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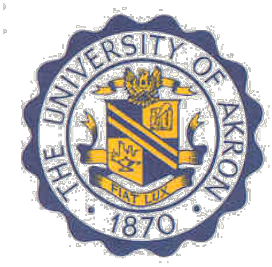

"The Relationship between Teacher Salary and Student Achievement in Ohio Public School Districts"

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Abstract:

This essay explores how teacher and non-teacher expenditures effects student achievement. 3rd and 8th grade results on the Ohio Achievement Assessment in 584 Ohio public school districts were used over the 2009-2010 school year. This study confirms a positive relationship with teacher salary expenditures and student achievement. I also find that non-teacher expenditures show a negative relationship with student achievement.

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Introduction

During the 2005-2006 school year Ohio public schools spent $17.9 billion. Of this $17.9 billion, $7.4 billion came from state funds, while $9.4 billion came from local taxes. One reason such quantities are invested in education is due to human capital theory. The logic behind this theory implies that the more education one has, the more productive a worker becomes, which leads to higher wages. Higher wages not only benefits the individual but also the entire economy as a whole by enhancing economic growth. In 2011 the unemployment rate was 14.1% for high school dropouts compared with 4.9% for those with a Bachelor's degree (Bureau of Labor Statistics). High school graduates can anticipate lifetime earnings of $250,000 more than high school dropouts, while college graduates earn $800,000 (Schiller (2008)).

Because education has great implications for the individual and also as a public good, investing an adequate amount of dollars in education is vital; but because of scarcity, it is important to invest those dollars wisely in order to achieve an efficient amount of output. Furthermore, it is imperative to make sure that each public school district is invested in fairly, giving each student in each public school district an equal chance to succeed.

Education reform has been a focal point in Ohio policy over the last couple of decades. The state has recently experienced dramatic changes in fairness across school districts and in adequate total spending. For example, Ohio school districts spent an average of $5,097 per pupil in the 1994-1995 school year; that number jumped to $10,088 in 2010-2011. This increase is due in large part to 1991's court case, *DeRolph v. State of Ohio*. DeRolph's position was that local property taxes were being relied on too heavily, allowing wealthier neighborhoods to have

an enormous advantage over poorer school districts. The State Supreme Court ruled in favor of DeRolph in 1994, finding the current system unconstitutional. By 2001, the court instructed parity aid to be implanted into Ohio's school funding policy; this increased the amount of financial support for poorer school districts. In 2001, Education Week's "Quality Counts" gave Ohio a C for adequate spending and F for fairness across districts. By 2008 the grade jumped to a B- for both adequacy and fairness.

Even with the recent, positive change, enormous challenges remain in existence. There still is a large disparity in test score passing rates across districts. For example, 147 districts had 90% of their 3rd grade students score proficient or above on May 2011's Ohio Achievement Assessment in reading. On the other hand, East Cleveland and Dayton passed only 45.4% and 55.9% of their students on the same test, respectively. In addition, these two school districts have scored in the bottom five percentile on this same test in each of the past five years.

Because certain schools annually report poor performance, certain children are at a tremendous disadvantage in many respects. These students are more likely to earn a lower income (Blau and Kahn (2004)), more likely to enter a life of crime (Lochner and Moretti (2001)), more likely to experience health problems, and less likely to have a voice in political issues (Lochner (2011)). For all of these reasons, such a disparity in test scores a humanitarian crisis; but it is also a strategic problem because these issues affect everyone.

There are many complex factors that cause the disparity in test scores. For example, children that do not have an intellectual role model to look up to, and children that grow up in a noisy neighborhood are prone to receive lower marks on tests. Also, students that don't have

access to the most effective teachers are automatically put at a disadvantage in the classroom. The role a teacher plays in student success is the focus of this paper.

The difference between an apathetic, unconcerned teacher versus one that is interested and responsive is easy to notice. The latter teachers play a huge role in elevating student achievement. For example, Rockoff (2003) used a fixed effects strategy to measure the quality level of the teacher. The New Jersey data he used connected teachers with their students' test scores for twelve years. He concluded that a rise in a teacher's quality by one standard deviation increases pupil test scores by between 0.24 and 0.20 standard deviations.

Like most any job, the location in which a teacher chooses to work is partially determined by wages. Figlio (1997) found a positive, significant relationship between teacher quality (measured by undergraduate college selectivity and subject matter expertise) and salary.

The link between teacher salaries and teacher quality and teacher quality and student achievement implies a direct link between teacher salary and student achievement. Lin (2010) using Pennsylvania data; claimed to be the first to measure this link, "no previous studies have examined the relationship between teacher salaries and student achievement." This essay uses Lin's model for the state of Ohio.

In addition to what Lin (2010) tested, this paper accounts for expenditures on administration and counseling. Others have found a negative relationship between administration and counseling and student achievement (Jacques and Brorsen (2002)). However, it is not known whether administration and counselors hinder student achievement

or whether another crucial variable is not being accounted for. In an attempt to find this variable, this essay accounts for the effect of misbehaved students.

Literature Review

Total School Expenditures and Student Outcomes

There are several studies that examine the relationship between total school expenditures and student achievement. Guryan (2001) analyzed 4th and 8th grade test scores in Massachusetts following school funding increases. He concluded that a one standard deviation increase in spending increases 4th grade scores by half of standard deviation. However, he did not witness a significant relationship for 8th grade scores.

Using data of public schools in New Jersey, Coate and VanderHoff (1999) found no relationship between total school expenditures and student test scores. They did find that the race of students, percent of students that enter and exit the district during the school year, income, and education of the district's community explain between 67 and 83 percent of the variation in student test scores.

Hanushek (2003) used correlation analysis to investigate the relationship between total expenditures and student achievement. He explained that aggregate school expenditures per pupil in US public schools have increased from $3,782 in 1970 to $7,591 in real dollars. These soaring school expenditures were accompanied by little change in test results on the National Assessment of Educational Progress. Hanushek (1997) suggested that such spending increases

occurred because of declining student teacher ratios, rising teacher salaries in an attempt to remain competitive with nonteaching salaries, and the rise in special education spending.

These are only a few examples of an abundance of studies have examined the link between total school expenditures and student achievement. The literature of how specific inputs, such as average teacher salary, affect student achievement is less well documented.

Average Teacher Salary

There are a couple of studies that examine the relationship between average teacher salary and student achievement. Chaudhary (2009) studied the effect of 1993's *Proposal A,* which changed the way school districts were funded in Michigan. She used a difference-in-difference estimation strategy to measure the effect of *Proposal A.* She used Illinois as a control group, which had similar demographics and school finance characteristics to Michigan. She explained that following *Proposal A,* teacher salaries in Michigan increased by 6.6% and class size decreased by 4.6%. After she analyzed both of these inputs, she concluded that the increase in average teacher salary was mostly responsible for the increase in student performance; not the decrease in class size. Although she found no increase in 7th grade test scores, she noticed a rise in 4th grade scores. She gave two possible explanations for the outcome differential across grades. Firstly, the amount of money allocated to grades could have varied. Secondly, younger grade levels could respond more strongly to inputs than older grades. She concluded that increasing teacher salary improves student test scores and suggested that teacher salary could be a crude proxy for teacher quality.

Lin (2010) claimed to be the first to directly test the relationship between teacher salary and student achievement. He used data of 500 school districts in Pennsylvania in the school years of 1999-2000, 2000-2001, and 2001-2002. His dependent variable was student achievement – an interaction variable measured by SAT scores and college attendance rates. His right hand side variables accounted for teacher salaries, community quality, student poverty, public school quality, student ethnicity, and school urbanization. He concluded that a positive, significant relationship existed between a teacher's salary and student achievement. 53 percent of the variance in student achievement was explained by his model. The only variable not to be significant at the 5% level was the public school quality variable.

The dependent variable used in this essay tests the effect of a teacher's salary on 3rd and 8th grade students. On the other hand, Lin (2010) tested how teacher salary affects high school students. Lin's dependent variable was an interaction term between SAT scores and college attendance rates. He used this dependent variable because he explained that only using SAT scores would create bias because only college bound students register for the SAT. He explained that by adding the proportion of public high school graduates enlisted in college would eliminate this bias. In using 3rd and 8th grade standardized test scores, I will not need to worry about this bias because every student is required to take the test.

In addition, Lin (2010) only focused on how a teacher's salary and other instructional resources influence student achievement and did not include spending on administration, and counseling as other inputs in his empirical model. This essay will use Lin's model as a foundation and add several other input variables that proxy non-teacher expenditures.

Other Inputs and Student Achievement

School expenditures other than a teacher's salary may also have a relationship with student achievement. Jacques and Brorsen (2002) used data from the Oklahoma Department of Education to estimate an education production function. They found expenditures on counselors and administrators had a negative, significant relationship with student performance. They proposed that an increased amount of attention on administrators could have caused the amount of classroom time to decrease. For example, school administrators could be substituting classroom time with announcements and assemblies. They also suggested that schools with greater problems are forced to spend more on counselors and administrators; that their socioeconomic variables may not be fully accounting for all the problems that schools face.

Jacques and Brorsen (2002) may have witnessed a negative relationship with student achievement and administrative and counselor expenditures because they do not account for student misbehavior. This is an important variable to add because the more behavior problems a school district has, the more counselors, teacher aides, and assistant principals are needed.

Hoekstra and Carrell (2010) explain that student misbehavior plays a large role in decreasing peer achievement levels. They conclude that misbehavior of two students in a classroom of twenty has the same negative effect on students as being assigned to a teacher who is one standard deviation below average teacher quality. Misbehaved students' decrease

teacher morale; increasing the likelihood of the teacher leaving the school district. They conclude that a counselor plays an enormous role in decreasing the amount of student behavior within a classroom. This ultimately leads to increased achievement levels of all students. Hoekstra and Carrell (2010) estimate that one counselor increases math and reading scores by 1.1%.

Therefore, it is unlikely that expenditures on counselors negatively impact student performance because "they take away valuable classroom time," which is one of the explanations Jacques and Brorsen (2002) gave. A more likely explanation is that schools with more misbehaved students invest more money on counselors. In this essay, I attempt to control for the effect of misbehaved students when also measuring counselor and administrative expenditures.

As explained above, this essay mimics Lin's (2010) work as a basic structure to see if I witness a similar positive relationship between teacher salary and student achievement in Ohio. In addition to what Lin (2010) did, I account for additional funding variables including expenditures on administration, and counselors. Jacques and Brorsen (2002) found a negative relationship with administration, and counselors and student achievement. However, it is not known whether administration and counselors hinder student achievement or whether another crucial variable is not being accounted for. In an attempt to find this variable, this essay accounts for the effect of misbehaved students.

Empirical Model

As outlined above, there is an enormous gap in student achievement in Ohio. There are many explanations as to why such a disparity exists. One reason is that some children are fortunate enough to grow up in a household that has enough income to provide the essentials – stability, a peaceful neighborhood, positive role models to admire, and a well-balanced nutritional diet. Other children grow up in households without one or more of these qualities.

Another reason is due to generational and cultural differences. In the 19th and 20th centuries, blacks have been put at a huge disadvantage when it came to being able to attend school. Many blacks were not allowed to go to school, and the ones that went, attended extremely ineffective schools. As a result, blacks have been less able to educate their offspring at home on how to best approach school. For example, less African American parents realize the importance of reading to their young children (Todd and Wolpin (2004)). Consequently, whites and blacks enter kindergarten at different cognitive abilities and the gap widens with age (Cook and Evans (2000); Fryer and Levitt (2005)). The black-white test score gap continues to decrease each year, but there are still noticeable differences.

In addition, the amount of quality teachers varies across school districts. To some extent, this disparity exists because of the differential in salary offered. Some Ohioan districts have the luxury of offering teachers over $70,000 per year (on average), while others offer less than $40,000. Therefore, more high quality teachers will pursue employment at districts offering a higher salary.

Also, the amount of student misbehavior that takes place within a district is another reason for the student achievement differential within the state. A classroom with more disruptive students shifts focus away from learning and act as a poor model to others of how to behave in a classroom. Disruptive students also force the teacher to act more as a disciplinarian instead of a teacher. This limits the amount of classroom learning that takes place.

To quantify these explanations for the student achievement gap in Ohio, an educational production function was set up. Student achievement is measured by standardized test scores. Standardized test scores can be thought of as a relevant economic output because higher test scores improve individual earnings and enhances economic growth (Neal and Johnson (1996); Hanushek and Kimko (2000); Murane, Willett, Braatz, and Duhaldeborde (2001); Blau and Kahn (2004)). In addition to controlling for a teacher's salary (*Salary*), student household income (*Poverty*), student race (*Black*), and disruptive students (*Suspension*), I account for other non-teacher expenditures (*Materials, Admin, Counsellor*), the education of the student's parents (*Education*), and the geographic location of the school (*Urban*).

$$\textit{Test Scores} = \beta_1 + \beta_2(\textit{Salary}) + \beta_3(\textit{Materials}) + \beta_4(\textit{Admin}) + \beta_5(\textit{Counsellor}) + \beta_6(\textit{Suspension}) + \beta_7(\textit{Education}) + \beta_8(\textit{Poverty}) + \beta_9(\textit{Black}) + \beta_{10}(\textit{Urban}) + \varepsilon$$

The focal point of this essay is to examine the relationship between teacher salary and student achievement. Therefore, the theme of this model is similar to Lin's (2010) thesis

because Lin claims to be the first to directly test the relationship between teacher salaries and student achievement. Like Lin, I measure teacher salary, instructional resources, student poverty, student race, and school location. I add four variables to Lin's model - *Admin, Counsellor, Suspension,* and *Education*.

I did not add all non-teacher expenditures to the model because I only chose to focus on non-teacher expenditures that would be higher with more misbehaved students. More misbehaved students' means school districts must spend more on assistant principals *(Admin)*, counselors *(Counselor)*, and teacher aides *(Materials)*. Therefore I did not include spending on teacher training, transportation, lunchroom operations, and building expenditures.

Inputs

Teacher salary is considered an input in the production function because past literature has shown a positive relationship to investing in a quality teacher and student test scores (Chaudhary (2009); Lin (2010)). Investing in teacher salary reduces district attrition rates of high quality teachers and attracts high quality teachers into the district (Imazeki (2005); Harris and Adams (2007)). These high quality teachers have proven to increase student test scores (Rockoff (2003); Hanushek (1992)). Therefore, I expect the sign of *Salary* to be positive.

Investing in instructional resources such as books, computers, and teacher aides *(Materials)* are all tools that encourage learning. Thus, an increase in *Materials* should increase student achievement, which is what Lin (2010) found.

Administrator expenditures *(Admin)* could be positive or negative. They could be positive because administrators play a vital role in selecting quality teachers, and in setting up an organizational structure that best fosters learning. On the other hand, there is some evidence that administrators could be too formalistic which could ultimately prohibit student achievement (Brewer (1996)). More administrators could mean more paperwork, rules, and regulations that teachers need to comply with, which decreases classroom time, which decreases student performance.

I think that counsellor expenditures will have a positive relationship with student achievement. As explained in detail above, investing in a counsellor has proven to be a cost-effective measure to reducing classroom misbehavior, which ultimately increases student achievement (Hoekstra and Carrell (2010)).

Socio-Economic Background

I expect the sign of *Suspension* to be negative, which serves as a proxy for the amount of misbehaved students within a district. Misbehavior decreases a teacher's confidence and distracts other students from classroom learning (Hoekstra and Carrell (2010)).

I expect the sign of *Education* to be positive. An educated parent is a great role model in how to most effectively approach school, and also is a knowledgeable reference for homework and test questions. Children without such parents are likely not to have access to this valuable non-classroom time. Ingel (2002) found that students who do not have a parent with a

bachelor's degree have a 73.3% chance of graduating high school compared to a 94.1% chance if one of their parents has a bachelor's degree.

I expect the sign of *Poverty* to be negative. One in poverty is less likely to have a good role model to look up to, less likely to have a well-balanced nutritional diet, more likely to live in a noisy, crime filled environment, and more likely to transfer school districts from one year to the next. These are all distractions that shift a student's focus away from learning. Duncan (1998) empirically found wealth to affect student achievement. He estimated that a $10,000 rise in family income increases the chances the child graduates college by 26%.

Adding *Education* and *Poverty* to the model could create a multicollinearity problem in the model because holding a bachelor's degree is correlated to higher earnings (Schiller (2008)). Therefore, *Poverty* and *Education* will be added with caution, in order to limit bias in the model.

Historically, blacks have been put at a huge disadvantage when it came to being able to attend school. Today there are still noticeable effects of that disadvantage blacks have been forced into. Therefore, I expect the percent of black students *(Black)*, to have a negative relationship with student achievement.

The more urbanized a district is, the more resources are available to students, such as public libraries; which contribute to learning. Also, urban school districts would have to spend less on transportation, allowing additional expenditures to be devoted to other resources. Therefore I expect *Urban* to have a positive relationship with student achievement, which is what Lin (2010) found.

Again, this is essay uses Lin's (2010) model to test the relationship between teacher salary and student achievement. In addition to Lin's work, I test other non-teacher salary expenditures while controlling for the amount of misbehaved students.

Data

584 public school districts from the 2010-2011 school year in the state of Ohio are used in this study. The data was found on the Ohio Department of Education's website, the National Center for Education Statistics' website, and the Census. The dependent variable, test scores, consists of third and eighth grade reading and math results on the Ohio Achievement Assessment taken on May 2011.

Results

A total of twelve different models were run; four different test score categories were used (3^{rd} and 8^{th} grade math and reading). In addition, three different models were used in each of these test score categories which measured three different combinations of inputs. One measured total expenditures, another measured teacher salary and all other non-teacher salary expenditures, and one measured teacher salary with specific expenditures on counsellors, administration, and instructional resources.

Like other studies (Coate and VanderHoff (1999); Hanushek (2003); Neymotin (2010)), I found no significant relationship with total school expenditures per pupil and student

achievement in all four test score categories. On the other hand, measuring individual expenditures against student achievement yielded clearer results. Teacher salary had a positive, significant relationship with student achievement in both models in which salary was run, for all four test score categories. A one standard deviation increase in teacher salary increases these test scores by between 1.1 and 2.7 points.

When tested individually, non-teacher expenditures appeared mostly insignificant, with the exception of expenditures on instructional resources (*Materials*). Again, these instructional resources include books, computers, and teacher aides. In all four test score categories, instructional resources showed an unexpected negative sign, with three of the models showing significance at the 5% level. *Materials* was probably negative because it experienced high correlation with the percentage of black students (0.45).

In addition, several of the expenditure variables were highly correlated with each other. *Materials* was correlated at a level of 0.45 with *Counselor* and 0.38 with *Admin*. Also, *Counselor* was correlated with *Admin* (0.45), *Salary* (0.53), and with *Education* (0.49). Thus, it would be more beneficial to test these expenditures individually, in separate models, or combine them as one variable.

Combining all non-teacher salary expenditures (*NonTeacher*) yielded a negative, significant relationship with student achievement in three of the four test score categories. One reason for this result was because of its high correlation coefficient with *Materials* (0.84). A one standard deviation increase in non-teacher salary expenditures decreased student achievement by between 0.93 and 1.65 points.

NonTeacher also could have been negative because *Suspension* was not adequately proxying student misbehavior. *Suspension* may have not been doing its jobs because it was correlated with *Black* (0.39). *Suspension* was negative in each model but was never significant. As explained earlier, the purpose of the misbehavior variable was to account for the fact that districts with more misbehaved students will spend more on counsellors (*Counsellor*), administrators (*Admin*), and teacher aides (*Materials*). Therefore, adequately controlling for misbehaved students may change the sign of non-teacher expenditures to positive.

The variable proxying the geographic location of the school district (*Urban*) was insignificant in almost most every model. This may have to do with the fact that it was highly correlated with teacher salary (0.52) and the percentage of black students (0.43).

Other control variables were significant, with their expected signs. For every one point increase in the percentage of black students, test scores dropped by between 0.16 and 0.27 points. In addition, for every one point increase in the percentage of students receiving a free or reduced lunch (*Poverty)*, test scores dropped by between 0.21 and 0.27 points. *Poverty* and *Black* were adequate control variables despite being correlated with each other (0.41).

One interesting finding in the *Education* variable was that it was significant in both 8^{th} grade test scores, and not 3^{rd} grade test scores. This could be because the 8^{th} grade school material is much more difficult than that of 3^{rd} grade. A parent with a college education is more able to assist a student at home with 8^{th} grade home work than a parent without a college education. On the other hand, at the 3^{rd} grade level, it may not take a parent with a college education to be able to help the student at home because the work is relatively easy.

Conclusion

The results showed that four variables (teacher salary, non-teacher salary expenditures, student race, and the student poverty rate) explained between 0.45 and 0.57 of the variance in 3rd and 8th grade test scores on the Ohio Achievement Assessment. In addition, I found that a college educated parent has a positive impact on 8th grade students, but I did not observe that such a parent has a positive impact on 3rd grade students.

I found that measuring total expenditures against student achievement yields insignificant results. On the other hand, measuring specific expenditures against student achievement produced clearer results. Like Lin (2010), I found that investing in a teacher's salary increases student achievement. While Lin examined the relationship of how teacher salary affects high school students, I focused on the relationship between teacher salary and student achievement in lower grade levels. I found that increasing a teacher's salary by one standard deviation increases 3rd and 8th grade test scores by between 1.1 and 2.7 points.

The increase of 1.1 to 2.7 points is more than trivial but is not overwhelming. One standard deviation in teacher salary is equal to about $700. Thus a one standard deviation increase in teacher salary increases test scores by between 0.1 and 0.3 standard deviations. To put it in more perspective, if the lowest achieving districts increased their average teacher salary by between $13,000 and $32,000, they would be among the highest achieving districts. Increasing teacher salary by this amount is not completely unrealistic considering the wide

variance in teacher salary that currently exists (15 districts have an average teacher salary of over $70,000, 10 districts are lower than $40,000).

Like Jacques and Brorsen (2002), I found that expenditures other than teacher salary exhibit a negative relationship with student achievement. I found that increasing non-teacher expenditures by one standard deviation decreases student test scores by between 0.93 and 1.65 points. It is difficult to argue that investing in non-teacher resources causes student test scores to decline. Perhaps these negative results are a product of omitted variable bias; another variable needs to be added to the model. Future research is needed to determine the reason non-teacher expenditures have a negative relationship with student achievement.

Some disparity in test score passing rates across school districts is necessary in order to give districts an incentive to perform highly. However, with some districts passing less than 60%, while others pass over 95%, the gap is far too wide. The students attending these schools do not have control over factors that play a part in determining their performance - their race, household income, and their teacher's quality level. Because race is impossible, and household income is costly to alter, the most effective way in closing the test score gap would be to increase average teacher salary in lower achieving districts.

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Table 1

Variable Descriptions & Statistics

Acronym	*Description*	*Source*	*Min*	*Max*	*Mean*	*Standard Deviations*
Dependent Variables						
TRead	3rd Grade percent proficient or above on Ohio Achievement Test on May 2010 in Reading in public school districts	*www.ode.state.oh.us/*	50.7	100	82.8	9.4
TMath	3rd Grade percent proficient or above on Ohio Achievement Test on May 2010 in Math in public school districts	*www.ode.state.oh.us/*	39.3	100	81.0	10.2
ERead	8th Grade percent proficient or above on Ohio Achievement Test on May 2010 in Reading in public school districts	*www.ode.state.oh.us/*	43.6	100	84.2	8.6
EMath	8th Grade percent proficient or above on Ohio Achievement Test on May 2010 in Math in public school districts	*www.ode.state.oh.us/*	26.4	100	76.3	7.6
Input Variables						
Salary	Average teacher salary of full time or equivalent teachers per public school district in Ohio in 2009 - 2010 school year. Reported in standard deviations.	*www.ode.state.oh.us/*	-3.0	3.8	0	1
NonTeach	Non-teacher salary expenditures during the 2009-2010 school year. Reported in standard deviations.	*www.ode.state.oh.us/*	-2.62	5.7	0	1
Materials	Expenditures on non full time or equivalent instructional resources such as aids, paraprofessionals, computers, books during the 2009-2010 school year. Reported in standard deviations.	*www.ode.state.oh.us/*	-3.63	4.11	0	1
Counsellor	Exenditures on guidance counseling, help in the media center or library, college advising, field trips, and psychological testing during the 2009-2010 school year. Reported in standard deviations.	*www.ode.state.oh.us/*	-1.97	6.58	0	1
Admin	Expenditures on the building principal's office costs during the 2009-2010 school year. Board of Education, Superintendent's Office, Fiscal Services, Business Manager, and Support Services. Reported in standard deviations.	*www.ode.state.oh.us/*	-2.62	11.37	0	1
Total	Total per pupil expenditures per district in the 2009-2010 school year. In thousands in 2010 dollars.	*www.ode.state.oh.us/*	6,970	21,191	9,837	1,716

Socio-Economic Variables						
Suspension	Number of out of school suspensions per 100 students per school district.	*www.ode.state.oh.us/*	0	75.8	3.58	7.17
Poverty	District percentage of students that qualify for a free or reduced lunch in 2009-2010 school year.	*www.ode.state.oh.us/*	0	99.97	37.35	18.18
Black	District percentage of black students in 2009-2010 school year.	*www.ode.state.oh.us/*	0	99	5.69	13.97
Urban	1 if district is located within a principal city or a large suburb within urbanized area of greater than 250,000 people. 0 otherwise.	*www.nces.ed.gov*	0	1	0.29	0.46
Education	Percent with a Bachelor's Degree in the community in each public school district in Ohio	*factfinder2.census.gov/legacy/aff_sunset.html*	0	69.9	12.93	9.8

Table 2

Regression results of student test scores of 584 public school districts in Ohio.

Dependent Variable: 8th Grade Proficient or better on Ohio Achievement Reading Assessment

Regressor	Model 1	Model 2	Model 3
Total Expenditures			-0.31 (0.21)
Teacher Salary	1.32*** (0.36)	1.32*** (0.35)	
Non-teacher Salary		-1.26*** (0.31)	
Materials	-1.04*** (0.39)		
Administration	-0.48* (0.28)		
Counsellor	-0.20 (0.32)		
Suspension	-0.05 (0.04)	-0.05 (0.04)	-0.05 (0.04)
Black	-0.17*** (0.02)	-0.18*** (0.02)	-0.18*** (0.02)
Poverty	-0.21*** (0.03)	-0.21*** (0.02)	-0.24*** (0.02)
Education	0.10*** (0.03)	0.10*** (0.03)	0.12*** (0.03)
Urban	0.84 (0.65)	0.87 (0.65)	1.64*** (0.63)
Intercept	91.56*** (0.96)	91.67*** (0.95)	95.23*** (1.73)
Summary Statistics			
MSE	5.66	5.67	5.77
R squared Adjusted	0.57	0.57	0.55
n	584	584	584

***Statistical significance of the t-statistic at the 0.01 level

**Statistical significance of the t-statistic at the 0.05 level

*Statistical significance of the t-statistic at the 0.10 level

Robust standard errors are reported in parenthesis.

Table 3

Regression results of student test scores of 584 public school districts in Ohio.

Dependent Variable: 8th Grade Proficient or better on Ohio Achievement Math Assessment

Regressor	Model 1	Model 2	Model 3
Total Expenditures			0.42 (0.28)
Teacher Salary	2.71*** (0.62)	2.73*** (0.73)	
Non-teacher Salary		-1.65*** (0.61)	
Materials	-1.90*** (0.54)		
Administration	-0.36 (0.48)		
Counsellor	0.18 (0.5)		
Suspension	-0.08 (0.06)	-0.09 (0.06)	-0.054** (0.026)
Black	-0.27*** (0.04)	-0.27*** (0.05)	-0.08*** (0.02)
Poverty	-0.24*** (0.03)	-0.25*** (0.03)	-0.13*** (0.02)
Education	0.11** (0.055)	0.10* (0.054)	0.15*** (0.05)
Urban	1.41 (1.12)	1.48 (1.17)	2.34*** (0.70)
Intercept	91.56*** (0.96)	82.73*** (1.76)	86.06*** (2.30)
Summary Statistics			
MSE	9.75	9.78	6.52
R squared Adjusted	0.45	0.45	0.28
n	584	584	584

***Statistical significance of the t-statistic at the 0.01 level

**Statistical significance of the t-statistic at the 0.05 level

*Statistical significance of the t-statistic at the 0.10 level

Robust standard errors are reported in parenthesis.

Table 4

Regression results of student test scores of 584 public school districts in Ohio.

Dependent Variable: 3rd Grade Proficient or better on Ohio Achievement Reading Assessment

Regressor	Model 1	Model 2	Model 3
Total Expenditures			-0.04 (0.21)
Teacher Salary	1.53*** (0.40)	1.41*** (0.45)	
Non-teacher Salary		-0.93** (0.43)	
Materials	-0.74** (0.35)		
Administration	-0.18 (0.32)		
Counsellor	-0.41 (0.36)		
Suspension	-0.04 (0.04)	-0.05 (0.05)	-0.04 (0.04)
Black	-0.16*** (0.03)	-0.16*** (0.04)	-0.16*** (0.03)
Poverty	-0.26*** (0.02)	-0.26*** (0.02)	-0.29*** (0.30)
Education			
Urban	0.15 (0.75)	0.13 (0.74)	1.0 (0.71)
Intercept	93.46*** (0.76)	93.47*** (0.82)	94.99*** (1.99)
Summary Statistics			
MSE	6.54	6.55	6.63
R squared Adjusted	0.52	0.52	0.50
n	584	584	584

***Statistical significance of the t-statistic at the 0.01 level

**Statistical significance of the t-statistic at the 0.05 level

*Statistical significance of the t-statistic at the 0.10 level

Robust standard errors are reported in parenthesis.

Table 5

Regression results of student test scores of 584 public school districts in Ohio.

Dependent Variable: 3rd Grade Proficient or better on Ohio Achievement Math Assessment

Regressor	Model 1	Model 2	Model 3
Total Expenditures			-0.24 (0.22)
Teacher Salary	1.10** (0.45)	1.11** (0.44)	
Non-teacher Salary		-0.52 (0.44)	
Materials	-0.51 (0.40)		
Administration	-0.33 (0.36)		
Counsellor	0.04 (0.41)		
Suspension	-0.06 (0.05)	-0.07 (0.05)	-0.07 (0.05)
Black	-0.18*** (0.03)	-0.18*** (0.03)	-0.17*** (0.03)
Poverty	-0.27*** (0.02)	-0.27*** (0.02)	-0.30*** (0.02)
Education			
Urban	1.30 (0.83)	1.33 (0.83)	2.28*** (0.81)
Intercept	91.90*** (0.87)	91.96*** (0.85)	94.90*** (2.08)
Summary Statistics			
MSE	5.66	7.41	7.44
R squared Adjusted	0.57	0.47	0.47
n	584	584	584

***Statistical significance of the t-statistic at the 0.01 level
**Statistical significance of the t-statistic at the 0.05 level
*Statistical significance of the t-statistic at the 0.10 level

Robust standard errors are reported in parenthesis.