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Does Spending on Schools Matter? The Determinants of Public School Performance in the State of Arkansas

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Abstract

Due to the relatively poor performance of many public schools in Arkansas, the issue of public school performance appears to have attained permanent agenda status at the state and local levels. Compared to other states, Arkansas schools rank extremely low on performance measures. It is just as important, however, to recognize that there is wide variation *within the state* in public school performance. The recent Arkansas Supreme Court ruling in *Lakeview School District No. 25 v. Huckabee* and the resultant mandate to the state legislature increases significantly the probability that state and local government institutions will formulate and adopt policies designed to address (1) the general problem of under funded public schools and (2) the issue of variation in public school performance within Arkansas.

To increase our understanding of these issues, we seek to answer the following research question: What are the determinants of public school performance in the State of Arkansas? The primary hypothesis we test is that school districts that spend more money per student perform better on measures of student achievement. Although our analysis fails to find support for this hypothesis, we find that district-level student performance is related to poverty, the teacher/pupil ratio, and average teacher salary.

Introduction

Despite the fact that the relationship between public school expenditures and public school performance is of theoretical and practical importance, relatively few states—generally the larger ones—have been subjected to systematic empirical analysis that isolates the effects of spending and other factors on performance. Recently, education and public policy scholars have devoted greater, and increasingly sophisticated

attention to these relationships. These scholars find that several factors contribute to levels of public school performance, but the primary assumption of many studies in this body of research—and an assumption of many proposals to reform public schools—is that there is a direct causal relationship between education spending and school performance (among others see Wendling and Cohen 1981; Miner 1983; Dayton 1993; Hedges, Laine, and Greenwald 1994; Thompson 1994; Burtless 1996; Addonizio 1997; Adams 1997; Clark 1998).

Although we discuss the literature on the determinants of school performance below, we can do little in this paper to help settle the broader debate about whether there is a causal relationship between spending and performance. The purpose of this paper is quite narrow as it focuses on a single state. We seek to add the State of Arkansas to the list of states for which there have been systematic, rigorous empirical tests of the relationship between spending and performance. Thus, our primary research question is how does the level of funding in Arkansas school districts affect public school performance? Or cast a bit more broadly, what are the determinants of public school performance in Arkansas?

To be sure, these questions are important in each of the 50 states, but in poorly performing, resource-poor states like Arkansas answers to these questions are of crucial importance. Systematic analysis of the determinants of public school performance in Arkansas can contribute to the development of education policy reforms in the state by suggesting to policy makers (1) the level of inputs necessary to reach a desired output and (2) how to target spending in order to produce the desired outcome(s). Only by verifying empirically the effects of various factors on school performance will state and local policymakers be in a position to draft well-informed, effective proposals designed to improve significantly the performance of Arkansas' schools—and to begin to break the persistent patterns which have resulted in Arkansas' extremely poor ranking among U. S. state education systems. Furthermore, policy initiatives focusing on inter-district resource disparities typically stem from concern about the relatively low academic performance of districts/schools serving high concentrations of economically disadvantaged children (Clark 1998). Thus, one of the underlying questions supporting this line of research is whether or not increased spending in resource poor school districts will increase the performance of students in those districts.

Literature and Theory

Research findings on the relationship between education expenditures and school performance are mixed. Some studies report a positive relationship between expenditures and student achievement (Wendling and Cohen 1981; Hedges, Laine, and Greenwald 1994; Thompson 1994; Crampton 1995), while other studies report a very limited or no relationship between these factors (Coleman et al. 1966; Hanushek 1986, 1989; Clark 1998). Hanushek (1986, 1989), based on extensive reviews of the literature, maintains that there is no strong or systematic relationship between school expenditures and student

performance. Burtless (1996) argues that this is the prevailing view among economists, who frequently study school performance using what is referred to as the *production-function approach.*

Many researchers from academic disciplines other than economics dispute the generalization that there is no relationship between expenditures and performance. Among these researchers are education scholars who tend to use the so-called *process-outcome approach*, an approach that tends to emphasize organization of the curriculum as well as relationships between and among students, teachers, and administrators (Hanushek 1989). Indeed, many education scholars report that student achievement is related to spending (for reviews of the literature see Hedges, Laine, and Greenwald 1994; Burtless 1996; Hadderman 1998). Hedges, Laine, and Greenwald (1994) find that, on average, an increase in spending of $500 per student (or about 10 percent) will lead to an increase in student achievement test scores of about 0.7 of one standard deviation. Weglinsky (1997) finds that math achievement among 4th and 8th graders was positively associated with expenditures on instruction and lower student/teacher ratios. Wendling and Cohen (1981), based on an empirical study of New York State schools, maintain that the distribution of additional funds to low spending school districts will lead to a general increase in levels of academic achievement.

Factors other than education expenditures have also been found to be associated with levels of public school performance such as the percentage of ethnic minority students, the percentage of students below the poverty level, family background (e.g. education and income level), school size, teacher experience, and student-teacher ratios (among others see Wendling and Cohen 1981; Hanushek 1989; Ferguson 1991; Thompson 1994; Hedges and Greenwald 1996; Weglinsky 1997). The Coleman (1966) report, a report based on findings from data on 600,000 students in 3000 schools across the country, found that socioeconomic/family background and the racial/ethnic composition of the student body were more likely to be related to student performance than were various teacher and school characteristics. Generally, these findings are consistent with the findings of those economists (see Hanushek 1986; 1989; Chubb and Hanushek 1990) who maintain that no systematic relationship exists between school inputs (e.g. spending per pupil, teacher-pupil ratios, teacher quality, teacher salaries) and student achievement (Burtless 1996).

Previous research tends to focus on school districts (or counties) in larger states (Wendling and Cohen 1981; Ferguson 1991; Smith and Meier 1995; Clark 1998; Wrinkle, Stewart, and Polinard 1999) or in very large urban areas like New York City (Crampton 1995). In fact, no studies of factors associated with public school performance in Arkansas have ever been published in *peer-reviewed academic journals.* This is not surprising because, as Wendling and Cohen (1981) maintain, rural schools are extremely under-researched. Miles (1968), in a masters thesis, found that two factors—school district size and financial capacity/ability—were related to public school performance in the State of Arkansas; however, these findings are based solely on bivariate analysis and correlation coefficients. Jackson (2001), in an undergraduate

honors thesis, finds that in the State of Arkansas two factors, pupil/teacher ratio and percentage of African American students, are associated with district-level average ACT scores. Jackson (2001) reports that there is no relationship between per pupil spending and public school performance in the State of Arkansas. In another honors thesis Cox (2002) finds that in Arkansas teacher quality, poverty, and per pupil expenditures are related to student test scores.

One shortcoming shared by many empirical studies is that the variable used to measure school spending aggregates spending on instructional and non-instructional items/services (notable exceptions include Childs and Shakeshaft 1986; Adams 1997; Weglinsky 1997). More money may not lead to higher performance in all instances because schools differ in their spending priorities, some favoring instructional/educational programs and others favoring non-instructional programs. The best available variable with which to determine the effect of student spending on performance would measure the *resources available to educate students.* Thus, we employ as our measure of expenditures spending on instruction per student within the school district.

Hypotheses

The primary hypothesis we test is that school districts that spend more money per student on instruction perform better on measures of student achievement. We focus on the district rather than on individual schools because it is at the district level that many decisions regarding resource allocation are made. Though, for other purposes it is important to focus on individual schools, the issue of funding is most appropriately addressed at the district level because political and legal issues focus on disparities across districts within the state rather than on disparities between schools within districts. In order to isolate the independent effect of per capita spending on performance, we control for a number of other factors that are typically included in models from the education policy literature. Other factors that may be related to district-level school performance are the percentage of students in gifted/talented programs, total enrollment in the district, poverty (e.g. percentage of students in the free/reduced lunch program), the teacher/pupil ratio, and average teacher salary. We hypothesize that districts with higher enrollments, higher percentages of students enrolled in gifted and talented programs, higher average teacher salaries, and larger teacher/pupil ratios (i.e. smaller class sizes) will perform at higher levels on student achievement tests. We also hypothesize that districts with higher percentages of students enrolled in the free and reduced lunch program will perform at lower levels on student achievement tests.

Data and Model

A majority of studies that seek to identify the determinants of student performance measure performance by employing standardized achievement test scores.

We employ as our dependent variable the percentage of 10th grade students in the district who score above the 50th percentile nationally on the 1999-2000 SAT9 test.[1] The education/school district data for our analysis were obtained from the following websites:

National Center for Education Statistics - http://nces.ed.gov/ccd/index.asp
Arkansas School Information Site - http://www.as-is.org/

Districts for which all of the variables were not available were dropped from this analysis. Our error diagnostics did not indicate any multicollinearity problems with the model below.

Our multivariate regression model is:

$PERFORM = b_0 + b_1EXP + b_2GIFTED + b_3ENROLLMENT + b_4LUNCH + b_5TEACH/PUP + b_6TEACHSALARY$

where:

PERFORM = Performance (measured as the percent of 10th graders in the district scoring above the 50th percentile nationally on the SAT9 test in 1999-2000.

EXP = Expenditures devoted to instruction per student by district for 1999-2000

GIFTED = Percentage of students enrolled in gifted and talented programs for 1999-2000

ENROLLMENT = Total enrollment in the district for 1999-2000

LUNCH = Percentage of students in the free and reduced lunch program in 1999-2000

TEACH/PUP = Average Teacher/Pupil ratio in the district for 1999-2000

TEACHSALARY = Mean teacher salary in the district for 1999-2000

[1] We also ran our multivariate model using data from the more recent 2000-2001 SAT9 test; however, these data were much more incomplete than the data for 1999-2000. The 2000-2001 data set was missing results for 40 school districts, while the 1999-2000 data set was missing data for only 17 districts. The 17 missing districts are: Fountain Hill School District, South Side Bee Branch, Bergman, Genoa, Harmony Grove School District, Bentonville Public Schools, White Hall School District, Pulaski Co. Spec. School District, Bryant Public Schools, Humphrey School District, Marion County Rural Schools, Lakeview School District, Cotton Plant School District, Rose Bud School District, So Miss County School District, Osceola School District, and Camden Fairview School District.

Empirical Results

Our findings are reported in Table 1. The parameter estimate for instructional expenditures per student, our primary variable of interest, provides no support for the proposition that school spending (as measured in this analysis) is related to public school performance in Arkansas. Rather, the most powerful predictor of public school performance in the full model is the percentage of students enrolled in the free and reduced lunch program, our operational measure of poverty in the district. The parameter estimate indicates that for each one percentage point increase in students enrolled in the free/reduced lunch program, the percentage of 10^{th} graders in the district scoring above the 50^{th} percentile on the SAT9 goes down by almost one-half of one percentage point. The standardized beta (-0.51) indicates that this variable explains more variance in school performance than do other variables in the model, a finding that is consistent with a number of studies in the literature showing that socio-economic background is much more important than either schools or peer influences in predicting the performance of students on standardized tests.

Table 1. Determinants of Public School Performance (All Districts)[a]

Variable	Coefficient	Standard Error	T-Score	St. Beta
Expend. per student	-0.00002	0.00005	-0.43	-0.02
% Gifted/Talented	-0.13277	0.23619	-0.56	-0.03
Total Enrollment	-0.00003	0.00005	-0.59	-0.04
Free/reduced lunch	-0.47313	0.05147	-9.19***	-0.51
Teacher/pupil ratio	2.19863	0.59916	3.67***	0.24
Avg. teacher salary	0.00001	0.00000	2.13***	0.16
Constant	0.2335	0.1543	1.51*	-
Adjusted R-square	0.27			
N	293			

*** p<.01; ** p<.05; * p<.10 (for a one-tailed test).

[a] Model was also run without observations for the Little Rock School District; this did not result in any changes in the statistical significance of unstandardized coefficients.

Does the fact that instructional spending is insignificant (and the measure of poverty highly significant) mean that schools and school resources are unrelated to school performance and do not matter? Not necessarily. The estimates reported in Table 1 also indicate that higher average teacher salaries are associated with higher levels of aggregate student performance on the SAT9 exam. This finding, however, does not lend itself to straightforward interpretation. Higher average teacher salaries may themselves be related to some combination of (1) higher levels of district wealth, (2) lower levels of teacher turnover, (3) higher levels of teacher experience, and/or (4) higher percentages of certified teachers. We also find that school districts with larger teacher/pupil teacher ratios (i.e. more teachers per student/smaller class sizes) tend to perform better on the 10^{th} grade SAT9 exam. The parameter estimates for the other variables in the model—percentage of students enrolled in gifted and talented programs and total enrollment—indicate that these factors are not related to district-level student performance.

Because small and large school districts may differ on a number of important dimensions (see Maranto, Milliman, and Stevens 2000), we grouped the data so that we could test our hypotheses for low enrollment vs. high enrollment districts. Realizing that any cutoff points for district size are arbitrary, we selected a cutoff of 1500 students, primarily because in the education literature this size district has been proposed as the optimal or most efficient size for the delivery of education services (Morphet, Johns, and Reller 1959). Coincidently, this was the cutoff point in the Arkansas Governor's first school consolidation plan proposed in 2002.

Table 2 reports the parameter estimates for two models—one for districts with less than 1500 students and the other for districts with greater than or equal to 1500 students. In the low enrollment model the same three variables, free lunch, average teacher salary, and percent enrolled in gifted and talented, remain significant with free and reduced lunch having the greatest impact on student performance (standardized beta = -0.43). It is important, however, to note that the impact of the free and reduced lunch variable is smaller than in the model reported in Table 1. By contrast, in the high enrollment model the parameter estimate indicates a much stronger relationship between free/ reduced lunch and school performance. The estimate reported in Table 2 for larger districts indicates that for each one percentage point increase in students enrolled in the free/reduced lunch program, the percentage of 10^{th} graders scoring above the 50^{th} percentile on the SAT9 goes down by over two-thirds of one percentage point. Although these findings strongly suggest that socio-economic background (e.g. poverty/education level of the parents) is the most important factor in student performance in both low and high enrollment districts, schools still matter in determining performance, especially in low enrollment districts (which happen to constitute the overwhelming majority of districts in Arkansas). The parameter estimate for average teacher salary is significant in the low enrollment model, once again suggesting that districts that pay higher teacher salaries perform at higher levels than those that pay lower average salaries. The teacher/pupil ratio is significant in the predicted direction in the low enrollment model, but is insignificant in the high enrollment model. Why does the teacher/pupil ratio (or

class size) matter in smaller districts, but not in larger districts? This may be caused by the fact that there is much more variance in the teacher/pupil ratio in smaller districts than in larger ones. Although average student performance varies a great deal in larger districts, average class sizes do not. These patterns in the data are the most likely cause of the insignificant parameter estimate for teacher/pupil ratios.

Table 2. Determinants of Public School Performance
Low and High Enrollment Districts

	Low Enrollment (<1500)			High Enrollment (>1500)[a]		
Variable	**Coefficient**	**t-score**	**Stand. Beta**	**Coefficient**	**t-score**	**Stand. Beta**
Expend. per student	-0.00001	-0.15	-0.01	-0.00011	-0.41	-0.04
% Gifted/Talented	-0.0791	-0.29	-0.02	-0.00005	-0.44	-0.04
Total Enrollment	-0.00004	0.03	0.01	-0.00001	-0.64	-0.08
Free and reduced lunch	-0.4061	-6.49***	-0.43	-0.71942	-9.49***	-0.79
Teacher/pupil ratio	2.1211	2.94***	0.24	1.30428	0.50	0.05
Avg. teacher salary	0.00001	1.49*	0.10	0.00001	0.76	0.09
Constant	0.24164	1.25	-	0.5602	1.67**	-
Adjusted R-square	0.19			0.60		
N	223			70		

*** p<.01; ** p<.05; *p<.10 (for a one-tailed test).

[a] The high enrollment model was also run without observations for the Little Rock School District; this did not result in any changes in the statistical significance of unstandardized coefficients.

We also split the sample of school districts near the median for total enrollment (i.e. less than 700 and greater than or equal to 700) and tested the same hypotheses we tested in Tables 1 and Table 2 (results not shown). In the larger districts we found that two variables—free/reduced lunch and average teacher salary—were associated with school performance. In the smaller districts, we found that free/reduced lunch and the teacher/pupil ratio were associated (in the hypothesized direction) with public school performance.

Conclusion and Discussion

Will spending more on public schools in the State of Arkansas increase levels of school performance? The effects of school expenditures on student achievement may never be fully understood, but the results reported here suggest that, by far, the most serious problems associated with student performance are rooted in poverty, disadvantaged family backgrounds, and the like. Nevertheless, our results do call into question the assertions of economists who maintain that school resources/expenditures are unrelated to student performance. Our results suggest that in Arkansas higher teacher salaries and higher teacher/pupil ratios (i.e. smaller class sizes) are each associated with better district-level school performance on standardized tests. The good news is that policy makers do have some level of control over resources that can be used to achieve the goals of high salaries and smaller class sizes, goals that will likely improve student performance. To be sure, however, until the State of Arkansas addresses the problems of poverty, school performance will remain poor and at the bottom of U. S. state educational rankings.

Policy makers clearly need to know more about the relationship between expenditures and performance. Some promising areas for future research are: (1) conduct multivariate analysis at the level of individual schools rather than districts; (2) using as units of analysis both schools and districts, examine the possibility of interaction effects between a number of factors such as instructional spending per capita and class size, teacher salaries and class size, and instructional spending per capita and teacher salaries; and (3) identify districts that are relatively homogenous along the most relevant dimensions, and then, attempt to explain variation in students' performance in the set of homogenous districts.

Having said this, we are struck by how little contemporary education policy debates have focused on the problem of increasing the quality or performance of public schools in Arkansas. Rhetoric that focuses on the typical school reform issues—consolidation of districts/schools, questions of efficiency (where efficiency, for example,

is viewed as a fixed set of resources used to reach a goal), and/or local control—has the effect of shifting the debate away from the most important question of student performance/achievement and toward issues that are politically less risky (Baumgartner and Jones 1993; Rochefort and Cobb 1994; Cobb and Ross 1997). To cite a report published one generation ago, by not focusing on the problem of low performance in Arkansas schools "...we are cheating our children and our future" (Rockefeller Foundation 1982). The Leadership Conference on Civil Rights (LCCR), a well-respected organization with broad social/ethnic representation, recently explored the issues raised by the "No Child Left Behind Act." Wade Henderson, their director, noted that, "The disparity between low-income school districts and their rich, suburban counterparts is a civil rights issue, one that must be addressed by the states that created these inequities as well as the federal government. This nation is founded on the principle that everyone – regardless of income – deserves access to a quality public education." (PA Times 2003).

At the same time, it is worth recognizing that state political institutions in Arkansas face a classic political dilemma, a dilemma that must be considered alongside technical/empirical analyses that attempt to identify the determinants of school performance. Any serious (i.e. less than incremental) attempts to reform Arkansas schools are likely to have costs that are immediate, large, and traceable to the elected officials who proposed/voted for the reforms. The benefits, on the other hand, will not be immediately evident, perhaps occurring generations from now, and furthermore, there may not be a clear causal chain that links reforms to better outcomes/performance (Arnold 1990). These political factors will continue to overshadow any incentives that elected representatives might otherwise have to address the problem of low levels of student performance in Arkansas schools.

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