy standards using this approach are reported in the first line of Table 2. For a district with average characteristics a spending level of $8,201 is estimated to be adequate to reach a performance level of 140. An additional $640 per pupil is required to reach a standard

of 150 and an additional $1,330 to reach a standard of 160 (compared to 140).

<Tables 2 about here>

For comparison purposes, we calculated a similar spending number using the "empirical identification approach." Specifically, we determined the number of districts meeting or above a particular adequacy standard, and trimmed the top 10 percent and bottom 10 percent with regard to both per pupil income and per pupil property values. The second row of Table 2 presents the mean spending levels for these districts without any cost adjustment. The mean spending level ($9,064) when the standard is 140 is higher than the benchmark cost using the cost function method. As expected the costs to reach adequacy go up as the standard increases, but at a much slower rate than the cost function approach. At the standard of 160, the mean spending level is roughly the same as under the cost function method.

The fact that spending increases only slightly when performance standards are raised reflects the fact that the characteristics of the districts used to calculate this benchmark changes significantly as the standard gets higher. To reflect the geographic cost differences that might exist across these different groups of districts, we divided spending into categories and used the cost indices developed by Chambers (1997), to deflate spending to reflect average resource prices.[14] The results of this process are reported in the third line of Table 2. Once geographic cost of living are accounted for there is very little growth in estimated adequacy costs as the standard increases from 140 to 160. The small increases in required spending are not credible, and indicate that the higher the standard the wealthier the school district, and the lower the share of high need students. In other words, spending should not be compared across the standards without adjusting for student need differences.

Carrying out a full RCM exercise was beyond the time and resources available for this

project. Instead, we developed an approach that mixes part of the RCM method and empirical identification method, and label this an "empirical staffing approach". Using an approach similar to the empirical identification approach we first determined which districts meet different performance levels. We then calculated average pupil to staff ratios for K-6 and 7-12 enrollments for teachers, principals, assistant principals, and other professional staff in the district. We found little variation in the average staffing ratios for districts meeting each standard. We then compared these staffing ratios to those used by Management Analysis & Planning Associates, L.L.C. (1997) for the state of Wyoming, and selected a set of ratios that seem consistent with both professional judgment and actual experience.[15] Once a set of staffing levels were determined they were multiplied by average county wage for this class of employee to reflect regional cost of living differences (to avoid rewarding districts with unusually high salaries), and by the state average fringe benefit rate (31 percent). Finally, for central administration, paraprofessional staff, and operating and maintenance categories we used the average spending in these categories for districts meeting the standard.[16]

Not surprisingly given the origins of these estimates, they are similar particularly to the cost adjusted estimates using the empirical identification methods. For a standard of 140, they are also very similar to the estimates for the cost function approach. There is little increase in the cost of adequacy as the standard is raised from 140 to 160, which is consistent with the emphasis in the RCM method on resources and not student performance.

It is difficult to directly compare the results of these three approaches, because of potential differences across benchmark districts in factors, such as student need, enrollment, and efficiency. However, the results are similar enough to suggest that there may not be large differences in the cost estimates for benchmark districts using any of these approaches. The

exceptions to this seem to be when standards are set very high. The cost function approach is likely to show that a significant increase in spending is required to move from lower to higher standards compared to either empirical identification method.

Estimating the Cost of Adequacy in All Districts

The final step in estimating the cost of adequacy is adjusting the adequacy cost in the benchmark district to reflect the unique characteristics of other school districts. If the adequacy standard is in terms of resources, then adjustments need to be made for the differences in input prices to purchase equal quality resources across school districts. If the adequacy standard is in terms of student performance then adjustments also need to be made for both student needs and physical characteristics, such as enrollment. The trial court in the *CFE* decision (2001) indicates that both "variations in local costs" (p. 115), and "socio-economic deficits" should be accounted for in designing the school finance system. We will begin by discussing the construction of a teacher wage index from a teacher wage model, before turning to cost indices from a full cost model. We will conclude this section by presenting estimates of the cost of adequacy using these different cost indices.

Estimating a teacher wage index: If the adequacy standard required by a state implies that the state must assure that all districts receive a minimum level of resources, then some adjustment needs to be made for the higher cost of business in some school districts than others. Given that the primary resource used by school districts are teachers and other professional staff, differences in the cost of hiring teachers would be particularly important to adjust for. Some districts may have to pay significantly more to recruit teachers of equal quality, because of 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. What teachers

consider difficult working conditions will clearly vary, but discipline problems, violence, and general lack of student motivation are likely to make a teaching job less attractive to most teachers. In addition, cost differences can also be calculated for other inputs, such as transportation, energy, and facilities.[17]

Using information on individual teacher salaries and teacher characteristics in 2000, and school and district factors, we have estimated a teacher wage model.[18] In developing a teacher wage index it is important to distinguish between discretionary factors that a district can control, and those labor market or working condition factors that are outside district control.[19] Factors that a district can influence include the experience and education of its teaching force, the certification level of its staff, the size of schools and class sizes, average student performance, and the general level of efficiency in the district. Factors outside a districts control include labor market factors, such as private sector salaries, and unemployment rates, and factors related to working conditions, such as high need students, juvenile crime rates, and pupil density. Table A-1 in the Appendix provides a list of the variables used in several teacher wage models and their source, and Table A-2 presents the results.[20]

To develop a measure of competitive salaries we use the average for the discretionary factors, and the actual district levels for the factors outside their control.[21] Competitive salaries are defined as what a district would have to pay to recruit a teacher with average characteristics in a district with average efficiency, and in a school and class of average size, compared to other districts in New York. Finally, to develop a teacher wage index the predicted competitive salary in a district is divided by the state average salary, and multiplied by 100.

Table 3 (first panel, column 2) presents the teacher wage index we developed, along with several other resource cost indices. The third and fourth columns present the overall

education cost index and teacher cost index developed for NCES by Chambers (1997). The last column (of the first panel) presents a regional cost index developed by the New York State Education Department based on average wages for 77 professional occupations for 9 labor market areas in New York. All the resource cost indices show a distinct upstate and downstate difference in resource costs. Most of the downstate districts are above the state average in terms of costs, and most of upstate differences are below average. The two NCES indices and SED regional cost index show very similar patterns across regions. The teacher wage index developed for this study has significantly higher index values for the large cities. New York City and Yonkers will have to pay teacher salaries over fifty percent higher than the average district to attract teachers of average education and experience. Both the higher cost-of-living in downstate New York, and the challenging working environment in both cities are major factors affecting competitive salary levels. Even though the other large cities, commonly called the Big Three, are located in upstate New York where cost of living are below average, they still predicted to have to pay salaries 25 percent above average salaries to recruit good teachers, because of more difficult working conditions. The significant differences between the resource cost indices for the large cities highlights the importance of careful analysis by states of factors affecting resource costs.

<Insert Table 3 about here>

Estimating cost functions and cost indexes. If the adequacy standard required by a state is that all districts should be given the opportunity to raise their students to an adequate level of student performance, then adjustments need to be made for both resource cost differences, and the higher level of resources required in some districts. More resources might be necessary, because a district is very small (economies of size), or has a large share of at-risk

students. An education cost function relates per pupil spending in a school district to factors outside a district's control, and factors, which a district can influence. Beginning with the latter, spending levels in a district are clearly affected by the level of student performance that school officials, and ultimately taxpayers want to support. We would expect a positive relationship between the level of student performance and spending, and the coefficient on this variable is used to estimate the required spending to achieve a particular performance standard.

The spending-performance relationship has to be tempered by the possibility of inefficiency in the use of resources. 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. It is particularly important in estimating cost models to adequately control for efficiency differences across districts, because the cost function results can be sensitive to what efficiency factors are included.[22] Table A-3 in the Appendix list the variables used education cost model, and Table A-4 presents the results.[23]

The other side of a cost function is those factors that are typically outside of a district's control, which can be roughly divided into three categories; resource prices, student needs, and physical characteristics of a district. As discussed above, some districts may have to pay significantly more to recruit teachers of a given quality. Factors affecting school readiness of students, their motivation, and their behavior not only influence the working conditions facing a teacher, and hence competitive salaries, but the quantity of resources that are required to help these students reach a particular performance standard. The cost function used in this study includes two student need factors—the share of enrollment that is limited English proficiency (LEP) students, and the percent of children between 5 and 17 years old living under the poverty line.[24] Finally, costs may be affected by certain physical characteristics of a district including

enrollment size, and physical terrain. We have included in the cost model variables measuring the enrollment levels in the district to reflect the fact that costs are likely to be higher in very small school districts.[25]

Predicted costs are calculated from the cost model by holding efficiency and performance at the state average, and allowing the factors outside a district's control to vary. The cost indices in the first two columns in the second panel of Table 3 are based on the cost function developed for this study. Greater student needs and the higher salaries both act to raise costs in New York's large cities. The full cost index (including all factors outside district control) for New York City is 183 indicating that New York City will have to spending 83 percent more than a district with average cost characteristics to reach the same level of student performance. Child poverty and limited English proficiency levels in New York City will raise the costs of achieving adequacy by 36 percent compared to a district with average poverty and LEP rates (student needs index). In addition, New York City will have to pay teachers more to attract teachers of equal quality, resulting in an increase in costs of almost 20 percent. Higher enrollment levels in New York City are predicted to raise costs by 12 percent compared to the average district.

Yonkers is estimated to also have to spend close to 80 percent more than the average district, driven by the same factors as New York City. The large upstate cities, commonly called the Big Three, are estimated to have to spend 51 percent more per pupil than the average district to reach the same student performance level. Student needs, in particular, raise the required spending by over forty percent. The only other group of districts with costs significantly above average is the downstate small cities, where the estimated costs of bringing students in these districts up to a given performance standard are almost 40 percent above the

average district. Higher costs are driven primarily by higher salaries required in downstate districts.

Weighted pupil counts: 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 students twice, for example, will assure more resources will go to districts with these types of students. While most states use the weighted pupil approach to adjusting for student needs, the origins of most of these weights remain obscure. It appears that most are based, at best, on professional judgments about the extra costs associated with certain types of students. Rarely are pupil weights the result of careful analysis of the actual relationship between student characteristics and costs. The results of the cost model estimated in this study can also be used to develop pupil cost weights for both children in poverty and LEP students.[26]

<Table 4 about here>

The first and third columns of Table 4 provide estimates of extra costs associated with a student of a certain type in different types of districts. We find that school-age children in poverty will generally required between $7,000 and $9,000 per student in additional resources to bring these students up to the average performance in the state. For LEP students the extra costs are even higher, in excess of $10,000 per student. Pupil weights are calculated by dividing these additional costs by spending required to bring non-LEP and poverty students up to average student performance (second and fourth columns). For both types of students the weights are approximately equal to one. A weight of one can be interpreted as indicating that a student of this type is twice as expensive to bring up to any given performance level as other students.

While no definitive list of pupil weights used by states exists, the limited evidence that we could find suggests that weights of 0.25 or lower for at-risk students are the norm in most states (Alexander and Salmon, 1995). For example, Kansas use weights of 0.1 and 0.2 in weighting students eligible for free lunch and bilingual education (Kansas Legislative Research Department, 2001). For illustrative purposes we calculated the student need index associated with different pupil weights (columns 3, 4 and 5 of Table 3). Confirming our estimates, the index associated with pupil weights of 1.0 for both children in poverty and LEP students is very similar to the student need cost index calculated from the cost regression. Contrasting this index to the case when the pupil weights are set at 0.25, illustrates just how important adjusting for student needs can be. With a weight of one, costs are estimated to be 30 percent higher in the large cities than average, compared to below ten percent higher when a weight of 0.25 is used. Assuming that the cost function estimates produced in this study are reasonably accurate, many states may be significantly underestimating the additional resources that are required to support at-risk students achieving higher standards.

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 provide students the opportunity to reach these standards. The cost index approach is particularly well suited for this stage of the process. To estimate the cost of adequacy in a particular school district, simply multiply the required per pupil spending in the benchmark school district for a particular adequacy standard by the cost index for that district. For example, to estimate the cost of reaching adequacy in New York City for a standard of 140, simply multiply 1.8271 (182.71/100) by $8,201 per pupil, which equals $14,983 (top panel, second column of Table 6).

For simplicity, we have used the spending level in the benchmark school district calculated using the cost function method for the three different performance levels reported in Table 2. However, given the similarity of the spending estimates from the other two methods (at a standard of 140), using a different method to calculate benchmark spending will not appreciably change the results. See Table A-5 in the Appendix for estimates of the cost of adequacy based on the empirical staffing approach for establishing the benchmark.

<Table 5 about here>

Table 5 provides estimates of the required per pupil spending for adequacy when adjustments are made for resource cost differences only. Comparisons are made to actual per pupil expenditures in the 1999-2000 fiscal year. As expected some significant variation in estimated required spending levels emerge, because of differences in the resource cost index. If the teacher wage index produced in this study is used to adjust for costs, then significant increases over actual spending would have to occur in the large cities and downstate small cities if the benchmark spending level was $9,500, which was below the state average (see second column and second panel of Table 5). In contrast, if one of the NCES indices or the SED regional cost index is used, relatively small spending increases would be required except in New York City to provide adequate resources.

When the focus of the adequacy standard is student performance, then adjustments need to be made for both resource cost and student need differences. Table 6 illustrates that the choice made about the resource index and need index can have a significant affect on the estimated cost of adequacy. For example, if the cost index from the cost model estimated in this study (which adjusts for all cost factors) is used, the required spending levels with a standard of 140 in New York City and Yonkers exceed $14,500 per pupil, and exceed

$12,000 per pupil in the large upstate cities. In other words, spending would have to increase by 20 percent in Yonkers, 33 percent in the other large upstate cities, and 70 percent in New York City to reach a standard of 140. If the standard is set at the state average of 160, the projected spending increase in the large cities would range from $4,500 per pupil in Yonkers to $8,600 per pupil in New York City.

<Table 6 about here>

A very different picture emerges about required spending increases if the NCES cost of education index is used along with pupil weights of 0.25 for LEP and poverty (column 6 of Table 6). Little additional spending is required in most districts except New York City to reach a standard of 140. The projected spending increase in New York City would be only $1,000 per pupil, an increase of 12 percent. Even when the standard is set 60 percent above present performance in the large cities (160), the projected spending increase in New York City would be only 30 percent, and 17 percent in the large upstate cities. Yonkers would be projected to already spend a sufficient level to reach this standard. In contrast to the relatively small differences between the three approaches in the estimated costs for adequacy in benchmark districts (Table 2), the choice made about the cost indices for resources and student needs can have a very large impact on the estimated costs of reaching an adequacy standard (Table 6).

Designing Aid Formulas to Achieve Adequacy

Education cost indexes are important largely because they make it possible to design aid formulas that are more effective at achieving educational equity objectives. This section explores the link between educational cost indices, adequacy standards, and the design of equitable aid formulas, and shows how to bring educational cost indexes into a foundation aid formula. The issues discussed here also arise in programs designed to reward districts that meet performance standards or to punish districts that fall short. As several states have discovered, rewards or punishments that focus exclusively on performance, with no adjustment for costs, end up helping the districts that need help the least and punishing the districts that are, through no fault of their own, stuck with the harshest educational environments (Ladd and Clotfelter, 1996).

About 80 percent of states use some form of a foundation grant system, which is designed to ensure that all districts meet some minimal performance standard. For the most part, however, these systems use spending as a measure of "performance", and therefore do not bring many districts up to any given performance standard defined on the basis of student performance. This need not be the case: cost indexes make it possible to design a foundation formula that brings all districts up to a performance standard defined by test scores or any other reasonable measure. [27]

To make the switch from spending to resources or performance, one must incorporate an educational cost index into the aid formula. This index indicates how much a district with a certain cost level would have to spend to achieve a given level of resources, or a given student performance target. The cost index needs to be consistent with the adequacy standard that is

selected. For the presentation below, we will focus on a definition of adequacy based on the student performance index developed in this study. A performance-based foundation formula that brings all districts up to the selected performance standard, S^*, at an acceptable tax burden on their residents is as follows:

$$A_i = S^* \ C_i - t^* \ V_i - \ FA, \text{ or } A_i = E^* \ c_i - t^* \ V_i - \ FA$$

where A_i is per pupil aid, and C_i is the amount the district must spend to obtain one unit of student performance (*S)* This can be reexpressed as E^*c, where E^* is required spending in the district with average characteristics, and 'c' is an education cost index (centered on the district with average characteristics). The amount of aid this district receives equals the spending level required to reach *S** minus federal aid and the amount of revenue it can raise at the specified tax rate *t**.

Taken literally, this formula implies that some districts with high tax bases actually receive negative aid. This formula is usually modified in practice, through minimum aid amounts or hold-harmless clauses, so that all districts receive some aid, thereby reducing the equalizing power of the formula. Moreover, a foundation grant usually is accompanied by a requirement that each district levy a tax rate of at least *t**; otherwise, some districts might not provide the minimum acceptable spending level, *E**c.

Aid Distribution Under a Performance Foundation System

To illustrate a performance foundation formula, we have used the estimates of required spending to reach particular adequacy standards reported in Tables 5 and 6. With regard to the minimum local tax effort, the state average contribution rate of $15 per $1,000 of market value is assumed. Comparisons are made to the estimated per pupil aid for the 2000-2001 fiscal

year.

<Table 7 about here>

Table 7 presents the aid distribution when only adjustments are made for resource costs in calculating the cost of adequacy. If the NCES or SED indices are used to measure resource costs, the aid to New York City and Yonkers would increase, but aid to most other districts would either remain the same or go down. The overall aid budget with a standard of 140 would only be slightly higher than the present aid budget. If the standard was 160, the aid budget would rise by over 35 percent with most of the aid increase occurring in the large cities. If the teacher wage index calculated in this study is used, the aid increases in the large cities to reach a standard of 140 would be much more dramatic (doubling in New York City and Yonkers, and increasing by 25 percent in the upstate large cities). The increase in aid to large cities would be financed by both an increase of the aid budget of 37 percent, and significant decreases in aid to many suburban and rural districts.

<Table 8 about here>

When a student performance standard is used, the distribution of aid across districts depends crucially on resource cost index and student need index that is selected. If the full cost index developed from the cost function estimated in this study is used (column 2 of Table 8), aid to New York City and Yonkers would increase by more than 150 percent, and aid to the large cities would increase by 60 percent for a standard of 140. If the standard was set at the state average of 160, aid would more than triple in New York City and Yonkers and double in the large upstate cities. These aid increases in the large cities would be financed by a rise in the aid budget of 60 to 100 percent, and significant decreases in aid in many suburban districts. With a

standard of 140, the large majority of downstate suburban districts would receive no aid under this aid formula.

In contrast, if the NCES education cost index were used in conjunction with pupil weights of 0.25 (column 6 of Table 8), increases in the overall aid budget would range from 8 percent for a standard of 140 to 40 percent for a standard of 160. Aid to the large cities would increase, but only by 7 percent (upstate large cities) to 55 percent (New York City) to reach a standard of 140. However, if the teacher cost index developed in this study is combined with pupil weights of one, the aid increases in the large cities would be even higher than with the full cost index. It is fair to say that the choice of cost adjustment is by far the most important decision that a state has to make in deciding how to finance an adequate education.

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Conclusions

States have moved aggressively in the last decade to implement higher standards, and almost half the states will require passage of exit exams for student graduation by 2004. Increasingly, state courts are interpreting the education clause in their state constitution as requiring the state to provide an opportunity for all children to reach an adequate level of content knowledge and skills. Despite the clear trend toward adequacy standards in education, states have been much less successful in implementing funding systems designed specifically to assist students (and schools) reach these standards.

The objective of this study is to examine several of the common approaches of estimating the cost of adequacy—empirical identification approach, resource cost model, and cost function approach. Estimating the cost of adequacy involves three steps: 1) selecting

measures of student performance (or bundles of resources) that can be used to identify adequate and inadequate performance; 2) estimate required spending for adequacy in at least one "benchmark" school district; and 3) adjusting this benchmark spending level to reflect different characteristics in other school districts.

The empirical identification approach is simple, and intuitive to explain to policymakers. This approach is focused on providing an estimate for step 2—what are the costs to achieve adequacy in several benchmark districts that are already meeting the standard. However, generalizing the adequacy costs produced by this approach to other school districts is likely to understate the required costs, especially in large cities. Districts already reaching high standards, are apt to have higher income and wealth, and relatively small populations of at-risk students. At a minimum the adequacy costs identified in this approach should be adjusted carefully for differences in input prices and student needs.

The resource cost model (RCM) approach can provide detailed estimates of costs associated with bundles of inputs selected by professional educators. In conjunction with good measures of resource price differences, the RCM can be used to determine the cost of reaching a resource adequacy standard in different districts. This approach, however, often does not provide a systematic link between spending and performance standards. To use this method to calculate the cost associated with higher performance standards requires estimates of the cost impact of student needs.

The cost function approach is explicitly designed to produce cost indices that capture the impacts of resource prices, economies of size, and student needs on the costs of producing education services. In essence this approach merges step 2 and 3 into estimates of the cost of adequacy in all districts based on historical relationships between spending and these factors.

For this approach to produce accurate estimates of costs, however, requires valid and accurate measures of cost factors, and appropriate specification of the cost model and selection of statistical methods. The cost model approach is also more difficult to explain to education policymakers, and does not provide a template of how districts should spend their money. The onus is on the researcher to explain and justify the cost model that is developed.

To highlight these differences we develop adequacy costs for school districts in New York. The results of this analysis indicate that the three methods produce similar estimates of the cost of adequacy in benchmark districts (step 2). The empirical identification and RCM methods appear to be fairly insensitive the level of the standard. Raising student performance by 14 percent from 140 to 160 results in spending increases of less than three percent with these methods. The cost function approach, on the other hand, projects required spending increases in the benchmark districts of 16 percent.

The largest variation in the estimated cost of adequacy emerges in the third step in the process, when benchmark spending is adjusted for differences in resource costs and student needs. The choice of cost adjustment is by far the most important decision that a state has to make in deciding how to finance an adequate education. The cost function approach is particularly well suited for the third stage of the process, because one of the outputs of this method can be education cost indices that measure the additional costs required because of geographic cost differences and student needs.

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Endnotes

[1] For a detailed review of state supreme court decisions on school finance, see Lukemeyer (1999), and (2001).

[2] *Campaign for Fiscal Equity, Inc., v. State*, 187 Misc. 2d 1,719 N.Y.S. 2d 475 (N.Y. Sup. Ct. 2001) (CFE).

[3] Some legal scholars have suggested that courts may be more willing to consider education clause claims, because they have less impact on other substantive areas of law, and avoid some difficult political controversies, such as recapture of revenue from wealthy districts (Enrich, 1995; Heise, 1995; Thro, 1994; and McUsic, 1994)

[4] For instance, in *Horton I* (1977), the Connecticut court relied on a trial court measure of the "quality of education," which included primarily school resources and services (size of classes, training, experience and background of teaching staff, materials, books, and supplies), but also included measures of student achievement.

[5] Exceptions include *Abbott II & III* (New Jersey 1990, 1994), *Campbell County* (Wyoming, 1995), and *Hornbeck* (Maryland, 1983).

[6] *Campaign for Fiscal Equity, Inc., v. State* (2001). The plaintiffs also challenged the constitutionality of the system on Title VI claims, and "the court finds that the State school funding system has an adverse and disparate impact on minority public school children." (p. 4)

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

[8] Augenblick (1997) derived the pupil weights he used for Ohio from a single-equation spending regression produced by Bruce Gensemer (1997). Gensemer states in this paper that, "If policy makers prove to be interested in a comprehensive cost adjustment, the more sophisticated simultaneous-equations approach should then be pursued in the second stage." (p. 4) He specifically cited the work of John Yinger and his colleagues, which is similar to the cost function approach presented in this study.

[9]For examples, see Chambers and Parish (1982), and Management Analysis (1997).

[10] For a detailed review of the evaluation literature on whole school reforms, as well as an evaluation of several reforms in New York City, see Bifulco (2001).

[11] For other examples of this approach, besides this report, see Downes and Pogue (1994), and Reschovsky and Imazeki (1997).

[12] For a detailed review of the data used in this study see Appendix A of the report, "Estimating

the Cost of An Adequate Education in New York," (Duncombe, 2002) available on the website, http://cpr.maxwell.syr.edu/efap/

[13] Newly developed examinations in mathematics and English language arts are required of all 4th and 8th grade students. SED has divided test results into 4 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 student reaching given levels is first identified, and then a weighted average of these percents is calculated with a weight of one for Level 2 and weight of 2 for Levels 3 and 4. New York is one of the first states in the country to move to a "high stakes" high school testing program. With relatively few exceptions (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 one, and the percent of students receiving above a 64 are weighted at two. 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% is applied to the Regents exams, 25% to 4th grade exams, and 25% to 8th 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.

[14] Specifically, spending was divided into teacher salaries, salaries for principals and supervisors, central administration, salaries for paraprofessional staff, and other support staff, and operating and maintenance spending. The NCES cost indices (for 1993) applied to these categories include a teacher cost index, administrator cost index (for both principals and central administration), cost index for secretaries and health services staff, and cost index for non-personnel categories. See Chambers (1997) for a detailed presentation of how these indices were calculated.

[15] For both elementary and second schools, pupil teacher ratios were set at 13.4. For elementary schools one principal and another professional staff person is assumed for each 300 students. For high schools a principal and assistant principal are assumed for each 600 students, and another professional staff person for each 200 students. Staff are assumed to be assigned fulltime to the school, which implies that the calculated staffing numbers are rounded up.

[16] To make the resource bundles represented by these cost estimates comparable across districts, we used the NCES cost of education indices to deflate these numbers. See the previous note for more details.

[17] For a good introduction to methods used for adjusting for input cost differences see *A*

Primer for Making Cost Adjustments in Education developed by Fowler and Monk (2001).

[18] See Appendix B in Duncombe (2002) for a discussion of the development of the teacher wage model.

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

[20] The dependent variable in the teacher wage equation is the natural logarithm of the teacher wage for fulltime classroom teachers. Because the equation is estimated at the individual teacher level, it is reasonable to assume that teachers are price takers. 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, 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 from each observation are not independent of each other. In particular, the estimated standard errors on district-level variables may significantly understate the actual standard errors. To correct for clustering in the standard errors we used a method for adjusting the standard errors to produce more accurate hypothesis tests. 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.

[21] One exception is the case of juvenile crime rates. The coefficient on this variable has a negative sign indicating literally that wages are lower in places with higher juvenile crime. This variable was at the county level, so may not be accurately reflecting the distinction between city districts and their suburbs. Because the variable may be reflecting fiscal capacity differences across school districts, not working conditions, it was held at the state average.

[22] 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) Incentives for efficient use of resources may be lower in wealthier or higher income districts, because easier financial constraints diminish the incentive for taxpayers to put pressure on their school district. State aid can act in a similar fashion to affect school district efficiency. The relative nature of efficiency implies that districts may compare themselves to similar districts in assessing how affluent they are. The need/resource capacity categories defined by SED were used, with the Big 5 treated as one peer group. To measure the relative affluence of a district, the difference between the per pupil income, per pupil property values, and aid as a percent of income in a district, and the average of these variables for their peer group is calculated. We would expect that the higher resources are, relative to their peer group, the less efficient a district will be, which in turn will raise spending (positive coefficients on these variables). See Appendix B in Duncombe (2002) for more detail on these measures.

[23] The dependent variable in the cost model is the natural logarithm of per pupil expenditure. The expenditure measure used is total expenditure minus spending for debt service, transportation, and tuition payments for students attending schools outside the district. The model is estimated with linear 2SLS treating the student performance index and teacher salaries as endogenous. See Appendix B of Duncombe (2002) for discussion of the process of selecting instruments.

[24] In another cost model, Duncombe (2002) used the share of elementary school children eligible for free lunch under the federal school lunch program as an indicator of poverty (see Appendix B). Based on recommendation from SED staff, free lunch shares for K-6 students were used, because this share is more representative of the underlying free lunch eligible population, than the actual share of users from all grades. The cost index results are not significantly different from those presented in Table 3.

[25] Previous research on New York has indicated significant economies of size moving from enrollment levels below 1000 students, to enrollment levels of 1500 to 3000 students. After this enrollment level, however, the cost savings from getting larger are generally small. See Duncombe, Miner and Ruggiero (1995), and Duncombe and Yinger (2001).

[26] See Appendix B in Duncombe (2002) for a description of the method used to construct these weights.

[27] This section draws heavily from Ladd Yinger (1994); Duncombe and Yinger (1998).

Figure 1. Comparison of Student Performance Index by Region

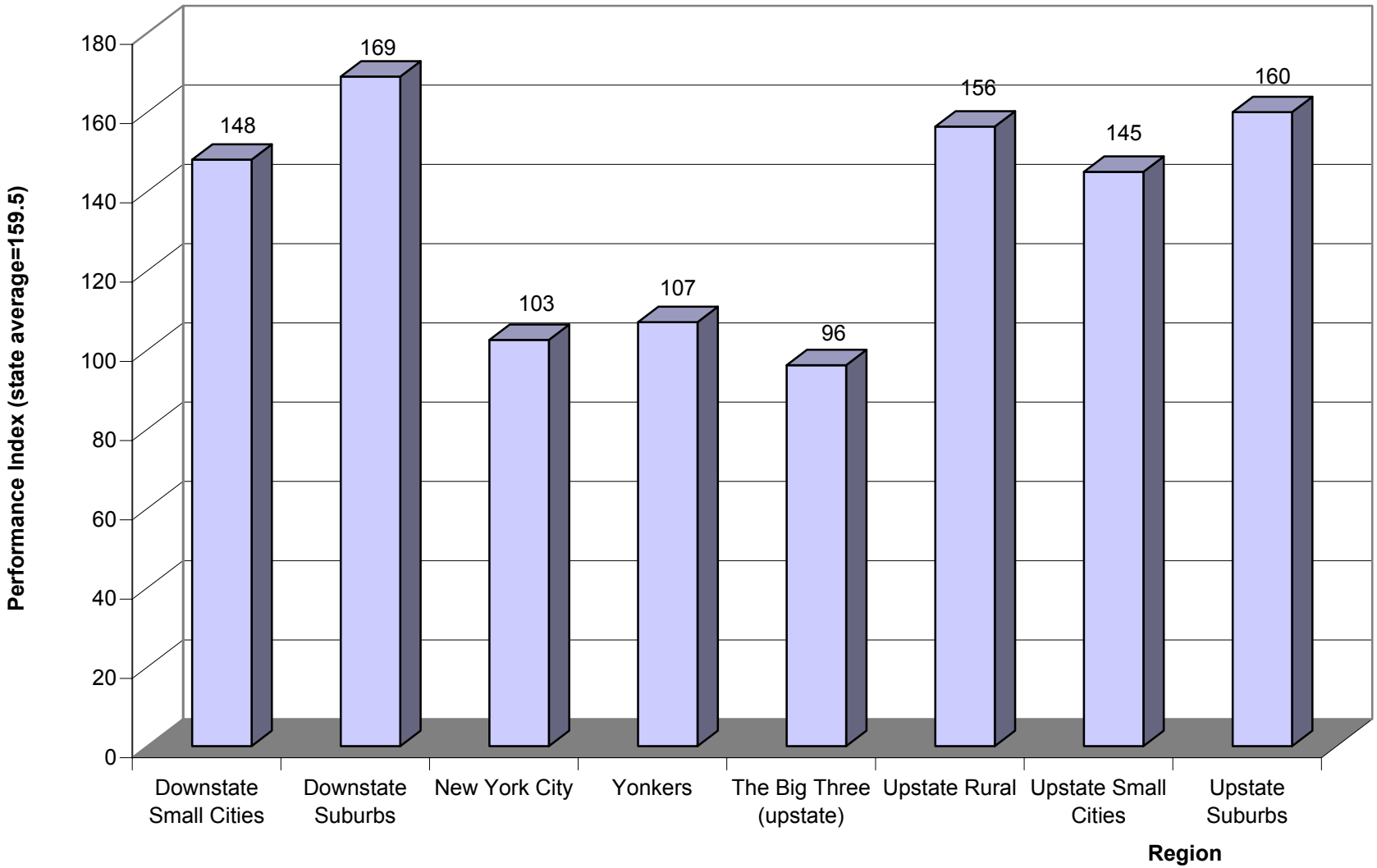

Table 1
Education clause standards selected
and determinations whether standard is met.
State supreme court cases 1971-1996[a]
N=33[b]

Standard Decision	*Number of cases*	*% of cases selecting this standard*	*% of total cases presenting education clause claims*
Adequacy	**14**		42.4
Met	7	50.0	21.2
Not met	1	7.1	3.0
Not decided	6	42.9	18.2
Adequacy with possible equality	**5**		15.2
Met	2	40.0	6.1
Not met	3	60.0	9.1
Not decided	0	0.0	0.0
Adequacy and equality	**2**		6.1
Met	0	0.0	0.0
Not met	2	100.0	6.1
Not decided	0	0.0	0.0
Equality variant	**4**		12.1
Met	0	0	0.0
Not met	4	100.0	12.1
Not decided	0	0	0
Access up to adequacy	**1**		3.0
Met	1	100.0	3.0
Not met	0	0.0	0
Not decided	0	0.0	0
No standard	**7**		21.2
Court notes adequate	2	28.6	6.1
No code	5	71.4	15.2

[a] States in which high courts issued multiple opinions in the course of the same suit are treated as a single case. The court's choice of standard is coded on the basis of all opinions considered from the vantage point of the last. In cases with multiple decisions, a court is counted as finding a standard "not met" if it found the standard "not met" in any decision in the series. In a few suits, courts have issued opinions after 1996. Those opinions are not considered in this table.

[b] N = all cases between 1971 and 1996 in which state supreme courts considered the merits of education clause claims except *Roosevelt Elementary School District No. 66 v. Bishop* (Arizona 1994) and *Coalition for Adequacy and Fairness in School Funding, Inc. v. Chiles* (Florida 1996). Both of these cases resulted in plurality opinions which could not usefully be categorized in terms of the presentation in this table. The cases reviewed in this table include *Washakie County School District No. 1 v. Herschler* (Wyoming 1980) in which the court interpreted the state's education clause in its opinion but was not clear with respect to whether plaintiffs presented an education clause claim.

Table 2. Required Spending to Achieve Adequacy Standards (1999-2000) In a Benchmark District--Comparison of Three Approaches

	Per Pupil Spending		
	Standard of 140	**Standard of 150**	**Standard 160**
Cost function approach:[1]			
Required spending for adequacy in a district with average costs	$8,201	$8,841	$9,532
Empirical identification approach:[2]			
Without cost adjustment	$9,064	$9,148	$9,533
With cost adjustment	$8,133	$8,161	$8,352
Empirical staffing approach[3]			
Without cost adjustment	$8,385	$8,490	$8,851
With cost adjustment	$8,385	$8,386	$8,468

[1]All variables in the cost function are set equal to the state average except student performance which is set equal to the adequacy standard. Defined as the spending required by districts with average costs to reach the adequacy standard.

[2]Districts equal to or above the standard are first identified. The top and bottom 10% of districts in terms of per pupil income and market value are trimmed from the sample. Average per pupil spending is then calculated for row "without cost adjustment". For row "with cost adjustment" expenditures are decomposed into different categories, and deflated using the NCES education cost indices (1993) for teachers, administrators, support services, paraprofessionals, and maintenance personnel.

[3]Personnel salaries for teachers, principals, assistant principals,and other professional staff are calculated by using a fixed pupil teacher ratio, pupil per principal (and assistant principal) ratio, and pupils per other professional staff for elementary and secondary schools. Personnel is then multiplied by average salaries at the county-level for these occupations and the state average fringe benefit rate. This is added to per pupil spending for central administration, other instructional, and operating and maintenance spending calculated the same way as empirical identification approach. Cost adjustment is done the same way as empirical identification approach.

Table 3. Summary of Resource and Need Cost Indices

Regions	Number of Districts	Resource Cost Indices: Teacher Wage Index (Wage Model)[1]	NCES Cost of Educ. Index (1993)	NCES Teacher Cost Index (1993)	NY SED Regional Cost Index (1998)[2]
Downstate Small Cities	7	128.37	118.95	124.34	117.04
Downstate Suburbs	168	113.61	114.79	118.82	118.39
New York City	1	153.83	111.41	113.02	119.29
Yonkers	1	152.09	118.95	123.97	116.15
The Big Three (upstate)	3	126.56	103.91	105.04	94.90
Upstate Rural	207	89.95	90.52	87.99	89.88
Upstate Small Cities	49	103.89	97.41	96.73	94.79
Upstate Suburbs	242	96.77	97.56	96.60	96.29

	Index with All Cost Factors (Cost Model)[1]	Student Need Cost Indices: Student Needs Index[4]	Based on LEP, and Child Poverty Weights[5] 0.25	0.50	1.00
Downstate Small Cities	139.47	108.44	101.57	103.01	105.53
Downstate Suburbs	113.86	95.78	98.52	97.17	94.79
New York City	182.71	135.73	108.31	115.89	129.23
Yonkers	177.74	136.95	108.49	116.24	129.87
The Big Three (upstate)	151.02	143.19	109.50	118.18	133.43
Upstate Rural	95.37	104.93	101.29	102.46	104.53
Upstate Small Cities	106.96	111.63	103.16	106.05	111.12
Upstate Suburbs	93.34	96.83	99.05	98.19	96.67

[1]Based on teacher wage regression (Model B) in Table A-2 in Appendix. This is predicted salary required to attract teacher with average characteristics, and in district with average school enrollment, class size, and efficiency.

[2]Based on average wages for 77 professional occupations for nine labor market regions in New York.

[3]Includes in the cost model a weighted performance measure, predicted wages,the percent of children in poverty (1997), share of students with limited English proficiency (LEP), enrollment, and efficiency variables. See Table A-4 (Model 1) in Appendix for results.

[4]Based on cost model with adjustment for children in poverty and LEP students only.

[5]Based on the ratio of weighted enrollment to total enrollment.

Table 4. Cost Impact of Student Needs (1999-2000)[1]

Classification	Extra Cost Per Child in Poverty[2]	Child Poverty Weight	Extra Cost Per LEP Student[2]	LEP Student Weight
Descriptive Statistics:				
Minimum	$2,425	0.30	$10,067	1.08
25th Percentile	$7,350	0.90	$10,115	1.08
Median	$7,927	0.97	$10,172	1.09
75th Percentile	$8,570	1.05	$10,339	1.10
Maximum	$23,780	2.92	$11,399	1.22
Need/Resource Capacity:				
New York City	$7,945	0.98	$10,762	1.15
The Big Four	$8,640	1.06	$10,582	1.13
High-Need Urban/Suburban	$7,943	0.98	$10,392	1.11
High-Need Rural	$8,082	0.99	$10,221	1.09
Average Need	$7,920	0.97	$10,225	1.09
Low Need	$7,993	0.98	$10,269	1.10
Regions:				
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

Note: Pupil weight is defined as the percent increase in costs associated with a student of a certain type. For example, the LEP student weight in New York City is 1.15. This indicates that bringing a typical LEP student in NYC up to a given performance level will cost 115 percent more than a non-LEP student with otherwise similar characteristics.

[1]Includes in the cost model a weighted performance measure, predicted wages, percent of children in poverty, share of students with limited English proficiency (LEP), enrollment and several efficiency variables (Model 1 in Table B-5).

[2]This is the cost of bringing a student with this characteristic up to average performance in the state, which is 159.5.

Table 5. Required Spending Per Pupil for Adequacy Adjustment for Resource Costs Only

Regions	1999-2000 Per Pupil Expenditure	Standard of 140: Teacher Wage Index (Wage Model)[1]	Standard of 140: NCES Cost of Educ. Index (1993)	Standard of 140: NCES Teacher Cost Index (1993)	Standard of 140: NY SED Regional Cost Index (1998)[2]
State Average	$9,781	$8,201	$8,201	$8,201	$8,201
Downstate Small Cities	$10,400	$10,527	$9,755	$10,197	$9,598
Downstate Suburbs	$11,723	$9,317	$9,413	$9,744	$9,709
New York City	$8,823	$12,615	$9,137	$9,268	$9,783
Yonkers	$12,437	$12,472	$9,755	$10,166	$9,525
The Big Three (upstate)	$9,289	$10,379	$8,521	$8,614	$7,782
Upstate Rural	$9,509	$7,376	$7,423	$7,216	$7,370
Upstate Small Cities	$9,335	$8,520	$7,988	$7,932	$7,773
Upstate Suburbs	$8,307	$7,936	$8,001	$7,922	$7,896

	Average Performance	Standard of 160: Teacher Wage Index (Wage Model)[1]	Standard of 160: NCES Cost of Educ. Index (1993)	Standard of 160: NCES Teacher Cost Index (1993)	Standard of 160: NY SED Regional Cost Index (1998)[2]
State Average	160	$9,532	$9,532	$9,532	$9,532
Downstate Small Cities	148	$12,236	$11,338	$11,852	$11,156
Downstate Suburbs	169	$10,829	$10,941	$11,326	$11,285
New York City	103	$14,663	$10,620	$10,773	$11,371
Yonkers	107	$14,497	$11,338	$11,817	$11,071
The Big Three (upstate)	96	$12,063	$9,904	$10,012	$9,046
Upstate Rural	156	$8,574	$8,629	$8,387	$8,567
Upstate Small Cities	145	$9,903	$9,285	$9,220	$9,035
Upstate Suburbs	160	$9,224	$9,300	$9,208	$9,178

[1]Based on teacher wage regression in Table A-1 in Appendix. This is predicted salary required to attract teacher with average characteristics, and in district with average school enrollment, class size, and efficiency.

[2]Based on calculated wages for 77 professional occupations for nine labor market regions in New York.

[3]Includes in the cost model a weighted performance measure, predicted wages,the percent of children in poverty (1997), share of students with limited English proficiency (LEP), enrollment, and efficiency variables. See Table A-2 in Appendix for results.

[4]Based on cost model with adjustment for children in poverty and LEP students only.

[5]Based on the ratio of weighted enrollment to total enrollment.

Table 6. Required Spending Per Pupil for Adequacy--Adjustment for Resource Costs and Student Needs

Regions	1999-2000 Per Pupil Expenditure	Standard of 140: Index with All Cost Factors (Cost Model)[1]	Teacher Wage Index and LEP, and Child Poverty Weights of 0.25	Teacher Wage Index and LEP, and Child Poverty Weights of 0.50	Teacher Wage Index and LEP, and Child Poverty Weights of 1.00	NCES Cost of Education Index and LEP, and Child Poverty Weights of 0.25	NCES Cost of Education Index and LEP, and Child Poverty Weights of 0.50	NCES Cost of Education Index and LEP, and Child Poverty Weights of 1.00
State Average	$9,781	$8,284	$8,199	$8,198	$8,195	$8,191	$8,182	$8,167
Downstate Small Cities	$10,400	$11,437	$10,703	$10,864	$11,146	$9,910	$10,051	$10,300
Downstate Suburbs	$11,723	$9,337	$9,189	$9,073	$8,868	$9,274	$9,147	$8,923
New York City	$8,823	$14,983	$13,663	$14,620	$16,302	$9,896	$10,588	$11,807
Yonkers	$12,437	$14,576	$13,531	$14,498	$16,198	$10,583	$11,339	$12,668
The Big Three (upstate)	$9,289	$12,384	$11,367	$12,269	$13,855	$9,333	$10,073	$11,376
Upstate Rural	$9,509	$7,821	$7,471	$7,558	$7,710	$7,517	$7,602	$7,751
Upstate Small Cities	$9,335	$8,771	$8,802	$9,059	$9,512	$8,242	$8,473	$8,879
Upstate Suburbs	$8,307	$7,654	$7,856	$7,783	$7,655	$7,919	$7,844	$7,713

	Average Performance	Standard of 160: Index with All Cost Factors (Cost Model)[1]	Teacher Wage Index and LEP, and Child Poverty Weights of 0.25	Teacher Wage Index and LEP, and Child Poverty Weights of 0.50	Teacher Wage Index and LEP, and Child Poverty Weights of 1.00	NCES Cost of Education Index and LEP, and Child Poverty Weights of 0.25	NCES Cost of Education Index and LEP, and Child Poverty Weights of 0.50	NCES Cost of Education Index and LEP, and Child Poverty Weights of 1.00
State Average	160	$9,628	$9,530	$9,528	$9,526	$9,521	$9,510	$9,492
Downstate Small Cities	148	$13,294	$12,441	$12,628	$12,956	$11,519	$11,683	$11,972
Downstate Suburbs	169	$10,853	$10,681	$10,546	$10,308	$10,779	$10,632	$10,372
New York City	103	$17,416	$15,881	$16,993	$18,949	$11,502	$12,307	$13,723
Yonkers	107	$16,942	$15,728	$16,851	$18,827	$12,301	$13,179	$14,724
The Big Three (upstate)	96	$14,395	$13,212	$14,260	$16,104	$10,848	$11,708	$13,222
Upstate Rural	156	$9,090	$8,684	$8,784	$8,961	$8,737	$8,836	$9,010
Upstate Small Cities	145	$10,195	$10,230	$10,530	$11,056	$9,579	$9,848	$10,321
Upstate Suburbs	160	$8,897	$9,131	$9,046	$8,897	$9,205	$9,118	$8,965

[1]Based on teacher wage regression in Table A-1 in Appendix. This is predicted salary required to attract teacher with average characteristics, and in district with average school enrollment, class size, and efficiency.

[2]Based on calculated wages for 77 professional occupations for nine labor market regions in New York.

[3]Includes in the cost model a weighted performance measure, predicted wages,the percent of children in poverty (1997), share of students with limited English proficiency (LEP), enrollment, and efficiency variables. See Table A-2 in Appendix for results.

[4]Based on cost model with adjustment for children in poverty and LEP students only.

[5]Based on the ratio of weighted enrollment to total enrollment.

Table 7. Distribution of Cost-Adjusted Foundation Aid Adjustment for Resource Costs Only[1]

Regions	2000-2001 Per Pupil School Aid[2]	Standard of 140: Teacher Wage Index (Wage Model)	Standard of 140: NCES Cost of Educ. Index (1993)	Standard of 140: NCES Teacher Cost Index (1993)	Standard of 140: NY SED Regional Cost Index (1998)
Total Aid Budget (millions)	$11,145	$15,297	$11,165	$11,382	$11,679
State Average	$4,053	$3,333	$3,330	$3,252	$3,290
Downstate Small Cities	$3,205	$2,851	$2,142	$2,475	$2,024
Downstate Suburbs	$2,419	$1,650	$1,708	$1,899	$1,844
New York City	$3,949	$7,836	$4,357	$4,489	$5,003
Yonkers	$3,112	$6,740	$4,022	$4,434	$3,792
The Big Three (upstate)	$5,835	$7,268	$5,410	$5,503	$4,671
Upstate Rural	$5,203	$3,574	$3,610	$3,317	$3,588
Upstate Small Cities	$4,937	$4,925	$4,418	$4,364	$4,203
Upstate Suburbs	$4,031	$3,906	$3,997	$3,895	$3,865

	Standard of 160: Teacher Wage Index (Wage Model)	Standard of 160: NCES Cost of Educ. Index (1993)	Standard of 160: NCES Teacher Cost Index (1993)	Standard of 160: NY SED Regional Cost Index (1998)
Total Aid Budget (millions)	$19,762	$14,955	$15,223	$15,556
State Average	$4,448	$4,440	$4,349	$4,397
Downstate Small Cities	$4,340	$3,429	$3,887	$3,252
Downstate Suburbs	$2,505	$2,579	$2,834	$2,754
New York City	$9,884	$5,840	$5,993	$6,591
Yonkers	$8,765	$5,606	$6,084	$5,339
The Big Three (upstate)	$8,953	$6,793	$6,901	$5,935
Upstate Rural	$4,680	$4,713	$4,351	$4,679
Upstate Small Cities	$6,289	$5,689	$5,626	$5,439
Upstate Suburbs	$5,133	$5,235	$5,108	$5,088

[1]Cost-adjusted foundation aid is calculated by taking the estimated per pupil spending in the benchmark district multiplied by the resource cost index (see Table 4) and subtract from it the required minimum local tax contribution (1.5% of property values) and federal aid. If the calculated aid is negative, it is set equal to zero.

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

Table 8. Distribution of Performance-Based Foundation Aid--Adjustment for Resource Costs and Student Needs[1]

Regions	2000-2001 Per Pupil School Aid[2]	Index with All Cost Factors (Cost Model)	Standard of 140: Teacher Wage Index and LEP, and Child Poverty Weights of 0.25	0.50	1.00	Standard of 140: NCES Cost of Education Index and LEP, and Child Poverty Weights of 0.25	0.50	1.00
Total Aid Budget (millions)	$11,145	$17,881	$16,537	$17,670	$19,667	$12,053	$12,866	$14,296
State Average	$4,053	$3,379	$3,347	$3,361	$3,388	$3,335	$3,343	$3,357
Downstate Small Cities	$3,205	$3,643	$3,074	$3,278	$3,635	$2,328	$2,497	$2,795
Downstate Suburbs	$2,419	$1,566	$1,607	$1,570	$1,513	$1,654	$1,609	$1,531
New York City	$3,949	$10,204	$8,884	$9,840	$11,523	$5,116	$5,809	$7,027
Yonkers	$3,112	$8,843	$7,799	$8,766	$10,465	$4,851	$5,606	$6,936
The Big Three (upstate)	$5,835	$9,274	$8,256	$9,158	$10,744	$6,222	$6,962	$8,265
Upstate Rural	$5,203	$3,975	$3,662	$3,743	$3,888	$3,696	$3,776	$3,919
Upstate Small Cities	$4,937	$5,200	$5,205	$5,460	$5,908	$4,669	$4,898	$5,301
Upstate Suburbs	$4,031	$3,627	$3,817	$3,735	$3,591	$3,904	$3,821	$3,677

Regions	Standard of 160: Index with All Cost Factors (Cost Model)	Teacher Wage Index and LEP, and Child Poverty Weights of 0.25	0.50	1.00	NCES Cost of Education Index and LEP, and Child Poverty Weights of 0.25	0.50	1.00
Total Aid Budget (millions)	$22,748	$21,194	$22,503	$24,814	$15,976	$16,911	$18,560
State Average	$4,497	$4,460	$4,472	$4,499	$4,442	$4,445	$4,454
Downstate Small Cities	$5,261	$4,599	$4,836	$5,252	$3,664	$3,879	$4,256
Downstate Suburbs	$2,400	$2,435	$2,374	$2,283	$2,492	$2,416	$2,297
New York City	$12,636	$11,102	$12,214	$14,169	$6,723	$7,528	$8,944
Yonkers	$11,209	$9,996	$11,119	$13,095	$6,569	$7,447	$8,992
The Big Three (upstate)	$11,284	$10,101	$11,149	$12,993	$7,737	$8,597	$10,111
Upstate Rural	$5,151	$4,786	$4,882	$5,052	$4,816	$4,910	$5,076
Upstate Small Cities	$6,598	$6,617	$6,916	$7,442	$5,980	$6,247	$6,715
Upstate Suburbs	$4,801	$5,027	$4,930	$4,765	$5,129	$5,031	$4,860

[1]Cost-adjusted foundation aid is calculated by taking the estimated per pupil spending in the benchmark district multiplied by the resource cost index (see Table 4) and subtract from it the required minimum local tax contribution (1.5% of property values) and federal aid. If the calculated aid is negative, it is set equal to zero.

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

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 PhD. 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 B.A. college is in US News 1st Tier	TCERT/*US News*	teacher	0.03037	0.17161
BA_USN	1 if M.A. college is in US News 1st Tier	TCERT/*US 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:					
Aiddif	Difference in aid per $ of income in this district and average district with similar need-capacity	State aid	district	-0.01208	0.02283
Fvdif	Difference in per pupil property value in this district and average district with similar need-capacity	State aid	district	13845.46	65577.61
Incdif	Difference in per pupil income (AGI) in this district and average district with similar need-capacity	State aid	district	-49725.67	251517.60
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
Regcost	Occupational wage index based on 77 professional occupations (1998)	SED	Labor force area	1.38028	0.16620
Avgunemp	Average unemployment rate (1997-1999)	BLS	county	4.63639	1.44679
Tchshare	District share of county fulltime teachers	IMF	district	0.41629	0.34830
Working condition variables:					
Lpupden	Log of CAADM per square mile	IMF	district	5.83664	1.96455
Ldisenr	Log of district CAADM (average enrollment)	IMF	district	9.85490	2.65105
Flunres[2]	Adjusted 2-year average of percent K6 enrollment receiving free lunch (1999-2000)	SED	district	-0.03499	0.26970
Avglep	2-year average of percent LEP students (1999-2000)	SED	district	0.05142	0.05515
Avhcost	2-year average of percent high cost special needs students (1999-2000)	SED	district	0.01497	0.00963
Crrate2	Violent crime rate for juveniles (under 18) 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, level variables, this is equivalent to a weighted average, weighted by the relative number of teachers. All data are for 2000 (or the 1999/00 school year or fiscal year) unless otherwise noted.

[2]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.

Sources: PMF = Personnel Master File, TCERT = teacher certification data base, IMF = Institutional Master File, State aid = state aid files, Census = U. S. Bureau of the Census, BLS = U.S. Bureau of Labor Statistics, *U.S. News = U.S. News & World Reports* rankings of undergraduate colleges, FBI= FBI Uniform Crime Reporting system, SED=Provided directly by SED staff.

Table A-2. Results of the Teacher Wage Models[1]

	Model A		Model B		Model C		Model D	
	Coefficient	**t-statistics**	**Coefficient**	**t-statistics**	**Coefficient**	**t-statistics**	**Coefficient**	**t-statistics**
Constant	7.84674	26.70	7.84418	26.40	8.81886	87.69	8.81924	87.68
Teacher characteristics:								
Total experience[2]	0.21602	10.12	0.21596	10.13	0.21860	9.94	0.21860	9.94
Masters or higher	0.06403	2.51	0.06403	2.51	0.05861	2.18	0.05862	2.18
Teacher of math/science	0.01265	6.04	0.01261	6.00	0.01397	8.65	0.01398	8.65
Percent of assignments certified	0.03318	7.85	0.03318	7.78	0.03500	11.79	0.03499	11.80
M.A. from top-rated school	0.00921	0.95	0.00932	0.97	0.01568	2.28	0.01565	2.27
B.A. from top-rated school	0.00219	0.91	0.00215	0.88	0.00273	1.29	0.00274	1.29
Factors under district control:								
School enrollment[2]	0.01808	4.55	0.01827	4.50	0.01443	6.39	0.01439	6.40
Class size	0.00006	1.38	0.00006	1.39	0.00006	1.27	0.00006	1.27
Aid efficiency variable[3]	0.61001	2.71	0.59311	2.55	0.29897	1.66	0.30344	1.68
Income efficiency variable[3]	0.00000	5.13	0.00000	5.00	0.00000	5.34	0.00000	5.32
Full value efficiency variable[3]	0.00000	0.39	0.00000	0.45	0.00000	-0.76	0.00000	-0.78
Average student peformance	0.00354	7.51	0.00348	7.50	0.00230	8.98	0.00231	9.09
Factors outside district control:								
Average unemp. rate (97-99)	-0.01680	-4.26	-0.01626	-3.95	0.01039	3.07	0.01021	3.03
Pupil density[2]	0.03108	5.69	0.03074	5.58	0.03086	8.04	0.03095	8.04
District enrollment[2]	0.02570	2.38	0.02708	2.50	0.01288	1.96	0.01262	1.92
Professional wage[2]	0.14898	5.26	0.14947	5.22				
Regional cost index					0.59341	17.43	0.59219	17.28
Percent high cost special needs	0.64721	0.81			-0.14274	-0.38		
Average percent LEP	0.41491	1.99	0.43459	2.03	0.02555	0.19	0.02217	0.17
Adjusted free lunch student rate[4]	0.23772	5.65	0.23406	5.38	0.16556	5.16	0.16658	5.24
Juvenile violent crime rate	-45.92430	-3.87	-45.71180	-3.72	-40.31091	-7.66	-40.34876	-7.71
Share of counties teachers	-0.16193	-2.93	-0.16798	-3.00	-0.17790	-4.49	-0.17663	-4.44
R^2	0.71420		0.71400		0.74210		0.74210	

[1]Estimated with ordinary least-squares regression, with standard errors adjusted for non-independence using Huber (White) method. Dependent variable is the natural logarithm of teacher salaries. Sample size is 121203.

[2]Expressed as natural logarithm.

[3]Calculated the difference between district level and average level in peer group. See text in Appendix B.

[4]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.

Table A-3. Descriptive Statistics for Variables in Cost Model

Variables	Mean	Standard Deviation
Per pupil spending[1]	9.106	0.231
Performance index	159.4347	17.5813
Efficiency variables:[2]		
Full value	0.00000	623613.33000
Aid	0.00000	0.02723
Income	0.00000	73010.23000
Average teacher salary[3]	10.5137	0.1342
Adjusted 2-year avg. free lunch[4]	0.0000	0.1526
Percent child poverty (1997)[5]	0.1580	0.0978
2-year avg. LEP[5]	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 in Appendix B.

[3] For fulltime teachers with 1 to 5 years experience. Expressed as natural logarithm.

[4]The residual from a regression of free lunch share regressed on the percent LEP students.

[5]All variables expressed as a percent of enrollment (or CAADM). For free lunch, this is the percent of K6 enrollment.

[6]The base enrollment is 0 to 1000 students. Variable equals 1 if district is this size, else it equals 0.

Table A-4. Results of the Education Cost Models[1]

Variables	Model 1 Coefficient	Model 1 t-statistics	Model 2 Coefficient	Model 2 t-statistics	Standardized Coeffcients Model 1	Standardized Coeffcients Model 2
Constant	-2.58360	-2.29	-1.50718	-0.45		
Performance index	0.00752	3.57	0.00946	2.40	0.573	0.721
Efficiency variables:[2]						
Full value	0.00000	10.55	0.00000	11.60	0.341	0.358
Aid	1.12073	3.83	0.51555	1.83	0.132	0.061
Income	0.00000	0.61	0.00000	-0.18	0.021	-0.006
Average teacher salary[3]	0.99296	7.65	0.87231	3.07	0.577	0.507
Adjusted 2-year avg. free lunch[4]			1.04423	2.83		0.690
Percent child poverty (1997)[5]	0.97819	5.46			0.414	
2-year avg. LEP[5]	1.07514	2.30	1.15393	2.17	0.143	0.153
Enrollment classes:[6]						
1,000-2,000 students	-0.09342	-4.20	-0.07613	-3.22	-0.189	-0.154
2,000-3,000 students	-0.07956	-2.72	-0.07678	-2.76	-0.127	-0.122
3,000-5,000 students	-0.09500	-2.68	-0.09678	-2.94	-0.144	-0.147
5,000-7,000 students	-0.07944	-2.01	-0.08547	-2.32	-0.082	-0.088
7,000-15,000 students	-0.09579	-2.08	-0.10451	-2.47	-0.092	-0.100
Over 15,000 students	0.05404	0.51	0.00247	0.03	0.024	0.001
Downstate small city or suburb			0.12282	1.70		0.233
Adjusted R-square	0.493		0.551			

[1]Estimated with two-stage linear regression, with the student performance and teacher salaries treated as endogenous. Selection of instruments is discussed in Appendix B. Sample size is 678.

[2]Calculated as the difference between district value and the average in peer group. See text in Appendix B.

[3] For fulltime teachers with 1 to 5 years experience. Expressed as natural logarithm.

[4]The residual from a regression of free lunch share regressed on the percent LEP students. All covariation between these two variables is assigned to the LEP variable.

[5]All variables expressed a percent. Coefficients are similar to elasticities.

[6]The base enrollment is 0 to 1000 students. The coefficients can be interpreted as the percent change in costs from being in this enrollment class compared to the base enrollment class.

Table A-5. Required Spending Per Pupil for Adequacy Using the Empirical Staffing Approach Adjustment for Resource Costs and Student Needs

Regions	1999-2000 Per Pupil Expenditure	Standard of 140: Teacher Wage Index[1] and LEP, and Child Poverty Weights of 0.25	0.50	1.00	NCES Cost of Education Index[2] and LEP, and Child Poverty Weights of 0.25	0.50	1.00
Downstate Small Cities	$10,400	$10,982	$11,655	$12,999	$10,608	$11,252	$12,538
Downstate Suburbs	$11,723	$9,613	$9,921	$10,538	$9,918	$10,228	$10,848
New York City	$8,823	$13,526	$15,134	$18,350	$10,570	$11,827	$14,340
Yonkers	$12,437	$13,459	$15,079	$18,319	$11,339	$12,704	$15,434
The Big Three (upstate)	$9,289	$11,542	$13,027	$15,996	$10,053	$11,347	$13,934
Upstate Rural	$9,509	$8,074	$8,536	$9,460	$7,964	$8,419	$9,328
Upstate Small Cities	$9,335	$9,268	$9,972	$11,381	$8,779	$9,438	$10,755
Upstate Suburbs	$8,307	$8,422	$8,725	$9,333	$8,420	$8,722	$9,324

	Average Performance	Standard of 160: Teacher Wage Index[1] and LEP, and Child Poverty Weights of 0.25	0.50	1.00	NCES Cost of Education Index[2] and LEP, and Child Poverty Weights of 0.25	0.50	1.00
Downstate Small Cities	148	$11,136	$11,817	$13,180	$10,696	$11,345	$12,642
Downstate Suburbs	169	$9,762	$10,075	$10,700	$10,003	$10,316	$10,942
New York City	103	$13,683	$15,310	$18,563	$10,662	$11,929	$14,464
Yonkers	107	$13,620	$15,260	$18,539	$11,430	$12,806	$15,558
The Big Three (upstate)	96	$11,696	$13,200	$16,209	$10,131	$11,435	$14,042
Upstate Rural	156	$8,214	$8,683	$9,623	$8,052	$8,512	$9,431
Upstate Small Cities	145	$9,413	$10,128	$11,558	$8,865	$9,530	$10,861
Upstate Suburbs	160	$8,562	$8,871	$9,489	$8,505	$8,810	$9,419

[1]Based on teacher wage regression in Table A-1 in Appendix. This is predicted salary required to attract teacher with average characteristics, and in district with average school enrollment, class size, and efficiency.

[2]Based on cost of education index calculated for NCES by Chambers (1997).