

**Class Size, Teacher Salaries, and Student Performance on the TAAS**

A Report of

The Texas Educational Excellence Project

January 1999

A key element in virtually all public policies is the distribution of resources. Some policies concern the distribution of services such as police protection, garbage collection, and medical care. Other policies distribute tangible benefits such as public assistance payments, unemployment benefits, and food stamps. Public policies also distribute opportunities, such as affirmative action programs that give disadvantaged groups and individuals opportunities to advance that they might not otherwise have. Decisions concerning how resources will be distributed and who will be the beneficiaries of these distributions are inherently controversial. As one source puts it “...there wouldn’t be a policy conflict if there were not some advantage to protect or some loss to prevent” (Stone 1988, 40). Governments are responsible for allocating scarce resources among many competing groups. Those who benefit from public policies may see them as inherently fair and reasonable, while those who gain few or no benefits may view such policies as inherently unfair.

The distributional consequences of public policies are of central importance to a wide array of issues in political science. For instance, a great deal of research has focused on whether the distribution of urban services is biased against certain groups such as minorities and the poor (Jones 1978, 1983; Mladenka 1981, 1989). Distributional consequences are of central concern in studies of regulatory policies. Agencies captured by the industries they regulate make policies that cater to narrow groups (Bernstein 1955, McCraw 1984). On the other hand, studies on deregulation find the opposite effect, with many efforts at deregulation dispersing benefits widely throughout society rather than concentrating them on narrow groups (Derthick and Quirk 1985). Scholars studying the influence of interest groups in the policymaking process have examined whether groups’ attempts at exerting influence lead to public policies that advantage particular individuals or groups at the expense of larger constituencies (Lowi 1979, Hansen 1991). Research on the policy making activities of Congress also takes distributional consequences into account, focusing on legislators’ tendencies toward particularism in policymaking (Mayhew 1974, Arnold 1979, 1990).

There is great interest among scholars, politicians, and the public over the distributional

consequences of public policies because questions of fairness arise when public policies affect different groups and individuals in different ways. One approach to addressing problems associated with the distributional consequences of public policies is to ensure that all parties affected by a policy are treated exactly alike. While the principle of strict equality in distributions seems plausible, this standard is often viewed as too rigid (Rawls 1971). As one observer points out, the paradox of many distributive problems is that “...equality may in fact mean inequality; equal treatment may require unequal treatment” (Stone 1988, 32). For example, some public policies are intentionally designed to distribute resources in unequal ways. Redistributive policies are premised on the idea that in some instances, certain groups should reap more benefits from public policies than others. Redistributive policies shift resources from haves toward have-nots. Prominent redistributive policy areas include education, welfare, health care, housing, and income stabilization (Meier 1993, 95).

Redistributive policies arise because markets sometimes produce outcomes that are socially undesirable (Wolf 1994, 28). For instance, a pure market environment would result in extreme disparities in income and wealth where many disadvantaged individuals would be unable to afford basic items needed for survival such as food and clothing. A pure market environment would also result in many citizens not being able to afford education. Consequences such as these are deemed socially unacceptable because they erode, rather than build levels of human capital (i.e., productive capacity) in society.

Public funding of education is a particularly important redistributive policy tool used to raise levels of human capital. The logic of public funding of education is that making education universally available to all citizens creates equality of opportunity. The primary means by which the socially disadvantaged obtain upward social mobility is through education. Higher levels of education are linked to higher incomes, making movement from a lower to higher social strata possible (Meier *et al*, 1989). Governments recognize that education is an important public good that enhances human capital, and have long acknowledged the importance of making education universally available to all citizens. The clear emphasis on public funding of

education is creating equality of opportunity for the most disadvantaged in society. Yet there is little systematic evidence as to whether educational finance policies are, in fact, structured to ensure that levels of investment in education are adequate for raising the performance of the most disadvantaged members of society.

This study analyzes the relationship between educational expenditures and investment returns in Texas public schools using 4 years of data covering 1043 Texas school districts. Specifically, this paper evaluates the *differential* impacts educational investments have across different student populations. The decisions that underlie how educational investments are made are inherently political ones. A particular level of investment in education may be adequate for ensuring high performance among one group of students, yet this same level of investment may be inadequate for improving the performance of another group of students. What are the distributive consequences of educational funding policies for white, minority, and low-income students? Do educational funding decisions take into account the generally higher levels of need among minority and low-income students as theory suggests they should? What are the policy implications of expenditure policies that produce differential results across different student populations? Should investment decisions aimed at improving student performance be based on the needs of specific student populations, or should investment decisions be made with more general criteria in mind? These questions are addressed in the remainder of the study.

### **Investments in Education and Student Performance**

A great deal of controversy exists over the role educational investment plays in enhancing student performance (Hanushek 1989, Hedges et. al 1994). Educational investment is a multidimensional concept that typically includes indicators such as student/teacher ratios, instructional spending per pupil, teacher experience, and teacher salaries. In several studies, Hanushek (1986,1989, 1996) argues that resource variables have little relationship to student performance. After reviewing dozens of studies on resources and student performance, Hanushek finds no clear and consistent relationship between variables such as teacher/student ratios,

teacher education, teacher experience, teacher salaries, expenditures per pupil, and overall student performance (Hanushek 1996).

Other research portrays the relationship between resources and student performance in a more positive light. Hanushek's meta-analyses have been critiqued on methodological grounds. One source finds that many of the studies reviewed by Hanushek actually show resources to have a positive impact on student performance (Hedges et al, 1994). Recent research on a national sample of twenty thousand students reveals that class size has a significant impact on student performance, with students in smaller classes consistently performing better than those in larger classes (Wenglinsky, 1997). Advocates of school choice also argue that private schools often perform better than public schools due to resources such as higher teacher salaries and low student-teacher ratios (Chubb and Moe 1990).

While much research has been done on the link between educational expenditures and student performance, our knowledge in the area remains tentative for several reasons. First, many studies on the link between resources and student performance are cross-sectional in nature (Hedges and Greenwald 1996, 80). Cross-sectional studies may provide an inaccurate picture of the true returns from public investment in education because investment dollars normally do not generate immediate returns. The effects of increased spending on education may not be contemporaneous, but may instead be felt one or more years after initial investments have been made. While some studies have taken a longitudinal approach to the relationship between resources and performance, many of these studies are over twenty years old (Hedges and Greenwald 1996).

A second limitation of most research on the relationship between expenditures and student performance is that expenditures are viewed as generic allocations of money. Expenditures are treated as a unidimensional concept, where money either has an impact on student performance or money has no influence on performance. Discussing money in a generic sense is an imprecise way of thinking about expenditures. Economists argue that the allocation of investment resources can be thought of in two distinct ways: capital stock, and capital flows.

Capital stock refers to the amount of capital invested at a given *point* in time (Haley and Schall 1973, 7). An example of a stock is the amount of money appropriated for public education in year  $t$ . Capital flows refer to changes in capital stock over a *period* of time. An example of a flow would be the change in investment dollars appropriated for public education from year  $t$  to year  $t + 1$ .

Separating capital flows from capital stock is an important step in gaining a more precise understanding of the returns of public investment on education. Program performance hinges crucially on levels of capital stock. Although the concept of capital stock has not explicitly been used in educational research, much emphasis has been placed on the linkage between overall levels of investment and student performance. Proponents of school choice argue that private schools perform better than public schools because overall levels of investment in private schools are generally higher than those in public schools. A major area where private schools excel is in the hiring of teachers, an investment that results in lower student-teacher ratios (Chubb and Moe 1990, 103). Proponents of school financing plans that equalize funding levels across school districts also argue that overall levels of investment are the key to better student performance. Districts that spend six thousand dollars on instruction per pupil have an inherent advantage in furnishing students with quality educations over districts that spend only twenty-five hundred dollars on instruction per pupil (Evans et. al 1997). Tentatively then, these studies suggest that *investment levels (i.e., capital stocks) can have a major impact on student performance* and that higher investment levels are more desirable than lower ones.

Can investment returns be assessed by looking at capital flows, rather than stocks? The disadvantage of measuring investment performance by looking solely at capital flows is that capital flows tell us little unless they are related to pre-existing capital stock. Returns on investment flows are conditioned by pre-existing investment levels. Assume one school district increases average teacher salaries by five percent, pushing salaries from thirty thousand dollars to thirty-one thousand five hundred dollars. Assume a second school district increases average teachers salaries by two percent, pushing them from thirty-five thousand to thirty five thousand

and seven hundred dollars. In this example, the rate of change in investment is higher in the first district; yet the second district, with a smaller rate of change in capital flows, still maintains a much larger investment base. The desired return on investment associated with teacher salaries is the hiring of well-qualified teachers. The level of teacher salaries, not the change in teacher salaries is most meaningful in this instance. When levels of capital are extremely low, incremental changes in investment flows may do little to attract quality teachers. When levels of capital are high, the likelihood of attracting better teachers increases, even if changes in capital flows are not as large as those in districts with low levels of capital stock.

### **The Distributional Consequences of Investment Stocks and Investment Flows**

Breaking down educational expenditures into stocks and flows is an important step for better understanding the distributional consequences of educational expenditures. If a crucial concern in education is providing an avenue of upward mobility to the socially disadvantaged, this has tremendous implications for how overall stocks or levels of investment in educational resources should be determined. The *principle of redress* (Rawls 1971) provides a rationale for inequality in the distribution of educational resources. The principle of redress states that “...in order to treat all persons equally, to provide genuine equality of opportunity, society must give more attention to those with fewer native assets and those born into the less favorable social positions...In pursuit of this principle greater resources might be spent on the education of the less rather than the more intelligent” (Rawls 1971, 50-1).

Following this logic, determination of investment levels should be structured in a manner that reflects the needs of the most disadvantaged students, rather than students from middle or upper class backgrounds. Investment decisions in education, such as instructional spending per pupil, spending on teacher salaries, and the hiring of teachers are uniform in the sense that separate allocations are not made to separate student groups such as middle class white, low-income, Hispanic, and African-American students. However, the concept of distributional

equity does come into play in determining the one **overall** level of investment that will be applied to an entire population of students - a level that ideally should reflect the needs of the most disadvantaged student groups.<sup>i</sup>

As an example, consider teacher salaries as an investment. Teacher salaries may be viewed as a proxy for teacher quality because higher salaries generally attract higher quality individuals as teachers (Hanushek and Pace 1995). A school district with an average teacher salary of thirty one thousand dollars may find it difficult to attract high quality teachers if average teacher salaries in another school district are thirty eight thousand dollars. Thus, teacher quality may differ radically across these districts. Middle class students may fare well in schools where teacher quality is low because they can compensate for this problem in other ways. These students may have stable family backgrounds and parents that are closely involved in overseeing their educational progress, home computers, and other learning resources that allow them to overcome the problem of low quality instruction. In this sense, a level of investment of thirty one thousand dollars in teacher salaries may be entirely adequate for producing satisfactory student performance among middle class students.

Contrast the above scenario to one in which low-income and minority students are put into an environment where the level of investment in teacher salaries and overall teacher quality are both low. Minority and low-income students often come from unstable family backgrounds. Family background has an extremely important influence on student performance (Coleman 1966, Chubb and Moe (1990, 106-7). Generally, students who come from families with higher incomes do better than students who come from families with lower incomes. Families with higher annual incomes can spend more on important learning tools such as computers,

---

<sup>i</sup> Of course this logic implies that investment resources may be wasted because the marginal impact of resource allocations aimed at benefitting disadvantaged students will tremendously benefit these students, but will have much less impact on students from better social and economic backgrounds. There is always a tradeoff between equality and efficiency in policymaking (Okun 1975). In the case of education, efficiency may not be as great a concern as leveling the playing field for disadvantaged students.

calculators, and encyclopedias. Parents from higher socioeconomic strata also tend to interact more with teachers and other school officials than parents from lower socioeconomic strata (Chubb and Moe 1990, 172-3). Disadvantaged students lack outside factors like these that would allow them to compensate for poor classroom instruction. Thus, an investment level in teacher salaries of thirty one thousand dollars could be wholly inadequate in this case. To positively address inherent inequalities across different student populations, the determination of a level of investment in teacher salaries would have to be made with reference to the most disadvantaged students, rather than middle or upper-middle class students. A similar logic would apply in making investment decisions about how many teachers to hire. Middle class students may perform well in high student-teacher ratio environments while minority and low-income students might perform very poorly because of a greater demand for highly individualized attention.

Are distributional consequences present in investment decisions that affect diverse student populations? Are some student groups hurt at the expense of other student groups when investment allocations are made? There is little systematic empirical evidence on these questions. The remainder of this paper will examine these questions, analyzing the effects of investment stocks and flows on white, African-American, Hispanic, and low-income students in Texas.

### **Investments and Distributional Equity - Educational Finance in Texas**

To what extent are investment levels influential in shaping student performance? What are the distributive consequences of investment levels to white, minority, and low-income students? What impact do incremental investment flows have in shaping student performance? The remainder of the paper examines this question using data on investment levels and student performance for 1043 school districts in Texas. The data in the analysis cover the years 1994 to

1997 and were pooled for a total of 4172 cases over the time frame of the study.<sup>ii</sup> Several production function models are used to examine the impact of resources on student performance. Autocorrelation is often a problem in pooled data. Accordingly, each model in the analysis included a set of three dummy variables representing individual years to control for serial autocorrelation in the data.<sup>iii</sup>

### **Dependent Variable - Measuring Student Performance**

State law in Texas mandates that public school students in grades 3 through 10 take standardized reading and mathematics tests every year. Tests like these clearly do not measure something as broad as the overall learning experience, but they do assess whether students are picking up basic academic skills. The Texas Education Agency also ranks schools and school districts based on student pass rates on these exams, indicating that these scores are important performance evaluation tools. What are the returns on investment in this case? The desired result of public investment in education, at a minimum, is the production of students who have at least basic reading and math skills. High investment returns would be indicated by high district pass rates on these exams. The dependent variable used in the analysis is the percentage of students in each school district who passed all standardized reading and mathematics tests

---

<sup>ii</sup> All data for the analysis were obtained from the Texas Education Agency web site. The data were relatively clean. However, there were instances of obvious errors such as missing data points for individual variables and misplaced decimal points. The data were cleaned by examining regression diagnostics for extreme values.

<sup>iii</sup> Regression diagnostics were examined for other potential problems. Heteroskedasticity, assessed using White's test, was not found to be a significant problem across the eight models. Tolerances were examined to determine whether colinearity was a problem. Tolerance statistics across the models were all within acceptable ranges. Studentized residuals were examined for influential observations. Results across individual models revealed relatively few significant studentized residuals.

each year. Since distributional equity is of primary concern, pass rates for white, African-American, Hispanic, and low-income students were analyzed in separate models.

### **Independent Variables - Investment Levels**

Various meta-analyses of student performance have assessed the impact of a many variables. However, most attention has been given to three variables: student-teacher ratios, teacher education, and teacher experience (Hanushek 1996; Hedges and Greenwald 1996). A similar strategy is adopted here. The first indicator of investment resources is the student-teacher ratio for each school district. Student-teacher ratios can be viewed as a stock or level variable. Hiring teachers is a costly proposition. Yet the expected payoff of such investments is smaller class sizes, which create opportunities for more individualized attention to students and more manageable classroom environments for teachers. Districts with high student-teacher ratios have low investment levels, which may dampen the likelihood of districts' achieving and maintaining high student pass rates on exams. This is especially true in the case of low-income and minority students who may need more individualized attention to excel in the school. Districts with low student-teacher ratios have high investment levels and expect that allocating dollars to reduce class sizes will pay off in the form of better student performance on standardized skills comprehension tests.

Teacher education and teacher experience are difficult to conceive of as investment level variables by themselves. These two variables are best thought of as the result of teacher salaries, an investment level variable. The presence of well-educated and experienced teachers hinges on teacher salaries (Hanushek and Pace 1995). Districts with high average teacher salaries can presumably attract better teachers than those with low average teacher salaries. As teacher quality improves, student performance should also improve. The marginal impact of higher teacher salaries should be especially great when looking at the exam performance of low-income and minority students, given that higher salaries generally attract better teachers. Thus,

the second level variable used in the analysis was the average teacher salary in each school district.

In each of the models presented below, both the student-teacher ratio and teacher salary variables were lagged by one year. Lagging is consistent with the idea that investment in education should be viewed as a long-term proposition, where returns are realized over time. High teacher salaries and low student-teacher ratios may not immediately result in better student performance. A more likely scenario is that the returns on these investments are distributed gradually over time, making lagging an appropriate strategy for understanding the long-term returns of educational investment levels on student performance.

In addition to lagging the investment level variables, district pass rates were lagged by one year and were included as independent variables in each respective model. Regression models with both lagged dependent and lagged independent variables as regressors are called distributed lag models.<sup>iv</sup> The dependent variable, district pass rates, was lagged because trends in scores are an important consideration when looking at longitudinal changes in district exam pass rates. Overall district pass rates in year  $t$  are likely a function of overall district pass rates from year  $t-1$ . In cases like this, lagged dependent variables provide powerful controls for past influences on current events.

The logic of the distributed lag model applies well in the current instance because changes in test scores and the investments directed at improving test scores are best understood when looked at over time. Investment results do not appear instantaneously, meaning that changes in district pass rates should be realized over time.

## **Controls**

---

<sup>iv</sup> For a discussion of autoregressive and distributed-lag models, see Gujarati (1993), pp. 505-52 and Kennedy (1992) pp. 140-43.

The makeup of student populations can vary widely across school districts. Urban school districts tend to have larger numbers of African-American, Hispanic, and low-income students than suburban school districts. Minority students tend to score lower on standardized tests than Anglo students (Rong and Grant 1992). The probability of low-income students having difficulties performing well on standardized tests is also high. Generally, students who come from families with higher incomes do better than students who come from families with lower incomes (Coleman 1966; Chubb and Moe 1990, 106-7). Three variables were used to control for district student makeup. The first was the percentage of African American students per district. The second was the percentage of Hispanic students per district. The third environmental diversity variable was the percentage of low income students per district. Specifically, this variable is defined as students who are eligible for free or reduced price meals through school lunch programs.

## **Findings**

Table One presents results from the production-function models on investment levels and the performance of specific student groups. The numbers presented in Table One are unstandardized slope coefficients for the teacher salary and student-teacher ratio variables from the white, African-American, Hispanic, and low-income student models. All four models included the same set of independent variables in order to facilitate the comparison of regression coefficients across models.<sup>v</sup> Complete results for these models can be found in Appendix One. The controls for percent African-American, Hispanic, and low income students are in the predicted negative direction.<sup>vi</sup> All four models also show a strong, positive relationship between

---

<sup>v</sup> The percent African-American, Hispanic, and low-income student variables along with the teacher salary, student teacher ratio, and dummy variables were included in each of the models. Slope coefficients for teacher salaries presented in Tables One and Two are multiplied by 1000 for ease of interpretation.

lagged test scores and current year test scores.

Table One indicates that investment levels play a significant role in structuring student performance. Average teacher salaries have a strong impact on pass rates for white, African-American, Hispanic, and low-income students. The second level variable indicates that class size has a negative impact on overall district pass rates for Hispanic and low-income students. Results for white and African-American students were not statistically significant.

### **Table 1 About Here**

Comparisons across the four student populations reveal important distributional consequences associated with levels of investment in educational resources. The slopes for white, Hispanic, African-American, and low-income student groups indicate the differential impacts of teacher salaries on student performance. In all cases, higher teacher salary levels have a positive impact on district pass rates; however, Hispanic students benefit the most from higher teacher salaries. For every thousand dollar increase in the level of teacher salaries, there is a .62 percentage point increase in Hispanic student pass rates in the same year. In the following year, there is a .30 percentage point increase in Hispanic student pass rates. For each successive year, the impact of teacher salary levels declines geometrically.<sup>vii</sup> The slopes for African-American and low-income students are smaller than those for Hispanic students, with an increase in teacher salary levels of one thousand dollars bringing about a .40 percentage point increase in student pass rates in the same year for both groups. The slope for white students is especially interesting when compared

---

<sup>vi</sup> In the equation predicting white student pass rates, the percent Hispanic student variable was found to have a positive impact on the pass rates of white students. The percent low-income and percent Hispanic student variables are highly correlated, indicating that multicollinearity is the likely cause of this finding. In the interest of comparing slope coefficients across models for all student groups, the same set of independent variables was included in each model.

<sup>vii</sup> Second year effects are determined by multiplying the coefficient for the lagged dependent variable (e.g., lagged Hispanic pass rates) by the coefficient for the lagged independent variable of interest (e.g., lagged teacher salaries).

to those for minority and low-income students. For every one thousand dollar increase in teacher salary levels, there is only a .18 percentage point increase in pass rates among white students in the same year. In the following year, there is a .11 percentage point increase in white student pass rates. The impact of teacher salary levels declines geometrically over each successive year.

The findings for the impact of class size on average district pass rates also reveal important distributional consequences across groups. Higher student-teacher ratios generally have a negative impact on district pass rates. The strongest effects of higher student-teacher ratios are felt among Hispanic students. For every additional student per class, average district pass rates for Hispanic students decline by .28 of a percentage point in the same year. In the following year, there is a .13 percentage point decline in average district pass rates for Hispanic students. The performance of low-income students also suffers as a result of higher student-teacher ratios. For every additional student per class, average district pass rates for low-income students decline by .26 of a percentage point in the same year, with negative impacts declining geometrically over successive years.

Significant results for the class size variable were not obtained in the equations for white and African-American district pass rates; however, the slopes for both groups were in the predicted negative direction. For white students, higher student-teacher ratios may not play as significant a role in dampening student performance as they do for Hispanic and low-income students. White students often have more stable family backgrounds and come from families higher in the socioeconomic strata than Hispanic and low-income students. Factors external to the classroom such as high parental interest in education and the ability to spend more on educational tools like computers may allow many white students to prosper even in crowded classrooms. The results for African-American students are less clear. The lack of significant findings for African-American students may be due in part to issues of problem tractability (Mazmanian and Sabatier 1989). For minority students, problems such as single-parent households, poverty, and lack of parental involvement in education are most severe among African-American students. In the face of such severe problems, student-teacher ratios may not

play a very significant role in shaping the performance of African-American students.

Improving educational performance among African-American students may require more than just resources, such as improved methods of education.

### **Differential Impacts - Investment Stocks and Flows**

Investment stocks and flows are interrelated. Examining investment flows without relating them to investment stocks can lead to unreasonable and inaccurate expectations about returns on incremental investments. Yet studying investment stocks alone is also problematic because it does not provide insight onto the question of how levels and flows interact. Table One revealed that investment levels play an important role in shaping white, African-American, Hispanic, and low-income student exam pass rates. Having established that levels matter, examining the impact of both investment levels and flows to determine how incremental changes in investment shape performance is also important.

The second production-function assesses the impact of both investment level and investment flow variables on exam performance. Looking at both levels and flows contemporaneously makes it difficult to sort out the separate impacts of each type of expenditure. To remedy this problem, both the student-teacher ratio and average teacher salary variables were lagged one year. These variables were lagged in order to create a baseline against which incremental changes in *future* investment flows could be evaluated. To measure investment flows, the student-teacher ratio and average teacher salary variables were differenced; that is, last year's value is subtracted from this year's value. Differencing results in variables that can be used to measure the *change* in resource flows from the baseline established using the lagged level variables discussed earlier. Including both sets of variables makes it possible to evaluate both the impact of investment levels and changes in investment levels on exam performance.

The second model contained all the control variables used in the original model, lagged

pass rates, plus the level and flow variables. Table Two shows the impact of both investment levels and flows on exam performance across the four student populations. Result for each individual model are presented in Appendix Two.

### **Table 2 About Here**

The findings from Table 2 indicate that investment levels are significant predictors of exam pass rates even when controlling for the impact of investment flows. The most pronounced distributional consequences occur in the case of Hispanic students. Specifically, for every thousand dollar increase in teacher salaries, average district pass rates for Hispanic students rise by .68 of a percentage point in the same year. In the following year, average district pass rates rise by .32 of a percentage point. The impact of teacher salary levels declines geometrically for each successive year. Results for the low-income and African-American student populations also reveal substantial distributional consequences, with coefficients of .51 and .37, respectively. The smallest distributional consequences stemming from teacher salary levels are found among white students. With a value of .23, the coefficient for white students is nearly half a percentage point lower than the coefficient for Hispanic students, indicating that white students benefit far less than Hispanic students from increases in teacher salary levels.

Across all four models, the coefficients for the class size variables reveal that the effects of student-teacher ratios vary across different student populations. Hispanic and low-income students fare poorly as a result of high student-teacher ratios. For every one student rise in the district student-teacher ratio average, there is a .32 percentage point decline in the test scores of Hispanic students and a .34 percentage point decline in the test scores of low-income students. While the results from the first set of models show higher student-teacher ratios have no significant affect on the performance of white students, when both investment levels and flows are taken into account, higher student-teacher ratios do have an affect on the performance of white students. However, the slope coefficient of -.14 indicates that white student performance does not decline nearly as much as the performance of Hispanic and low-income students does in

the face of higher student-teacher ratios.

The effects of investment flows were assessed by differencing the teacher salary and student-teacher-ratio variables. Results across three of the four models indicate that investment flows contribute positively to exam pass rates. A one-time increase in teacher salaries of a thousand dollars results in a one time .62 percentage point rise in average pass rates among Hispanic students. The impact of a one-time thousand dollar increase in teacher salaries for low-income and white students are much lower, indicated by slope coefficients of .38 and .29, respectively. Across all four models, a one student increase in the average student teacher ratio per district leads to approximately a one time .75 percentage point decline in average exam pass rates.

Although the coefficients for the flow variables are fairly large, the overall net impacts of the flow variables are much smaller than those of the stock(level) variables. The treatment of investments as stocks means that impacts can be expected year after year unless the stock of capital disappears (which is highly unlikely in this case). Additionally, the effects of investment levels distribute over time, while the effects of flow variables are felt only for one time period (see Table 3 for descriptive statistics).

### **Equalizing Performance Across Student Groups**

The findings presented above indicate that significant distributional consequences are associated with investments in educational resources. In general, low-income and minority students benefit more from higher levels of investment in educational resources than white students. A cursory examination of these findings would suggest that to equalize performance across all student groups, the solution is to simply increase expenditures for low-income and minority students until performance across all student groups is equalized. While this logic is appealing, it is important to first examine whether the increases in investment needed to achieve such changes are politically and fiscally feasible. For example, what sort of increase in teacher

salaries would be needed to equalize exam performance among white and Hispanic students? Table Four presents equations for white, Hispanic, African-American, and low income student performance that can be used to address such questions.

#### **Table Four About Here**

The equations in Table Four treat an district pass rates for each student group as a function of an unknown teacher salary level multiplied by the respective slope coefficient for teacher salaries shown in Table One. The equations assume that all other pertinent factors responsible for pass rates are held constant, making it possible to examine the effects of teacher salaries in isolation. By setting one equation equal to another, it is possible to algebraically determine the particular teacher salary level needed to result in the equations being equal. Since white students have the highest average exam pass rate, the equation for white students is used as a baseline for comparison. For example, setting the equation for white students equal to that for Hispanic students and solving for the unknown quantities reveals that a forty five thousand dollar increase in teacher salaries would be necessary to fully equalize the exam performance of white and Hispanic students. Equalizing the exam performance of white and African-American students would require approximately a one hundred thirty thousand dollar increase in teacher salaries. Low-income and white student performance could be equalized through an increase in teacher salaries of approximately sixty nine thousand dollars. As the monetary costs of closing performance gaps across student populations are quite high, the conclusion will discuss the implication of these findings and examine alternative strategies for improving the performance of minority and low-income students.

#### **Conclusion**

An important point demonstrated by the above exercise is that while money may be part

of the solution to improving the performance of minority and low-income students, increases in educational investments clearly cannot be viewed as the only solution for effecting such changes. One time non-incremental increases that double or even triple existing resources bases are unrealistic. High levels of investment capital are influential in shaping student performance, but increases in capital flows, rather than one time non-incremental investments, may be the only feasible solution for raising capital stocks. Consistent increases in capital flows result in higher levels of capital stock over time. However, sporadic increases in investment flows may do little to jolt programs out of ingrained patterns of performance. The key to building up capital stocks then, is *consistently increasing* capital flows so that the cumulative impact of capital flows results in higher levels of capital stock over time. Incrementalism is the norm in policymaking, and slowly building capital stocks may be the only politically and fiscally feasible way of using money to chip away at performance barriers across different student populations.

Since relying on money alone to close performance gaps is unrealistic, other alternatives for improving the performance of minority and low-income students need to be considered. One possibility is the increased hiring of minority teachers. Minority teachers serve as positive role models for minority students. The presence of more minority teachers may also help combat discrimination in tracking and grouping, such as attempts at labeling minority students as low-achievers (Meier and Stewart 1991). Teacher quality could also be improved by making teacher competency tests mandatory. Several states that have adopted such measures have found that a surprising number of experienced teachers fail these tests (Dye 1997, 431). Minority and low-income students are especially in need of high quality classroom instruction, given the unstable family backgrounds of many of these students. Greater reliance on teacher competency tests would a fairly low cost way of ensuring that minimum standards of teacher quality are being met. Instructional technologies such as the increased use of computers may also help improve the performance of minority and low-income students.

There is no guarantee that any of the reforms proposed here will help close performance gaps among white, minority, and low-income students. In some cases, our knowledge of how to

solve problems in educating disadvantaged students is quite low. The findings for African-American students presented in Tables One and Two, for instance, reveal that altering class size may do little to improve the performance of African-American students. Similarly, to equalize the performance of African-American and white students through teacher salaries would require over a one hundred thirty thousand dollar increase in teacher salaries. It is difficult to predict what factors will lead to improvements among African-American students because some of the problems faced by these students are among the most intractable in society. Problems such as poverty, high teenage pregnancy rates, unstable family environments, and racial discrimination through academic grouping are especially prevalent among African-American students. Severe environmental conditions that occur outside of school environments may make it difficult to develop adequate solutions for improving performance among African-American students.

In spite of these caveats about the relationship between educational investments and student performance, the finding that educational finance has distributive consequences serves as an important reminder that one cannot assume that the effects of public policies are constant across all cases. Focusing on distributional consequences is important from a program evaluation standpoint because it encourages the use of a broad lens in evaluating the effects of programs - one that recognizes that policies may have desired effects in some instances, but undesirable effects in others. One could simply assume that the effects of educational investments are constant across diverse student groups, yet as the findings here reveal, examining the distributional consequences across a variety of groups provides a much richer picture of the true relationship between educational expenditures and student performance.

## References

- Arnold, R. Douglas. 1979. *Congress and the Bureaucracy: A Theory of Influence*. New Haven, CT.: Yale University Press.
- Arnold, R. Douglas. 1990. *The Logic of Congressional Action*. New Haven, CT: Yale University Press.
- Bernstein, Marver. 1955. *Regulating Business by Independent Commission*. Princeton, N.J.: Princeton University Press.
- Chubb, John and Terry Moe. 1990. *Politics, Markets, and America's Schools*. Washington, D.C.: Brookings.
- Coleman, James S. et al., 1966. *Equality of Educational Opportunity*. Washington, D.C.: U.S. Government Printing Office.
- Derthick, Martha, and Paul J. Quirk. 1985. *The Politics of Deregulation*. Washington, D.C.: Brookings Institution.
- Dye, Thomas R. 1997. *Politics in States and Communities*, 9<sup>th</sup> Ed. New Jersey: Prentice Hall.
- Evans, William N., Sheila E. Murray, and Robert Schwab. 1997. "Schoolhouses, Courthouses, and Statehouses After Serrano." *Journal of Policy Analysis and Management* 16 (Number 1), 10-31.
- Fernandez, Raquel and Richard Rogerson. 1997. "Education Finance Reform: A Dynamic Perspective." *Journal of Policy Analysis and Management* 16 (Number 1), 67-84.
- Goodsell, Charles. 1994. *The Case for Bureaucracy*, 3<sup>rd</sup> Ed. Chatham, NJ: Chatham House.
- Gujarati, Damodar, N. *Basic Econometrics*, 2<sup>nd</sup> Ed. New York: McGraw-Hill.
- Haley, Charles W. and Lawrence D. Schall. 1973. *The Theory of Financial Decisions*. New York: McGraw-Hill.
- Hanushek, Erik. 1986. "The Economics of Schooling: Participation and Performance." *The Journal of Economic Literature* 24 (Number 3), 1141-1177.
- Hanushek, Erik A. 1989. "The Impact of Differential Expenditures on School Performance." *Educational Researcher* 18 (Number 2), 45-61.
- Hanushek, Erik A. 1996. "School Resources and Student Performance." In *Does Money Matter?*, Gary Burtless, ed. Washington, D.C.: Brookings Institution.
- Hanushek, Erik A. and Richard R. Pace. 1995. "Who Chooses to Teach (and Why)?" *Economics of Education Review* 14, 107-117.

Hansen, John Mark. 1991. *Gaining Access: Congress and the Farm Lobby, 1919-1981*. Chicago: University of Chicago Press.

Hedges, Larry V. and Rob Greenwald. 1996. "Have Times Changed? The Relation Between School Resources and Student Performance." In *Does Money Matter?*, Gary Burtless, ed. Washington, D.C.: Brookings.

Hedges, Larry V., Richard D. Laine, and Rob Greenwald. 1994. "Does Money Matter? A Meta-Analysis of Studies of the Effects of Differential School Inputs on Student Outcomes." *Educational Researcher* 23 (Number 3), 5-14.

Jones, Bryan D., Saadia Greenberg, Clifford Kaufman, and Joseph Drew. 1978. "Service Delivery Rules and the Distribution of Local Government Services." *Journal of Politics* 40 (Number 2), 332-68.

Jones, Bryan D. 1983. *Governing Urban America: A Policy Focus*. Boston: Little, Brown.

Kennedy, Peter. 1992. *A Guide to Econometrics*, 3<sup>rd</sup> Ed. Cambridge, MA: MIT Press.

Lowi, Theodore J. 1979. *The End of Liberalism: The Second Republic of the United States*, 2<sup>nd</sup> Ed. New York: Norton.

Mayhew, David. 1974. *Congress: The Electoral Connection*. New Haven, CT.: Yale University Press.

Mazmanian, Daniel A. and Paul Sabatier. 1989. *Implementation and Public Policy*. New York: University Press of America.

McCraw, Thomas K. 1984. *Prophets of Regulation*. Cambridge, MA.: Harvard University Press.

Meier, Kenneth J., Joseph Stewart, Jr., and Robert E. England. 1989. *Race, Class, and Education: The Politics of Second-Generation Discrimination*. Madison, WI.: University of Wisconsin Press.

Meier, Kenneth J. 1991. *The Politics of Hispanic Education*. Albany: SUNY Press.

Meier, Kenneth J. 1993. *Politics and the Bureaucracy: Policymaking in the Fourth Branch of Government*, 3<sup>rd</sup> Ed. Pacific Grove, CA.: Brooks/Cole.

Mladenka, Kenneth R. 1981. "Citizen Demands and Urban Services: The Distribution of Bureaucratic Response in Chicago and Houston." *American Journal of Political Science* 25 (Number 4), 693-714.

Mladenka, Kenneth R. 1989. "Blacks and Hispanics in Urban Politics." *American Political Science Review* 83 (Number 1), 165-92.

Okun, Arthur. 1975. *Equality and Efficiency: The Big Tradeoff*. Washington, D.C.: Brookings Institution.

Rawls, John. 1971. *A Theory of Justice*. Cambridge, MA.: The Belknap Press of Harvard University Press.

Rong, Xue Lan and Linda Grant. 1992. "Ethnicity, Generation, and School Attainment of Asians, Hispanics, and Non-Hispanic Whites." *Sociological Quarterly* 33 (Number 4), 625.

Stone, Deborah. 1988. *Policy Paradox and Political Reason*. New York: HarperCollins.

Wenglinsky, Harold. 1997. *How Educational Expenditures Improve Student Performance and How They Don't*. Princeton, NJ: Educational Testing Service.

Wolf, Charles. 1994. *Markets or Governments: Choosing Between Imperfect Alternatives*, 2<sup>nd</sup> Ed. Cambridge, MA.: MIT Press.

Table 1 - Investment Levels and Returns to Different Student Populations

Group	Teacher Salaries	Student/Teacher Ratio
Hispanic	.622*	-.284*
Low-Income	.449*	-.258*
African-American	.407*	-.138
White	.180*	-.057

Note: Numbers in cells are unstandardized regression coefficients. \* p < .05

Table 2 - The Impact of Investment Levels and Flows on Student Performance

Group	Teacher Salaries (Level)	Teacher Salaries (Flow)	Student/Teacher Ratio (Level)	Student/Teacher Ratio (Flow)
Hispanic	.681*	.619*	-.315*	-.718*
Low-Income	.511*	.381*	-.344*	-.748*
African- American	.369*	.322*	-.238	-.780*
White	.232*	.296*	-.142*	-.735*

Note: Numbers in cells are unstandardized regression coefficients. \*p <.05

Table 3 - Descriptive Statistics for Investment Levels and Flows

Variable	Mean	Standard Deviation
Investment Levels		
Teacher Salaries	27452	2550
Student-Teacher Ratio	13.44	2.80
Investment Flows		
Teacher Salaries	1096	1243
Student-Teacher Ratio	.146	.977

Table Four - Equations for Teacher Salary Levels and Student Performance

---

White Students	pass rate = $74.5 + .180 \text{ ts}^*$
Hispanic Students	pass rate = $54.6 + .622 \text{ ts}$
African-American Students	pass rate = $44.8 + .407 \text{ ts}$
Low-Income Students	pass rate = $56.9 + .449 \text{ ts}$

---

\* ts denotes teacher salary

Appendix - Results for Individual Models

Table 1  
Investment Levels and Student Performance on Standardized Tests - White Students  
(Dependent Variable = Percentage of Students Passing Exams)

Independent Variable	Parameter	Standard Error	t statistic
Lagged Pass Rates ( <i>t</i> -1)	.605	.011	56.71*
Investment Levels			
Lagged Teacher Salaries ( <i>t</i> -1)	.0002	.00005	3.28*
Lagged Student- Teacher Ratio ( <i>t</i> -1)	-.056	.042	-1.35
Controls			
% Low Income	-.727	.009	-7.29*
% African-American	-.006	.011	-.58
% Hispanic	-.035	.007	4.88*
Constant = 27.47			
R2 = .67			
Adj. R2 = .66			
F = 863.79			
N of Cases = 4068			

\*  $p < .05$

Notes: Dummy variables used to control for autocorrelation are not reported. Teacher salary coefficients rounded to four decimal points.

Table 2  
Investment Levels and Student Performance on Standardized Tests - Hispanic Students  
(Dependent Variable = Percentage of Students Passing Exams)

Independent Variable	Parameter	Standard Error	t statistic
----------------------	-----------	----------------	-------------

Lagged Pass Rates ( <i>t</i> -1)	.479	.014	34.84*
Investment Levels			
Lagged Teacher Salaries ( <i>t</i> -1)	.0006	.0001	6.19*
Lagged Student- Teacher Ratio ( <i>t</i> -1)	-.284	.083	-3.44*
Controls			
% Low Income	-.045	.018	-2.53*
% African-American	-.079	.019	-4.16*
% Hispanic	-.053	.013	-4.09*

Constant = 17.97  
R2 = .52  
Adj. R2 = .51  
F = 404.76  
N of Cases = 3395

\*  $p < .05$

---

Notes: Dummy variables used to control for autocorrelation are not reported. Teacher salary coefficients rounded to four decimal points.

Table 3  
Investment Levels and Student Performance on Standardized Tests - African-American Students  
(Dependent Variable = Percentage of Students Passing Exams)

Independent Variable	Parameter	Standard Error	t statistic
Lagged Pass Rates ( <i>t</i> -1)	.643	.002	26.01*
Investment Levels			
Lagged Teacher Salaries ( <i>t</i> -1)	.0004	.0001	2.67*
Lagged Student-Teacher Ratio ( <i>t</i> -1)	-.138	.160	-.86
Controls			
% Low Income	-.052	.031	-1.68
% African-American	-.016	.026	-.60
% Hispanic	.016	.025	.67
Constant = 5.61			
R2 = .62			
Adj. R2 = .62			
F = 198.69			
N of Cases = 1083			

\*  $p < .05$

Notes: Dummy variables used to control for autocorrelation are not reported. Teacher salary coefficients rounded to four decimal points.

Table 4  
Investment Levels and Student Performance on Standardized Tests - Low-Income Students  
(Dependent Variable = Percentage of Students Passing Exams)

Independent Variable	Parameter	Standard Error	t statistic
----------------------	-----------	----------------	-------------

Lagged Pass Rates ( <i>t</i> -1)	.553	.012	47.51*
Investment Levels			
Lagged Teacher Salaries ( <i>t</i> -1)	.0004	.00007	6.40*
Lagged Student- Teacher Ratio ( <i>t</i> -1)	-.258	.016	-4.58*
Controls			
% Low Income	.022	.013	1.72
% African-American	-.199	.014	-14.01*
% Hispanic	-.103	.009	-11.03*

Constant = 18.34  
R2 = .67  
Adj. R2 = .66  
F = 917.76  
N of Cases = 4079

\*  $p < .05$

---

Notes: Dummy variables used to control for autocorrelation are not reported. Teacher salary coefficients rounded to four decimal points.

Table 5  
The Impact of Investment Levels and Flows on Student Performance - White Students  
(Dependent Variable = Percentage of Students Passing Exams)

---

Independent Variable	Parameter	Standard Error	t statistic
Lagged Pass Rates ( <i>t</i> -1)	.602	.011	56.59*

Investment Levels

Lagged Teacher Salaries ( <i>t-1</i> )	.0002	.00006	4.13*
Lagged Student-Teacher Ratio ( <i>t-1</i> )	-.142	.044	-3.23*

Investment Flows

Teacher Salaries	.0003	.0001	2.76*
Student-Teacher Ratio	-.736	.114	-6.44*

Controls

% Low Income	-.075	.009	-7.47*
% African-American	.005	.011	-.44
% Hispanic	.035	.007	4.95*

Constant = 27.27  
R2 = .66  
Adj. R2 = .66  
F = 718.58  
N of Cases = 4065

\*  $p < .05$

---

Notes: Dummy variables used to control for autocorrelation are not reported. Teacher salary coefficients rounded to four decimal points.

Table 6  
The Impact of Investment Levels and Flows on Student Performance - Hispanic Students  
(Dependent Variable = Percentage of Students Passing Exams)

---

Independent Variable	Parameter	Standard Error	t statistic
Lagged Pass Rates ( <i>t-1</i> )	.478	.014	34.78

Investment Levels			
Lagged Teacher Salaries ( <i>t-1</i> )	.0007	.0003	6.67*
Lagged Student-Teacher Ratio ( <i>t-1</i> )	-.315	.083	-3.78*
Investment Flows			
Teacher Salaries	.0006	.0002	2.72*
Student-Teacher Ratio	-.718	.241	-2.98*
Controls			
% Low Income	-.042	.018	-2.36*
% African-American	-.082	.091	-4.26*
% Hispanic	-.055	.013	-4.27*
Constant = 16.39			
R2 = .52			
Adj. R2 = .51			
F = 333.84			
N of Cases = 3392			

\*  $p < .05$

---

Notes: Dummy variables used to control for autocorrelation are not reported. Teacher salary coefficients rounded to four decimal points.

Table 7  
The Impact of Investment Levels and Flows on Student Performance - African-American Students  
(Dependent Variable = Percentage of Students Passing Exams)

---

Independent Variable	Parameter	Standard Error	t statistic
Lagged Pass Rates ( <i>t-1</i> )	.642	.025	26.01

Investment Levels

Lagged Teacher Salaries ( <i>t-1</i> )	.0004	.0002	2.29*
Lagged Student-Teacher Ratio ( <i>t-1</i> )	-.238	.168	-1.42

Investment Flows

Teacher Salaries	.0003	.0002	-1.42*
Student-Teacher Ratio	-.780	.370	-2.11*

Controls

% Low Income	-.062	.031	-1.99*
% African-American	-.009	.027	-.36
% Hispanic	.024	.025	.96

Constant = 8.32  
R2 = .63  
Adj. R2 = .62  
F = 163.73  
N of Cases = 1082

\*  $p < .05$

---

Notes: Dummy variables used to control for autocorrelation are not reported. Teacher salary coefficients rounded to four decimal points.

Table 8

The Impact of Investment Levels and Flows on Student Performance - Low-Income Students  
(Dependent Variable = Percentage of Students Passing Exams)

---

Independent Variable	Parameter	Standard Error	t statistic
Lagged Pass Rates ( <i>t-1</i> )	.549	.012	47.32*
Investment Levels			
Lagged Teacher Salaries ( <i>t-1</i> )	.0005	.00007	7.12*
Lagged Student-Teacher Ratio ( <i>t-1</i> )	-.344	.059	-5.87*

Investment Flows

Teacher Salaries	.0004	.0001	2.79*
------------------	-------	-------	-------

Student-Teacher Ratio	-.748	.145	-5.15*
-----------------------	-------	------	--------

Controls

% Low Income	.021	.013	1.64
--------------	------	------	------

% African-American	-.200	.014	-14.00*
--------------------	-------	------	---------

% Hispanic	-.104	.009	-11.09*
------------	-------	------	---------

Constant = 17.79

R2 = .67

Adj. R2 = .67

F = 759.46

N of Cases = 4076

\*  $p < .05$

---

Notes: Dummy variables used to control for autocorrelation are not reported. Teacher salary coefficients rounded to four decimal points.

Endnotes