POLICY REPORT

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The Determinants of Student Achievement in Ohio's Public Schools

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Executive Summary

One of the most important, and seemingly intractable, policy problems facing the state of Ohio is how to improve student achievement in public schools. This report rigorously analyzes the factors most commonly thought to affect student achievement. It uses quantitative econometric techniques to separate the factors that truly matter from the ones that only distract policy makers from effective change. To capture the changing dynamics of both different academic subjects and students at different ages, this analysis evaluates student performance in five subjects (math, reading, writing, science and citizenship) across grades 3 to 12. This combination gives us 21 separate analyses, or mathematical models. Controls were also included for geography, student socio-economic status, race, and learning disability.

This study breaks new ground by also analyzing the factors that influence student performance in charter schools. Charter schools are a new system of public schools, created by the legislature in 1997. To date they are authorized only in large cities. By assessing whether the inputs that affect achievement in traditional public schools are similar to those that affect achievement in charter schools, we can determine to what degree these two public institutions are similar.

Many of the factors commonly held to be important to student achievement simply are not. The regression analysis finds the following *factors do improve student achievement: increasing student attendance, increasing the proportion of teachers who are rated as 'highly qualified,' increasing instructional spending, and reducing student mobility*. These factors had a statistically significant relationship to student achievement in at least half of the models. (Table below)

The study also finds that charter schools are in fact a substantially different educational institution where different factors matter to student success. They cannot simply be treated as an extension of the traditional public school system. Any attempt to regulate charter schools as though they are traditional public schools will be ineffective at best, and harmful to academic achievement at worst.

Traditional Public Schools - Which Inputs Matter Most?

Policies	Direction of Effect	# of models where this factor was significant	% of models where this factor was significant
Money			
Total Revenue	Positive	1	4.76%
Instruction Spending	Positive	16	76.19%
Administration Spending	Negative	4	19.05%
Teachers			
Student to Full Time Teacher Ratio	Positive	13	61.90%
Teacher Experience	Negative	1	4.76%
Teacher Masters	Positive	3	14.29%
Teacher High Quality	Positive	18	85.71%
Students			
Attendance	Positive	21	100.00%
Highly Mobile	Negative	11	52.38%
Discipline	Negative	2	9.52%
Controls			
Disadvantaged	Negative	21	100.00%
Disabled	Negative	19	90.48%
Black	Negative	18	85.71%
Urban	Negative	3	14.29%

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The Buckeye Institute for Public Policy Solutions is a nonpartisan research and educational institute devoted to representing the viewpoint of individual liberty, economic freedom, personal responsibility and limited government in the policy debates about Ohio's present and future.

The Buckeye Institute assists policymakers, scholars, businesspeople, the media and the public by providing objective analysis and sound solutions to state and local policy questions, particularly in the areas of taxation, government spending, regulation and education.

Our work challenges government intervention as the default solution to our society's needs. We do this by offering a compelling vision of greater prosperity being the certain consequence of policies that maximize the freedom and independence of our citizens.

Committed to its independence, the Buckeye Institute for Public Policy neither seeks nor accepts any government funding. It enjoys the support of foundations, individuals and businesses sharing a concern for Ohio's future and an appreciation of the role of sound ideas and a more informed debate.

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Introduction

One of the most important services that government provides is that of public education. It affects the well-being of every citizen by providing the knowledge and skills necessary to live and work in our society. We also know that the quality of an education system has an impact on a state's economy, spending priorities, and ability to attract and retain residents. Thus, one of the most important public policy questions that we face is: How can we improve our education system and increase student achievement?

It is tempting to believe that we can simply buy a better education system. But Ohio has been purposefully boosting its financial commitment to public schools for at least the past two decades, roughly doubling its spending even after inflation (Chart 1). Once we look at achievement, it is clear that this effort was based on a false hope. According to Education Week's 2006 Quality Counts report, only 38% of Ohio students scored proficient or above in math on the National Assessment of Educational Progress. In reading, only 35% did that well. According to the same report, by the way, on Ohio's own state standardized test, 63% of students were proficient or above in math, and 78% of students were proficient or above in reading. This suggests that Ohio's standards are not as rigorous as the NAEP. (1)

The increased spending on Ohio's education system has not brought the kind of returns that have been hoped. Math proficiency has increased for white students from a poor 16 percent proficient or better in 8th grade to a rate of 38 percent, still mediocre (chart 2 and 4). African-American students have seen little progress in their math scores, which have lagged their white counterparts. Reading proficiency has remained stagnant over time for both groups. Over the last 13 years, the best reading proficiency or better rate, 41 percent, occurred in 2005 (chart 3 and 5).

Trends in spending and achievement, while interesting, do not account for other factors that might influence academic performance. For example, students who move often or face violence at school may find their educational environment too distracting. Schools that use fewer teachers per classroom (i.e., they have large class sizes) might lessen the effectiveness of those teachers. These and other factors should be considered before making policy decisions about the effectiveness of spending on student achievement.

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By using an Ordinary Least Square (OLS) regression method, a standard statistical tool used by social scientists, it is possible to examine a number of variables, or factors, and determine how much effect each one has on student achievement. The results of the OLS regression indicate which education policies are likely to improve student performance, and which policies are not. (Appendix A describes in detail the methodology; the tables of Appendix B give detailed

Chart 1: Student Enrollment and State Education Expenditures in Ohio 1978-2005

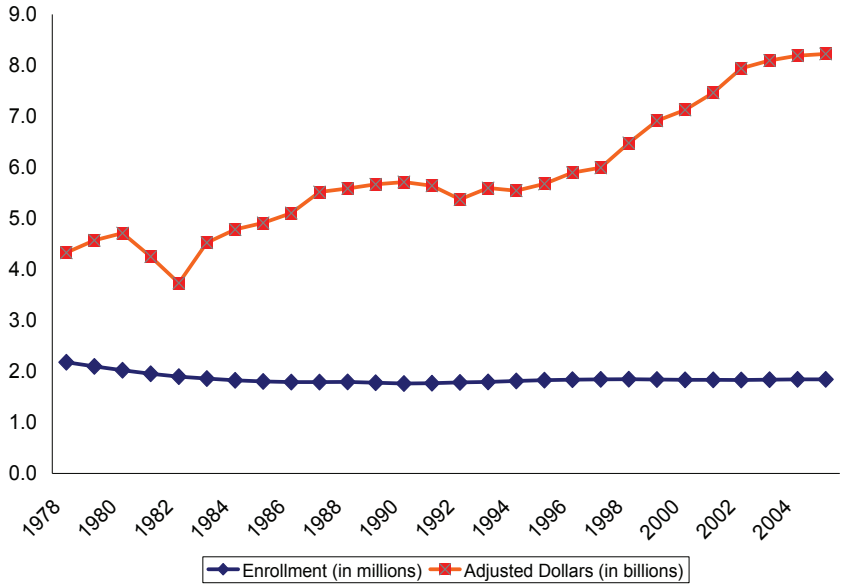


Chart 2: Percentage of Ohio Students At or Above Proficient: 4th Grade NAEP Math Test

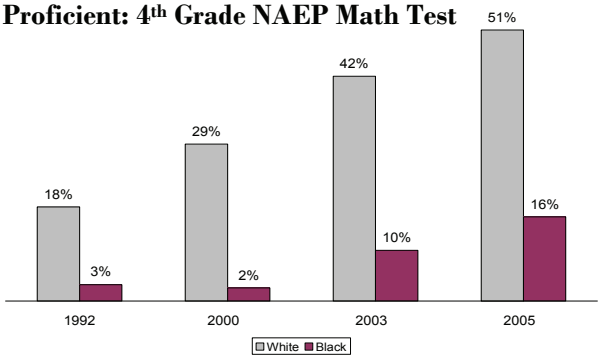


Chart 3: Percentage of Ohio Students At or Above Proficient: 4th Grade NAEP Reading Test

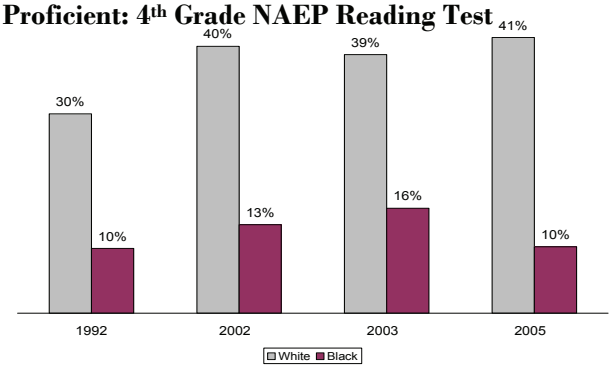


Chart 4: Percentage of Ohio Students At or Above Proficient: 8th Grade NAEP Math Test

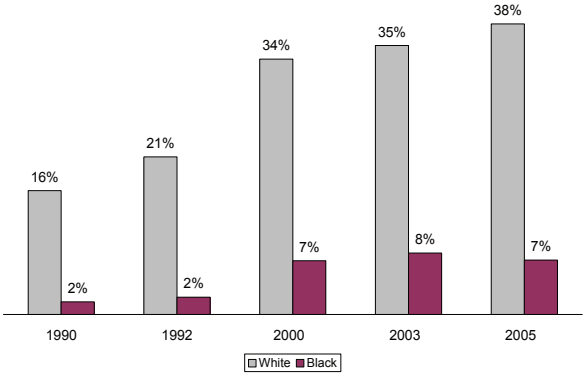
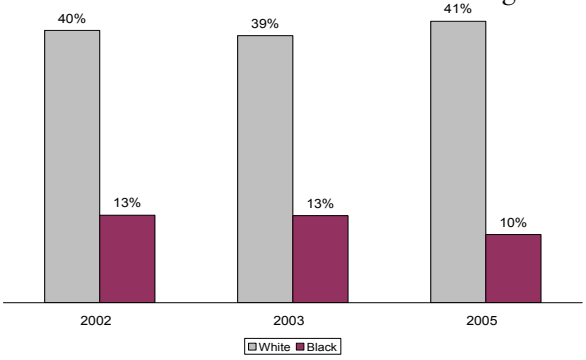


Chart 5: Percentage of Ohio Students At or Above Proficient: 8th Grade NAEP Reading Test



results of the various regression analyses)

The same method can be used to see whether the same factors that affect the outcomes in traditional public schools work the same way in charter schools, and if not, where they differ. This allows us to see whether or not the ways that charter schools teach students and go about daily business, what in the literature is called the "education production process," varies substantially from what is observed in traditional public schools.

Evaluating Competing Inputs as Policy Alternatives

The analysis used in this report examined five factors, policy alternatives widely believed to have a significant impact on student achievement. Each of these alternatives involves an input to schooling. The five policies are: increasing school funding, changing the spending priorities (instructional vs. administrative), reducing class sizes, improving the teacher corps, and altering student behavior.

Increasing School Funding

The most common policy prescription for increasing student achievement is to increase the funding for K-12 education across the state. Of the inputs to the education production process, overall spending is the one that is most obviously changed by state policymakers. Ohio currently spends an average of $8,498 per pupil. (Tables 5 and 6 give descriptive statistics for both traditional and charter schools in Ohio)

One of the most frequently debated policies for improving student achievement, both in Ohio and in many other states, is increasing the total amount of revenue for schools. In the *DeRolph I* case, the majority opinion declared that this policy alternative was constitutionally required:

> Lack of sufficient funding can also lead to poor academic performance. Proficiency tests are a method of measuring education. The ninth grade proficiency

> test was designed to measure that body of knowledge pupils are expected to have mastered by the ninth grade. R.C. 3301.0710. Passage of the ninth grade proficiency test is required before a student may receive a high school diploma. R.C. 3313.61 (A). As of the fall of 1993, thirty-two out of ninety-nine seniors at Dawson-Bryant had not passed all parts of the ninth grade proficiency test. This means that nearly one third of the senior class had not met basic graduation requirements. The district did not have enough money to pay tutors to assist these students. ***Poor performance on the ninth grade proficiency tests is further evidence that these schools lack sufficient funds with which to educate their students.*** (Emphasis added) (2)

Increasing total funding for schools in Ohio and elsewhere, however, has not been conclusively shown to increase student achievement. As Figlio (1999) points out: "while real per pupil expenditures on education have increased monotonically over the last 30 years, average student performance on standardized tests has stagnated." (3) Marlow (2000) found "higher education spending does not appear to raise student achievement." (4) Hanushek (1986) was even more succinct when he wrote that "there is no systematic relationship between school expenditures and student performance." (5)

The advocacy of higher funding, despite the research showing that it has little or no impact, stems in part from a confusion over the difference between revenues and spending. The research findings and the Ohio Supreme Court's ruling both assume that total revenues are synonymous with instructional spending. But this is not the case. Among Ohio school districts, there is great variation in the proportion of total funding that is actually allocated to the classroom. Thus, it is critically important that any analysis of the education production process include not just how much money is spent, but what it is being spent on as well.

Changing the Spending Priorities

A second policy option is to alter the allocation of existing spending. Two questions must be examined when looking at school funding. The first question is whether the government is allocating sufficient resources overall. The second question, which isn't asked nearly as often, is whether schools are spending the money on the right things.

The proportion of funding which is spent on instruction versus administration varies widely from district to district. During the 2004-05 school year, Ohio's school districts spent an average of $4,656 per pupil on instruction. The lowest amount spent in the state was $3,398 per pupil—73 percent of the average, while the highest was $9,026 per pupil, or 194 percent of the average. Administrative spending was similarly varied. The state average was $1,042 per pupil, but the lowest amount spent was just 62 percent of that, or $644 per pupil. The highest was $3,738 per pupil, well over three times the statewide average.

During the 2004-05 school year, Ohio's school districts spent an average of $4,656 per pupil on instruction

If the total funding that Ohio is putting into its education system isn't buying better performance, the reason may lie with how those funds are being spent. This analysis examines the *how* along with *how much*.

Reducing the Student-Teacher Ratio

A third policy alternative is to reduce the pupil-teacher ratio. While this is slightly different from reducing the average class size, the two concepts are sufficiently similar for this analysis. Currently, the average pupil to full time teacher ratio in Ohio is 16.24. According to research on this subject, reducing the ratio would come most likely from increasing the number of teacher aides. (6) Because we can intuitively surmise that reducing class sizes through the use of teacher aides will not be an effective solution, the real question is whether

reducing class sizes by increasing the number of full-time teachers will be. To that end, this study examines the ratio of students to the number of Full Time Equivalent teachers in each district.

The research on the impact of class sizes has been mixed, although public opinion seems to be much less so. As of 2005, twenty-four states had implemented class-size reduction policies. (7) An article in *State Legislatures* summed up the situation: "It's hard to find many public policy proposals more popular than reducing class size… (but) the research is not at all clear on whether smaller classes translate into improved learning." (8)

While Figlio (1999) found that "students attending schools with lower student-teacher ratios fare somewhat better," a 2002 study of class sizes and student achievement found that "pupils in large classes do no worse – and sometimes even better – than identical pupils in small classes." (9) Buckingham (2003) provides a sound explanation for why researchers are finding such mixed results. She writes: "research tells us that effective teaching is much more important than the number of children in the classroom." (10) Thus, it is important to disaggregate and control for both the teacher-student ratio and the traditional measures of teacher quality, the next set of policy variables.

Improving Teacher Quality

The fourth alternative for improving student achievement is to increase the quality of the teaching corps. If teachers are on the front line of the education system, then improving their quality should intuitively increase the quality of the service they provide. This in turn should improve the education output, or test scores of students. There are several metrics by which teacher quality can be assessed.

This study examines the quality of a school or district's teaching staff by three separate measurements. The first is teacher experience, as measured by the average number of years spent in the profession. The second measurement is the percentage of teachers rated as 'highly qualified' under the requirements of the No Child Left Behind Act. The federal Department of Education defines a 'highly qualified teacher' as a teacher who has "a bachelor's degree … full state certification and demonstrate(s) subject-matter competency." (11) The final measurement is the percentage of teachers who hold Masters degrees.

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Lasley et al. (2006) put it best when they state that "(e)veryone now knows that teachers make a difference. The unanswered question is how best to ensure that more high-quality teachers enter and stay in American classrooms." (12) The question that gets lost in this debate, however, is what exactly defines a 'quality' teacher. Teacher salaries are determined by two of the measurements, experience and higher level education, while the federal government now has its own definition of a 'high quality' teacher. Together, these three measures of quality are the quantifiable factors that are commonly associated with teacher quality.

Improving Student Behavior

The final alternative is to implement policies to affect student behavior. The goals of such policies include increasing student attendance rates, reducing behavioral disruptions, and keeping students in the same school system (i.e., reducing parental mobility). It is intuitive that the amount of time students actually spend in the classroom, uninterrupted, should have a significant impact on their educational achievement. Research supports this belief. (13) While such student behavior variables may seem intangible or intractable, they are not immune from change. Truancy programs can reduce absenteeism and disciplinary policies can reduce behavioral disruptions. New pedagogical approaches such as early intensive intervention and acclimation programs can reduce the effects of mobility. (14)

While much has been written in the popular press about school violence and the impact of disruptive behavior on student achievement, there has been remarkably little research on the subject. (15) Thompson and Massat (2005) found that the level of violence that urban African-American children were exposed to, either in the home or in the community, had a significant negative impact on student achievement. (16) Marcoulides et al. (2005) found that student achievement is significantly related to the climate of a school, including perceptions of student safety. (17)

The Charter School Education Production Process

In addition to the five policy options just discussed, another policy alternative embraced by some lawmakers is the establishment of charter schools. Charter schools are public schools that are operated by private, non-profit organizations. These schools face fewer regulations from the state, which gives them more flexibility to operate. For example, charter schools in Ohio do not have to hire certified teachers like their traditional counterparts, though most do. These schools are publicly funded, must admit all students who wish to enroll (so long as the school has the capacity to take them in), and are under the same financial and academic reporting requirements as traditional public schools. Charter schools, then, have more freedom to try different pedagogical and staffing approaches, based on internal assessments about the most effective programs and policies. Indeed, evidence suggests that charter schools are different (Table 1 and 2).

Table 1: Descriptive Statistics—Traditional Public Schools

Policies	Mean	Standard Deviation
Money		
Total Revenue	$8,498	$1,485
Instruction Spending	$4,656	$736
Admin Spending	$1,042	$260
Teachers		
Student to Full Time Teacher Ratio	16.2	2.2
Teacher Experience (years)	14.3	2.7
% Teachers w/ Masters	52.4%	13.1%
% Teachers Rated High Quality	95.1%	9.7%
Teacher Salaries	$46,080	$5,897
Students		
Attendance	95.2%	0.9%
Highly Mobile	2.0%	0.9%
Discipline Incidences	17.4	21.7
Controls		
% Disadvantaged	26%	16%
% Disabled	14%	3%
% Black	6%	14%

Table 2: Descriptive Statistics—Charter Schools

Policies	Mean	Standard Deviation
Money		
Total Revenue	$8,211	$2,505
Instruction Spending	$4,979	$3,027
Admin Spending	$2,409	$1,646
Teachers		
Student to Full Time Teacher Ratio	19.7	12.7
Teacher Experience	3.4	3.4
Teacher Masters	16.9%	19.4%
Teacher High Quality	76.1%	31.8%
Teacher Salaries	$29,900	$7,155
Students		
Attendance	89.8%	13.0%
Highly Mobile	9.5%	11.0%
Discipline	36	43
Controls		
Disadvantaged	63%	26%
Disabled	18%	23%
Black	63%	35%

Charter schools employ many of the same resources as traditional public schools. Given the freedom they enjoy over the use of those resources, we would expect that the factors that lead to student success may vary between traditional and charter schools, or even among charter schools.

Moreover, we would expect charter schools to exhibit a larger variety of different types of production

functions. Put simply, because charter schools are free to innovate, we expect that they will find new ways to educate students that will look very different from the way traditional public schools operate.

The literature supports this hypothesis. Researchers such as Greene (2003) and Hoxby (2004) have acknowledged the institutional differences between charter schools and traditional public schools that make comparisons difficult. For example, Greene noted that

> assessing the academic performance of charter schools is difficult, because many charter schools serve specifically targeted populations such as at-risk students, disabled students, and juvenile delinquents. This makes it very difficult for researchers to draw a fair comparison between charter schools and regular public schools. (18)

Hoxby points to some of the more qualitative differences when she notes that "charter schools … may also be innovators in school management, curriculum, and the use of technology." (19)

In this report, we run the same mathematical models on charter schools that we use for the traditional public schools. This lets us see whether the production processes for these two types of schools are, in fact, similar. If we find that some inputs are significant for student achievement in one type of school but not another, then we will know that charter schools exist in a unique policy environment. The implication will be that they require unique policy prescriptions to improve their performance, and imposing uniform regulations will likely produce lower student achievement.

Table 3 shows each of the independent variables, as well as how they were measured.

Table 3: Operationalization of Inputs in a School

Input	How the Variable Was Operationalized
Teacher Experience	The average number of years of experience among the teaching corps
Teacher Highly Qualified	The percentage of teachers rated as being 'highly qualified'
Teacher Masters Degree	The percentage of teachers that hold a Masters degree
Revenue per Pupil	The average revenue per pupil
Class Size	The ratio of the number of full time teachers to the number of students
Disabled Students	The percentage of the student body labeled as being 'disabled'
Disadvantaged Students	The percentage of the student body labeled as being 'disadvantaged'
% Black	The percentage of the student body that is black
Instruction Spending per Pupil	The per pupil spending that goes toward instruction
Admin Spending per Pupil	The per pupil spending that goes toward administration
Disciplinary Incidences	The number of disciplinary incidents per 100 students
Student Mobility (High)	The percentage of students whose tenure is less than one year
Student Attendance	The attendance rate
Urban	A 1/0 dummy variable for Ohio's "Big Eight urban districts

Findings for Traditional Public Schools

According to the statistical analysis, the variables measured explained between 40 and 60 percent of the change in student achievement in the traditional public school models (Table 4). This relatively low number is a common result for studies such as these and speaks to the difficulty of precisely measuring all the factors that influence student achievement. (20)

The factors that have the largest impact on student achievement include instructional spending, the student to FTE teacher ratio, teacher quality, student attendance, and student mobility (Table 4). The results are consistent enough across academic subject and grade level to let us make judgments about the validity of the typical policy alternatives for improving Ohio's schools.

Student Attendance

The only variable statistically significant across all 21 models was student attendance. Getting students into the classroom may be the most important thing any school can do to boost achievement. The models show that increasing student attendance increases student achievement. *Getting students to attend, independent of all of the other inputs and control variables measured, improves student performance.*

Teacher Quality

A second significant finding is that teachers matter a great deal. Specifically, it is far more important that a teacher is rated 'highly qualified' by the standards of the No Child Left Behind Act (NCLB) than whether he or she has a long tenure or a masters degree. This is a particularly interesting finding since most compensation schedules for teachers are based solely on years of teaching and possession of a graduate level degree. (21) Having a higher percentage of teachers rated as 'highly qualified' had a statistically significant impact on student achievement in 18 out of 21 models. The variables "teacher experience" and "teacher masters," the traditional definitions of teacher quality, only had a statistically significant and positive effect in 4 out of the 21 models, combined. The implication is clear: we need *teachers who know their subjects and who have proven their competency over the subjects they teach more than we need teachers with higher levels of experience or higher levels of degree attainment.*

Table 4: Traditional Public Schools - Which Inputs Matter Most?

Policies	Direction of Effect	# of models where this factor was significant	% of models where this factor was significant
Money			
Total Revenue	Positive	1	4.76%
Instruction Spending	Positive	16	76.19%
Admin Spending	Negative	4	19.05%
Teachers			
Student to Full Time Teacher Ratio	Positive	13	61.90%
Teacher Experience	Negative	1	4.76%
Teacher Masters	Positive	3	14.29%
Teacher High Quality	Positive	18	85.71%
Students			
Attendance	Positive	21	100.00%
Highly Mobile	Negative	11	52.38%
Discipline	Negative	2	9.52%
Controls			
Disadvantaged	Negative	21	100.00%
Disabled	Negative	19	90.48%
Black	Negative	18	85.71%
Urban	Negative	3	14.29%

This finding is all the more significant given that in May 2006 "the U.S. Department of Education announced that no state had achieved one of NCLB's key provisions – that all core academic classes, such as math and reading, have a highly qualified teacher by the end of the 2005-06 school year." (22)

Class Size

A third finding from the analysis, also related to teachers, is that the ratio of students to full-time teachers has a significant impact on student achievement. The results show that a higher ratio of students to full-time teachers is associated with higher levels of student achievement. What this means is that reducing class sizes by increasing the

number of part-time staff will not improve student achievement.

There are two likely explanations for this finding. The first is that it is more important to accept higher class sizes with full time teachers than to artificially reduce class sizes through the use of part-time staff or teacher aides. Jay Greene explained how this phenomenon works when he wrote:

> Larger classes mean hiring fewer teachers, and less money spent on hiring teachers means more money available for raising teachers' salaries. Better pay would attract higher quality teachers who might otherwise take jobs in other fields and would also attract better teachers … from other states. A top-quality teacher in front of a somewhat larger class … would provide a better education than a lousy teacher in front of a small one." (23)

A second explanation is suggested by Dobbelsteen et al. (2002), who found similar results. They hypothesized that "pupils' achievement benefits from a larger number of classmates with similar levels of competence." (24) As a result, lowering class sizes, or the student-teacher ratio, is detrimental to student achievement.

Spending in the Classroom

The spending variables also provide interesting results. The total revenue variable was insignificant, meaning that increasing the total amount of funding for Ohio's schools is unlikely to create any difference in student achievement. However, the variables for how schools spend their funds provide instructive results.

Instructional spending per student had a positive and statistically significant relationship in 16 out of 21 models. Administrative spending, by contrast, was largely insignificant. When it achieved significance, the impact was on student achievement was negative. This shows that how schools spend their funds is indeed important to student performance. Making sure that our education dollars get into the classroom, as opposed to ending up in the administrative bureaucracy, is critical to improving student success. Ohio doesn't need to increase its total funding for these schools, but rather needs to ensure that the current dollars are being spent in the classroom for instruction. Such a student-centric spending approach is the best way to ensure that education spending will result in increased student achievement.

Student Behavior and Mobility

A fifth finding from this study is that student behavior, in particular poor student behavior, does not have the effect that many assume. Only 2 of the 21 models showed a significant and negative relationship between the number of disciplinary incidences and student achievement. This is not to say that student safety isn't an important issue in its own right. But it does show a distinction between safety and student achievement. Policies that keep students safe are important, but we should not expect them to also have an impact on student performance in the classroom.

Instructional spending per student had a positive and statistically significant relationship in 16 out of 21 models.

Sixth, high student mobility had a negative and statistically significant relationship to student achievement in 11 of the 21 models. When a student body experiences a lot of turnover, the school is less likely to perform well academically. This is particularly interesting given that the attendance rate is being held constant in the model. *What this means is that having a large portion of the student body changing schools frequently, even if the students are attending at a high rate, still has a deleterious effect on their achievement.*

Poverty and Demographics

Lastly, the results of the control variables, while not surprising, are instructive. The percentage of the student body that is labeled as learning disabled had a

consistently negative and statistically significant relationship to student achievement in general. This tells us that having special needs students taking these standardized tests does indeed draw down the overall achievement level of these schools. This is to be expected, but NCLB requires that these students be tested and their results aggregated with those of the general student population. This appears to be unfair and likely results in artificially low passage rates for otherwise high-performing schools.

Also, the background of the student population continues to matter a great deal. Both race and socio-economic status had consistent and statistically significant relationships with student achievement. The characteristics of the student body matter a great deal in determining student achievement levels. Policymakers would be well advised to note that students from different environments react to these standardized tests differently.

These findings indicate that an effective school limits the influence of the demographic variables and maximizes the influence of the school input variables. This, ultimately, is the goal of any good school – to provide a learning environment where students can learn regardless of their personal background.

Findings for Charter Schools

The analysis of traditional public schools found multiple variables that had a statistically significant relationship to student achievement. The situation is far different for charter schools.

Among the input variables there is little consistency except for the control variable for race, which was negative and statistically significant in 13 of the 14 models used. The rest of the input variables did not have a consistently statistically significant relationship to student achievement (Table 5).

Table 5: Charter Schools - Which Inputs Matter Most?

Policies	Direction of Effect	# of models where this factor was significant	% of models where this factor was significant
Money			
Total Revenue	Negative	6	42.86%
Instruction Spending	None	0	0.00%
Admin Spending	Negative	3	21.43%
Teachers			
Student to Full Time Teacher Ratio	Negative	1	7.14%
Teacher Experience	None	0	0.00%
Teacher Masters	Negative	3	21.43%
Teacher High Quality	None	0	0.00%
Students			
Attendance	Positive	8	57.14%
Highly Mobile	Positive	1	7.14%
Discipline	None	0	0.00%
Controls			
Disadvantaged	Positive	5	35.71%
Disabled	Negative	6	42.86%
Black	Negative	13	92.86%

It could be argued that the results turned out this way because nothing can make charter schools work. But the findings of other research efforts suggest that this is not likely. (25)

Far from being useless, the statistical analysis of charter school inputs and test scores does tell us something. It is an example of where null findings—the failure to find a relationship—can have great significance for researchers and policy makers. The variables analyzed are not consistently and significantly related to student achievement, quite unlike the situation with traditional public schools. The conclusion we may draw is that an institutional difference clearly exists between charter schools and the traditional public schools. Based on these results, it may be said that charter schools in Ohio should not be treated as though they were the same as, or simply an extension of, the traditional public school system. The typical policy alternatives that would likely raise student achievement in the traditional public school system, such as increasing the number of 'highly qualified' teachers, or raising instructional spending, would not have the same effect in the charter schools.

Unfortunately, our research methods and available data did not allow us to examine as precisely as we would have liked what factors did influence student achievement in charter schools. Evidence from other studies, however, shows that charter schools are much more diverse than traditional public schools. (26) Their curricula, administration, student populations, and family socioeconomic background tend to be much more varied. Statistical techniques such as regression analysis can identify and isolate patterns. For example, if teacher quality has a consistent pattern of improving student achievement that is separate from another variable, such as class size, the statistical technique will identify it. Given the diversity of charter schools, these patterns are not as consistent or identifiable as with traditional schools.

The results indicate that charter schools are different from the traditional public school system, governed by different mechanisms for producing educational achievement. Furthermore, these results bolster the theoretical assumptions about the qualitatively different nature of the charter school educational production process. (27) The variables most likely to have a significant effect on student achievement in these schools are not easily quantified, such as innovation and the nascent education market that such schools face. (28)

Lastly, it should be noted that the control variable for the percentage of the student body that is labeled as disadvantaged was statistically significant and positive in 5 of the 14 models. This finding indicates that in some subjects charter schools may be doing a better job of reaching these kinds of students. In the traditional public schools this student population tended to have a negative relationship to student achievement. That charter schools would show the opposite result is cause for hope that these schools may be finding ways to reach the population that needs a good education the most.

The implications for public policy toward charter schools are significant and dramatic. Given the uniqueness and diversity of individual charter schools, education policymakers should:

- Avoid adopting one-size-fits-all approaches to charter schools. What works in one charter school is unlikely to have the same effect, and could negatively impact, another charter school;

- Avoid adopting reforms that emphasize *inputs* into the education process. Mandating standards such as uniform class size, curricula, or credentialing teachers is likely to be counterproductive in these schools;

- Focus accountability on *outcomes* and *performance*. In the end, what matters most is whether charter school students are educated and perform well. They should be judged and held accountable primarily on performance, not whether their administration, organization, or teaching mimic traditional public schools, statewide curriculum standards, or even other charter schools.

Conclusion

This study set out to answer several questions about Ohio's education system. What inputs affect student achievement in the public school system? What inputs affect student achievement in the charter school system? Are the factors that affect student achievement the same in the two systems? To answer these questions, regression models were run on the academic achievement levels of students for every school district and every charter school, using the five subject areas covered by the state's standardized student achievement test.

Several policy prescriptions can be drawn from this study. For traditional public schools, several policies are likely to have a positive impact on student achievement.

1. Teacher competency is what matters most. Having a 'highly qualified' teacher in every classroom will do more to improve academic achievement than getting teachers with more experience or additional formal education.

2. Programs to increase attendance clearly have a strong effect on student achievement.

3. Money matters but only when spent in the classroom. Administrative spending does not raise student achievement. Classroom spending does. That provides a sound rationale for our funding priorities.

4. Reducing class sizes is not an effective policy alternative. Intuitive and attractive as it may seem, the data simply does not bear it out as an effective alternative.

5. Student mobility among traditional public schools is a serious obstacle to academic achievement. Not surprisingly, a stable home may be one of the most important inputs for the chances of academic success for any student.

Another critical policy implication is that Ohio policymakers should not treat charter schools as though they were the same as traditional public schools. They clearly are not. Indeed, they are a unique institution with a distinct educational production process. Attempting to transfer regulatory or reform policies directly from the traditional system to the charter system is unlikely to have a positive effect at best; at worst, it could have serious deleterious consequences for these schools and their students.

Policymakers should be careful to avoid mandating approaches to teaching students or running schools. One of the benefits of the charter experiment is that it allows for a diversification of the approaches to learning, managing, and operating schools. This diversity implies that old ways of evaluating success, particularly the reliance on administrative and operational rules, no longer apply. Policymakers need to focus more on performance and administrative transparency than adherence to specific rules. They also should avoid making decisions over inputs, including mandatory teacher training, mandatory class size limits, or the technology used in the classroom.

In the end, charter schools in Ohio remain an enigma. Future research must take a more qualitative approach and scholars in the field should begin laying the groundwork for such a study by formulating a general theory for how these schools work. Without such a general theory much of the research work in this field will continue to be erratic and contradictory. Charter schools are a new social institution, replete with their own production processes for the daily business of education. Treating them as such is the first step toward better understanding how those processes operate and how we can make them better.

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Appendix A: Methods

All of the data for this policy analysis were collected from the 2004-2005 school year, as presented on the Ohio Department of Education (ODE) website. A single database was constructed by integrating several ODE reports. The district or charter school IRN numbers (a six digit code from the Ohio Department of Education that identifies each district and each school building) was used to ensure accuracy.

By using OLS regression we were able to disaggregate the effects of multiple input variables on the primary dependent variable, student achievement on the various standardized subject tests. The tests examined were the 2004-2005 Ohio Achievement Tests. The passage rates were examined at each of the 612 Ohio public school districts, and the 95 charter schools for which data was available on all salient variables. The list of tests available for analysis was comprised of the following: third grade reading and math; fourth grade citizenship, math, reading, writing, and science; fifth grade reading; sixth grade citizenship, math, reading, writing, and science; seventh grade math; eight grade math; and Ohio Graduation Tests on citizenship, math, reading, writing, and science.

The independent variables (inputs/policy alternatives) used covered several major theoretical factors believed to affect student achievement. These factors were then broken down, where appropriate, in an effort to better understand their role. The variables used to examine the impact of teachers measured teacher experience, teachers with Masters degrees, and the percentage of the teaching staff rated as 'highly qualified' under No Child Left Behind. A fourth variable related to teachers, measuring the average teacher salary, had to be removed due to multicollinearity with teacher experience, teacher degree attainment and instructional spending per student. In discussing this connection between salaries, education levels, and experience Hassell (2002) notes that: "Advanced credentials in education, while certainly a worthy pursuit, do not translate into improved student learning, according to research studies. Teaching experience appears only loosely related to teaching quality, especially beyond the first few years of teaching." (29)

Another major theoretical component of student achievement, class size, was examined. Because class sizes can be artificially lowered by bringing in part-time staff (thereby confounding efforts to study the efficacy of reducing class sizes) the variable used in this analysis was the ratio of students to full time teachers.

Because much of the policy debate about the education system today turns on questions of funding and expenditures, several variables were used to measure this component. One variable was used for instructional spending per student and a second was used for administrative spending per student. Also, a related variable was used to examine the relative wealth of the district, total revenue per student. This factor was included because it is an important part of Ohio's school finance formula. (30) Several student-based variables were also included to determine the relative impact that the student has on achievement in general. These variables included a measure of disciplinary incidences per 100 students, student attendance, and student mobility.

Control Variables

We also include a rigorous set of control variables to reduce the threat of confounding input variables and certain inherent student characteristics. Control variables were used for geography (a dummy variable for the eight urban districts), income (percent of students labeled as disadvantaged), race, and the percentage of the student body labeled as being disabled. Finally, given the difficulty of disentangling the relationships between many of the input variables, a Variance Inflation Factor (VIF) test was used on each model to determine whether multicollinearity was present among the variables.

This same methodology and variable set was used to examine the student achievement in Ohio's charter schools. The control variable for urban districts was removed from the charter school models because current policy limits charter schools to urban areas. Since a limited number of charter schools serve high school students, reliable results could not be obtained at this grade level.

Appendix B: Data

Table 1: Traditional Public Schools Grade 3 Reading

Variable	B (se)	P > |t|
Revenue per Pupil	.001 (.000)	.123
Instruction Spending	**.002 (.001)**	**.064**
Administration Spending	**-.004 (.002)**	**.019**
Teacher Experience	.039 (.143)	.784
Teacher Master's Degree	-.011 (.029)	.707
Teacher Highly Qualified	**.084 (.041)**	**.044**
Student Attendance	**1.77 (.470)**	**.000**
Student Mobility (High)	**-145.04 (51.51)**	**.005**
Disciplinary Incidences	-.015 (.018)	.411
Pupil FTE Teacher Ratio	**.469 (.179)**	**.009**
Disadvantaged Students	**-19.14 (3.44)**	**.000**
Disabled Students	-7.17 (12.15)	.555
% Black	**-7.04 (3.23)**	**.029**
Urban	-2.05 (3.09)	.508
Constant	-101.99 (45.8)	.508
R2	.434	
F-statistic	**28.14**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 2: Traditional Public Schools Grade 3 Math

Variable	B (se)	P > |t|
Revenue per Pupil	.001 (.001)	.146
Instruction Spending	**.002 (.001)**	**.022**
Administration Spending	**-.005 (.002)**	**.010**
Teacher Experience	-.213 (.166)	.200
Teacher Master's Degree	.016 (.034)	.646
Teacher Highly Qualified	**.102 (.048)**	**.035**
Student Attendance	**2.46 (.546)**	**.000**
Student Mobility (High)	**-143.5 (59.89)**	**.017**
Disciplinary Incidences	.003 (.021)	.901
Pupil FTE Teacher Ratio	**.566 (.208)**	**.007**
Disadvantaged Students	**-23.54 (3.999)**	**.000**
Disabled Students	-10.80 (14.13)	.445
% Black	**-13.79 (3.75)**	**.000**
Urban	-5.44 (3.59)	.131
Constant	**-176.31 (53.26)**	**.001**
R2	4.88	
F-statistic	**35.02**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 3: Traditional Public Schools Grade 4 Citizenship

Variable	B (se)	P > |t|
Revenue per Pupil	.000 (.001)	.999
Instruction Spending	**.002 (.001)**	**.044**
Administration Spending	-.002 (.002)	.360
Teacher Experience	-.037 (.198)	.853
Teacher Master's Degree	.050 (.041)	.218
Teacher Highly Qualified	**.183 (.058)**	**.002**
Student Attendance	**2.44 (.652)**	**.000**
Student Mobility (High)	-114.06 (71.46)	.111
Disciplinary Incidences	-.001 (.025)	.970
Pupil FTE Teacher Ratio	.285 (.248)	.250
Disadvantaged Students	**-24.31 (4.77)**	**.000**
Disabled Students	**-56.01 (16.86)**	**.001**
% Black	**-9.74 (4.48)**	**.030**
Urban	-3.95 (4.28)	357
Constant	**-177.81 (63.54)**	**.005**
R2	.430	
F-statistic	**27.67**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 4: Traditional Public Schools Grade 4 Math

Variable	B (se)	P > |t|
Revenue per Pupil	-.000 (.001)	.828
Instruction Spending	**.003 (.001)**	**.016**
Administration Spending	-.001 (.002)	.688
Teacher Experience	-.218 (.191)	.254
Teacher Master's Degree	**.084 (.039)**	**.033**
Teacher Highly Qualified	**.134 (.056)**	**.016**
Student Attendance	**3.11 (.629)**	**.000**
Student Mobility (High)	**-162.37 (68.96)**	**.019**
Disciplinary Incidences	-.034 (.024)	.155
Pupil FTE Teacher Ratio	.352 (.239)	.141
Disadvantaged Students	**-17.66 (4.60)**	**.000**
Disabled Students	**-39.33 (16.27)**	**.016**
% Black	-6.85 (4.319)	.113
Urban	.248 (4.134)	.952
Constant	**-243.44 (61.32)**	**.000**
R2	.418	
F-statistic	**26.32**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 5: Traditional Public Schools Grade 4 Reading

Variable	B (se)	P > |t|
Revenue per Pupil	.000 (.000)	.941
Instruction Spending	**.002 (.001)**	**.030**
Administration Spending	-.001 (.001)	.706
Teacher Experience	-.005 (.130)	.970
Teacher Master's Degree	.041 (.027)	.123
Teacher Highly Qualified	**.130 (.038)**	**.001**
Student Attendance	**1.96 (.429)**	**.000**
Student Mobility (High)	**-113.11 (46.98)**	**.016**
Disciplinary Incidences	.002 (.016)	.893
Pupil FTE Teacher Ratio	**.414 (.163)**	**.011**
Disadvantaged Students	**-16.93 (3.14)**	**.000**
Disabled Students	**-42.58 (11.09)**	**.000**
% Black	**-11.43 (2.94)**	**.000**
Urban	-2.60 (2.82)	.356
Constant	**-122.13 (41.78)**	**.004**
R2	.526	
F-statistic	**40.70**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 6: Traditional Public Schools Grade 4 Writing

Variable	B (se)	P > |t|
Revenue per Pupil	.000 (.000)	.917
Instruction Spending	.001 (.001)	.120
Administration Spending	.000 (.002)	.870
Teacher Experience	**-.280 (.153)**	**.069**
Teacher Master's Degree	**.083 (.032)**	**.009**
Teacher Highly Qualified	.093 (.045)	.037
Student Attendance	**1.82 (.505)**	**.000**
Student Mobility (High)	-88.26 (55.32)	.111
Disciplinary Incidences	-.001 (.019)	.968
Pupil FTE Teacher Ratio	.240 (.192)	.211
Disadvantaged Students	**-18.98 (3.69)**	**.000**
Disabled Students	**-42.48 (13.05)**	**.001**
% Black	-3.25 (3.46)	.348
Urban	-4.01 (3.316)	.227
Constant	**-99.73 (49.19)**	**.043**
R2	.411	
F-statistic	**25.58**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 7: Traditional Public Schools Grade 4 Science

Variable	B (se)	P > |t|
Revenue per Pupil	-.001 (.001)	.370
Instruction Spending	.002 (.001)	.109
Administration Spending	.002 (.003)	.446
Teacher Experience	-.312 (.243)	.199
Teacher Master's Degree	**.092 (.050)**	**.065**
Teacher Highly Qualified	**.226 (.070)**	**.001**
Student Attendance	**3.07 (.798)**	**.000**
Student Mobility (High)	-130.80 (87.51)	.136
Disciplinary Incidences	-.030 (.031)	.329
Pupil FTE Teacher Ratio	.399 (.304)	.189
Disadvantaged Students	**-12.82 (5.84)**	**.029**
Disabled Students	**-74.47 (20.65)**	**.000**
% Black	**-18.50 (5.48)**	**.001**
Urban	-3.80 (5.246)	.470
Constant	**-243.61 (77.81)**	**.002**
R2	.364	
F-statistic	**21.02**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 8: Traditional Public Schools Grade 5 Reading

Variable	B (se)	P > |t|
Revenue per Pupil	-.000 (.000)	.922
Instruction Spending	**.002 (.001)**	**.001**
Administration Spending	-.002 (.001)	.169
Teacher Experience	-.007 (.125)	.956
Teacher Master's Degree	.011 (.026)	.674
Teacher Highly Qualified	**.117 (.036)**	**.001**
Student Attendance	**1.73 (.412)**	**.000**
Student Mobility (High)	-70.84 (45.12)	.117
Disciplinary Incidences	-.023 (.016)	.151
Pupil FTE Teacher Ratio	**.301 (.156)**	**.055**
Disadvantaged Students	**-20.66 (3.01)**	**.000**
Disabled Students	**-20.82 (10.65)**	**.051**
% Black	**-12.35 (2.83)**	**.000**
Urban	**-6.14 (2.71)**	**.024**
Constant	**-97.87 (40.12)**	**.015**
R2	.555	
F-statistic	**45.78**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 9: Traditional Public Schools Grade 6 Citizenship

Variable	B (se)	P > |t|
Revenue per Pupil	.000 (.000)	.907
Instruction Spending	.001 (.001)	.169
Administration Spending	-.001 (.002)	.534
Teacher Experience	-.015 (.142)	.915
Teacher Master's Degree	.039 (.029)	.178
Teacher Highly Qualified	**.087 (.041)**	**.034**
Student Attendance	**2.20 (.466)**	**.000**
Student Mobility (High)	**-107.55 (51.12)**	**.036**
Disciplinary Incidences	-.016 (.018)	.369
Pupil FTE Teacher Ratio	.145 (.177)	.414
Disadvantaged Students	**-24.05 (3.41)**	**.000**
Disabled Students	**-29.12 (12.06)**	**.016**
% Black	**-15.442 (3.20)**	**.000**
Urban	**-5.39 (3.06)**	**.079**
Constant	**-134.84 (45.46)**	**.003**
R2	.578	
F-statistic	**50.26**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 10: Traditional Public Schools Grade 6 Math

Variable	B (se)	P > |t|
Revenue per Pupil	.000 (.001)	.840
Instruction Spending	**.003 (.001)**	**.022**
Administration Spending	-.002 (.003)	.499
Teacher Experience	-.169 (.227)	.458
Teacher Master's Degree	.039 (.047)	.404
Teacher Highly Qualified	.034 (.066)	.606
Student Attendance	**3.31 (.747)**	**.000**
Student Mobility (High)	-16.44 (81.87)	.841
Disciplinary Incidences	-.006 (.029)	.830
Pupil FTE Teacher Ratio	**.477 (.284)**	**.094**
Disadvantaged Students	**-24.94 (5.47)**	**.000**
Disabled Students	**-80.73 (19.32)**	**.000**
% Black	**-15.31 (5.13)**	**.003**
Urban	-1.03 (4.91)	.834
Constant	**-253.36 (72.80)**	**.001**
R2	.398	
F-statistic	**24.28**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 11: Traditional Public Schools Grade 6 Reading

Variable	B (se)	P > |t|
Revenue per Pupil	.000 (.001)	.871
Instruction Spending	**.002 (.001)**	**.078**
Administration Spending	-.001 (.002)	.451
Teacher Experience	-.086 (.175)	.623
Teacher Master's Degree	.042 (.036)	.245
Teacher Highly Qualified	**.188 (.051)**	**.000**
Student Attendance	2.23 (.577)	.000
Student Mobility (High)	-71.86 (63.29)	.257
Disciplinary Incidences	**-.037 (.022)**	**.099**
Pupil FTE Teacher Ratio	.262 (.220)	.234
Disadvantaged Students	**-16.20 (4.23)**	**.000**
Disabled Students	**-63.89 (14.94)**	**.000**
% Black	**-10.09 (3.96)**	**.011**
Urban	-1.32 (3.79)	.728
Constant	**-153.11 (56.28)**	**.007**
R2	.416	
F-statistic	**26.12**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 12: Traditional Public Schools Grade 6 Writing

Variable	B (se)	P > |t|
Revenue per Pupil	.001 (.000)	.142
Instruction Spending	**.001 (.001)**	**.079**
Administration Spending	**-.003 (.001)**	**.067**
Teacher Experience	-.179 (.123)	.145
Teacher Master's Degree	.010 (.025)	.689
Teacher Highly Qualified	**.091 (.036)**	**.011**
Student Attendance	**1.19 (.403)**	**.003**
Student Mobility (High)	**-103.15 (44.19)**	**.020**
Disciplinary Incidences	**-.026 (.015)**	**.089**
Pupil FTE Teacher Ratio	.089 (.153)	.561
Disadvantaged Students	**-10.61 (2.95)**	**.000**
Disabled Students	**-41.46 (10.43)**	**.000**
% Black	**-5.85 (2.77)**	**.035**
Urban	.224 (2.65)	.933
Constant	-33.34 (39.30)	.397
R2	.378	
F-statistic	**22.34**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 13: Traditional Public Schools Grade 6 Science

Variable	B (se)	P > |t|
Revenue per Pupil	.000 (.001)	.658
Instruction Spending	.001 (.001)	.606
Administration Spending	-.001 (.002)	.578
Teacher Experience	.026 (.202)	.898
Teacher Master's Degree	.032 (.042)	.443
Teacher Highly Qualified	**.188 (.059)**	**.001**
Student Attendance	**1.87 (.664)**	**.005**
Student Mobility (High)	-54.75 (72.75)	.452
Disciplinary Incidences	-.039 (.025)	.128
Pupil FTE Teacher Ratio	**.429 (.252)**	**.090**
Disadvantaged Students	**-23.42 (4.86)**	**.000**
Disabled Students	**-59.40 (17.17)**	**.001**
% Black	**-22.25 (4.56)**	**.000**
Urban	-6.03 (4.36)	.167
Constant	**-117.35 (64.69)**	**.070**
R2	.470	
F-statistic	**32.52**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 14: Traditional Public Schools Grade 7 Math

Variable	B (se)	P > |t|
Revenue per Pupil	.001 (.001)	.804
Instruction Spending	**.004 (.001)**	**.001**
Administration Spending	-.002 (.002)	.458
Teacher Experience	-.121 (.187)	.518
Teacher Master's Degree	.039 (.038)	.312
Teacher Highly Qualified	**.111 (.054)**	**.042**
Student Attendance	**4.124 (.615)**	**.000**
Student Mobility (High)	**-249.78 (67.44)**	**.000**
Disciplinary Incidences	-.003 (.024)	.910
Pupil FTE Teacher Ratio	**.712 (.234)**	**.002**
Disadvantaged Students	**-24.42 (4.50)**	**.000**
Disabled Students	**-70.91 (15.91)**	**.000**
% Black	**-19.20 (4.22)**	**.000**
Urban	-.778 (4.043)	.848
Constant	**-.346.69 (59.97)**	**.000**
R2	.602	
F-statistic	**55.50**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 15: Traditional Public Schools Grade 8 Reading

Variable	B (se)	P > |t|
Revenue per Pupil	**.001 (.000)**	**.085**
Instruction Spending	.001 (.001)	.320
Administration Spending	**-.003 (.001)**	**.024**
Teacher Experience	.021 (.108)	.843
Teacher Master's Degree	.024 (.022)	.277
Teacher Highly Qualified	.013 (.031)	.673
Student Attendance	**1.57 (.354)**	**.000**
Student Mobility (High)	**-124.15 (38.78)**	**.001**
Disciplinary Incidences	-.015 (.014)	.267
Pupil FTE Teacher Ratio	**.371 (.135)**	**.006**
Disadvantaged Students	**-16.05 (2.59)**	**.000**
Disabled Students	**-37.07 (9.15)**	**.000**
% Black	**-13.98 (2.43)**	**.000**
Urban	**-6.71 (2.33)**	**.004**
Constant	**-67.48 (34.49)**	**.051**
R2	.618	
F-statistic	**59.52**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 16 Traditional Public Schools Grade 8 Math

Variable	B (se)	P > |t|
Revenue per Pupil	.001 (.001)	.323
Instruction Spending	**.003 (.001)**	**.009**
Administration Spending	-.003 (.002)	.158
Teacher Experience	.126 (.202)	.533
Teacher Master's Degree	.040 (.042)	.335
Teacher Highly Qualified	**.136 (.059)**	**.021**
Student Attendance	**2.64 (.666)**	**.000**
Student Mobility (High)	**-239.93 (73.02)**	**.001**
Disciplinary Incidences	-.009 (.026)	.732
Pupil FTE Teacher Ratio	**.563 (.253)**	**.027**
Disadvantaged Students	**-26.65 (4.88)**	**.000**
Disabled Students	**-91.48 (17.23)**	**.000**
% Black	**-22.51 (4.57)**	**.000**
Urban	-3.26 (4.38)	.457
Constant		**.002**
R2	.564	
F-statistic	**47.56**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 17: Traditional Public Schools Citizenship Ohio Graduation

Variable	B (se)	P > |t|
Revenue per Pupil	.000 (.000)	.325
Instruction Spending	**.002 (.001)**	**.012**
Administration Spending	-.001 (.001)	.532
Teacher Experience	.145 (.114)	.205
Teacher Master's Degree	.028 (.023)	.228
Teacher Highly Qualified	.053 (.033)	.111
Student Attendance	**1.65 (.375)**	**.000**
Student Mobility (High)	-48.09 (41.14)	.243
Disciplinary Incidences	.011 (.014)	.441
Pupil FTE Teacher Ratio	**.264 (.143)**	**.065**
Disadvantaged Students	**-23.98 (2.75)**	**.000**
Disabled Students	**-62.32 (9.71)**	**.000**
% Black	**-11.52 (2.58)**	**.000**
Urban	-2.74 (2.47)	.267
Constant	**-82.21 (36.58)**	**.025**
R2	.618	
F-statistic	**59.49**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 18: Traditional Public Schools Math Ohio Graduation Test

Variable	B (se)	P > |t|
Revenue per Pupil	.000 (.000)	.288
Instruction Spending	**.001 (.001)**	**.046**
Administration Spending	-.001 (.001)	.338
Teacher Experience	.139 (.101)	.173
Teacher Master's Degree	-.000 (.021)	.998
Teacher Highly Qualified	**.070 (.029)**	**.018**
Student Attendance	**2.12 (.334)**	**.000**
Student Mobility (High)	**-76.91 (36.61)**	**.036**
Disciplinary Incidences	.020 (.013)	.125
Pupil FTE Teacher Ratio	**.218 (.127)**	**.086**
Disadvantaged Students	**-21.71 (2.44)**	**.000**
Disabled Students	**-38.02 (8.64)**	**.000**
% Black	**-16.78 (2.29)**	**.000**
Urban	1.25 (2.19)	.568
Constant	**-124.06 (32.55)**	**.000**
R2	.659	
F-statistic	**70.88**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 19: Traditional Public Schools Reading Ohio Graduation

Variable	B (se)	P > |t|
Revenue per Pupil	.000 (.000)	.664
Instruction Spending	**.001 (.000)**	**.081**
Administration Spending	.000 (.001)	.999
Teacher Experience	.043 (.059)	.460
Teacher Master's Degree	.006 (.012)	.630
Teacher Highly Qualified	**.033 (.017)**	**.053**
Student Attendance	**.782 (.193)**	**.000**
Student Mobility (High)	-13.34 (21.11)	.528
Disciplinary Incidences	.006 (.007)	.427
Pupil FTE Teacher Ratio	**.151 (.073)**	**.040**
Disadvantaged Students	**-11.93 (1.41)**	**.000**
Disabled Students	**-28.10 (4.98)**	**.000**
% Black	**-3.70 (1.32)**	**.005**
Urban	-.393 (1.27)	.756
Constant	16.16 (18.77)	.389
R2	.556	
F-statistic	**46.05**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 20: Traditional Public Schools Writing Ohio Graduation Test

Variable	B (se)	P > |t|
Revenue per Pupil	.000 (.000)	.719
Instruction Spending	**.001 (.001)**	**.059**
Administration Spending	-.002 (.001)	.163
Teacher Experience	.121 (.106)	.253
Teacher Master's Degree	.019 (.022)	.376
Teacher Highly Qualified	**.085 (.031)**	**.006**
Student Attendance	**1.36 (.348)**	**.000**
Student Mobility (High)	-60.04 (38.10)	.116
Disciplinary Incidences	-.001 (.013)	.457
Pupil FTE Teacher Ratio	-.011 (.132)	.935
Disadvantaged Students	**-20.00 (2.54)**	**.000**
Disabled Students	**-51.04 (8.99)**	**.000**
% Black	-3.02 (2.39)	.207
Urban	-.320 (2.28)	.889
Constant	-45.82 (33.88)	.177
R2	.549	
F-statistic	**44.68**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 21: Traditional Public Schools Science Ohio Graduation Test

Variable	B (se)	P > |t|
Revenue per Pupil	.000 (.000)	.319
Instruction Spending	**.002 (.001)**	**.005**
Administration Spending	-.000 (.001)	.789
Teacher Experience	.090 (.134)	.501
Teacher Master's Degree	.018 (.028)	.513
Teacher Highly Qualified	**.082 (.039)**	**.035**
Student Attendance	**1.98 (.440)**	**.000**
Student Mobility (High)	**-150.45 (48.25)**	**.002**
Disciplinary Incidences	.008 (.017)	.641
Pupil FTE Teacher Ratio	**.463 (.167)**	**.006**
Disadvantaged Students	**-27.57 (3.22)**	**.000**
Disabled Students	**-57.30 (11.39)**	**.000**
% Black	**-24.21 (3.02)**	**.000**
Urban	-.510 (2.89)	.860
Constant	**-124.49 (42.90)**	**.004**
R2	.672	
F-statistic	**75.23**	**.000**
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 22: Charter Schools Grade 3 Reading

Variable	B (se)	p > |t|
Revenue per Pupil	.001 (.001)	.442
Instruction Spending	-.000 (.001)	.989
Administration Spending	.001 (.002)	.655
Teacher Experience	.590 (.77)	.449
Teacher Master's Degree	-.111 (.143)	.441
Teacher Highly Qualified	-.135 (.087)	.127
Student Attendance	**1.78 (.81)**	**.033**
Student Mobility (High)	**43.26 (22.32)**	**.057**
Disciplinary Incidences	.002 (.072)	.982
Pupil FTE Teacher Ratio	.05 (.17)	.777
Disadvantaged Students	**23.77 (10.39)**	**.025**
Disabled Students	**-72.53 (20.35)**	**.001**
% Black	**-27.86 (20.35)**	**.001**
Constant	-104.55 (82.31)	.208
R2	.373	
F-statistic	**3.15**	**.001**
N	82	
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 23: Charter Schools Grade 3 Math

Variable	B (se)	p > |t|
Revenue per Pupil	**.003 (.001)**	**.046**
Instruction Spending	-.001 (.001)	.349
Administration Spending	-.001 (.002)	.793
Teacher Experience	-.424 (.885)	.633
Teacher Master's Degree	-.080 (.15)	.591
Teacher Highly Qualified	-.114 (.092)	.219
Student Attendance	**3.68 (1.163)**	**.002**
Student Mobility (High)	22.1 (23.44)	.349
Disciplinary Incidences	.02 (.078)	.790
Pupil FTE Teacher Ratio	.03 (.184)	.874
Disadvantaged Students	**19.53 (11.0)**	**.080**
Disabled Students	**-71.2 (21.36)**	**.001**
% Black	**-33.75 (8.13)**	**.000**
Constant	**-296.57 (115.4)**	**.012**
R2	.375	
F-statistic	**3.09**	**.001**
N	80	
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 24: Charter Schools Grade 4 Citizenship

Variable	B (se)	p > |t|
Revenue per Pupil	.001 (.001)	.299
Instruction Spending	-.000 (.001)	.595
Administration Spending	-.001 (.002)	.458
Teacher Experience	-.184 (.709)	.796
Teacher Master's Degree	-.097 (.135)	.476
Teacher Highly Qualified	-.003 (.080)	.974
Student Attendance	**3.46 (1.01)**	**.001**
Student Mobility (High)	11.14 (19.84)	.576
Disciplinary Incidences	-.066 (.066)	.316
Pupil FTE Teacher Ratio	-.183 (.151)	.231
Disadvantaged Students	8.89 (8.94)	.324
Disabled Students	**-45.39 (14.84)**	**.003**
% Black	**-29.03 (6.82)**	**.000**
Constant	**-273.49 (100.36)**	**.008**
R2	.437	
F-statistic	**3.89**	**.000**
N	78	
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 25: Charter Schools Grade 4 Math

Variable	B (se)	p > |t|
Revenue per Pupil	-.000 (.002)	.923
Instruction Spending	-.001 (.001)	.162
Administration Spending	-.002 (.002)	.245
Teacher Experience	-.764 (.841)	.367
Teacher Master's Degree	**-.305 (.16)**	**.061**
Teacher Highly Qualified	-.078 (.094)	.413
Student Attendance	3.13 (1.20)	.011
Student Mobility (High)	-11.50 (23.52)	.627
Disciplinary Incidences	-.033 (.078)	671
Pupil FTE Teacher Ratio	-.132 (.179)	.463
Disadvantaged Students	21.39 (10.60)	**.048**
Disabled Students	-36.03 (17.59)	**.045**
% Black	-31.55 (8.09)	**.000**
Constant	-217.16 (118.99)	**.073**
R2	.368	
F-statistic	**2.91**	**.002**
N	78	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 26: Charter Schools Grade 4 Reading

Variable	B (se)	P > |t|
Revenue per Pupil	-.001 (.001)	.554
Instruction Spending	-.000 (.001)	.730
Administration Spending	-.002 (.002)	.191
Teacher Experience	.155 (.782)	.844
Teacher Master's Degree	-.126 (.146)	.392
Teacher Highly Qualified	-.060 (.086)	.488
Student Attendance	**2.10 (1.10)**	**.061**
Student Mobility (High)	1.43 (21.34)	.947
Disciplinary Incidences	-.011 (.071)	.877
Pupil FTE Teacher Ratio	-.086 (.163)	.598
Disadvantaged Students	**18.20 (9.68)**	**.065**
Disabled Students	**-37.67 (16.04)**	**.022**
% Black	**-32.38 (7.4)**	**.000**
Constant	-110.28 (110.29)	.321
R2	.385	
F-statistic	**3.08**	**.001**
N	77	
N	528	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 27: Charter Schools Grade 4 Writing

Variable	B (se)	P > |t|
Revenue per Pupil	.002 (.002)	.345
Instruction Spending	-.001 (.001)	.644
Administration Spending	-.002 (.002)	.483
Teacher Experience	.369 (1.03)	.721
Teacher Master's Degree	**-.487 (.192)**	**.014**
Teacher Highly Qualified	-.153 (.113)	.180
Student Attendance	**3.58 (1.45)**	**.016**
Student Mobility (High)	-31.47 (28.05)	.266
Disciplinary Incidences	-.03 (.094)	.772
Pupil FTE Teacher Ratio	**-.451 (.214)**	**.039**
Disadvantaged Students	**29.93 (12.72)**	**.022**
Disabled Students	**-64.37 (21.08)**	**.003**
% Black	**-39.61 (9.72)**	**.000**
Constant	**-251.41 (144.97)**	**.088**
R2	.393	
F-statistic	**3.19**	**.0001**
N	77	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 28: Charter Schools Grade 4 Science

Variable	B (se)	P > |t|
Revenue per Pupil	-.001 (.001)	.695
Instruction Spending	-.000 (.001)	.698
Administration Spending	-.003 (.002)	.104
Teacher Experience	.200 (.746)	.790
Teacher Master's Degree	**-.287 (.142)**	**.047**
Teacher Highly Qualified	-.027 (.084)	.744
Student Attendance	**3.06 (1.06)**	**.005**
Student Mobility (High)	-13.88 (20.86)	.508
Disciplinary Incidences	.009 (.069)	.891
Pupil FTE Teacher Ratio	-.204 (.159)	.202
Disadvantaged Students	10.63 (9.4)	.262
Disabled Students	-24.72 (15.6)	.118
% Black	**-30.8 (7.17)**	**.000**
Constant	**-223.25 (105.52)**	**.038**
R2	.403	
F-statistic	**3.38**	**.001**
N	78	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 29: Charter Schools Grade 5 Reading

Variable	B (se)	P > |t|
Revenue per Pupil	-.002 (.002)	.139
Instruction Spending	.000 (.001)	.714
Administration Spending	-.001 (.002)	.540
Teacher Experience	.256 (.783)	.745
Teacher Master's Degree	-.08 (.132)	.551
Teacher Highly Qualified	-.037 (.082)	.651
Student Attendance	1.43 (1.13)	.209
Student Mobility (High)	-7.41 (22.36)	.741
Disciplinary Incidences	-.02 (.072)	.779
Pupil FTE Teacher Ratio	.06 (.166)	.721
Disadvantaged Students	10.97 (10.52)	.301
Disabled Students	1.75 (16)	.913
% Black	**-18.7 (7.20)**	**.011**
Constant	-54.78 (112.53)	.628
R2	.218	
F-statistic	1.46	.156
N	81	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 30: Charter Schools Grade 6 Citizenship

Variable	B (se)	P > |t|
Revenue per Pupil	**-.003 (.001)**	**.028**
Instruction Spending	.001 (.001)	.304
Administration Spending	-.001 (.002)	.450
Teacher Experience	-1.21 (.878)	.174
Teacher Master's Degree	.181 (.157)	.255
Teacher Highly Qualified	.013 (.084)	.876
Student Attendance	.468 (.801)	.562
Student Mobility (High)	34.72 (23.06)	.137
Disciplinary Incidences	.023 (.072)	.751
Pupil FTE Teacher Ratio	-.057 (.164)	.730
Disadvantaged Students	-7.71 (12.13)	.528
Disabled Students	-1.23 (15.72)	.938
% Black	**-23.83 (7.96)**	**.004**
Constant	39.07 (81.1)	.632
R2	.397	
F-statistic	**2.98**	**.002**
N	72	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 31: Charter Schools Grade 6 Math

Variable	B (se)	P > |t|
Revenue per Pupil	**-.003 (.002)**	**.007**
Instruction Spending	.000 (.001)	.795
Administration Spending	.000 (.002)	.859
Teacher Experience	-1.22 (.987)	.222
Teacher Master's Degree	-.271 (.177)	.130
Teacher Highly Qualified	.068 (.094)	.471
Student Attendance	.938 (.901)	.302
Student Mobility (High)	.082 (25.92)	.997
Disciplinary Incidences	-.057 (.081)	.486
Pupil FTE Teacher Ratio	.037 (.185)	.842
Disadvantaged Students	4.91 (13.64)	.720
Disabled Students	-18.64 (17.68)	.296
% Black	**-21.83 (8.95)**	**.018**
Constant	-22.57 (91.17)	.805
R2	.326	
F-statistic	**2.20**	**.021**
N	72	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 32: Charter Schools Grade 6 Reading

Variable	B (se)	P > |t|
Revenue per Pupil	**-.003 (.002)**	**.082**
Instruction Spending	.001 (.001)	.369
Administration Spending	.001 (.002)	.720
Teacher Experience	-1.00 (.989)	.314
Teacher Master's Degree	-.123 (.177)	.491
Teacher Highly Qualified	-.005 (.094)	.958
Student Attendance	.531 (.903)	.559
Student Mobility (High)	14.88 (25.98)	.569
Disciplinary Incidences	-.05 (.082)	.540
Pupil FTE Teacher Ratio	.070 (.185)	.707
Disadvantaged Students	.414 (13.67)	.976
Disabled Students	-11.12 (17.72)	.533
% Black	**-24.14 (8.97)**	**.009**
Constant	29.06 (91.38)	.752
R2	.277	
F-statistic	**1.74**	**.077**
N	72	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 33: Charter Schools Grade 6 Writing

Variable	B (se)	P > |t|
Revenue per Pupil	-.001 (.001)	.352
Instruction Spending	.001 (.001)	.412
Administration Spending	-.000 (.001)	.763
Teacher Experience	-.814 (.679)	.235
Teacher Master's Degree	.090 (.122)	.457
Teacher Highly Qualified	-.040 (.065)	.515
Student Attendance	.530 (.620)	.396
Student Mobility (High)	27.63 (17.85)	.127
Disciplinary Incidences	.086 (.056)	.130
Pupil FTE Teacher Ratio	.007 (.127)	.959
Disadvantaged Students	-3.32 (9.39)	.725
Disabled Students	-14.93 (12.17)	.225
% Black	-8.97 (6.16)	.151
Constant	37.7 (62.77)	.550
R2	.234	
F-statistic	1.39	.192
N	72	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 34: Charter Schools Grade 6 Science

Variable	B (se)	P > |t|
Revenue per Pupil	-.002 (.001)	.132
Instruction Spending	.001 (.001)	.418
Administration Spending	-.002 (.002)	.339
Teacher Experience	-.919 (.846)	.282
Teacher Master's Degree	-.025 (.152)	.870
Teacher Highly Qualified	.101 (.081)	.216
Student Attendance	.733 (.772)	.346
Student Mobility (High)	-13.5 (22.22)	.546
Disciplinary Incidences	.080 (.070)	.258
Pupil FTE Teacher Ratio	-.080 (.158)	.616
Disadvantaged Students	-11.8 (11.69)	.316
Disabled Students	-10.00 (15.15)	.512
% Black	**-29.25 (7.67)**	**.000**
Constant	2.19 (78.15)	.978
R2	.420	
F-statistic	**3.29**	**.001**
N	72	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 35: Charter Schools Grade 7 Math

Variable	B (se)	P > |t|
Revenue per Pupil	**-.004 (.002)**	**.081**
Instruction Spending	-.002 (.002)	.320
Administration Spending	**-.007 (.003)**	**.008**
Teacher Experience	-.858 (1.070)	.427
Teacher Master's Degree	-.185 (.171)	.286
Teacher Highly Qualified	-.034 (.098)	.731
Student Attendance	.831 (.835)	.325
Student Mobility (High)	10.64 (29.66)	.722
Disciplinary Incidences	-.02 (.072)	.783
Pupil FTE Teacher Ratio	-.163 (.192)	.401
Disadvantaged Students	8.41 (13.91)	.548
Disabled Students	-5.89 (23.04)	.799
% Black	**-19.32 (9.11)**	**.039**
Constant	26.70 (89.11)	.766
R2	.443	
F-statistic	**2.88**	**.004**
N	60	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 36: Charter Schools Grade 8 Reading

Variable	B (se)	P > |t|
Revenue per Pupil	**-.005 (.002)**	**.018**
Instruction Spending	-.001 (.001)	.417
Administration Spending	-.003 (.002)	.222
Teacher Experience	-.509 (.802)	.530
Teacher Master's Degree	.040 (.141)	.800
Teacher Highly Qualified	-.090 (.076)	.240
Student Attendance	**1.11 (.616)**	**.080**
Student Mobility (High)	20.88 (22.7)	.364
Disciplinary Incidences	.02 (.058)	.722
Pupil FTE Teacher Ratio	-.114 (.139)	.416
Disadvantaged Students	9.00 (11.71)	.447
Disabled Students	-3.72 (21.69)	.865
% Black	**-17.09 (7.45)**	**.028**
Constant	16.52 (67.55)	.808
R2	.571	
F-statistic	**3.69**	**.001**
N	49	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

Table 37: Charter Schools Grade 8 Math

Variable	B (se)	P > |t|
Revenue per Pupil	**-.006 (.002)**	**.015**
Instruction Spending	-.001 (.001)	.524
Administration Spending	**-.007 (.003)**	**.010**
Teacher Experience	-.109 (.962)	.911
Teacher Master's Degree	-.267 (.170)	.124
Teacher Highly Qualified	-.143 (.091)	.125
Student Attendance	1.22 (.739)	.108
Student Mobility (High)	-4.96 (27.25)	.856
Disciplinary Incidences	.006 (.069)	.930
Pupil FTE Teacher Ratio	-.049 (.167)	.770
Disadvantaged Students	12.53 (14.05)	.379
Disabled Students	6.33 (26.03)	.809
% Black	-8.40 (8.94)	.354
Constant	-11.06 (81.07)	.892
R2	.577	
F-statistic	**3.77**	**.001**
N	49	

Unstandardized regression coefficients with standard errors in parentheses. Statistically significant coefficients at .1 or less are in bold.

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