

How Much Does Funding Matter? An Analysis of Elementary and Secondary School Performance in Missouri, 1990-2004

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Abstract

The individual works of Eric Hanushek and the collaborative efforts of Hedges, Laine, and Greenwald in the 1980s and 1990s focused a substantial amount of attention on the relationship between education budget allocations and school performance. Using their opposing hypotheses as a theoretical framework, this study focuses on K-12 education in Missouri for the period from 1990 to 2004, taking into account the cuts in state aid to education that began in 2000. Utilizing four distinct measures of school performance, the results suggest funding levels have a significant impact on student achievement. Per-pupil expenditures alone, however, are not the most significant variable in the models. Other variables, such as rural/urban geographic location, the poverty level of a school district, and the demographic makeup of a district are also influential to school performance levels.

Introduction

Recent state budget crises in the United States have placed the issue of education funding under intense scrutiny. When these cuts are coupled with increasing pressure from federal agencies through programs like No Child Left Behind, the evaluation of school performance and funding allocations becomes even more critical (Peterson & West, 2003). This study aims to identify the influence that education funding, as measured by per-pupil expenditures, has on school performance. Further, the analyses calculate the effects of other school characteristics, such as teacher-pupil ratios and various student demographics, in order to determine which factors are most influential in determining overall school performance.

Using school districts as the unit of analysis, this paper assesses the performance of Missouri's elementary and secondary education system for the school years 1990-2004. Importantly, the imposition of substantial cuts to Missouri's school budget during the years 2000-2004 provides a natural control group in this study. In this way, the effects of funding on education are compared between a control group – school districts before budget cuts – and an experimental group – school districts after the budget cuts. The concept of school performance is operationalized through four different dependent variables – high school graduation rates, average Missouri Assessment Program (MAP) test scores for an the entire school district, average MAP test scores for only high schools, and average ACT scores. Utilizing multiple dependent variables enables comparison between models and ensures reliability of the findings.

This study is presented in four sections. First, the literature pertaining to how funding affects school performance is reviewed. The next section includes a discussion on the background of Missouri's budgetary problems, pointing out their causes and their consequences. The third section contains the study's hypotheses, followed by an explanation of the data, methods, and the variables incorporated in the models to measure school performance. Finally, the paper concludes with a discussion of the results and some concluding remarks, and potential avenues for future research are suggested.

After comparing these results to both the Hanushek (1986, 1989a, 1989b, 1997) and Hedges et al. (1994a, 1994b) arguments of funding and education through a quantitative analysis, the evidence presented here suggests that both sides of this debate are correct in distinct manners. The findings of this study suggest the link between budgetary cuts and school performance are not necessarily highly correlated. The results also suggest, however, that increased funding does indeed increase the effectiveness of education, contrary to Hanushek's argument and in favor of Hedges, Laine, and Greenwald.

The Coleman Report and its Effects on Education Policy Analysis

Countless studies have analyzed the effectiveness, efficiency, and equity of the educational system in the United States and the role that monetary support plays in the relationship between these three key components (Hanushek, 1989a, 1989b, 1991, 1996; Hedges et al., 1994a, 1994b; Mintrom, 1994;

Teddlie & Reynolds, 2000). *Equality of Educational Opportunity* (Coleman, 1966), published through the U.S. Department of Education, is a seminal work in the field of education system performance and its relationship to school funding. The study, known commonly as the Coleman Report, was among the first works to use a production function approach to analyzing school performance. Coleman proposed the production function $S_{it} = f(F_{it}, T_{it}, R_{it}, E_{it}, I_{it})$, which derives a quantitative model of school inputs at time t and for student i , such as funding levels (F_{it}); teacher quality (T_{it}); teacher-pupil ratios (R_{it}); student ethnicity (E_{it}); and family income level (I_{it}), and relate them to school outputs, such as standardized test scores (S_{it}). The output serves as a function (f) of the cumulative effect of the inputs for student i at time t . Thus, the relationship between an output (dependent variable) and its inputs (independent variables) resembles a linear equation utilized in Ordinary Least Squares (OLS) regression models.

The central argument of the Report centered on the finding that by far the strongest factor affecting how well a student performed in school was the student's family background, *not* the amount of money spent per child in school (Hacsi, 2002). Coleman found that the amount of money allotted per pupil, a factor easily and often changed by shifts in policy, made no significant difference in terms of improving a child's performance in school. Rather, an unalterable factor, the student's family background, was the main determinant of a child's school performance (Coleman, 1966). The divisive notion that school resources, such as funding levels per pupil and teacher-pupil ratios, were not the most influential factors in educational performance was controversial in 1966 and continues to be today.

Although the conclusions reached in the Coleman Report suggest that funding levels had little effect on school performance, a demand for more equality in school funding took shape in the early 1970s (Dayton, 1996). These claims were based primarily on the argument that school funding formulas which relied heavily on local taxes were unconstitutional because of an inherent flaw – wealthy districts were able to provide substantially “better” schools than poorer ones due to a greater supply of resources. Many school districts were at a distinct disadvantage because the majority of school district funding comes from local property taxes. Reluctance in state legislatures to alter school funding formulas persuaded plaintiffs in several states to sue for more equity in funding through state court systems (Colton, 1996).

Subsequently, since the 1970s, U.S. school districts across the country have witnessed numerous court battles based on financial inequalities in education, including the landmark *Serrano v. Priest* (1971) case in California and *Rose v. The Council for Better Education, Inc.* (1989) in Kentucky. Since *Serrano*, dozens of suits in over thirty states have been bitterly fought in state supreme courts as well as the United States Supreme Court (Murray, Evans, & Schwab, 1998). In the vast majority of these cases, state governments were ordered to adjust spending levels in impoverished districts to coincide more closely with their wealthier counterparts.

Hanushek and the Ineffectiveness of “Throwing Money”

Education in the U.S. is a core issue of public policy often viewed idealistically as an inalienable right that must be extended to all citizens (McDonnell, Timpane, & Benjamin, 2000). “[The] opportunity to learn is a key factor in children’s learning – perhaps the most critical one” (Stevens, 2002, ¶ 5). The plaintiffs in *Serrano* (1971) and *Rose* (1989), who claimed that unequal funding is essentially equivalent to withholding the opportunity for quality education, employed such an argument successfully. The arguments put forth by Hanushek (1981), however, fundamentally oppose this line of reasoning and the subsequent lawsuits based upon it. After discrediting the argument in favor of state aid to assist in leveling the distribution of education funds, Hanushek (1986) went on to comment on the weakness of the plaintiffs’ claims in cases such as *Serrano* and *Rose*:

Much of this discussion [pertaining to school funding lawsuits] appears motivated by an underlying assumption that poor districts (in terms of property tax bases) are the same as poor students. This, it turns out, is not uniformly the case. But, more than that, the discussion is based entirely on a presumption that expenditures per student are the appropriate focus for policy. Without this presumption, an unwarranted one from the previous evidence [in his paper], the line of argument – legal and academic – becomes quite peculiar. (p. 1170)

Hanushek’s (1996) meta-analysis of some 90 previous studies (which contained 377 separate models total) focused on identifying the relationship between school resources and performance, and he found that the most of the

studies in question – roughly 83 percent – did not find that school resources have a significant, positive effect on school performance. Hanushek employed a vote-count method, which entails tallying the effects of each resource input in a production function in terms of its statistical significance (significant or nonsignificant) and its sign (positive, negative, or unknown). Although he found that only 17 percent of the studies in question demonstrated robust and positive influences of resources on performance, Hanushek also found that about seven percent of the models he surveyed suggested a significant, *negative* relationship between resources and school performance. Further, about 74 percent of the models indicated no strong link of any kind between resources and performance (Hanushek, 1996).

A point of theoretical weakness Hanushek (1996, 1997) claims plagues many school performance studies resides in the fact that measures of school inputs and outputs vary drastically across studies. For instance, in his meta-analysis, Hanushek (1996) identifies no less than seven distinct measures for gauging educational resources concerning funding. Further, there exists no consensus as to which measure of school output is best suited for assessing school quality. Many variables have been proposed (graduation rates, standardized test scores, truancy rates, and college admission rates), but no single measure is used consistently (Speakman et al., 1997). Due to wide variation in model specification and statistical results, Hanushek (1991, 1996) argues that the theoretical frameworks of many previous studies are inconsistent and thus conclusions recommending greater funding allocations to education are suspect.

Hanushek (1989a) found that since the influential school finance cases of the 1970s, school funding, both in general terms and in terms of equality, has risen dramatically nationwide. School performance measures, however, have not improved as rapidly or sharply as have school budget allocations, and in many cases school performance has actually declined significantly despite drastic increases in school funds (Hanushek, 1989a, 1997; Speakman et al., 1997).

More broadly, Hanushek (1989b, 1997) extrapolates his criticisms of education policy studies to the policy prescription arena. He contends that much of the focus on school resources has been misguided and that a serious reconsideration of basic education policy analysis is in order (Hanushek & Kain, 1972). Because of the apparent disconnect between resource allocation

and school performance, Hanushek (1991) recommends a focus on incentives in education policy. Put differently, he bases his argument in the language of economics scholars: people respond to incentives (Easterly, 2002). Rather than focusing on the inputs and funding aspects of education, such as classroom size and expenditures per pupil, he argues that policymakers should concentrate instead on outputs and performance criteria of schools (Hanushek, 1991). Hanushek (1997) places little faith in schools to administer their resources effectively and efficiently: “Schools as a whole demonstrate an inability to use available resources effectively. There is little reason to believe that an additional dollar put into a school will improve student achievement” (p. 32). There is, of course, another side to this debate.

Funding Does Matter - But How Much?

Hanushek’s evidence was met with substantial criticisms, the most well known of which formulated by Hedges et al. (1994a, 1994b) in a series of articles and rejoinders intended for Hanushek and his supporters (Greenwald, Hedges, & Laine, 1996a, 1996b). Taking issue with Hanushek’s argument that there is no systematic relation between resource inputs and school outputs, Hedges et al. (1994a) reproduced Hanushek’s (1989) study and found results contrary to those in the original piece. Among the critiques posed against Hanushek’s work, Hedges et al. (1994a) sharply criticized the use of vote counting as an accurate and reliable method by which to gauge the influence of resources on school performance. Specifically, Hedges et al. contend that the vote count method offers no way of classifying the magnitude of the effects in question. By using simple tallies of each category – positive or negative and significant or nonsignificant – readers are left without any notion of how strong the results were in the sampled studies.

In order to correct for this shortcoming, Hedges et al. (1994a, 1994b) employed an inverse chi-square (Fisher) combined significance test in order to measure the collective influences of school resources on school performance. Aggregating the coefficients in the models Hanushek utilized in his study, the authors found that most of the inputs that Hanushek had used to measure school performance, none of which he found to effect education efficacy, did in fact positively influence the effectiveness of schools (Hedges et al., 1994a). These findings suggested the “exact opposite conclusion” of Hanushek’s argument

– Hedges et al. (1994a) found that, “expenditures are positively related to school outcomes” (p. 6). The authors went so far as to specifically quantify the amount of money necessary to improve a student’s school performance – they concluded that increasing per pupil expenditures by \$500 would result in an approximately 24 percent increase in student achievement (Hedges et al., 1994a).

In the end, Hanushek (1997) was persuaded to somewhat soften his stance and concede that funding can in fact have a significant influence on school performance. He was cautious, though, to stress the caveat that this relationship is its strongest only in particular instances (Hanushek, 1997). Of course, Hedges et al. (1994a, 1994b) and Greenwald et al. (1996a, 1996b) do not contend that *any* increase in funding to the educational system will result in higher performance of students. Although the dialogue between Hedges et al. (1994a, 1994b; Greenwald et al. 1996a, 1996b) and Hanushek (1989b, 1996, 1997) became quite vivacious, in the end the two sides of this debate did come to share some broad, general convictions concerning funding and school performance improvement. Both sides, for example, agree that only money spent on factors linked to school success may increase student performance evaluations (Greenwald et al., 1996b; Hanushek, 1996). Ambiguity arises, however, when the question as to which factors are specifically linked to school success; the respective Hedges et al. and Hanushek camps hold distinctly different views as to which inputs influence school performance and to what extent they do so (Greenwald et al., 1996a; Hanushek, 1996). Overall, Hedges et al. (1994b) take a much more optimistic approach to the effects of funding on education than Hanushek. They posit that increased aid to schools results in relatively clear and strong performance improvements. On the other hand, Hanushek is more skeptical of these supposed improvements resulting from relatively straightforward increases in school funding.

The same line of reasoning supported by Hedges et al. (1994a, 1994b) is essentially similar to the basis behind the *Serrano* (1971) and *Rose* (1989) cases: budget allocations and student education are positively correlated; thus, any student who is deprived of a relatively equal funding allotment is inherently discriminated against and therefore less likely to perform well in school. The fact that the plaintiff in the overwhelming majority of the equal school funding cases won their suits demonstrates that many state courts and the U.S. Supreme Court coincide with the general sentiment that inequitable

funding is inherently unjust, and hence unconstitutional. The rulings on these suits changed the way states and local governments interact concerning funding elementary and secondary education throughout the nation. When local means were deemed insufficient to provide quality educational facilities for students, state aid was required to close the gap between wealthy and poor districts.

Court orders forcing state governments to allocate more funding for education have led to a dramatic increase in spending on education within the past thirty years (Cooper, Fusarelli, & Randall, 2004). A study conducted by Rothstein (1998), however, covering school expenditures from 1970-1995 suggests that although state funding of education in general has increased, these funds are not being spent on the factors necessary to improve overall school performance. Rather, Rothstein (1998) argues that the “regular education” portion of school budgets actually fell nearly 21 percent during his study, while funding for special education, bilingual education, and other factors increased; ultimately defeating the intended purpose of the court mandates (1998).¹ This finding suggests that even when school budgets expand it remains difficult to discern the exact effects resulting from the extra funding. Thus, although it is generally agreed among scholars and officials that money can influence school performance, the strength and nature of that relationship continues to be difficult to identify concretely.

The Case of Missouri

It is clear that education policymakers and analysts are far from identifying a reliable, effective measure of school performance; only further research will help uncover the exact nature of this relationship, and focusing on an individual state lends greater ability to understand the intricacies of education policy formation. There are several reasons why Missouri proves to be an advantageous sample case study in this research field, including the fiscal constraints that have crippled the state budget.

The economic excess of the mid to late 1990s in the United States bestowed many states with surplus revenue, enabling them to increase

1 Rothstein defines “regular education” as funds spent on typical students, their teachers, and normal operating costs. “Other factors” include food services, counseling, desegregation funding, security increases, and vocational training.

expenditures in many areas. New state revenue was generated in several different sectors of the economy, and policymakers took the opportunity to improve numerous governmental programs, including education (McNichol, 2003). Missouri was no exception to this economic windfall, experiencing falling unemployment and increasing returns on investments. Some of the state's excess income was funneled toward improving deficient school districts in both urban and rural environments. The legislature was also influenced by state judicial pressure to equalize education through the outcomes of and public reaction to *The Committee for Educational Equality v. Missouri* (1994) and the subsequent *Lee's Summit School District v. Missouri* (1994), both of which were heard by the Missouri Supreme Court. When faced with growing pressure by the courts, leaders in Jefferson City began to dip into their growing coffers, and Missouri's legislature approved massive increases in education expenditures.

Furthermore, the prosperous financial environment that prevailed for most of the 1990s helped swell state reserves to the point where legislators could afford to reduce taxes. When all these forces were combined, Missouri was left in a precarious situation: expenditures were rapidly increasing and revenues were quickly decreasing, as former Missouri State Budget Director Jim Moody summarized quite pessimistically:

During the period from 1995 to 1999, Missouri state government significantly reduced future state general fund tax revenues by reducing taxes, while at the same time accelerating spending on government programs... sending the state budget into a death spiral. (quoted in McLure, 2003, p. 2)

Any combination of factors such as these is never a positive sign, and unfortunately, the economic boom that had helped create Missouri's surplus could not last forever.

Economic expansion was met with the grim reality of the economic lethargy that began in 2000 and continued through 2004. With the state budget from the previous decade requiring inflows of revenue to fund new projects, declines in returns to the state were taking their toll. Government reserves were simply not large enough from 2000-2004 to continue funding at the levels that had become common during the previous decade. Missouri's legislators were left with the prospect of streamlining their budgets. In the end, they were forced to eliminate many projects and significantly reduce the funding

available to others. Major reductions were needed across several different areas, including the oft-sheltered K-12 financial plan (McNichol, 2003).

These budgetary woes began in fiscal year 2000, and they remained the rule rather than the exception in each of Missouri's states budgets through the 2003-2004 school year. In 2000, state aid to education was frozen, and by 2002, state aid was cut across the board by 15 percent (Carnahan, 2000). During this time, schools had to operate with an average six percent reduction in their budgets (King, 2004). These problems continued through 2004.

Although school districts during this time period experienced reduced state aid allocations, individual districts maintained control over their expenditures. Thus, budget cuts could affect some districts in more negative ways than others, depending on individual districts' spending allocations. Cuts in state aid place more pressure on local governments to increase funding for their individual school districts. School districts across the state made efforts to replace cut state aid, but their limited fund-raising powers could not completely offset the state budget reductions (McNichol, 2003). Thus, districts with a higher dependence on state funding (poorer districts) could be more adversely affected by state budget cuts in education.

Research Questions and Hypotheses

Based on the above literature and Missouri's budget crisis, this analysis is centered on two general research questions aimed to define more clearly the link, if any, between education and funding. In the process, the influence of several other factors on school performance are also be evaluated. The first research question focuses on the overall influence of the budget cuts on Missouri school performance. When approached through the theory of Hanushek (1997), one would posit that no correlation exists between a loss of funding and school performance rates. On the other hand, Hedges et al. (1994a) suggest that a reduction of funding could easily lead to decreased school effectiveness. The first hypothesis is based on the latter argument.

H₁: Higher per-pupil expenditures have a positive effect on school performance; thus, Missouri's education budget cuts had a negative effect on school performance levels.

When a budget cut occurs, school spending will decrease, taking with it the school's effectiveness. Hedges et al. (1994a, 1994b), however, ensure

that they are not quoted as claiming that funding is the only important factor in education. “We do not argue that money is everything” (Greenwald et al., 1996a, p. 395). They contend that several other factors also contribute to school performance, such as the proper allocation of monetary resources. This point relates to the second research question: Other than funding levels, what other variables have a significant influence on graduation rates?

A wide range of variables have been suggested to have influences on school performance, including teacher salary, teacher experience, and student family background.² Further, previous research presented by Hanushek (1989a, 1991, 1996, 1997), Greenwald et al. (1996a), and Speakman et al. (1997) suggests that, other than funding level, some variables of particular interest are teacher-pupil ratio, expenditures per-pupil, standardized test scores, poverty levels, the presence of budget constraints, and rural/urban geographic location. Although many of these variables have been suggested to be correlated to positive school performance, hypotheses 2 and 3 follow Hedges et al.’s (1994a) reasoning and suggest that teacher-pupil ratios and poverty rates have the greatest influence on education effectiveness relative to the other variables mentioned.

H₂: Teacher-pupil ratios have a negative effect on school performance; as ratios decrease (there are more teachers for each pupil), levels of school performance increase.

H₃: The wealth of citizens in a school district is positively related to school performance; thus, as the percentage of students receiving free and reduced price lunch increases, levels of school performance decrease.

Throughout his studies, Hanushek (1989a, 1997) concluded that none of the above variables had any consistent, reliable impacts on school performance measures. Contrarily, Hedges et al. (1994a, 1994b) argue per-pupil expenditures and teacher experience are the most influential factors. While the influence of per-pupil expenditures on school performance can be directly tested (hypothesis 1), the effects of teacher experience cannot be due to data limitations.³

Instead, the second hypothesis suggests that a low teacher-pupil ratio will positively affect graduation rates. This argument is in line with Hedges et al.’s

2 Hanushek (1996) and Greenwald et al. (1996a) incorporate teacher experience and salary in their models, while the main explanatory variable of the Coleman Report (1966) is student family background.

3 The Missouri Department of Elementary and Secondary Education does not have variables related to teacher performance sufficient for this study.

(1994a, 1994b) theory because the salary of teachers is one factor included in computing per-pupil expenditures in Missouri.⁴ For example, if teacher-pupil ratios fall, per-pupil expenditures will increase, relatively. The inclusion, however, of the teacher-pupil ratio is not based primarily on Hedges et al.'s (1994a) expenditures per-pupil claim. Student-teacher ratios are much more valid and reliable figures when compared to per-pupil expenditures. Further, the more individual attention that can be given to each student will enhance that student's learning experience, which will improve the performance of the student overall. Following this line of reason, lower teacher-pupil ratios will increase high school graduation rates. The third hypothesis posits that districts with fewer students receiving free and reduced price lunch experience lower levels of school performance. Again, this proposition is based on Hedges et al.'s (1994a, 1994b) framework. Hedges et al. (1994a) and Berube (1984) have defended the link between less funding, brought upon by lower incomes and poverty, and decreased school performance. They contend that poorer school districts are more likely to have low graduation rates.

Data, Variables, and Methods

Nearly all of the data used in this research project were obtained from the Missouri Department of Elementary and Secondary Education (MODESE) (*Missouri School Data and Statistics: 1985-2005*, 2006). Employing the school district as the unit of analysis, statistics from 1990-2004 were collected from all 522 Missouri school districts. The selection of variables and subsequent model construction was based on the production function model depicted earlier. Speakman et al. (1997) argue for the representation of four core conceptual areas in any production function related to school performance evaluations. Accordingly, each of these categories – outcome factors, cost function, school qualities, and contextual factors (control variables) – is accounted for in the models. Four separate models are run with different outcome factors – high school graduation rates, average Missouri Assessment Program (MAP) scores including all schools in a district, MAP scores for high schools only, and average American College Text (ACT) scores – as dependent variables to ensure that the results are reliable, regardless of dependent variable used. Further, none of these four indicators is included in the other three models as an independent variable, as doing so would violate the logic of the

4 As defined by the Missouri Department of Elementary and Secondary Education.

production function model; inputs and outputs must be on opposite sides of the equation, and outcome factors must only be placed on the left-hand side of the equation.⁵

Cost function factors indicate variables directly related to instructional costs, such as expenditures per-pupil. School qualities signify resource allocation in a school district and are demonstrated by figures such as teacher-pupil ratios. Finally, contextual factors serve as control variables in a statistical model and include demographic information such as ethnicity, rural/urban location of a school district, and socio-economic status of students.

Outcome Factors (Dependent Variables)

High school graduation rate. Graduation rate is a valid measure of school outputs because it measures a school's ability to produce educated students. Hanushek's (1989) and Hedges et al. (1994b) support the use of outputs such as test scores, graduation rates, and job retention after graduation. This variable measures the percentage of eligible pupils that graduate high school from each district each school year.⁶

MAP test scores. This statewide, standardized test provides officials a measure to gauge pupil performance and improvement in the core subject areas: communication arts, mathematics, science and social studies.⁷ The average index score of the MAP test for all students is used in model 2, and the average index score of high school students only is used in model 3.

ACT scores. This variable is the percentage of students in the district who received a score at the national average or higher for that particular year. Hanushek (1997) and Hedges et al. (1994a, 1994b) use standardized tests, such as the ACT, as measures of school performance.

Cost Functions and School Qualities (Independent Variables)

Expenditures per-pupil. The main substantive variable of Hedges et al.'s (1994) theory, expenditures per-pupil gives a general assessment of

5 Models were run, however, with graduation rates and MAP scores as the dependent variables while controlling for ACT scores in order to control for Missouri high school students' performance on a national level. These findings were not significantly different from the models presented below, suggesting that even when controlling for ACT performance, the paper's findings are robust.

6 Eligible pupils attend at least 80% of school days, according to MODESE. Further, the student must be able to acquire all the credits needed to graduate within the particular school year.

7 The MAP also conducts tests on fine arts and physical education proficiency, but these data are widely unavailable and do not directly measure the abilities of students in basic, classroom subjects.

the wealth of the school district in relation to the number of students in it. Hanushek (1997) also tested this variable in his analysis, but found it not to be significant, while the Coleman Report (1966) found ambiguous results. This variable is calculated by summing all the money paid out by the district for instructional purposes and dividing that sum by the number of eligible pupils in the district. This value is then divided by 1,000 in order to make its parameter estimate more similar to the others in the model.

Teacher-pupil ratio. The Coleman Report (1966), Hanushek (1996), and Hedges et al. (1994a) all incorporated this variable into their theoretical models. The smaller a teacher-pupil ratio is, the more likely the pupil is to receive one-on-one attention. This individualized consideration is suggested to increase student retention of knowledge in addition to allowing the teacher to remain more informed of the student's progress.

Budget cuts. This dummy variable categorizes the years before budget cuts took place, 1990-1999 (coded as zero), and the years during budget cuts, 2000-2004 (coded as one). The exact nature of the K-12 education budget cuts are difficult to discern because of the discretion in spending habits allowed to each school district in Missouri. In the fifteen years of this study, state aid to education equaled roughly 40 percent of each district's total budget once local funding and federal aid were accounted for. School districts are relatively free to spend this state money on programs and projects that they see most fit for improvement. Therefore, without an in-depth study of each district's financial plans, it is impossible to determine exactly which aspect of the school district's budget is being reduced. This study, however, is focused on the presence of budget cuts, not necessarily the precise effects they have on the specific sections of school districts' budgets.

Contextual Factors (Control Variables)

Reduced/free lunch. This variable represents the percentage of the district's students that receive reduced or free lunch discounts due to their parents' low income, and is meant to control for poverty and its negative effects on school performance (Evans, Murray, & Schwab, 1997). In relation to Hedges et al.'s (1994a, 1994b) argument, the more poor a school district's citizens are, the less funding will be available to a school's budget, thus the less likely it is that school performance will be high.

Rural/urban categorization. Gaps in urban education and suburban education have been the subject of numerous studies and research programs (Orfield & Reardon, 1992; Slavin, Karweit, & Madden, 1989; Vinovskis, 1999). Missouri's demographics, however, encourage not only analysis of poor, urban school districts, but also of the small, poverty-stricken rural districts of the state as well. The plight of the rural school district has begun to receive more attention in policy discussions as of late (Imazeki & Rechovsky, 2003; Ward, 2003); accordingly, this study focuses on rural school districts in Missouri. As *Serrano* (1971) did for urban funding deficiencies, cases like *Tennessee Small School Systems v. McWherter* (1993) and *DeRolph v. Ohio* (2001) overturned prevailing regulations that were ruled unconstitutional for preventing rural school districts from performing as well as districts in more affluent neighborhoods. Urban-rural categories as defined by the National Center for Education Statistics (NCES) are used to transform this variable into a dummy variable (urban = 0 , rural = 1). In this way, as Sielke (2004) suggests, "[I] adopt the most conservative definition of rural throughout this report, including only open country and those communities with fewer than 2,500 people" (p. 223).

Percentage of minority students. The findings of the Coleman Report (1966) suggested that the main determinant of school performance is the demographic background of students under evaluation. Thus, the percentage of each district's total student population represented by minority students is controlled for in the models.

Results and Discussion

Table 1 (see next page) illustrates the means, standard deviations, minimums, and maximums for each variable from 1990 to 2004. As expected in a state with such sharp geographical and economic cleavages, the minimums and maximums of graduation rates, teacher-pupil ratios, and expenditures per-pupil illustrate a wide gap in school factors. Missouri's expenditures per-pupil ranked 38th in the nation in 2004, and ACT scores in Missouri, on average, scored above the national average in the same year. By analyzing the rural/urban dummy variable, it becomes apparent that the majority of school districts in Missouri are rural. In this study, 367 of Missouri's 524 school districts are rural while 157 school districts are urban.

Table 1
Descriptive Statistics of Missouri School Data, 1990-2004

Variable	Mean	Standard Deviation	Minimum	Maximum
Graduation rate (%)	85.7	9.6	33	100
ACT score above national average (%)	30.1	11.2	2.5	85.7
Percentage on reduced/free lunch (%)	42.6	16.2	4.3	96.8
Teacher-pupil ratio	13.1	3.1	2	23
Expenditures per pupil (\$)	5,035	1,546	1,904	13,885
Percentage of minority students (%)	5.3	4.9	0	100
Percentage of white students (%)	94.7	4.2	0	100
Rural/urban (0 = rural, 1 = urban)	0 (mode)	0.5	0	1
Total district enrollment	1,620	1,587	20	44,782

Table 2 (see next page) compares the same statistics with the years 1990-1999 and the years 2000-2004 as acting as different segments. In this way, the differences in these variables can be assessed before and after education budget cuts began in Missouri. Some surprising trends emerge from Table 2. These figures indicate that graduation rates have *increased* since the budget cuts began- a finding contrary to the first hypothesis.

While the average ACT score exhibits virtually no change between the two time periods, the percentage of students receiving free or reduced price lunches increases by roughly 10%. This increase may not only be due to an increase in poverty levels, however; Missouri increased the minimum income level to qualify students for receive lunch discounts, resulting in more students being eligible for free or reduced price lunches (*Missouri School Data and Statistics: 1985-2005*, 2006). Table 2 illustrates another interesting trend through the change in teacher-pupil ratio over time; the average teacher-

pupil ratio has *decreased* since budget cuts began. This result is surprising considering the obvious implications of budget cuts on hiring staff. Finally, the effects of the budget cuts become evident in the last row of Table 2 with a decrease in the annual increase in state educational expenditures. The decrease in this value indicates that the state's education budget was relatively stagnant from 2000-2004 when compared to 1990-1999. When considering that the annual inflation rate of the later timeframe was an average of 2.55% (Consumer Price Index: 1990-2005, 2006), the increases in state budgetary allocations over time were barely sufficient to keep pace with yearly increased costs of living.

Table 2
Comparison of Means Before and During Budget Cuts

Variable	1990-1999	2000-2004
Graduation rate (%)	85.2	87.3
ACT score above national average (%)	30.2	30.1
Percentage on reduced/free lunch (%)	40.9	44.7
Teacher-pupil ratio	13.4	12.2
Annual increase in expenditures (%)	4.7	2.7

The findings of the OLS regressions are illustrated in Table 3 (see next page).⁸ As the dependent variable, model 1 utilizes graduation rates, model 2 employs all MAP test scores, model 3 uses only high school MAP test scores, and model 4 specifies ACT scores, respectively.⁹ Regardless of the measure of school output utilized, there remain strikingly similar results for each independent and control variable in terms of direction of relationship (positive or negative) and significance levels. For instance, *expenditures per pupil* remains positive and highly significant across all four models, indicating

⁸ Colinearity tests using correlation matrixes and variance inflation factors found no problems of note.

⁹ Only two districts – St. Louis City and McDonald County – were found to have consistent disproportional influence and leverage in the models. These districts are predominantly urban and rural, respectively, and thus exerted undue influence on many of the models. All four models were run with both cases excluded together and individually, with no substantial differences from the models presented in the paper.

that higher levels of spending per pupil lead to greater school performance, be it measured by graduation rates, MAP test scores, or ACT scores. Taken alone, this finding supports the first point of the first hypotheses; higher per-pupil expenditures lead to higher levels of school performance. Further evaluation, however, is necessary before accepting the second point of the first

	Model 1- Graduation Rate	Model 2- All MAP Scores	Model 3- H.S. Map Scores	Model 4- ACT Scores
Variable				
Expenditures per pupil	0.001** (1.50E+5) <i>0.075</i>	0.002*** (0.1.75E+4) <i>0.266</i>	0.002*** (2.40E+5) <i>0.202</i>	0.001*** (1.84E+4) <i>0.124</i>
Teacher-pupil ratio	-0.906*** (0.056) <i>-0.309</i>	-0.552*** (0.072) <i>-0.159</i>	-0.602*** (0.099) <i>-0.140</i>	-0.202* (0.070) <i>-0.056</i>
Budget cut dummy	2.657*** (0.310) <i>0.143</i>	5.979*** (0.379) <i>0.244</i>	7.409*** (0.520) <i>0.245</i>	0.681‡ (0.375) <i>0.030</i>
Reduced/free lunch	-0.120*** (0.010) <i>-0.201</i>	-0.330*** (0.011) <i>-0.485</i>	-0.337*** (0.015) <i>-0.401</i>	-0.385*** (0.011) <i>-0.527</i>
Rural/urban dummy	-2.781*** (0.429) <i>-0.116</i>	-1.262† (0.512) <i>-0.046</i>	-1.260‡ (0.703) <i>-0.037</i>	-1.102† (0.516) <i>-0.038</i>
Percentage of minority students	-0.128*** (0.011) <i>-0.120</i>	-1.621*** (0.105) <i>-0.281</i>	-1.172*** (0.144) <i>-0.164</i>	-0.054 (0.107) <i>-0.009</i>
Constant	102.4*** (1.624) <i>0</i>	175.6*** (2.020) <i>0</i>	160.7*** (2.775) <i>0</i>	36.43*** (1.974) <i>0</i>
<i>F</i> -value	250.2***	346.1***	186.34***	246.5***
<i>R</i> ²	0.272	0.410	0.272	0.271
Adjusted- <i>R</i> ²	0.271	0.409	0.271	0.270
<i>N</i>	7,032	7,136	7,296	7,191

Note: Standard error in parentheses; standardized beta coefficient in italics. *** $p \leq 0001$, ** $p \leq .001$, * $p \leq .01$, † $p \leq .05$, ‡ $p \leq .10$.

hypothesis – namely, that Missouri’s education budget cuts had a negative effect on school performance.

The positive and highly significant relationships of *budget cut* to each dependent variable in the first three models indicate that although the state’s education budget was reduced and/or frozen each year from 2000-2004, school performance still rose during those years. Note that in model 4 *budget cut* does not reach the high significance levels it did in the first three models. This is most likely due to the fact that ACT test scores have remained relatively level across time, as demonstrated in Table 2. The results of models 1, 2, and 3, however, suggest that budget cut years were positively associated with school performance, a finding that could be construed to support Hanushek’s (1997) argument that funding levels and school effectiveness are not necessarily strongly correlated. In turn, the general Hedges et al. (1994a; 1994b) hypothesis is not supported by these findings.

Before wholly rejecting the Hedges et al. hypothesis, though, some factors must be discussed as to why these results were reached. First, the relatively short time period of the budget cuts being in place raise some concerns. Certainly, it is not expected that school performance measures will change immediately after budget cuts are enacted. A time lag of some sort must be assumed – a budget cut during a student’s senior year of high school will affect that student much less than a pupil who experiences cuts every year from grade school to high school.¹⁰ Further, the increased spending by the Missouri state legislature in the 1990s may have had strong effects on the quality of the resources available to students in the years with reduced budgets. For example, expenditures made during the 1990s to improve computer facilities or to hire highly qualified teachers will remain in place even after budget cuts occur. In short, in order to gain a better perspective on the effects of the budget cuts, more time may need to pass to see if students who spent 2000-2004 in school were more negatively effected by the cuts than students who spent only half (or none) of this time period in school.

The evidence supports the second hypothesis across all four models; as *teacher-pupil ratio* decreases, school performance increases. This suggests that as more teachers become available for students, students can receive more individual attention and thus become more likely to perform well academically.

10 Ideally, this study would be able to employ a time lag in the models, but enough time has not passed since the budget cuts were imposed to make such a lag possible, as doing so would eliminate too many observations.

An interesting pattern arises comparing the standardized beta coefficients of *teacher-pupil ratio* across the models. In model 1, where graduation rates are the dependent variable, *teacher-pupil ratio* has the highest standardized beta coefficient when compared to all other variables in the model. When MAP test and ACT scores, however, are employed as the dependent variable, this relatively strong effect loses much of its power to other variables in the model, namely to *reduced/free lunch*. This trend suggests that although the overall relationships between dependent and independent variables seem to follow a similar pattern across models, the influence of particular school inputs and qualities may affect different school outputs in varying manners. *Teacher-pupil ratio* is a relatively stronger explanatory variable when predicting graduation rates than when predicting MAP test or ACT scores.

This finding lends support to the Hedges et al. (1994a) hypothesis that increasing school resources increases student achievement. In other words, the production function model implies that improving school inputs (teacher-pupil ratios) would in turn improve school outputs (graduation rates and/or MAP test and ACT scores). These results also refute the findings of the Coleman Report (1966) by shifting the focus from non-systematic factors, such as family background, to a school-related characteristic, such as teacher-pupil ratios. Further, this finding weakens Hanushek's (1991, 1997) argument. It would seem as though "wisely" spent money may include allotting funds for hiring more teachers.

The evidence presented in all four models supports the third hypothesis. As the percentage of students receiving free and reduced price lunch increases, levels of school performance decrease. The statistical significance of *reduced/free lunch* remains very high across all the models, as do its standardized beta coefficients. This variable emerges as the strongest indicator of school performance relative to all other explanatory variables in models 2, 3, and 4, suggesting that the level of poverty in a school district is a relatively strong predictor of MAP test and especially ACT performance. This falls in line with the argument that the wealth of a school district and school performance are positively correlated. The Berube (1984) and Hedges et al. (1994a; 1994b) hypotheses are also supported by these findings, as is the legal reasoning behind *Serrano* (1971) and all the other similar court cases.

Aside from the three hypotheses, some other results worthy of note include the findings regarding the *rural/urban* and *percentage of minority*

students variables. Model 1 reveals that rural school districts are less likely to graduate their high school seniors than are their urban counterparts. When regressed on MAP test and ACT scores, *rural/urban* loses some of its statistical significance, but the surprising point remains that rural districts are negatively correlated with graduation rates. This trend among rural schools has become the focus of a greater number of studies over the past decade (Beeson & Strange, 2003; Dayton, 1998; Kannapel & DeYoung, 1999), yet more research is necessary in order to discern the causal mechanisms behind this trend. The classification scheme used to code school districts as rural and urban may require the addition of more precise categories, as some suburban school districts could be considered as “borderline” districts, meaning they could be rural or urban.

Percentage of minority students also exhibits some interesting results across the four models. The findings indicate that school districts with higher percentages of minority students have lower graduation rates and MAP test scores than predominately white school districts. Interestingly, though, these effects lose all statistical significance when ACT scores are employed as the dependent variable. This unexpected result suggests that while districts with large minority populations may fail to graduate as many seniors or to perform as well on MAP tests as predominantly white districts, these differences in school performance tend to be less evident when a national standardized test such as the ACT is used as the dependent variable.

The impact of the six independent and control variables have distinctly different patterns of influence in model 4, in which ACT test scores are the dependent variable, than they do in models 1, 2, and 3. Most notably, the effects of *teacher-pupil ratio*, *budget cut*, and *percentage of minority students* all change significantly when ACT scores are the measure of school output. The main difference between ACT scores and graduation rates/MAP test scores as indicators of school performance is that the latter are constructed and dictated by local- and state-based guidelines while ACT scores are not.

Further, the R^2 and adjusted- R^2 values of each model elicit a pattern suggesting that although the influence of some independent variables varies across models, the general fit of each model other than model 2 is remarkably similar – models 1, 3, and 4 all have R^2 values of 0.271 or 0.272. This finding is indeed surprising, especially when considering the diverse effects of each independent variable in model 4, as discussed above. Model 2 is markedly

different from the other three models, however, with an R^2 of 0.410. This high value suggests that this model specification, which employs all MAP scores in a district as its dependent variable, helps explain the most variance in the data relative to the other three dependent variables used in this study. Overall, although there is a remarkable consistency of R^2 values in models 1, 3, and 4, the divergent R^2 value of model 2 and the distinct difference in the effects of independent variables in model 4 suggest that all measures of school output are not equal.

The last finding worthy of note from these analyses concerns the overall influence of school funding and its effects on school performance. The evidence suggests that a wide range of school inputs – including cost functions, school qualities, and contextual factors – can influence school outputs, and that one specific category of variables does not necessarily have an overwhelming and disproportionate impact on school performance relative to other categories. Indeed, the effects of expenditures per pupil, teacher-pupil ratios, poverty measures, rural/urban geographic location, and minority population are all shown to have significant impacts on all four different measures of school output.

Conclusion

As Hanushek (1997) maintains, “throwing money” at schools is not an appropriate fix to school performance problems; “We cannot assume that schools allocate money wisely” (Hanushek 1989a, p. 47). In short, we must think before we spend. This is not to say, though, that funding and school performance are not related. The results presented here suggest that they are closely related, indeed. These findings, however, also indicate that other variables, such as teacher-pupil ratios, rural/urban geographic location, and the percentage of minority students in a district, are closely related to school performance in Missouri.

Serrano (1971) and other related court cases seem to have focused on a relevant public policy concern in education – relatively poor school districts are inherently disadvantaged compared to wealthy districts. The basis of the U.S. education system is giving each student the opportunity to learn and succeed; this study and others have shown that students without access to proper funding may be excluded from taking advantage of this opportunity. Money, when spent on the appropriate factors, has been shown to improve

the school performance of the K-12 education system. *Serrano* was based on poor inner city districts receiving less money than their more affluent counterparts do, while *Tennessee Small School Systems* (1993) was based on poor rural districts being neglected. Regardless of the geographical region, the conclusion remains the same – funding is an important component of an effective school. Further, the main conclusion of the Coleman Report (1966) – a student’s family background, not expenditures per pupil, is the main determinant behind school performance – is not supported by the findings of this study.

The potential avenues for future research in the field of education policy are plentiful. One such issue this study brings to the forefront is the impact of budget cuts on school performance. Such cuts, although unfortunate, offer public policy analysts excellent opportunities to study the impact of funding levels on school performance and student achievement. These cuts offer valuable cases that can serve as experimental situations through which hypotheses can be tested. The relatively short time period of budget reductions included in this study hindered its ability to reach a solid conclusion. Future research must continue to take advantages of these opportunities in order to determine the link between funding and school performance in a more concrete fashion.

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