Estimating the Costs of Meeting the Texas Educational Accountability Standards

Jennifer Imazeki
Department of Economics
San Diego State University
5500 Campanile Drive
San Diego, CA 92182
(619) 594-5012
jimazeki@mail.sdsu.edu

and

Andrew Reschovsky
Robert M. La Follette School of Public Affairs and
University of Wisconsin-Madison
1225 Observatory Drive
Madison, WI 53706
(608) 263-0447
reschovsky@lafollette.wisc.edu

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EXECUTIVE SUMMARY

In this report, we present statistical evidence that the minimum amount of money needed by school districts in Texas to meet the accountability standards mandated by both Texas statutes and by *No Child Left Behind* varies across school districts for reasons that are outside the control of local school officials. We demonstrated, by estimating a cost function for public education, that the costs of achieving accountability standards are higher in some districts than in other districts because more resources are needed to educate some children compared to others, because school districts in some parts of the state will need to pay more to attract high-quality teachers than districts located in other parts of the state, and because of other characteristics of districts, such as size, that districts can not control.

Using our cost function estimates, we calculate the additional costs that will be needed to meet the state and federal accountability standards. Depending on exactly how one defines a 55 percent passing rate standard, the additional costs (in 2004 dollars) range from $1.7 to $5.5 billion. These estimates represent 6.2 and 19.8 percent of total public school revenue in 2004, respectively. To meet passing rates of 70 to 90 percent, additional costs would range from $4.2 to $7.9 billion. Both *No Child Left Behind* and state accountability standards require that for schools and school districts to perform at an academically acceptable level, the passing rate standard must be met separately by several sub groups of students—blacks, whites, Hispanics, and students from economically disadvantaged students. Because of data limitations, the cost estimates mentioned above are based only on school district average passing rates. There is little question that for many school districts the cost of meeting the accountability standards for each sub-group will substantially exceed the cost of meeting the average standard. We thus conclude that the numbers cited above provide an under-estimate of the total additional costs of meeting the accountability standards.

Introduction

Since the early 1990s Texas has been a leader in providing annual measures of student academic performance and developing a system that holds schools directly accountable for the educational performance of their students. In 2001, the basic elements of the Texas accountability system were adopted by the whole nation, when the Congress enacted the No Child Left Behind Act of 2001. This federal legislation requires annual testing of all students in grades 3 through 8, and requires that schools make annual progress in meeting student performance goals for all students and for separate groups of students characterized by race, ethnicity, poverty, disability, and limited English proficiency (U.S. Department of Education, 2002).

Although the Texas accountability system is well established, there is very little connection between how well school districts and their students perform and the allocation of state financial resources to school districts through the state's Foundation School Program (FSP). Until recently the core of the Texas accountability system was student performance on a series of standardized reading, writing, and mathematics tests, known as the Texas Assessment of Academic Skills (TAAS). Starting in the 2002-03 school year, the state adopted a new set of tests called the Texas Assessment of Knowledge and Skills (TAKS). These tests, which now include a science test, will be linked with tougher standards for promotion from grades three, five, and eight, and a new 11^{th} grade exam that will be required for graduation. Although meeting these new, more rigorous academic standards will require the expenditure of additional money in some school districts, the school funding system in Texas has not be changed to reflect the fiscal implications of the changing accountability system.

Embedded in the concept of educational adequacy is an understanding that just because a school funding system provides school districts with equal resources does not guarantee that school districts are able to generate equal academic performance. In other words, finance systems that equalize revenues may still exhibit large disparities in student outcomes and not succeed in providing many of their students with an "adequate" education. The reason for this outcome is that the amount of money needed to achieve any given student performance standard may be very different across school districts located in different parts of a state or with students from different backgrounds.

In this report, we provide statistical evidence that the minimum amount of money needed by school districts in Texas to meet the accountability standards mandated by both Texas statutes and by *No Child Left Behind* varies across school districts for reasons that are **outside the control of local school officials**. These dollar amounts are referred to as the *costs* of providing required education services. We will demonstrate, as have a number of other studies, both in Texas and elsewhere, that costs are higher in some districts than in other districts because more resources are needed to educate some children compared to others, because school districts in some parts of the state will need to pay more to attract high-quality teachers than districts located in other parts of the state, and because of other characteristics of districts, such as size, that districts can not control.

The underlying premise of the *No Child Left Behind* legislation and of the Texas system of testing student performance on an annual basis is that schools and school districts must be held accountable for the academic performance of all their students. In fact, the federal legislation rewards schools that succeed in meeting state-imposed achievement goals and sanctions schools that fail. Requiring that school districts increase the academic performance of their students is an important step in improving the quality of education in Texas. If, however, cost differences among school districts are substantial, then imposing statewide student performance standards without simultaneously allocating additional state financial resources to school districts with relatively high costs may result in some school districts with high costs not having access to sufficient resources to educate their students to meet the new standards. These schools may fail, not necessarily because of their own inability to effectively educate children, but because they have insufficient fiscal resources to do the job.

This paper will employ a statistical approach to estimate the minimum amount of money Texas school districts need to achieve state and federally mandated student performance goals. Specifically, we estimated a *cost function* for K-12 education in Texas. A cost function allows us to quantify the relationship between per-pupil spending for education, student performance, various student characteristics, and the economic and spatial characteristics of school districts. Thus, by estimating a cost function, we are able to determine how much a school district with, for example, a large number of children from poor families must spend relative to the average district in order to meet the state's student performance standards.

In recent years, as school finance systems have been challenged on educational adequacy grounds in state courts around the country, there has been a growing interest in "costing out" educational adequacy. Over the past decade or so, a number of alternative methodologies have been developed to determine the costs of providing an adequate education. While we believe that educational cost functions provide a powerful tool for estimating the cost of meeting alternative student performance goals, and for determining the contribution to total costs of various student and school district characteristics, each of the alternative methods has its advantages and disadvantages.

One method that has been used in a large number of states is the "professional judgment model." With this approach, several panels of experienced educators within a state are asked to design educational programs that would result in an "adequate" education for students in a typical school and in schools with different characteristics, such as small size, or a high proportion of children from poor families. The analyst then calculates how much money would be required to meet the staffing and other resource needs of each alternative educational program. Smith and Seder (2004) have recently used this approach to estimate the costs of "providing a constitutional adequate education" (p.3) in a set of Texas school districts.[1] Two other approaches are the "successful schools" approach and the evidence-based or "whole schools" approach.

[1] Panelists were asked to design educational program that would meet various educational goals that are specified in Texas statute. One example of these statutory mandates is the following statement from the Texas Education Code § 4.001(a) that requires that all school districts provide "all Texas children…access to a quality education that enables them to achieve their potential and fully participate now and in the future in the social, economic, and education opportunities of our state and nation."

Several authors have recently written assessments of the strengths and weaknesses of each approach. Rather than repeating the arguments here, we refer the reader to Baker, Taylor, and Vedlitz (2004), Duncombe and Lukemeyer (2002), Duncombe, Lukemeyer, and Yinger (2004), Gutherie and Rothstein (1999), and Reschovsky and Imazeki (2001).

In the next section of this report, we describe the procedure we followed in estimating an educational cost function for K-12 public education in Texas. We detail the data we used and discuss briefly some important statistical and estimation issues. In the following section, we report on the results of our cost function estimates. We then provide estimates of the additional amount of money that would be required by school districts in Texas to satisfy various state and federal accountability standards. We also discuss a number of costs that we were unable to include in our analysis.

Estimating a Cost Function for K-12 Education in Texas

Estimating cost functions provides a practical way to identify and quantify the factors that influence the costs of education, where the *output* of school districts can be measured using multiple measures of student performance. By estimating a cost function based on data on K-12 school districts, we can characterize in detail the relationship between spending per pupil by school districts and various measures of student performance, while also taking account of the characteristics of each school district's student body, other characteristics of the school district, such as size, and the prices the school district must pay for inputs into the education process.[2]

We follow the approach found frequently in the literature of estimating a log-linear cost function using data for K-12 districts in Texas. For reasons to be explained below, our measures of student performance are for the 2001-02 school year. Our dependent variable is thus per pupil expenditures in that year. Following quite standard practice, we exclude both spending on transportation and food expenditures from our measure of per pupil spending.

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[2] In algebraic terms, a cost function can be represented by the following equation: $E_{it} = h(S_{it}, P_{it}, Z_{it}, F_{it}, e_{it}, u_{it})$, where per pupil expenditures, E_{it}, are specified as a function of public school outputs, S_{it}, a vector of input prices, P_{it}, the characteristics of the student body, Z_{it}, other characteristics of the school district such as its size, F_{it}, a vector of unobserved characteristics of the school district, ε_{it}, and a random error term u_{it}

Student Performance Measures

Although student performance can, in principle, be measured in various ways, most states measure how effective school districts are in improving the academic performance of its students by relying on standardized exams. Furthermore, the federal No Child Left Behind Act of 2001 explicitly requires that all states develop accountability systems based on assessment tests. Texas has long had a well-developed testing system for the majority of students. Until 2002-03, all students in grades 3 though 8 and in grade 10 were tested in the spring of each year as part of the Texas Assessment of Academic Skills (TAAS). In 2002-03, the TAAS was replaced with the Texas Assessment of Knowledge and Skills (TAKS), a more rigorous test, and testing was extended to students in grades 9 and 11. Passing rates on the TAKS are the primary basis for ratings within the Texas accountability system.

For this report, one of our measures of student achievement is passing rates on these standardized exams. In estimating our cost function, we focus on annual changes in passing rates. Economists refer to this focus on the *change* in student performance rather than on the *level* of student performance as a *value-added* approach.[3] We believe that it is appropriate to use a value-added measure of student academic performance in estimating a cost function because a primary objective of schools is to improve, on an annual basis, the knowledge and skills of students. An additional reason for using a value-added measure of student performance is that both No Child Left Behind and Texas accountability standards call for students to make *annual yearly progress* towards the achievement of the accountability standards.

Ideally we would like to estimate a cost function using two years of data from the tests that are currently in use, the TAKS. Unfortunately, as of this writing (mid May 2004), the second year of TAKS results (for the 2003-04 academic year) have not yet been released by the Texas Education Agency. As we can only measure student improvement by comparing test scores in one year with the test scores for the same students in the next year on a comparable set of exams, we have no choice but to base our cost function estimates on test score results from the last two years in which the TAAS exams were administered. The cost function we estimate thus includes for each school district

[3] In their cost function estimate Gronberg et al. (2004) also employ a value-added approach.

the average passing rate on the TAAS reading and mathematics exams administered to students in grades 4 through 8 and in grade 10 in 2001-02. To create a value-added measure, these results are compared to the average passing rate on the TAAS administered to students in 2000-01.

Although we estimate our cost function using TAAS scores, an important objective of this report is to predict the costs of achieving a number of different student performance standards that are measured in terms of passing rates on the new TAKS exam. As the TAKS exams are more difficult than the TAAS, and the passing standard for the TAKS is different than the passing standard for the TAAS, using the results from a cost function estimated with TAAS passing rates would seriously under-predict the costs associated with achieving a given passing rate on the TAKS.[4] To deal with this problem, prior to estimating the cost function, we will convert the TAAS passing rates to TAKS rates using a methodology to be described later in the report. In effect, we will base our cost estimates on the passing rates that a school district would have achieved if the TAKS had been in place in 2001-02.

Not all students take the TAKS exams. Some students in special education programs take the State-Developed Alternative Assessment (SDAA) instead. We therefore include the passing rate on the SDAA exams as an additional outcome measure. The accountability system also includes standards for grade completion and dropout rates for students in grades 7 through 12. As an additional output variable, we include the annual retention rate, defined as one minus the dropout rate. It is important to account for the fact that the more high-school students a district has, the more difficult it will be to achieve any particular retention rate. We therefore interact the retention rate with the percent of a district's total number of students enrolled in high school.[5] As a final school output variable we use the percentage of graduating seniors who achieve a score of 1100 or above on the SAT or a score of 24 or above on the ACT.[6]

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[4] The raw score that a student needs to achieve in order to be considered passing is at a different cutoff for the TAKS than for the TAAS.

[5] Although the accuracy of the dropout rate has been questioned, we decided to include these data in our analysis primarily because dropout rates are part of both the state and NCLB accountability standards, and efforts to reduce dropout rates (or increase retention rates) will presumably contribute to the costs of education.

[6] The 1100 criterion for the SAT and the 24 for the ACT were established by the Texas Education Agency.

The statistical estimation of a cost function should take special account of the fact that while decisions by local school boards to raise the level of student performance presumably will require additional spending, decisions concerning per student spending are likely to directly influence student performance. In the language of economists and statisticians, this two-way relationship between per pupil expenditures and student performance indicates that these variables are simultaneously determined. To deal with this simultaneity, we estimate our cost function using a statistical technique called two-stage least squares, a technique which is commonly used to correct for any bias caused by the simultaneous relationship between variables.[7]

Teacher Cost Index

Teachers are the single most important factor in the production of education and not surprisingly, teacher salaries account for the largest share of school expenditures. In our estimation of education cost functions, we include only teacher salaries, excluding explicit treatment of other public school employees. It is important to recognize that teacher payrolls are determined both by factors under the control of local school boards, and factors that are largely outside of their control. In setting hiring policies, districts make decisions about the quality of teachers that they recruit and these decisions have obvious fiscal implications. For example, a district can limit its search for new teachers to those with advanced degrees, to those with high grade-point averages or to those with a certain number of courses in their teaching specialty. Teacher salary levels are generally determined through a process of negotiation with teacher unions, and school boards have a substantial impact on the outcome of these negotiations. At the same time, the composition of the student body, working conditions within schools, and area cost-of-living play a potentially large role in determining the salary a school district must offer in order to

[7] As instruments for the endogenous school output variables, we draw upon a set of variables that are related to the demand for public education. Following a long literature on the determinants of local government spending, we model the demand for public education as a function of school district residents' preferences for education, their incomes, the tax prices they face for education spending, and the intergovernmental aid their school district receives. To the extent that the median voter model provides a reasonable explanation for school district spending decisions, it is appropriate to use median income and the tax price faced by the median voter as instruments. In the first-stage regression, we also include each district's Tier 1 Foundation School Program aid as another instrument. Finally, we include as instruments several socioeconomic variables that may be related to the preferences for public education. These include the percentage of households with children, the percentage of household heads who are homeowners, and the percentage of adults who have earned a four-year college degree.

attract teachers of any given quality. These factors will be reflected in student and district cost variables, to be described below.

Our goal is to isolate factors that contribute to higher levels of education spending, but are outside the control of local school districts. To accomplish this goal we use an index of teacher costs developed by Lori Taylor (2004). Her index separates variations in compensation arising from uncontrollable district characteristics (such as area cost of living) from variations arising from factors that districts can influence (such as teacher experience and educational background).

Student Characteristics

There exists a quite large literature that has demonstrated that it costs more to educate students from economically disadvantaged families, students with various mental and physical disabilities, and students with limited proficiency in English, than students without these disadvantages.[8] In fact, these higher costs have been recognized in the design of the state's Foundation School Program (FSP), which allocates additional funds to school districts with students who are from economically disadvantaged families, who qualify for "special education", or who enter the schools with limited proficiency in English. To measure the number of children from economically disadvantaged families, we use the percentage of students who qualify for the federal government-financed Free and Reduced Price Lunch program or other public assistance. It should be noted that *No Child Left Behind* includes a requirement that students classified as economically disadvantaged must show annual yearly progress towards meeting the state's accountability standards. For purposes of meeting this requirement, Texas identifies students as economically disadvantages if they are eligible for free or reduced price meals under the National School Lunch and Child Nutrition program (U.S. Department of Education, 2003).

We also include in our cost function a measure of the percentage of students in each district who have been identified as limited English proficient (LEP), and two measures of disabilities – the percentage of students who are classified as having a learning or

[8] Cost function studies that have found that school districts with high concentrations of students with these characteristics face higher than average costs include Downes and Pogue (1994), Duncombe, Ruggiero, and Yinger (1996), Duncombe and Yinger (1998), and Reschovsky and Imazeki (2003, 2004).

speech disability, and the percentage of students who are classified as having any other kinds of disability.[9]

Both *No Child Left Behind* and the Texas accountability system explicitly require districts to meet student performance standards not only for all students, but separately for subgroups of white, black, Hispanic and economically disadvantaged students. Although separate outcome (student performance) measures for these subgroups are available, the fact that they are quite highly correlated means that we are not able to explicitly include these separate student performance measures in the cost function we estimate. However, as higher scores for any given subgroup will contribute to higher average scores, the impact of each subgroup is implicitly part of the average passing rate that we include in the cost function. Because we expect that the cost per student of meeting the accountability standard will vary by subgroup, we need to account for the relative size of each subgroup within each school district. The percent of students who qualify for the Free and Reduced Price Lunch Program already captures the importance of the economically disadvantaged subgroup. We include the percentage of students who are black and the percentage of students who are Hispanic as variables in the cost function to account explicitly for the importance of these two groups.

School Characteristics

Finally, to account for the possibility that different levels of resources may be needed to provide a high school education as compared to an elementary school education, we include the proportion of each school district's student body that is enrolled in high school. It is important to point out that this variable can be difficult to interpret because the percentage of a district's total student body enrolled in high school may reflect higher than average dropout rates in some districts or higher rates of student transfers to other public or private schools. We deal with the problem of differential dropout rates by, as previously discussed, including as an outcome measure the high school retention rate interacted with the percent of students attending high school in a district.

There exists a long history of research on economies of scale in public education. In a recent review of this literature, Andrews, Duncombe, and Yinger (2002) present strong evidence that small school districts have higher costs per student than larger

[9] These are the same measures of disability used by Gronberg et al. (2004).

school districts. Although the results are less conclusive, they also provide some evidence that per student costs are higher for large districts. Following standard practice, to reflect potential diseconomies of scale associated with both small and large school districts, we include each district's enrollment and enrollment squared in the cost function.

Efficiency

Some school districts may have higher per pupil expenditures, not because of higher costs, but because they are not using their resources efficiently. A number of authors have used complex statistical techniques to attempt to identify spending that is high relative to spending in districts with similar performance and costs.[10] The measurement of school district efficiency using these statistical methods is, however, highly sensitive to the way that school district output is measured. Thus, for example, in school districts that emphasize vocational education, or arts and music--subjects not directly measured by standardized tests--money spent on these alternative educational objectives will be counted as inefficient spending.

Rather than attempting to measure efficiency directly, in this report we address the issue of efficiency by assuming that school districts will operate more efficiently if they face a competitive local educational market. Lori Taylor (2000), after reviewing the literature on government competition, concludes that, "Almost across the board, researchers have found that school spending is lower, academic outcomes are better, and school-district efficiency is higher where parents have more choice in their children's education provider." (p. 7) To measure public school competition, we use a Herfindahl index. This index, which has also been used by Hoxby (2000), is constructed on the assumption that counties can be used to define local "markets" for education.[11] The index increases with the amount of competition so if district efficiency is correlated with the

[10] See, for example, Duncombe, Ruggiero and Yinger (1996), McCarty and Yaisawarng (1993), and Deller and Rudnicki (1993).

[11] A Herfindahl index for school districts in county k can be calculated using the following formula:

$$\text{Herfindahl Index} = 1 - \sum_i \left(\frac{enrollment_i}{enrollment_k} \right)^2$$

For a county with just one district and no competition, the index will equal zero. For a county with n equally-sized districts, the index will equal 1 – 1/n. Thus, the index approaches 1 as the number of districts, and presumably competition, increases.

amount of competition that the district faces, then we would expect spending to be lower in districts with higher values of the Herfindahl index.

Cost Function Results

We estimate the cost function using data for academic year 2001-02.[12] In Texas education from kindergarten through 12th grade is provided by 975 K-12 school districts. Because of missing data, we were forced to drop 148 K-12 districts from our estimation sample. The 827 districts that remain in our sample, however, educate 98.3 percent of all students in the 1,040 school districts in Texas. Table 1 presents descriptive statistics for the 827 districts that are used to estimate the cost function. For each variable, the table displays the average (mean) value of the variable, the standard deviation, and the minimum and maximum values.

The results of the cost function estimation are shown in Table 2.[13] In general, all coefficients have the expected signs. Each of the outcome measures has a positive sign, indicating that it costs more to achieve higher levels of performance. Since lagged scores are a proxy for past levels of student achievement, high scores mean that districts can spend less to achieve any given level of educational progress. The cost variables generally have the expected signs and most of them are statistically significant. In particular, the percentage of minority students and students eligible for free and reduced-price lunch are positive and statistically significant. Consistent with previous studies, we found a U-shaped relationship between per-pupil spending and school district size; with our estimates, average costs are lowest in a district with 56,843 students. At that point, costs begin to rise again. We also find U-shaped relationships between per-pupil spending and the percentage of LEP and disabled students. These results suggest economies of scale in the specialized programs provided for these students. Any district with even one LEP or special education student is required to provide extra services for that student, thus, when there are few such students, the per-pupil costs could be quite high. For LEP students, these services can range from tutoring to a full bilingual curriculum. If there are more than 20 LEP students in an elementary grade, the district must offer a bilingual program.

[12] The data for the lagged test scores are for 2000-01.
[13] We weighted all variables by district enrollment.

Given these requirements, it is not surprising to find that economies of scale can be found for at least lower levels of LEP students. The coefficients on the LEP variables indicate that these economies of scale can be found for districts having up to 54.6 percent of their students receiving specialized services; after that, costs begin to rise. For students with disabilities other than learning or speech disabilities, economies of scale stop at only 8 percent, perhaps indicating the more individualized services that such students may require.

In contrast to some other studies, we find that costs are *inversely* related to the percentage of high school students in the district. There is no compelling reason why we would expect costs to be higher in school districts with a larger share of high school students, especially since class sizes tend to be substantially lower in elementary school grades. One explanation for the negative relationship between the percent of high school students and costs may reflect the possibility that highly-motivated students leave schools with heavy concentrations of "high-cost" students. Although we can't observe student motivation, the departure of these "low-cost" students would reduce the percent of high school students in a district and also tend to raise the average cost of educating the remaining students.

Finally, the negative sign on the Herfindahl index provides a measure of school district inefficiency. The result indicates that, as expected, school districts located in areas of the state where there is more competition among schools tend to operate more efficiently.

The Construction of a Cost Index for Texas School Districts

Estimating a cost function provides information about the contributions of various characteristics of school districts to the costs of education. The calculation of a cost index allows for the summarization of all the information about costs into a single number for each district. For any given accountability standard, a cost index can be constructed that will indicate, for each school district, how much money that district must spend, *relative to the district with average costs*, for its students to meet the accountability standards.

Actual school district spending will vary not only because of differences in student and district characteristics that influence costs, but also because school boards in

some districts, presumably reflecting the preferences of the district's residents, will choose to provide a quality of education that exceed the state's accountability standards, or choose to provide courses in areas not covered by the state's accountability standards. Actual spending can also differ from the costs of education if districts are operating inefficiently.

Thus, our objective in constructing a cost index does not involve consideration of the current spending level of school districts, but rather the calculation for each district of the minimum amount of money it will need to achieve any given TAKS accountability standard, given the district's student and district characteristics. In this section of the report we present the results of calculating a cost index using two alternative accountability standards. The use of different standards will not affect the relative ranking of districts in terms of their costs, but will change the cost index values.

To calculate the cost index value for any given district, we use our estimated cost function coefficients to calculate how much the district would have to spend given the amount of student performance gain it must provide in order to fulfill the chosen accountability standards, the actual values of its student and district characteristics, and the statewide average values of the other variables in the cost function. This calculation results in what might be called a *hypothetical* level of spending for each district. To determine the cost index value for any particular district, we divide the hypothetical spending number for that district with hypothetical spending in a district with average characteristics. If we assume that the per pupil cost of education to meet some given accountability standard is $7,500, then a school district with a cost index value of 1.1 will need to spend $8,250 ($7,500 times 1.1) to reach the accountability standards. Another district with a cost index value of 0.9 will be able to meet the standards at a cost of $6,750 (0.9 times $7,500).

A prerequisite to calculating a cost index is determining an accountability standard. The current accountability standards established by the State Board of Education are calibrated in terms of the TAKS exams and there are several elements involved in determining these standards. First is the decision of what grade on any examination will be considered passing (which we refer to as the passing standard), and second are the passing rates, or the increase in passing rates, that are considered high enough to meet the

standard (which we refer to as the passing *rate* standard). As explained previously, our cost function is estimated using TAAS test score results. In order to predict the costs of meeting a given passing rate standard on the TAKS, we must first convert performance on the TAAS to the higher passing standard associated with the TAKS. As the TAKS is phased in over the next few years, the passing standard will increase each year until it reaches the panel recommendation level in 2005. We use data for TAAS passing rates that have been converted to passing rates defined in terms of the 2005 TAKS panel recommendation passing standard. The conversion is based on a conversion schedule developed by the Texas Education Agency that indicates how a given score on the TAAS correlates to expected performance on the TAKS (e.g., a student would need a particular TAAS score in order to have passed the TAKS at the 2005 panel recommendation). See Gronberg et al. (2004) for a full description of this conversion.

The Texas Consolidated State Application Accountability Workbook (U.S. Department of Education, 2003) lists passing rate targets for each year that will satisfy the requirements of *No Child Left Behind*. For school year 2005-06, all students in all grades and in all sub-groups (economic disadvantaged, black, white, and Hispanic) need to achieve a TAKS passing rate of 53.5 percent on the reading/language arts examination and a 41.7 percent passing rate on the mathematics exam, or make acceptable progress towards those goals on an annual basis. In calculating a cost index value for each school district we started with a TAKS passing rate standard of 55 percent. This is the same standard used by Gronberg et al. (2004) in their cost index calculations.

Although the target is 55 percent, the Texas accountability system also allows for the fact that some districts may be so far below the standard that expecting them to reach the standard in such a short time period is unrealistic. According to the Commissioner of Education, districts that do not meet the absolute performance standard can still meet the Academically Acceptable accountability standard by demonstrating sufficient improvement (Texas Commissioner of Education, 2004). This improvement is measured as the gain necessary to reach the accountability standard in a set number of years. The *No Child Left Behind* legislation refers to this requirement for annual improvement as *adequate yearly progress*. We incorporate this into our calculations of cost in the following way: in calculating the cost of meeting the accountability standard, all school districts

which had a TAAS converted passing rate of less than 52 percent were assigned a required gain of one-third of the difference between the 55 percent standard and their current passing rate. School districts with passing rates between 52 and 55 percent were assigned a required gain of the full difference between their current passing rate and 55 percent. Descriptive statistics of the resulting cost index are displayed in the first column of Table 3.[14]

The average cost per student assuming the 55 percent passing rate accountability standard is $6,963, measured in 2002 dollars. If we add to that number average per pupil spending for transportation and food services of $513 (amounts that were excluded from the spending data used to calculate the cost function), the average per pupil cost of achieving the 55 percent standard is $7,476. In order to put this number in 2004 dollars we use the percentage change in the Bureau of Labor Statistics' (2004) Employment Cost Index for all civilian workers between the first quarter of 2002 and the first quarter of 2004. According to that index, over this two-year period costs role by 7.9 percent. Thus, in 2004 dollars, the average cost per pupil of meeting the 55 percent standard would be $8,067.

We calculated a second set of cost index values, this time based on a TAKS passing rate standard of 70 percent. 70 percent is the 2005-06 standard for a school district to be considered a *Recognized* district by the Commissioner of Education (Texas Commissioner of Education, 2004). In calculating the cost index, the required gain in passing rate was set equal to one-third of the difference between 70 percent and the actual passing rate for all districts except those with current rates between 67 and 70 percent. The required gain for these districts was the entire gap between their current passing rate and 70 percent. The results of these calculations are shown in the second column of Table 3. Following the same procedure outlined above, the average cost per pupil of achieving the 70 percent standard would be $9,919.

[14] We calculate our cost index for 968 school districts. These districts educate 99.6 percent of all public school students in Texas. We are able to calculate cost index values for more districts that we use in estimating our cost function because we include districts that are missing one of the outcome values. For the alternative assessment test, the SAT/ACT measure, and the retention rate variable, we substitute the average values-something we do anyway in calculating the cost index. For districts missing the TAAS score, we set it equal to the sample average (TAKS converted) rate of 53.3.

Table 3 demonstrates that there is a wide range of costs across school districts in Texas at both the 55 and 70 percent passing rate standard. The lowest cost school district could meet the standard at a cost of about 40 percent less than the district with average costs. On the other hand, the district with the highest cost would need to spend about 375 percent more than the district with average costs to meet the accountability standards. This wide range of costs, however, reflects the impact of a few districts. If we rank school districts by their cost index values, the district at the 10^{th} percentile level has costs about 25 percent below average, while the district at the 90^{th} percentile, i.e. only 10 percent of districts have higher costs, has costs that are about 30 percent above average.

To provide an indication of how the cost index varies across school districts characterized in different ways, we have divided school districts into quintiles defined in terms of the percentage of poor students in each district and district size. In defining quintiles we weight districts by student enrollment so that each quintile contains twenty percent (one fifth) of all Texas K-12 students. Thus the first poverty quintile includes the 133 districts with the lowest percentage of poor students. These districts enroll approximately 20 percent of all public school students. Table 4 displays the average cost index value (based on the 55 percent passing rate standard) in each quintile, in addition to the minimum and maximum cost index value in each quintile.

The data in Table 4 show quite clearly the importance of poverty (and poverty related factors) in the determination of cost index values. Thus, the average cost index in the lowest poverty quintile is 0.748, and not a single school district in this quintile has a cost index value greater than one. By contrast, the average cost index in the highest poverty quintile is 1.47, and nearly all the school districts in this quintile have cost index values substantially higher than one.

Table 5 displays student weighted quintiles of district size. We observe that the 775 smallest K-12 districts (out of the 968 district for which we estimate cost functions) educate only 20 percent of public school students. The 8 largest districts in the state also educate 20 percent of public school students. The data in Table 5 indicates that the average cost index in the smallest district quintile is 1.02. There is however a tremendous variation in the costs faced by small districts. For some small districts, other factors, such as the characteristics of their student body compensate for small size, and result in low

cost index values. In other small districts, especially in rural areas, diseconomies of scale caused b small size combine with large numbers of economically disadvantaged and LEP students resulting in very high cost index values. Table 5 also shows that while the average cost index value in the largest district quintile is 1.12, some of the largest districts have below average costs.

The Estimation of the Costs of Meeting Accountability Standards

In this section, we draw upon the results of our cost function estimation and our cost index calculations to provide estimates of the **additional** costs that will be required to meet several alternative accountability standards. We will then discuss several reasons why we believe that our cost estimates result in an under-estimate of the total additional cost of meeting the education accountability standards mandated by the state and by the *No Child Left Behind* legislation.

We start by describing three alternative definitions of a 55 percent passing rate accountability standard. The first definition corresponds with the standard used to calculate the cost index described in the previous section. School districts that have TAKS passing rates that are equal to or greater than 55 percent require no additional money to meet the standard. For districts with TAKS passing rates between 52 and 55 percent, we calculate the cost of moving from the current rate to the 55 percent passing rate, and for districts with current passing rates below 52 percent, we calculate the cost of moving one-third of the way to the 55 percent standard. The one-third gain is a measure of the required annual improvement mandated by the Texas accountability system.

In order to determine the cost of any given improvement in passing rates, we use our cost function results to calculate, for each school district, the predicted cost of the current passing rate and then subtract that cost from the predicted cost of the passing rate goal. For example, a school district with a 40 percent passing rate would need to raise its passing rate to 45 percent, i.e. one third of the way to 55. The *additional* cost of achieving this required annual improvement would be the difference between the predicted cost of achieving a 45 percent passing rate and the predicted cost of achieving a 40 percent passing rate.

Our second definition of a 55 percent passing rate standard is identical to our first definition for all districts with current passing rates below 52 percent. All school districts

with existing passing rates above 52, including those with current passing rates greater than 55 percent, would be required to show annual yearly progress, which in this case we define as a three percentage point increase in its passing rate.[15] Our third definition is similar to the second definition, except that school districts with passing rates below 52 percent are required to close the gap to 55 in a single year. For all other school districts, we need to calculate the cost of improving the passing rate by three percentage points. The third definition is closest to the definition used by Gronberg et al.

Table 6 presents the results of these calculations of additional costs for the three alternative definitions of accountability standards associated with the 55 percent passing rate. The additional cost calculations are made using data from 2002. We again use the Employment Cost Index to transform the cost calculations into 2004 dollars. For each of three definitions, the estimated additional costs are presented for all K-12 districts and for 43 of the 46 plaintiff districts in the *West Orange-Cove v. Nelsen* school finance case.[16] Our calculations indicate that for the state as a whole, the additional costs of achieving a 55 percent passing rate standard range from $1.7 to nearly $5.5 billion. On a per pupil basis, costs would have to increase from $421 to $1,341. The calculations demonstrate that per pupil costs in the plaintiff districts are somewhat higher than the state average.

The 55 percent passing rate standard which is the basis of the cost estimates shown in Table 6 reflects what the Commissioner of Education classifies as an *academically acceptable* level of student performance. The Texas accountability standards also include for the 2005-06 school year a passing rate standard of 70 percent for districts to be classified as *recognized* and a passing rate standard of 90 percent for districts to be classified as *exemplary*. In Table 7 we present estimates of the additional cost of achieving passing rates of 60, 70, and 90 percent. The cost calculations are based on a definition of each passing standard that parallels the first definition of the 55 percent passing rate standard. Thus, for example, for the 70 percent passing standard, districts with passing rates greater than 70 percent contribute no additional costs, while any district with a current passing rate of less than 67 percent must close one-third of the passing rate gap

[15] We chose an annual increase equal to three percentage points because it appears that the statewide average increase in TAAS passing rates between 2000-01 and 2001-02 corresponds to an approximately three percentage point increase in the TAKS passing rate.

[16] The combined enrollment of the 3 plaintiff districts for which we were not able to estimate costs is 279 students.

between its current passing rate and 70 percent. The cost estimates in Table 7 make it very clear that the additional costs of achieving higher passing rate standards are substantial. As the passing standard is increased, not surprisingly, costs rise at a more than proportional rate. Thus, while moving from a 55 percent to 60 percent passing rate standard would increase costs per pupil by $186, moving from a 60 percent to a 70 percent passing rate standard would result in a cost increase of $419.

There are several reasons why the cost estimates in Tables 6 and 7 provide an under-estimate of the total additional costs necessary to meet the accountability standards imposed by the State and by *No Child Left Behind*. One of the most serious shortcomings of our empirical approach to estimating the cost of meeting the accountability standards is that, as explained previously, we have had to assume that a school district met any given passing rate standard if its overall passing rate exceeded the standard. In fact, a central tenet of the *No Child Left Behind* legislation is that for a school district to meet an accountability standard, every group of students within a school district must meet the standard.

Although we are not able to provide a precise estimate of the cost of having all sub-groups of students meet the Texas accountability standards, we suspect that the cost estimates provided in Tables 6 and 7 provide a significant under-estimate of the cost of every sub-group meeting the standard. We reached this opinion by examining the data from a number of individual school districts.[17] Consider, for example, the Fairfield Independent School District. This district with around 1,600 students just exceeded the 55 percent passing rate standard, and thus according to our first definition of the 55 percent standard would not require any additional spending to meet the standard. However, when we examine the TAAS passing rate data for the sub-groups, we observe that the passing rate for blacks was 7.8 percent below the overall TAAS passing rate, the rate for Hispanics was 13.4 percent the overall rate, and the rate for economically disadvantaged students was 8.9 percent below the overall rate.

The clear implication of these numbers is that Fairfield ISD will have to spend additional money to bring the passing rates of these sub-groups of students up to the re-

[17] Twenty-seven of the plaintiff districts in the *West Orange-Cove v. Nelson* court case have overall passing rates above 55 percent. In almost all of these school districts, the passing rates for some or all of the sub-groups are below the overall rate.

quired passing rate standard. Although we are unable to assign a particular number for the required additional costs, our cost function results imply that everything else equal, it will cost more than average to improve the educational performance of black, Hispanic, and economically disadvantaged students.

It is also important to emphasize that our estimates of the additional costs needed to meet the federal and state accountability standards are based on a subset of the standards. The basis of our cost estimates is student performance on the reading/language arts and mathematics exams. The TAKS accountability standards for 2005-06 also include passing standards for social studies and science examinations. In addition, there are new examination-linked standards for promotion from grades 3, 5, and 8, and a new 11th grade examination that will be required for graduation. Although we can provide no empirical estimate of the additional costs associated with meeting these standards, it is difficult to believe that there will be no additional costs involved.

Conclusion

In this report, we have presented statistical evidence that the minimum amount of money needed by school districts in Texas to meet the accountability standards mandated by both Texas statutes and by *No Child Left Behind* varies across school districts for reasons that are outside the control of local school officials. We demonstrated, by estimating a cost function for public education in Texas, that the costs of achieving accountability standards are higher in some districts than in other districts because more resources are needed to educate some children compared to others, because school districts in some parts of the state will need to pay more to attract high-quality teachers than districts located in other parts of the state, and because of other characteristics of districts, such as size, that districts can not control.

Using the results of our cost function estimates, we calculate the additional costs that will be needed to meet the state and federal accountability standards. Depending on exactly how one defines a 55 percent passing rate standard, the additional costs (in 2004 dollars) range from $1.7 to $5.5 billion. These estimates represent 6.2 and 19.8 percent of total public school revenue in 2004, respectively. Both *No Child Left Behind* and state accountability standards require that for schools and school districts to perform at an aca-

demically acceptable level, the passing rate standard must be met separately by sub groups of students—blacks, whites, Hispanics, and students from economically disadvantaged students. Because of data limitations, the cost estimates mentioned above are based only on school district average passing rates. There is little question that for many school districts the cost of meeting the accountability standards for each sub-group will substantially exceed the cost of meeting the average standard. We thus conclude that the numbers cited above provide an under-estimate of the total additional costs of meeting the accountability standards.

Table 1

Descriptive Statistics, 827 K-12 School Districts

Variable	Mean	Standard Deviation	Minimum Value	Maximum Value
Per pupil expenditures, 2001-02 (excludes transportation and food)	$6,733	$1,345	$4,395	$18,037
2001-02 TAAS passing rate, converted to TAKS 2005 standard	53.3	10.9	18.5	88.2
Composite lagged TAAS pass rate, 2000-01	91.2	5.0	63.7	99.8
Percent of graduates who performed above criteria on SAT or ACT	12.9%	8.5%	0.0%	57.2%
Passing rate on state-defined alternative assessment	71.4	14.4	6.7	100
Annual retention rate	99.5	0.6	96.3	100
Teacher wage index (monthly wage)	$2,400	$125	$2,176	$2,777
Percent of students eligible for free and reduced price lunch	47.3%	18.9%	2.5%	98.1%
Percent of students with learning or speech disabilities	10.8%	3.0%	3.6%	23.9%
Percent of students with other disabilities	3.1%	1.5%	0.2%	24.5%
Percent of students who are black	8.8%	12.5%	0.0%	84.3%
Percent of students who are Hispanic	30.1%	27.2%	0.2%	99.8%
Percent of students with limited English proficiency	10.8%	9.2%	0.0%	58.9%
Percent of students enrolled in high school	29.6%	3.4%	19.9%	58.5%
Student enrollment	4,874	13,148	186	210,670
Herfindahl (efficiency) index	0.608	0.220	0.000	0.887

Table 2

Education Cost Function, 2001-02
827 K-12 School Districts

Dependent variable: Log of expenditures per pupil

Independent variables	Coefficient	t-statistic
Intercept	6.02	1.39
Log of 2001-02 TAAS passing rate, converted to TAKS 2005	0.914**	1.72
Log of composite lagged TAAS pass rate, 2000-01	-2.69*	-2.57
Percent of graduates who performed above criteria on SAT or ACT	0.38	1.18
Log of passing rate on state-defined alternative assessment	0.35	0.89
Retention rate times the percent of students enrolled in high school	104.5*	3.23
Teacher wage index (in logs)	1.44*	4.56
Percent of students eligible for free and reduced price lunch	.477*	3.41
Percent of students who are black	.306*	2.95
Percent of students who are Hispanic	.307*	3.60
Percent of students with learning or speech disabilities	0.688	1.11
Percent of students with other disabilities	-3.03**	-1.90
Percent of students with other disabilities squared	19.1	1.52
Percent of students with limited English proficiency	-.836*	-2.93
Percent of students with limited English proficiency squared	.766**	1.74
Percent of students enrolled in high school	-481.6*	-3.24
Log of student enrollment	-.284*	-3.29
Square of log of student enrollment	.013*	3.01
Herfindahl (efficiency) index	-.102**	-1.88
Sum of squared residuals	8.431	

* indicates statistically significant at the 5% level
** indicates statistically significant at the 10% level

Table 3

Distribution of Education Cost Indicies

	Cost Index With 55 Percent Passing Rate	Cost Index With 70 Percent Passing Rate
Mean	1.00	1.00
Standard Deviation	0.29	0.27
Minimum	0.55	0.61
Maximum	3.77	3.59
At 10th Percentile	0.75	0.77
At 90th Percentile	1.30	1.28

Table 4

Cost Index Values by Poverty Quintiles

Student Weighted Quintiles	Number of School Districts	Cost Index Values		
		Average	Minimum	Maximum
1(lowest)	133	0.75	0.55	0.98
2	256	0.88	0.64	1.43
3	283	0.98	0.75	1.51
4	214	1.18	0.82	2.48
5 (highest)	82	1.47	0.99	3.77
Total	968	1.00	0.55	3.77

Table 5

Cost Index Values by District Size Quintiles

Student Weighted Quintiles	Number of School Districts	Cost Index Values		
		Average	Minimum	Maximum
1(smallest)	775	1.00	0.55	3.77
2	125	0.91	0.56	1.62
3	40	0.99	0.60	1.30
4	20	0.92	0.66	1.50
5 (largest)	8	1.12	0.74	1.52
Total	968.0	1.00	0.55	3.77

Table 6

Additional Costs of Meeting the 55 Percent Passing Rate Standard

Definition of Standard	Additional Cost (Millions of 2004 dollars)		Costs per Pupil (Millions of 2004 dollars)	
	All Districts	Plaintiff Districts	All Districts	Plaintiff Districts
Definition 1	1,720.2	490.4	421	474
Definition 2	2,211.5	620.8	542	600
Definition 3	5,476.6	1,574.7	1,341	1,521

Source: See text.

Table 7

Additional Costs of Meeting 60, 70, and 90 Percent Passing Rate Standards

Definition of Standard	Additional Cost (Millions of 2004 dollars)		Costs per Pupil (Millions of 2004 dollars)	
	All Districts	Plaintiff Districts	All Districts	Plaintiff Districts
60 Percent	2,479.6	690.8	607	667
70 Percent	4,189.5	1,135.2	1026	1097
90 Percent	7,897.6	2,131.1	1,934	2,059

Source: See text.

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