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Is More Money the Answer? The Effect of Educational Funding on High Stakes Exams in New York City

Megan L. Brodzik

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Megan L. Brodzik

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Megan L. Brodzik May 22, 2018

ABSTRACT

In the cases which make up the *Campaign for Fiscal Equity et al. (CFE) v. The State of New York et al*. the court system found that the state of New York was not fulfilling its obligation to provide all students with the opportunity to obtain a sound basic education. The state was ordered to increase funding to New York City schools by $1.93 billion. It is crucial to evaluate the effectiveness of education finance reform, especially court-order reform, as a tool for policy. This paper examines the effects of New York City primary school spending on student's educational achievement as measured by schools' pass rate on the 4th grade state-mandated English Language Arts and math exams in 1999, 2006 and 2014 while controlling for student demographics, school size, and teacher education and experience. It is found that increased total per pupil expenditure has effectively zero, if not somewhat negative, effect on student exam pass rates suggesting inefficiencies in school level funding. This opens doors for further research especially using disaggregated spending data.

Keywords: Educational Inequality; New York City; School Expenditure; Standardized Testing

JEL Classifications: I21, I24, I26, I28

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1. INTRODUCTION

Determining the effects of school inputs on student performance is an important policy issue. This is especially true in the United States which is projected to spend an estimated $623.5 billion on public elementary and secondary education in the 2017-2018 school year—over 3.1 percent of GDP (National Center for Education Statistics 2017). Despite this large government investment, the marginal effect of additional educational spending on student achievement remains contested. Differences in school's financial resources by neighborhood is often cited as a primary explanation for observable achievement gaps by racial/ethnicity group and socioeconomic status.

School finance reform is one of the primary tools used by policy makers to improve educational equity. These reforms are often the result of state court rulings which find the given educational funding structures unconstitutional. Such a finding was reached in both 2003 and 2006 in the cases which make up the *Campaign for Fiscal Equity et al. (CFE) v. The State of New York et al*. In this case the court system found that the state of New York was not fulfilling its obligation to provide all students with the opportunity to obtain a sound basic education. After years of court struggles, the court ultimately directed the state to funnel an additional $1.93 billion to New York City to sufficiently meet the needs of all students.

It is crucial to evaluate the effectiveness of education finance reform, especially court-order reform, as a tool for policy. Court-order reform is distinctive from other legislative action as the court system does not have the power to pass laws or set state budgets. The courts can find the state funding structure unconstitutional and order the state to change its ways, but it does not have the power to directly address the issue. So, court-ordered reform is a two-step system: first the court ruling, second the corrective legislative action. This can make the process slow and inefficient, as was the case in New York State. Due to the Great Recession of 2007-08, the state was unable to fulfill its obligation in a timely manner and the full additional state aid did not reach New York City schools until 2014.

In this paper, I examine the effects of New York City primary school spending on student's educational achievement as measured by schools' pass rate on the 4^{th} grade state mandated English Language Arts (ELA) and math exams. I study the relationship between per pupil total spending and school exam pass rate in the years 1999, 2006 and 2014 while controlling for student demographics, school size, and teacher education and experience. In addition to the regression models, I also estimate counterfactuals to answer the question: what would the exam pass rates be in 2014 with the funding structures of 1999 or 2006? These counterfactuals allow me to gauge the full effect of increased spending on student achievement while keeping all other factors constant.

Given the debate surrounding the effect of school spending on student outcomes, (see Hanusheck 1997) and the continued prevalence of court-ordered school finance reforms, (see Wood and Lange 2006), this paper provides important evidence that increases in total per pupil educational expenditure do not necessarily improve performance on state mandated exams.

The remainder of the paper is organized as follows. In the remainder of this section I describe the background of the *Campaign for Fiscal Equity v. The State of New York* and the subsequent state funding changes. Next, I summarize previous literature on the inequality of school funding, the relationship between school funding and student achievement, and the relation between high stakes testing and life outcomes. The fourth section presents my methodology. In the fifth section I share the results, first examining various marginal effects on school exam pass rates, then the counterfactual results. The sixth and final section concludes the paper with suggestions for further research.

1.1 Background of School Finance Reform in New York

In May of 1993 the *Campaign for Fiscal Equity et al. (CFE) v. The State of New York et al*. was filed claiming that the state's public school financing system was unconstitutional and fails to provide public school students in New York City "an opportunity to obtain a sound basic education" (CFE 1995). The Court defines a sound basic education as one consisting of

> basic literacy, calculating, and verbal skills necessary to enable children to eventually function productively as civic participants capable of voting and serving on a jury. If the physical facilities and pedagogical services and resources made available under the present system are adequate to provide children with the opportunity to obtain these essential skills, the State will have satisfied its constitutional obligation. (CFE 1995).

Additionally, children have the right to

> minimally adequate physical facilities and classrooms which provide enough light, space, heat, and air to permit children to learn. Children should have access to minimally adequate instrumentalities of learning such as desks, chairs, pencils, and reasonably current textbooks.

> Children are also entitled to minimally adequate teaching of reasonably up-to-date basic curricula such as reading, writing, mathematics, science, and social studies, by sufficient personnel adequately trained to teach those subject areas. (CFE 1995).

Beyond these basic definitions, the Court of Appeals refused to definitively state what the components of a sound basic education are arguing that Regents and Commissioner standards went above and beyond minimally adequate. The court argued instead that what was relevant was whether the plaintiffs could establish a causal link between "the present funding system and any proven failure to provide a sound basic education to New York City school children" (CFE 1995).

The State contested these claims arguing that (at the time) New York spent more per student than all but three other states and therefore, New York City was receiving adequate funding (Belfeild and Levin 2002, 186). If New York City students were not receiving sufficient funds it was the fault of the New York City Board of Education for not adequately managing its funding and failing to supplement state funding enough.

In 2001, the State Supreme Court ruled in favor of CFE and charged the state with dramatically increasing funding to New York City public schools (Belfeild and Levin 2002, 186). In order to ensure a sound basic education, Justice DeGrasse ordered the state to provide, at minimum, the following seven resources:

> sufficient numbers of qualified teachers, principals, and other personnel; appropriate class sizes; adequate and accessible school buildings with sufficient space to ensure appropriate class size and implementation of a sound curriculum; sufficient and up-to-date books, supplies, libraries, educational technology, and laboratories; suitable curricula, including an expanded platform of programs to help at-risk students by giving them more time on task; adequate resources for students with extraordinary needs; and a safe, orderly environment. (Huerta 2006, 381).

Following a reversal by the Appellate Division, the Court of Appeals upheld the Supreme Court's order in June 2003. The court looked at evidence of education inputs—teaching, facilities and instruments of learning—and their resulting outputs – test results and graduation and dropout rates—to determine whether New York City schools deliver the opportunity for a sound basic education (CFE 2003). They found that based on teacher certification, test performance and experience, the quality of teachers in New York City is deficient. They also found that the large class sizes negatively affect student performance. The court also found that New York City schools are deficient in instruments of learning such as classroom supplies, textbooks, libraries and computers (CFE 2003). The court noted that although some schools in the city may be excellent, "tens of thousands of students are placed in overcrowded classrooms, taught by unqualified teachers, and provided with inadequate facilities and equipment" and that this is large enough "to represent a systemic failure" (CFE 2003).

Looking at the outputs of education—school completion and test results—proved equally grim. At the time, only 50 percent of New York City high school students graduated in four years and 30 percent did not graduate or receive a GED at all (CFE 2003). This was especially prevalent for minority and poor students. Between 1994 and 1998, 30 percent of New York City sixth graders scored below the state reference point in reading. Statewide, 90 percent scored above (CFE 2003). The court reasoned that the "causal link" between present funding and poor performance of City schools could be established and that improved inputs would yield better results.

The court ruled that the state had until July 2004 to "ascertain the actual cost of providing a sound basic education in New York City" (CFE 2003). As a response, the CFE commissioned the New York Adequacy Study conducted by the American Institute for Research and Management Analysis and Planning (AIR/MAP) to outline the process of costing out a sound basic education in New York determining the level of resources needed for all students to meet the Regents Learning Standards. The Study recommended smaller class sizes coupled with professional teacher development and additional pupil support personnel and found an additional \$6.2 - \$8.4 billion would be needed (Huerta 2006, 383). Many other costing-out reports were also commissioned. The New York State Commission on Education Reform (the Zarbb Commission), for example, estimated that New York City needed \$1.9 billion, defining an adequate education defined as one in which 80 percent of students met the Regents Learning Standards by passing the 4th grade English and math exams and five high school Regents Exams (Hanushek 2005, 71). The City of New York proposed \$5.4 billion in additional funding would be adequate while The New York State Board of Regents calculated \$3.8 billion and Standard & Poor's independent study estimates ranged from \$7.3 billion to \$1.9 billion (Hanushek 2005, 69).

In 2006, the Court of Appeals ruled that "the constitutionally required funding for the New York City School District includes … additional operating funds in the amount of \$1.93 billion" in 2004 dollars (CFE 2006). This amount is the minimum required to safeguard rights provided by the New York State Constitution, but the court made clear that it is a matter of policymaking if funding is to exceed this number.

Prior to the CFE court decision, New York State schools were funded through numerous state grants aimed at wealth equalization. Low wealth districts received five to six times more aid per student than high wealth districts. However, due to such a large discrepancy in property taxes between high and low wealth districts, per pupil spending in low wealth districts was about two-thirds the spending per pupil in high wealth districts (NYSED Primer 2005, 18). While the CFE case paints a grim picture regarding New York State funding, there were significant increases in education spending every year from 1993-94 to 2006-07 except for 2003-04 (NYSED Primer 2005, 11).

In 2006-07, the year before the CFE court mandate, public education spending came from three sources: around six percent from federal sources, 44 percent from state aid and grants, and 50 percent from local revenue (NYSED Primer 2007, 2). Local property taxes made up nearly 90 percent of local education revenue. State revenue came from three sources: The School Tax Relief Program (STAR) accounting for 20 percent of state revenue, the state general fund (68 percent of revenue), and a special revenue fund (12 percent) supported by lottery receipts (NYSED Primer 2007, 2). Under the STAR program, the state provides revenue to school districts so certain homeowners are partially exempt from district property taxes. The STAR program was implemented in 1998-99 and following its inception, state revenue as a percent of total education revenue increased by three percentage points.

In 2007, as a response to the 2006 CFE court decision, the New York State legislature and executive passed a comprehensive educational finance reform changing how state aid was calculated, shifting many of its preexisting categorical aid programs into foundation aid and introducing more realistic weights for poor children (Yinger 2013, 3). It also created a new accountability mechanism called the Contract for Excellence to regulate how the new funding could be spent.

The new foundation aid formula has three components: a target spending level, an expected local contribution, and a state aid amount (Yinger 2003, 2). The target spending level is that which the state believes will allow students to receive an adequate education. The expected local contribution varies with a district's wealth so wealthier districts are expected to contribute more. Thus, state aid is the difference between the target level and the expected local contribution. The CFE case also stressed the principle that an education finance system must account for the higher costs of educating at risk students (Yinger 2003, 3). Although this applied only to New York City schools, the state adopted this idea in its new foundation aid formulas, applying weights to certain at-risk groups. So, the target spending level is adjusted to reflect pupil need as well as regional costs (NYSED Primer 2007, 21).

The state aid formula adopted is as follows. District Aid per Pupil = [Foundation Amount X Pupil Need Index X Regional Cost Index] – Expected Minimum Contribution. The Foundation Amount is the cost of providing an adequate education determined by the instructional costs of those districts who are performing well. The Pupil Need Index adds the costs of providing extra support to students with extraordinary needs. It is 1 + the Extraordinary Needs percent which is 0.65 X the 3-year average free and reduced-price lunch percent + 0.65 X the census percent of persons aged 5-17 in poverty + 0.5 X number of English Language Learners + a scarcity count which is factor for districts with fewer than 25 students per square mile (NYSED Primer 2007, 21). The Regional Cost Index considers purchasing power across the state based on the wage of non-school professionals. The Expected Minimum Local Contribution is the amount districts are expected to spend.

In 2007-08, the first year with the newly implemented state funding formula, New York State schools funding was distributed nearly identically to the year before. Federal funds made up five percent of revenue, state funds were 45 percent, and local funds were 50 percent (NYSED Primer 2008, 2). Between districts, state funding was changed dramatically, however. State funding increased an average of 8.2 percent to all districts, though this was widely varied. Some districts saw state funding gains of over 80 percent (Millbrook School District received the largest increase of 84.1 percent more from the state in 2007 than in 2006) while others saw decreases of over 20 percent (Salamanca received 22.4 percent less from the state). New York City received 11.9 percent more state funding between 2006 and 2007.

The reform was meant to provide an additional $5.5 billion in state aid phased in over four years (Atchison 2017, 8). During the first two years following the enactment of the new foundation aid formula, state aid increased $2.1 billion, however during the 2009-10 and 2010-11 school years, due to the Great Recession, the state legislature froze increases in state aid, even reducing aid to New York City schools from 2009 to 2012 (New York State Education Department Fiscal Profiles).

The Great Recession greatly impacted the state's plan to phase in additional education aid. Starting in 2010, New York reduced school aid by $1.4 billion, growing to a $2.6 billion reduction in 2011-12 (DiNappoli 2016, 5). These reductions are known as the Gap Elimination Adjustment (GEA) and allowed New York State to close its multi-billion-dollar deficit. Although reductions were need-based (reductions were lower for high-need districts than for low-need), because such a large percentage of funding for low need districts comes from the state, the average per pupil effect in high need urban/ suburban districts was -$1,206 while only -$633 in low-need districts (DiNappoli 2016, 5). Over time, the GEA's effects have been reduced more quickly on high need districts than on low need so by 2015-16, the average GEA for high need districts was -$32 while the GEA was -$224 for low need districts (DiNappoli 2016, 5). In the 2016-17 budget, the GEA was permanently eliminated.

So where does that leave New York City? Due to the misstep in funding because of the Great Recession and GEA, it took New York City until 2014 to receive its minimum state funding increase of $1.93 billion.

While there is ample reporting on state level funding to districts, district allocation to individual schools is paid relatively little attention. Prior to New York City's adoption of the Fair Student Funding program in 2007, schools did not receive a lump sum of funds from the district, but rather received teacher position allocations based on enrollment and class size requirements. This creates several issues. First, schools with lower-paid teachers do not have additional funds nor do schools with high-paid teachers face budget constraints as the positions are allocated, not the revenue (Schwartz et al. 2009, 7). Thus, this method promotes the more senior teachers to be in the lowest need schools.

Prior to 2007, New York City funded their schools through a basic instructional services formula which had three components: school overhead allocation, base teacher allocation and basic instructional services per capita allocation. School overhead provided a minimum for overhead needs such as principals, secretaries, etc. The base teacher allocation funds the number of teacher positions needed given by dividing the projected registered students for each grade by the class size for each grade. The basic instructional services per capita provides materials and supplies not covered by the other components.

Following the CFE case, funding in New York City changed dramatically. Now, schools are funded through four main categorial allocations: fair student funding, categorical funds, programmatic allocations and children first network support. Fair Student Funding covers basic instructional needs based on need-level of students at individual schools. Categorical allocations include state and federal programs as well as Contracts for Excellence Funds. These are funds from the state "as a result of its commitment to increase funding to New York City" and must be allocated according the City's contract of excellence with the state (New York City Department of Education 2012, 5). Programmatic allocations fund unique programs outside the scope of fair student funding. Finally, children first network support funds provide flexible revenue to school principals to meet needs such as textbooks, supplies and equipment.

Fair Student Funding transforms the traditional positions allocation approach to a transparent funding formula similar to that used for state foundation aid. It takes a fixed sum of $225,000 per school and weights students based on grade level, poverty, English Language proficiency, special education needs and type of school. A fixed amount is then added to a school's funding based on the total weights (NYCDOE 2012, 11). This policy is aimed at providing the fairest level of funding for all children.

Contract for Excellent funds come directly from the state and began in 2007-08 following the CFE case. Contract for Excellent dollars must be spent in the following program areas: class size reduction, time on task, teacher and principal quality initiatives, middle school and high school restructuring, full day pre-kindergarten, and modeling programs for English Language Learners (NYCDOE 2012, 52). Additionally, the funds must be used predominately for those students with the greatest need (English Language Learners, students with disabilities, poor students and low-academic achievers). The Contract for Excellence funds are supplemental and may not be used to cover the cost of programs previously funded with local tax dollars. This is the state's way of directing the CFE funds to programs it believes will provide adequate opportunity for all students.

2. LITERATURE REVIEW:

The relationship between school funding and student achievement is hardly a new area of study. Since 1966 and the publication of the Coleman Report, researchers have tried to answer how more money affects schools. This analysis focuses on a specific case, The

Campaign for Fiscal Equity v. The State of New York, to see if the main goal of the case—funding New York City schools at an appropriate level to ensure all students can attend "successful schools"—was met. To answer this question, I begin with a review of previous literature first looking at historical inequalities in school funding across the United States and in New York. These inequalities are what lead many states to court ordered school finance reform. In New York this took form as the CFE case. Second, I review literature on the relation between school funding and student achievement to see if the research shows that increased funding will necessarily result in more successful schools. Finally, the literature review examines test scores and life achievement. The CFE case defined successful schools as those in which 80 percent of students passed state standardized tests. This literature investigates whether this is an appropriate metric of success and what increased test scores translate to later in life.

My analysis of the Campaign for Fiscal Equity is an important addition to this previous literature. Past studies have looked at the effects of the case on district equality across New York State (see Atchison 2017), but none, to my knowledge, have examined the effects at the school level for an individual district. This paper fills that gap by studying New York City individually.

2.1 Inequality of School Funding

New York State is hardly the only state using the court system to fight education funding battles. Over the past 50 years, parties have increasingly turned to the courts to address perceived education opportunity inequalities in state education finance distribution formulas (Wood and Lange 2006, 1). In fact, all but 19 states[1] had State Supreme Court rulings on the constitutionality of the state's school finance system between 1967 to 2010 (Jackson et al. 2016, Appendix D). In response to large within-state per pupil spending differences between wealthy and poor districts, state supreme courts overturned state finance systems in 26 states from 1971 to 2010.

Scholars separate these constitutional challengers into two periods: the early challenges based on equity and the later challenges based on adequacy (Jackson et al. 2016, Lafortune et al.

[1] Delaware, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Louisiana, Maine, Minnesota, Mississippi, Nebraska, Nevada, Oklahoma, Pennsylvania, Rhode Island, South Dakota, Utah and Virginia all had State Supreme Court rulings on their school finance systems.

2016, Lukemeyer 2004). Equity reforms of the 1970s and 1980s aimed to reduce resource disparity across districts. These cases claimed that the school funding systems violated the equal protection clauses of the Fourteenth Amendment to the US Constitution and within each state's constitution.

Reforms since the 1990s have been adequacy reforms aimed to achieve sufficient funding in low income districts, regardless of their implications for equity. This second wave of finance reform is commonly dated to the 1989 Kentucky, Montana and Texas Supreme Court rulings which held that these states violated their states' education clauses. To win such cases, the plaintiffs must successfully meet two burdens. First, they must prove to the court that the education clause in that state requires the state to meet a "judicially definable and enforceable obligation" such as equal access to education (Lukemeyer 2004, 61). Second, the plaintiff must prove that the state is not meeting this obligation.

One of the leading cases to achieve both these victories is the Kentucky Supreme Court case *Rose v. Council for Better Education, Inc* which found that the state constitution requires "every child must be provided with an equal opportunity to have an adequate education" and that Kentucky's school system was unequal, underfunded and inadequate (Rose n.d.). The Kentucky legislature responded by revamping the state's educational finance, governance and curriculum with the Kentucky Education Reform Act of 1990 (Lafortune et al. 2016, 8).

However, since the 1990s, courts have tended to be vague in defining the states' educational obligations as well as what constitutes an adequate education. This lack of clarity makes it difficult to craft a suitable school finance system. The general approach to equity reform cases was to focus on a district's property tax base or even decrease funding in certain districts to create equal funding (Lafortune et al. 2016, 11). However, with the second wave adequacy cases, such action would not satisfy the mandate. So, once school finance was found constitutionally inadequate, most states increased funding to all districts to weaken the relationship between the level of education spending and wealth or income level of the district (Jackson et al. 2016, 162). This approach, however, ignores an important aspect of school funding inequality: intra-district inequality.

There are two types of disparities that result in educational inequalities: inter-district disparities in school revenues and intra-district disparities. In 2006-07, New York State ranked in the bottom ten for progressive inter-district school funding. That is, there existed "a strong, negative and systematic relationship between school district poverty and state and local revenues per pupil" (Baker and Welner 2010, 20). This means, prior to the CFE court ruling, poor districts were systematically expected to receive less funding than low-poverty districts. Following the CFE case, New York State dramatically changed its school funding formula to more equitably distribute resources to all students. Research has shown that this change did not result in improved levels of horizontal or vertical education funding. Horizontal equity refers to the disparity between districts while vertical equity refers to the distribution of funds within a district aimed at reducing poverty (Atchison 2017, 12). Districts with a large proportion of poor students continue to receive less revenue than districts with wealthier students while spending disparities between districts have not been significantly reduced. Atchison (2017) shows that the lack of improvement is not due to a poorly designed finance reform, but instead due to the failure to fund and implement the plan as designed. If the additional funds had been phased in according to plan, both vertical and horizontal equity would have drastically improved.

Despite concerns about funding inequalities between schools and districts, the literature on large-scale analysis of intra-district inequality in the United States is limited by data constraints. Ejdemry and Shores (2017) recently attempted to fill this hole in the literature. Using school-level finance data for nearly every U.S. school district between 2012 and 2014, they calculated measures of vertical inequality. They find that on average, poor and minority students receive 1 to 2 percent more resources than non-poor and white students in the same district. However, there is a large share of districts which under-allocate resources to disadvantaged students and variation among districts is non-trivial. In the districts with the most intra-district inequality, the poor receive between $300 and $500 less per pupil than the non-poor. Additionally, while inter and intra-level inequality are nearly identical between poor and non-poor students, intra-district inequality exceeds inter-district inequality for black and Hispanic students relative to white students. This means that while funds are allocated more equally at the state level by race, at the district level black and Hispanic students are getting less.

Similarly, there is "considerable evidence that resources vary across schools within larger districts" such as New York City and there is concern that these within district disparities are often perverse (Schwartz et al. 2009, 2). For example, schools with fewer low-income, high-need students often get the most experienced teachers and staff. Lankford, Loeb and Wyckoff (2002) use data on New York State teachers to determine variations in average attributes and find that urban areas generally have fewer qualified teachers than non-urban areas. Additionally, within urban districts, poor, low-performing and minority students are more likely to have uncertified teachers or teachers who failed certification exams.

This is of importance in this analysis since the Campaign for Fiscal Equity case focused on how additional resources would be distributed across districts within the state, but it ignored how the funds would be allocated within the districts. Ignoring such a discussion may have limited the success of the decision to improve the adequacy of student opportunity. Furthermore, focusing on average expenditure or revenue of a district (the information the state collects) suggests that resources reach schools within that district evenly which is not always the case.

2.2 School Funding and Student Achievement

Following the publishing of the Coleman Report (Coleman et al. 1966)—which found variations in per pupil spending are unrelated to variations in student achievement on standardized tests—many researchers have questioned if increased school spending improves student outcomes. The consensus among scholars is that dollars have the potential to make a difference in educational opportunities, but the translation from potential to actual student achievement is not clearly or closely observed (Jefferson 2005, 122). This translation from potential to actual outcomes all depends on how the available funds are used.

This idea is demonstrated by Hanushek (1997) in a meta-analysis of some 400 studies of student achievement. He demonstrates that there is no systematic relationship between measured attributes of teachers or schools and student performance. Of 163 studies which use total expenditure per pupil, only 27 percent found positive, statistically significant marginal effects on student performance. When only single state samples are used, there are even a smaller percentage of studies which shows positive, significant results. Table 1 below summarizes his findings.

Table 1: Percentage Distribution of Estimated Effect of Expenditure Per Pupil

		Statistically Significant		Statistically Insignificant		
Expenditure Per Pupil	Number of Estimates	Positive	Negative	Positive	Negative	Unknown Sign
Total	163	27%	7%	34%	19%	13%
Single State Samples	89	20%	11%	30%	26%	12%
Multiple State Samples	74	35%	1%	39%	11%	14%

Source: Hanushek, Eric A. 1997. "Assessing the Effects of School Resources on Student Performance: An Update." *Educational Evaluation and Policy Analysis* 19, no. 1:141-164.

Hanushek argues these results are not because money does not matter, but rather because there is no guarantee that a school with more funds will use that money effectively. This is consistent with others who show that how the money is spent is more important than how much funding a school receives (Boser 2011; Greene et al. 2007; Wenglinsky 1997). In fact, in a nationally representative study of more than 9,000 school districts, Boser (2011) showed that after controlling for factors outside a district's control such as cost of living and student poverty, 41 states have the potential for double digit percentage increase in student achievement on standardized tests without spending any more money. This is because more than one million of the total 54 million K-12 students in the United States attend highly inefficient schools. Furthermore, in only 16 states does increased spending correspond to increased student achievement (Boser 2011, 227).

Of the schools that are successful in translating additional spending into increased student achievement, the common thread is the creation of an educational environment which supports and respects teachers. Schools where students have the greatest college aspirations are those with the highest percentage of faculty with advanced degrees (Greene et. al 2007, 64). It has been shown a positive school environment – one in which teachers, principals and students have good relationships, high morale and positive attitudes about their school—is among the only proven factor to contribute to higher student achievement (Wenglinsky 1997, 221). Schools can achieve this environment of respect through professional development, employee compensation, and reduced class sizes (Greene et al. 2007 and Wenglinsky 1997).

Evidence from New York City schools suggests similar trends to those seen at state and district levels: there is a little evidence between aggregated measures of spending and student achievement, however, when the data is disaggregated, there is some connection especially between teachers and students' outcomes. New York City schools also experience increased successes when teachers are more respected and developed. Using school- level, per pupil expenditure data, Chellman and Weinstein (2005) find that successful schools in New York City spend significantly more on human resources than on any other resource such as textbooks, supplies, computers or equipment. When the aggregate spending line "teacher spending" is examined, there are no significant differences between successful and unsuccessful schools. However, when that line is disaggregated into categories such as all teacher salary and benefits, full-time teachers, part-time teachers, and other teacher salary and benefits, there are many statistically significant differences, though the authors do not indicate which ones. Overall, the data shows that schools that emphasize human resources have better teacher and administrative attitudes with lower turnover which leads to better student outcomes and a reduction in test score gaps (Chellman and Weinstein 2005, 23).

Rockoff (2008) finds similar results in analyzing a teacher mentoring program in New York City. He finds that student high achievement in math and reading is higher among those with teachers who receive more hours of mentoring. This supports the theory that teachers who feel more supported and respected produce better school environments and therefore better student results.

Interestingly, this support is not necessarily tied to compensation. This can be seen in the results of a teacher incentive program implements in 200 New York City public schools from 2007-08 to 2009-10. Under this scheme, schools would be rewarded additional funds to distribute to teachers as they see fit for schools who were able to improve the school environment, student progress and student performance. The scheme did not increase student achievement (Fryer 2013, 400). Fryer contributes the lack of the scheme's success to evidence that shows incentives tied to inputs are more likely to influence student behavior than those linked to student outcomes (Fryer 2013, 404). Teachers who are offered incentives to alter education inputs are much more likely to change their behavior while incentivizing outcomes had no significant effect on changing teacher behavior. Thus, increasing spending on teacher professional development may be a way to improve student outcomes.

While there are mixed results concerning the correlation between school funding and student achievement, there does appear to be a systematic relationship between school spending and student outcomes in the form of labor market earnings. Verstegen and King (1998) review 35 years of research relating school spending and student achievement and find a strong and persistent relation between school spending and increased earning over time. This is consistent with the work of Jackson, Johnson, and Perisco (2015) who track the effects of increased school spending on children through their lives. After controlling for parental education and occupation status, parental income, mother's marital status at birth, birth weight, child health insurance coverage, gender, and race as well as other policies which may have had an effect, including school desegregation, hospital desegregation, state kindergarten funding, Title I funding, average childhood spending on food stamps, Aid to Families with Dependent Children, and Medicad, they found a 10 percent increase in per pupil spending for all 12 years of education results in in improved life outcomes for students; Students completed more years of education and earned higher wages as adults. Poor students who experienced the spending increases while in school were also less likely to be poor as adults (Jackson et al. 2015, 213).

Caution must be used when interpreting results from these studies, however. The use of production equations, such as those used in cost-benefit analysis of school funding and student achievement, are limited as they model only quantitative contributions of resources and ignore qualitative aspects that may have a large effect on students (Verstegen and King 1998, 261). Costrell et al. (2008) argue that cost function regression analysis is useful for providing estimates of average spending for districts given certain characteristics and indicating how spending varies by the characteristics. However, the authors warn, that it is a significant stretch to go from a regression to claiming estimates of the costs needed to achieve any given performance level for districts. Relationships between cost and performance are highly unreliable and the authors point to numerous studies which only achieved the results they did by tinkering with the model specification. They also point out that average spending (offered by regression analysis) differs greatly from minimum spending (the main policy concern). The usual practice in cost function analysis is to identify the cost of public school education as the average spending, thus defining the minimum cost of successful schooling as the average cost.

This leads to policies that raise expenditures on those below the average which raises the average again. The authors argue “this methodology is a recipe for perpetual findings of inadequacy under forever-recurring litigation” (Costrell, et al. 2008, 221).

Beyond being cautious with the econometric method, some scholars argue that standardized test scores are not the best metric to predict and measure student achievement suggesting the use of high school grade point averages instead. Using University of California students, Geiser and Santelices (2007) found that high school grades are consistently the best indicator of how students are likely to perform in college both in their first year and for long-term outcomes such as college graduation rate and cumulative college GPA. Another argument against using standardized tests as a measure of achievement is these tests reflect student performance in a single, multi-hour setting and more often measure test-taking ability and skill rather than English or math. In contrast, high school GPA reflects years of performance across a variety of subjects and reflects motivation, discipline and perseverance, skills which are much more important to possess in college and beyond.

Additionally, using national panel data of over 14,000 students, Rumberger and Palardy (2005) found that schools with the largest growth in student achievement are not necessarily effective in preventing or reducing dropout and transfer rates. It is intuitive to believe that factors which increase student learning such as committed and competent teachers and leaders would also improve dropout rates, but research suggests that pressure for school accountability on rigorous high school exams has pressured some schools to discharge the lowest-performing students. The literature shows that using test scores alone to measure school or student performance is insufficient. Without using alternative measures, tests scores may lead to incorrect conclusions regarding which schools are effective and what lead those schools to be effective.

Even with decades of research, little consensus has been reached regarding the connection between school district spending and student achievement. Most scholars argue that through channels which increase school efficiency and environment, better student outcomes can be achieved. There is a stronger consensus regarding labor market outcomes and the literature shows that increased school spending does result in improved labor market outcomes for students later in life.

2.3 Test Scores and Life Achievement

High stakes, state mandated testing has been growing in popularity in the United States, particularly in high schools. As of 2012, 26 states required students to pass at least one exit exam to receive a high school diploma (Holme et al. 2010, 476). In 2000, New York State's Board of Regents began the phasing in a series of college preparatory courses and exams required for every student to graduate high school. By June 2005, the phase in was complete and high school graduation required the passage of a minimum of five end of course exams (Sipple et al. 2004, 143). These exams are intended to meet several goals: to incentivize schools to educate even the lowest achieving students, to increase student effort, and to certify that students have mastered some set of skills. However, critics of exit exams argue that instead of achieving the above goals, these exams set unnecessary restrictions on graduation and discourage the low achieving students, those most often from disadvantaged socio-economic backgrounds, from persisting in schools thus increasing dropout rate and educational inequality (Reardon et al. 2010, 499).

When the literature is examined, there is very little evidence to conclude that exit exams have either positive or negative effects on students. In a study of four large California public schools, 10th graders who failed the California High School Exit Exam (CHSEE) with scores very near the passing score (roughly 15 percent of the students who took the exam) showed no systematic positive or negative effects on subsequent achievement, persistence, graduation, or course selection after failing on their first attempt (Reardon et al. 2010, 513). This study focused only students whose scores were near passing and so it is not possible to generalize these results to students with very low skills. However, the lack of any difference in outcomes for those just above and just below the passing score suggests that failing the exit exam has little motivational discouragement.

Likewise, Carnoy et al. (2001) review the literature on the positive and negative claims for the Texas accountability system and the impact of the Texas exit exams—the Texas Assessment of Academic Skills (TAAS). These tests are administered each year in grades 3 through 8 and again in 10th grade when passing the exam is a requirement for graduation. The authors found "little relationship between changes in TAAS scores and changes in dropout rates across high schools" (Carnoy et al. 2001, 3). The authors find schools with larger increases in student pass rate on the tenth grade TAAS do have larger declines in dropout rates. However, there is a much weaker relationship between increases in the 10th grade TAAS pass rate and the proportion of 10th graders who reach 12th grade two years later. There is also no significant relationship between 10th grade TAAS scores and the school's average SAT score (Carnoy et al. 2001, 25).

Given these findings, Holme et al. (2010) conduct a review of 46 unique studies of school exit exams focusing on four domains: student achievement, graduation, postsecondary outcomes, and school response. The literature points to a lack of overall achievement effects especially for students at the bottom of the achievement distribution. There is some evidence that the high-stakes nature of these tests reduces performance for racial and ethnic minorities and girls in some subjects due to stereotype threat (Holme et al. 2010, 491). When it comes to dropout and graduation rates, minimum competency exams—exams which ask students to perform at middle school levels— have little impact on dropout rates, yet the more rigorous high school exit exams are consistently associated with increased dropout rates, especially for low achievers and urban, high poverty schools. There is consistent evidence that exit exams induce dropout through student discouragement and negative psychological effects, especially for high poverty urban schools (Holme et al. 2010, 504).

For elementary school students, there are also negative psychological impacts of high stakes testing. When comparing test anxiety on high stakes standardized tests and low stakes classroom testing, elementary school students reported significantly more anxiety in relation to the high stakes tests—68 percent reporting moderate to high test anxiety on the high stakes exams compared to 55 percent on low stakes exams (Segool et al. 2013, 495). Beyond reporting higher levels of test anxiety, elementary school students also experienced significantly increased cognitive and psychological symptoms of anxiety in relation to high stakes tests.

Another of the goals of high stakes testing is to certify that students have met some set of measured skills. Does possession of these skills translate to labor market outcomes? The literature indicates that exit exams, both rigorous and not, have no consistent connection to employment or earnings overall. Subgroup effects by race, ethnicity and gender are inconsistent and in total indicate few positive effects (Holme et al. 2010, 515). Diplomas do serve as a positive signal in the labor market, yet it is unclear whether diplomas are attractive to employers because of exit exams or other factors.

The literature also suggests that the perceived pressure to increase test scores is experienced most deeply by teachers serving the most impoverished students. This translates to increased use of "skill and drill" instruction in poor and urban schools, where teachers spend more time on test preparation activities. This means decreased time spent by these students on long-term projects, performance-based activities, hands-on experiments and other enrichment activities. The same type of teaching to the test does not occur in suburban schools with higher socioeconomic status. Thus, poor, urban and minority students "who are often among the most disengaged in the school system, face repetition of minimum level, test-like information, at the expense of diverse and interesting learning opportunities and subject matter not covered in state tests (such as science and social studies at the elementary level, and fine or performing arts)" (Moon et al. 2007, xiii).

Much of the literature shows that schools are increasing remediation for at-risk students, however, some schools adopt responses that are not necessarily in the students' best interests. For example, a study in New York found that interviewed superintendents and principals shifted students on the verge of dropping out to GED programs so that students could be counted as transfers, not dropouts. This was commonly referred to as "disappearing" students (Sipple et al. 2004, 159). Similarly, as a response to TAAS, the high-stakes Texas exams, Texas high schools either encouraged students to dropout before 10^{th} grade or strategically retained and skipped students over the 10^{th} grade year. Not surprisingly, schools with high retention rates and student "disappearances" had higher exit exam scores (Holme et al. 2010, 520).

School exit exams were adopted to incentivize schools to educate even the lowest achieving students, to increase student effort, and to certify that students have mastered some set of skills. The literature provides little evidence of reaching any of these. It appears that instead of incentivizing schools to focus on the lowest achievers, these students are strategically pushed out of the system to avoid low test scores. Instead of increasing student effort, these tests demoralize students—especially those of color and in high-poverty urban schools—and lead to dropout. The final goal may be reached if we consider that employers value diplomas and as an extension may therefore value the exit exams, although this is stretch. Overall, high-stakes exams seem to do more harm than good.

3. METHODOLOGY

3.1 Measuring Student Outcomes:

For the purposes of this paper, I will be attempting to explain student achievement at the individual school level as measured by the percentage of 4th graders who passed the state English and math exams. The Zarb Commission defined successful schools as those in which 80 percent of fourth graders passed the math and English exams and 80 percent of high schoolers passed at least five high school graduation tests in calculating that an estimated additional $1.9 billion needed for New York City schools (Hanushek 2004, 71). This definition of the objective of an adequate education was ultimately accepted in the court's decision as the ruling in 2006 mandated that New York City school receive a minimum of $1.93 billion more. Thus, for my analysis I will be measuring the change in the amount of New York City elementary schools who became successful, as per the above definition, after the additional funds were received.

There is some trepidation among scholars in using standardized test scores as a measure of school and teacher effectiveness. This is because these methods can fail to separate other influences on learning and create confusion about relative influences on student achievement (Baker 2010, 8). There are great limitations to using test scores to estimate causal quantities as there are many other factors that contribute to student achievement. These concerns are recognized in this analysis, however following the court's accepted definition of adequate student outcomes seems to be the best course of action when determining if adequacy was indeed met. Additionally, other metrics such as graduation rate or student GPA, were not available to me at the individual elementary school level.

3.2 Why Elementary Schools?

The Campaign for Fiscal Equity v. The State of New York and subsequent state funding change affected all public schools in the state. The courts defined a successful school as one where at least 80 percent of students passed the 4th grade math and ELA exams and/or five or more high school Regents exams. This analysis will focus solely on public elementary schools and the 4th grade math/ELA exams. There are two main reasons for this decision: (1) the Small Schools of Choice (SSC) program in New York City high schools and (2) the difference in the high stakes nature of exams.

The first reason why elementary schools are more desirable than high schools in this analysis is the conception and implementation of Small Schools of Choice which operated between 2002 and 2008 in New York City. During this time, small public high schools in New York City were created in mostly high-poverty communities to replace large, low-performing high schools. The schools then compete for students through the city's system of school choice. These new schools have between 100 and 200 students enrolled compared to the 350 or more that traditional large high schools had. The SSC program also included new principals and teachers, start-up funding, assistance with leadership and staff development, and partnerships with local businesses to offer students out-of-the-classroom experiences (Social Programs 2017, 2). To populate these schools, all rising 9th graders in the city's public schools rank their preferences for which high school to attend and are placed in their most preferred school with an open spot.

This study will use the years 1999, 2006 and 2014 to analyze the effectiveness of increased schools funding on exam pass rates in New York City schools. Because of the SSC movement between 2002 and 2008, only a dozen high schools that were operational in 1999 still existed in 2014. Isolating the impact of funding changes in the context of a complete organizational overhaul is next to impossible and would not yield valid results. The SSC program had no effect on elementary schools, however, which makes them the clear choice for this analysis.

The second reason for focusing on elementary schools instead of high schools concerns the difference in the stakes of the respective exams. In both elementary and high schools, students take state standardized exams—either the 4th grade math and ELA exams or the high school Regents exams. These tests are considered high stakes because both are tied directly to student promotion, though in different ways. Since the tests' implementation in 1999, elementary school students who scored at the lowest level on the 4th grade math and ELA exams would not be able to advance to the next grade without being reassessed and scoring at the next highest level (Short and Campanile 2014). In the spring of 2014, the policy was changed slightly. For students who scored at the lowest level on the exams, "performance portfolios" would be compiled (Darville 2015). If the principal determines that the student's portfolio meets state standards, they do not have to reassess or attend summer school. If the portfolio is not satisfactory, the student will attend summer school at the end of which his or her performance will be considered again.

This change had little impact on student retention rates in its first year, however. In 2013, the last year when test scores determined promotion, 10 percent of third through eighth grade students were recommended for summer school and 2.5 percent of all students in those grades were ultimately retained. In 2014, with the adoption of the promotion portfolio approach, 7.4 percent of students were still recommended to summer school while 1.2 percent of all students were held back (Darville 2015). Additionally, this new retention criteria were passed in April 2014. Elementary students would have already taken the exams for that year in March and teachers would have prepared students in the same way they had in past. Neither teacher nor student behavior would be different for the 2014 exams.

Conversely, the high stakes nature of the high school Regents exams have changed more dramatically between 1999 and 2014 and are arguably more high stakes than the comparable elementary school exams. The Regents exams began as high school end-of-course exams in 1878. Starting in 1999, however, the Regents began to be phased in as requirements for high school graduation. In 1999 students needed to pass only the English exam to graduate, but by 2005 all exams were phased in and graduation required the passing of five exams throughout one's high school career (Sipple, Killen and Monk 2004, 147). For my analysis, which begins in 1999, there is once again not enough data for high schools. Since the nature of the exams was changing from 1999 to 2005, it is not possible to know if changes in the pass rates on these exams was due to changes in the exams or changes in school funding. The stakes of the 4th grade exams remained largely unchanged for the entire period.

Furthermore, I argue that the Regents exams are more high stakes than the elementary exams. While I am not negating the importance of being held back in the fourth grade, I do argue that not graduating high school is a much larger consequence. Likewise, high school graduation rates are much more widely reported, scrutinized and tied to school funding than fourth grade exam rates. Studies have shown that at the high schools often react to high stakes exams by "disappearing" students (Holme et al. 2010; Sipple et al. 2004). That is, schools will shift at risk students to GED programs, strategically retain and skip students over grades, and even encourage some students to dropout all to increase the schools' exam scores. This behavior will lead to bias in the high school Regents exam pass rates. These practices are not as widespread at the elementary level and again make elementary schools the clear choice for my study.

3.3 Description of Data:

I will be using two datasets for my analysis. Both datasets are available with annual data from 1999-00 to 2015-16. The first contains data on New York City School expenditures while the second contains data on student assessments and demographics. The school expenditure data comes from the New York City Department of Education and are titled School Based Expenditure Reports (SBER). These reports include per student expenditure by school.

The second dataset is the school report card data (SRCD) from the New York State Education Department. This includes demographic information by school such as racial and gender makeup of the school, the percentage of English Language Learners and the percentage of students who receive free and reduced-price lunch. It also includes information about each school such as average class size, annual attendance rates, number and percent of suspensions and graduation rates. Staff demographics are also recorded such as percent of teachers without certification or with a Master's degree.

Finally, this dataset is important as it includes information on student assessments. For the 4th grade math/ ELA assessment, the number and percent of students at each school scoring at each level (Level 1 through 4) is recorded along with the overall mean score for that school. A Level 1 score indicates the student is well below proficient in the standards for their grade while a level 2 score shows students are partially proficient. Both level 1 and level 2 are failing scores. Scores of level 3 or level 4 are considered passing, with proficiency and excellence, respectively (State Education Department 2014).

3.4 Imputation Methods:

The 1999 School Report Card Data was unfortunately missing much demographic information regarding both students and teachers. To still use 1999 as a base year in my analysis, I imputed the demographic data for the following variables. For students: the percent receiving free or reduced-price lunch and racial/ethnic demographics (percent black, Hispanic, white, Asian, and American Indian). For teachers: experience (the percent with fewer than three years of experience, percent teaching outside their certification area), education (the percent with no valid certification and the percent with a Masters degree or more), and the five-year turnover rate.

I imputed these values using a linear extrapolation method. I had data on the above variables for both 2006 and 2014. I assumed that the annual rate of change seen in the variables of interest between 2006 and 2014 was the same as the annual rate of change between 1999 and 2006. I found the difference in the variables between 2006 and 2014 then multiplied that difference by 7/8 to find the rate of change between 1999 and 2006. Once this was found I simply subtracted this from the observed values in 2006.

I was able to impute the variables for 454 out of 602 schools in 1999. The other 148 schools could not follow this method as data was missing for either 2006 or 2014. In those instances, I found the average imputed value by community school district and imputed that value. New York City has 32 community school districts which share geography and population. For this reason, the average of each community district would serve as an appropriate estimate for any missing data within that district. For example, in New York City Community School District #9, there were 19 elementary schools in 1999. Three of these school's demographics were not able to be imputed linearly since there was missing data from 2006 or 2014. Using the 16 schools with imputed data I found the average of each variable (60.9 percent Hispanic, for instance) and imputed this value for the three schools with missing values. This method ensured that the average for each community school district remained unchanged.

Once all values were imputed, I changed any negative values to 0 and any values above 100 percent to 1. Since all the variables imputed were all demographic percentages, it does not make sense to leave these negative or exceeding 100 percent.

To check that this was an appropriate method, I compared the imputed values' averages by community school district to the recorded averages by community school district in the Education Demographic and Geographic Estimates (EDGE) data from the 2000 Census. This contains data on children enrolled in public schools by school district for the year 2000. The mean values of student racial and ethnic characteristics in the dataset were compared to the mean values from my imputation for each of the 32 community school districts in New York City. Referring to my previous example, the average imputed value for the percent of Hispanic students in NYC Community district #9 is 60.9 percent while the actual value reported in the edge data is 60.4 percent. The mean differences between the two are very small, all within 2 percentage points, apart from the percent of black students. The imputed average is 34.6% while the EDGE data averages 38.9%. This difference is not particularly worrisome, however, as it is still with 5% of the imputed value and the EDGE data is for 2000 while my imputed values are for 1999. I was not able to check the validity of the imputation for the percent of students on free or reduced-price lunch since this data is not available disaggregated by school districts.

For the teacher data, I was only able to compare the percent of teachers with no valid certification and the percent of teachers with a master's degree or more. I compared these imputed values to the reported percentages by the New York State Education Department Personnel Master File Statistics (PMF). The earliest year of available data is 2001. Just like the EDGE data, the Personnel Master Files provide summary data by school district. In this case, information such as education level and salary are collected for all public-school teachers. There is a mean difference between the imputed value and the reported value for the percent of teachers with no certification of 9.8 percentage points. The mean difference is 5.8 percent for percent with master's degree or more.[2] There are obvious issues in using the PMF to check the validity of my imputation. First, the data are not for the same year. Second, the Personnel Master Files are for all schools in each community district, not just elementary schools as is the case with the imputed values. Even with these difficulties, the imputed values for teacher characteristics are still within 10 percentage points of the actual values.

3.5 Descriptive Statistics:

3.5.1 Testing Trends:

The fourth grade English Language Arts (ELA) and math exams are scored on a level system. Students with a level 1 score are performing well below proficiency for the standards in their grade. They demonstrate limited and insufficient knowledge or skills for the expectations of fourth grade. Students with a level 2 score are partially proficient. Although their knowledge and skills are insufficient, they are still considered on track to meet New York State graduation requirements with some remediation. Students at a level 3 are proficient in the standards of the grade. Their knowledge and skill are considered sufficient for the fourth grade. Students at a

[2] Tables summarizing my imputation results with comparisons to either EDGE or PMF data by community school district are available in the Appendix.

level 4 are excelling and have knowledge and skill that is more than sufficient for the expectations of the grade (State Education Department 2014, 2).

The court in the Campaign for Fiscal Equity v. The State of New York defined a successful elementary school as one in which at least 80 percent of students passed the fourth grade ELA and math exams. For the purposes of this analysis, I am defining "passing" the exam as achieving a level 3 or 4 score in 1999 and 2006 and a level 2, 3, or 4 score in 2014. These differing definitions are an attempt to correct for a change in the structure of the ELA and math exams between 2006 and 2014. In 2010, New York State decided that the state exams had become too easy to pass and implemented exams that were more difficult. The state made the test questions less predictable and raised the number of correct answers needed to pass. For example, in 2009 a fourth grader needed 37 out of 70 questions correct on the math exam to reach a level 3. The following year, a fourth grader need 51 out of 70 to reach the same level (Medina 2010).

As a result, scores dropped statewide. In 2009, 86 percent of students were deemed at or above grade level in math and 77 percent at or above grade level in English. One year later, 61 percent were passing in math and only 53 percent in English (Medina 2010). In 2013 the exams got even more difficult by aligning the exams to the Common Core. The new standards require students to show more advanced analytical skills through solving math problems with multiple steps and writing in-depth essays (Hernandez and Gebeloff 2013). In New York City, scores dropped dramatically. The year before the change 47 percent of city students passed the English exam and 60 percent passed the math exam. In 2013, with the adoption of the Common Core standards, 26 percent of students passed the English exam and 30 percent passed in math (Hernandez and Gebeloff 2013).

Figures 1 and 2 below show the percent of 4th grade students, both across New York state and in New York City[3], scoring at a level 3 or 4 from 1999 to 2016. From the graph, we can see the sharp drop in pass rates after 2009 and 2012, the two times the state made the exams more difficult. We can also see the state pass rate has historically been slightly above the city pass rate, but scores move together, and this is no different after 2009 or 2012.

[3] New York City's percent of students scoring at a level 3 or 4 was unavailable in 2000 and 2001 for math and 2001 for English.

Figure 1: Percent of Students Level 3+, 4th Grade Math

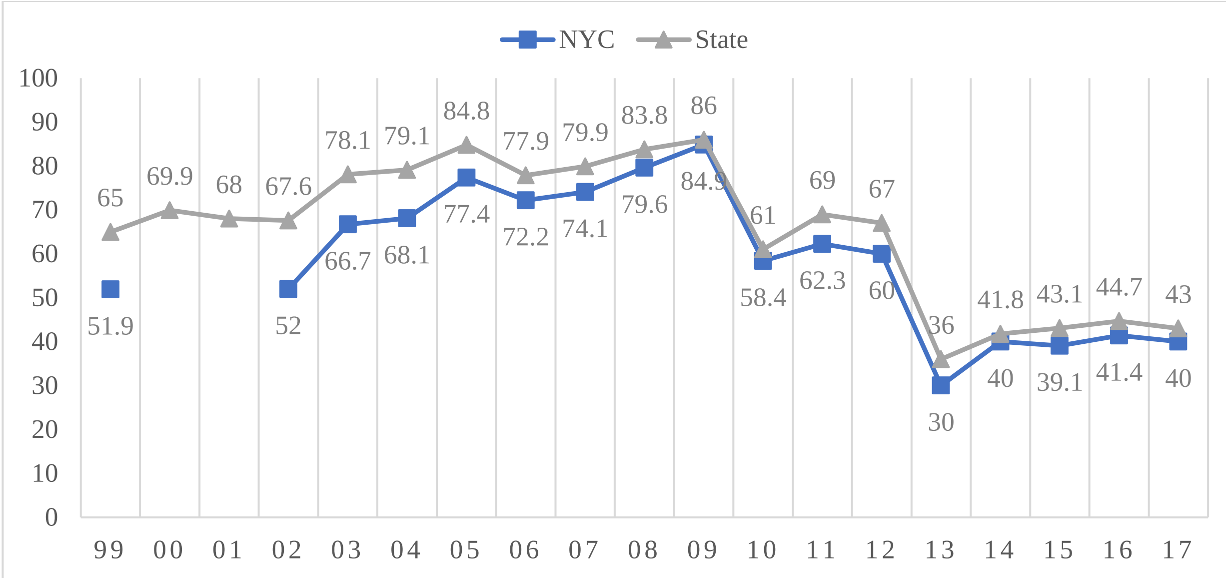
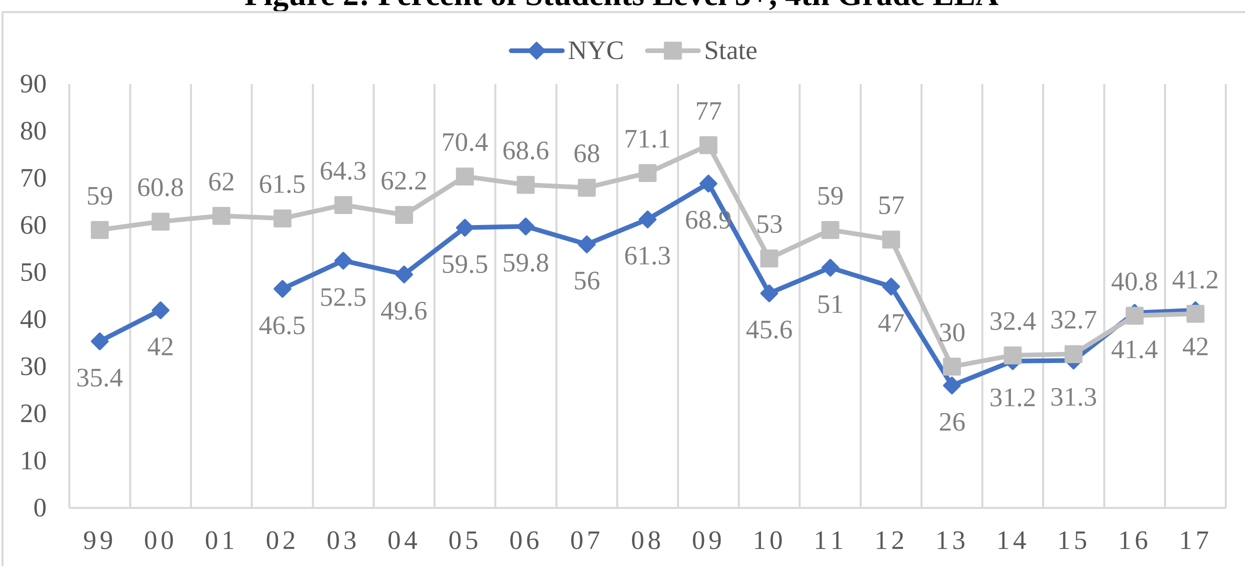


Figure 2: Percent of Students Level 3+, 4th Grade ELA



Because the exams have gotten dramatically more difficult from 2006 to 2014, I am expanding my definition of “passing” from levels 3 and 4 in 1999 and 2006 to levels 2, 3 and 4 for 2014. This will keep the school performance data, my dependent variable, from being biased due to the change in exam structure in 2010 and 2013. From this point forward, when I refer to “passing an exam” these are the definitions I mean.

Performance on the exams has been rising over time. In 1999, 35.4 percent of city students passed the English exam while 51.9 passed in math. In 2006, those numbers rose to

59.8 percent in English and 72.2 percent in math. In 2014, 68.5 percent of city fourth graders passed the ELA exam and 69.9 percent passed the math exam.

Figure 3: Fourth Grade ELA Exam Results

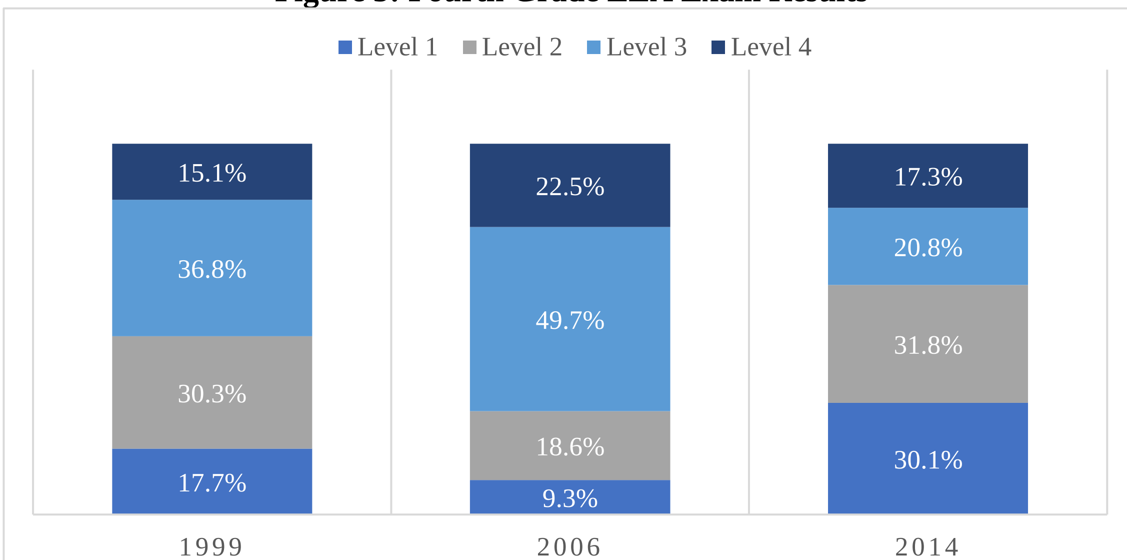
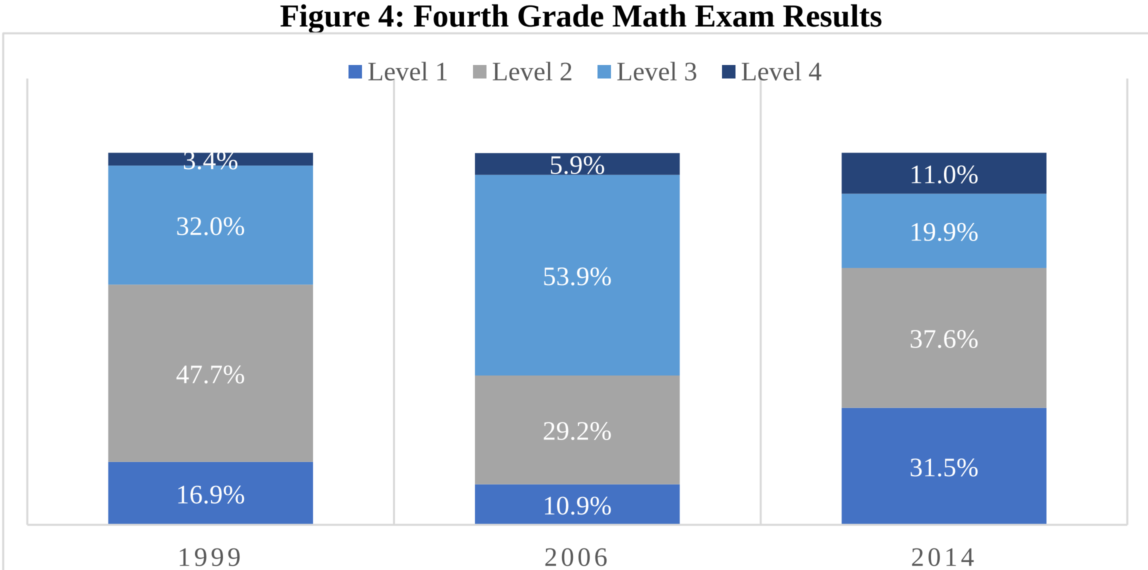


Figure 4: Fourth Grade Math Exam Results



3.5.2 Student Characteristics:

There are 602 elementary schools in my sample for 1999, 586 in 2006 and 591 in 2014. The New York City public elementary school student population has remained largely unchanged from 1999 to 2014 except for noticeable shifts in the shares of black and Hispanic students.

Table 2: Elementary School Student Demographics

2014 (N = 591)

		Mean	Median	Min	Max
Free/Reduced Price Lunch		74.33%	81	4	100
Race					
	Black	27.24%	16	0	97
	Hispanic	40.71%	34	2	98
	Asian	13.80%	5	0	94
	White	16.39%	3	0	91
	Native American	0.89%	0	0	31
English Language Learners		14.97%	12	0	69

2006 (N = 586)

		Mean	Median	Min	Max
Free/Reduced Price Lunch		78.65%	87	0	100
Race					
	Black	31.49%	22	0	97
	Hispanic	38.41%	31	2	98
	Asian	13.10%	4	0	93
	White	16.43%	3	0	91
	Native American	0.45%	0	0	4
English Language Learners		15.88%	13	0	63

1999 (N= 602)

		Mean	Median	Min	Max
Free/Reduced Price Lunch		80.77%	88	0	100
Race					
	Black	35.13%	25.31	0	100
	Hispanic	36.02%	29.63	0	100
	Asian	13.23%	4.88	0	92.13
	White	16.68%	4.06	0	97.13
	Native American	0.48%	0	0	6.63
English Language Learners		14.23%	11.98	0	54.93

The largest change has been the percent of students receiving free or reduced-price lunch (FRPL). In 1999, over 80 percent of students, on average, received the service. In 2006 this percent had decreased to just over 78 percent and by 2014, 74 percent of elementary students received free or reduced-price lunch. Despite the decrease at the mean, in every year there were still schools with 100 percent of its students on free and reduced-price lunch. The program provides either free meals or meals for 25 cents to students whose families earn below some income threshold. The Federal guidelines for the program state the cutoff for reduced lunch is 185 percent of the official poverty line while those with income below 130 percent of the official poverty line eat school lunch for free. In addition to these guidelines, in New York State, students automatically quality for the program if they live in a family already receiving Supplemental Nutritional Assistance Program (SNAP) or Temporary Assistance for Needy Families (TANF) benefits.

For the purposes of this analysis, the percent of students receiving free or reduced-price lunch will serve as a proxy for the percent of students living in poverty. This is a common practice in education policy. This is because the measure is more available at the school level while poverty rate is generally not. Additionally, since the FRPL program eligibility is derived from the federal poverty level, it is highly related to it and is therefore useful for analysis (Snyder and Musu-Gillete 2015).

Other student characteristics, such as race/ethnicity and English Language status did not see as great a change from 1999 to 2014. The percent of English Language Learners (ELL) remained around 15 percent over the period. In New York State, ELL students are those who "speak a language other than English by reason of foreign birth or ancestry and either understand and speak little English or score below a specific threshold on a proficiency exam" (Education Commision 2014). The percent of White, American Indian, and Asian students all remain largely unchanged—around 16 percent, under one percent, and around 13 percent, respectively. The percentage of Hispanic students has grown from 1999 to 2014 (from 36 percent to 40 percent) while the percent of Black students has declined (from 35 percent to 27 percent) between 1999 and 2014. It is important to note that that there is widespread segregation in New York City, however, as there are schools in every year with close to 100 percent Black, Hispanic, Asian or white students.

3.5.3 Teacher Characteristics:

While there was relatively little change in student demographics from 1999 to 2014, there are large changes in teacher characteristics. On average, New York City elementary school teachers became more educated and more experienced over the period.

Table 3: Elementary Teacher Demographics

2014 (N = 591)

	Mean	Median	Min	Max
Student to Teacher Ratio	14.99	14.95	4.83	78.56
No Valid Certification	0.23%	0	0	9
Teaching Outside Certification	4.00%	2	0	33
Less Than 3 Years' Experience	9.37%	8	0	48
Masters Degree or More	48.76%	48	5	90
5 Year Turn Over Rate	13.64%	0	0	88

2006 (N = 586)

	Mean	Median	Min	Max
Student to Teacher Ratio	13.57	13.56	3.15	45.69
No Valid Certification	3.50%	3	0	18
Teaching Outside Certification	11.60%	11	0	38
Less Than 3 Years' Experience	14.76%	13	0	47
Masters Degree or More	36.43%	35	0	88
5 Year Turn Over Rate	17.76%	17	0	75

1999 (N= 602)

	Mean	Median	Min	Max
Student to Teacher Ratio	15.98	16.05	5.48	24.33
No Valid Certification	6.28%	4.75	0	33.75
Teaching Outside Certification	18.91%	16.88	0	71.25
Less Than 3 Years' Experience	19.87%	18.35	0	73.88
Masters Degree or More	26.23%	23.19	0	98
5 Year Turn Over Rate	25.31%	22.3	0	100

The percent of teachers without any valid certification dropped from over 6 percent to less than one percent while the percent of teachers with Master's degrees nearly doubled (from 26 percent to 48 percent). Teachers were also more likely to teach within their certification area. In 1999, nearly one in five teachers taught outside their field while by 2014 that ratio reduced to only one in 25. Teachers were also more likely to stick around. The five-year turn-over rate was cut almost in half, from 25 percent in 1999 to 14 percent in 2014. The student-teacher ratio remained fairly constant with averages of 16, 14, and 15 in 1999, 2006 and 2014, respectively.

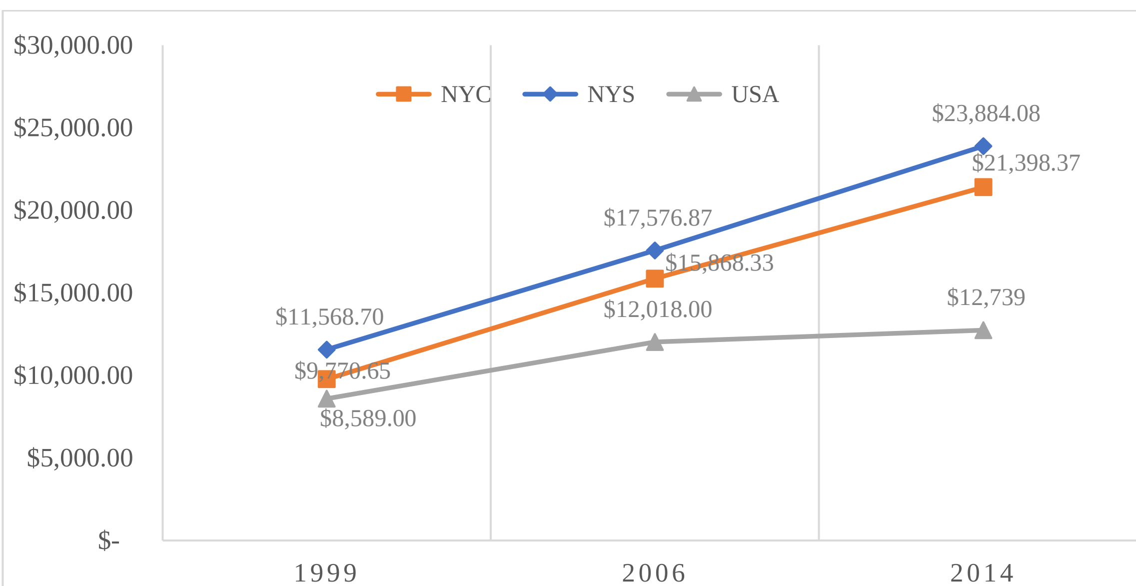
3.5.4 Spending Trends:

From 1999 to 2014, the mean per pupil expenditure in New York City elementary schools more than doubled. In 1999, schools spent an average of just over $9,770 per student. In 2006, the year before the CFE case, New York City schools were spending an average of $15,868 per student. By 2014, when all of the additional funding mandated by the CFE case was realized, these same schools were spending $21,393 per student.

On average, New York City spends about $2,000 less per student every year than the state as whole, however, the upward trend in spending is in line with per pupil spending in the rest of the state. In 1999, New York State averaged per pupil spending of $11,569 while averaging $23,884 in 2014.

Both New York State and New York City spend more per pupil, on average, than the rest of the nation. The average per pupil spending in the US in 1999 was around $8,500. This number increased in 2006 to around $12,000 but then leveled out. By 2014, US schools were only spending $721 more per pupil than 2006.

Figure 5: Mean Total Expenditure Per Pupil



The split in expenditure between New York and the rest of the country could be explained by the CFE case and the resulting change in funding structure. Following the ruling, New York not only increased funding to New York City, but completely changed its funding formula and as a result total state funding increased and many disadvantaged districts received more state resources. Without the CFE ruling it is possible that both New York City and New York State mean expenditure per pupil would have followed the national trend and remained constant from 2006 to 2104.

3.6 Model Specification:

Many education policy studies examine the link between student achievement and school spending using panel data with time periods that span some policy change which led to an exogenous change in spending. Papke and Wooldridge (2008) argue that "standard linear panel data models are not well suited to pass rates as it is difficult to impose a positive yet bounded effect of spending on pass rates" (p. 121). Linear functional forms have several drawbacks in this type of analysis. First, there is the question as to whether linear models accurately capture the diminishing returns of spending for those schools at the top of the spending distribution. Second, linear functional forms for conditional means might miss important nonlinearities. Furthermore, the traditional solution—using the log-odds transformation—fails at the corners, zero and one (Papke and Wooldridge 2008, 122).

A solution to the above difficulties is to use a fractional response model when the dependent variable is continuous and greater than or equal to zero and less than or equal to one. The method is most often used for outcomes such as rates, proportions, and fractional data. Applications of this model have been applied to study 401(k) retirement plan participation rates, Gini index values for the prices of art, and the probability of a defendant's guilt and the verdict. Of particular interest is Papke and Wooldridge (2008) who studied the fourth-grade math test pass rates in Michigan from 1992 through 2001 attempting to show the effects of the 1994 Proposal A which dramatically changed the way Michigan schools were funded.

Fractional response methods for dependent variables in [0,1] avoid model misspecification and predictions falling outside the interval as is possible in a standard OLS. Additionally, the method captures nonlinear relationships especially when the dependent variable is close to 0 or 1. This method is appropriate in this analysis as my data is on the proportion of students in each school that passed the state exams rather than the data on whether individual students passed an exam.

Fractional regression is a model of the mean of the dependent variable y conditional on covariates **X**, denoted μ_X. Since y is in [0,1], it must be assured that μ_X is also in [0,1]. To do this, a probit or logit model is used for μ_X. In this case, I follow Papke and Wooldridge (2008) and assume the functional form of the expected exam pass rate is a standard normal cumulative distribution function, $\Phi(\cdot)$ and $E(y_{it}|\boldsymbol{X_{it}},\ c_{it}) = \Phi(\mathbf{X_{it}}\beta + c_i)$ for cross-sectional observation *i* in time *t* where y is the dependent variable in [0,1], **X** is a set of explanatory variables and c is the unobserved effect (p. 122-123). The model is estimated using a quasi-maximum likelihood (QML) method, a more general application of maximum likelihood estimation. The QML method differs from maximum likelihood estimation in that the specifying density function may not be the correct one. In the traditional ML method, the specified density function is assumed to be the true density function, so the specification errors are assumed away.

The log-likelihood function which is maximized for fractional models takes the form

$$lnL = \sum_{j=1}^{N} y_j \ln\{G(\mathbf{X_j}\beta)\} + (1 - y_j)\ln\{1 - G(\mathbf{X_j}\beta)\}$$

where N is the sample size, y_j is the dependent variable, and $\mathbf{X_j}$ are the covariates for individual j. For a fractional probit model, G(.) takes the form of $\Phi(\mathbf{X_{it}}\beta)$ where Φ is the standard normal cumulative density function.

Following the works of Jackson, Johnson and Persico (2015) and Hyman (2014), the following linear model is specified.

$$Y_{st} = \beta_0 + \beta_1 \log(Spend_{st}) + \beta_2 X_{st} + \beta_3 Z_{st} + \beta_4 S_{st} + \epsilon_{st} \qquad (1)$$

Where Y_{st} is the educational attainment of school s in time t. In this case, the dependent variable is the percent of students in each school in each year who passed the 4^{th} grade ELA or math exam. Two models will be estimated in each year—one for each exam. The independent variables are: $\log(Spend_{st})$—the log of per pupil spending of school s in time t, X_{st}— a vector of student demographics (race, percent of student receiving free lunch or reduced price lunch, percent of ELLs), Z_{st}— a vector of teacher characteristics (the percent of teachers with a

Master's degree or more, the percent of teachers with fewer than 3 years of experience, the percent of teachers with no valid certification, and the 5-year teacher turnover percent), and S_{st}—a vector of school characteristics including the student-teacher ratio, the total enrollment and the average attendance rate. The attendance rate was normalized by dividing by the average attendance in that year to account for very few observations below 75 percent. Finally, ϵ_{st} is the error term.

However, since the dependent variable—exam pass rates—is bounded in [0,1], I transform equation (1) to a fractional probit model with the following form:

$$E(Y_{st}) = \Phi(\psi_{st} + \beta_1 \log(Spend_{st}) + \beta_2 X_{st} + \beta_3 Z_{st} + \beta_4 S_{st} + \epsilon_{st}) \qquad (2)$$

I run the above model for the years 1999, 2006 and 2014. I choose 1999 as the first year I have data and far enough away from the CFE case that will serve as a useful baseline. This is also the initial year high stakes testing was mandated in 4^{th} grade. The year 2006 is the year right before the mandates from the CFE case took effect. Finally, 2014 is the year in which New York City finally received all its promised funding increase. The funding was meant to be phased in over a four-year period, however due to the recession in 2008, the state was unable to fulfill this promise. Instead, by 2014, New York City schools were finally being funded $1.93 billion more than in 2006.

4.7 Marginal Explanatory Values

In an ordinary least squares regression, the t-statistics are used in deciding if the independent variable is statistically significant in explaining the dependent variable. However, the validity of this approach is subject to numerous conditions: there must be a true equation of the exact form of the estimated equation, the independent variables **X** are *a priori* known, **X** must be non-stochastic, the errors must be uncorrelated with each other, have all the same variance, and be normal (Almon 1999, 8). Additionally, t-statistics and standard errors are highly sensitive to sample size. Small standard errors are meant to assure us that the variable's sign is true, yet it can be hard to tell if this is due to the correct speciation of the model or the large sample size. Almon (1997) suggests the use of marginal expletory values, or mexval, instead. These measurements provide an alternative way of evaluating a variable by measuring how much the sum of square residuals, SSR, increases when that variable is dropped from the model. Another way to consider this is to ask, “by what percent the standard error of estimate goes up by when the variable is eliminated, and all others adjust to compensate as best they can for the elimination” (Almon 1997, 9). This measure, mexval, can be found through the following equation,

$$m = 100\left(\sqrt{1 + \frac{t^2}{T - n}} - 1\right)$$

where t is the t-statistic, T is the number of observations, and n is the number of parameters estimated. I will use this measure to determine which of explanatory variables explains the most variance in student exam pass rates.

4.8 Counterfactuals:

While the above analysis will be useful in determining how each explanatory variable affects the pass rate on the exams for each year, it will do little in explaining if the funding increase to New York City schools had any effect in altering the pass rates or in causing more schools to be successful. To answer these questions, I create counterfactual estimates. Counterfactuals are hypothetical situations which allow me to ask and answer what if the funding structures seen in 1999 (and 2006) were the same as those in 2014? What effect would this have on test pass rates?

To answer such questions, I run my model in 2014 and save the predicted values. Then I change $Spend_{st}$ for each school to the per pupil spending observed for that school in 1999 (or 2006). I then predict the 2014 model again with the spend variables from 1999 (or 2006) to see what the exam pass rates would have been if the per pupil spending at each school had not changed over the period.

4. DISCUSSION OF RESULTS

4.1 Fractional Probit Model Results

Table four shows the conditional marginal effects[4] on the 4th grade ELA exam pass rates, reported as first derivatives, at the mean values of each explanatory variable. I have called these QML since they are derived from quasi maximum likelihood estimation. These results are compared to the standard ordinary least squares (OLS) regression of the same variables. Table five shows the same information for the 4th grade math exam.

Table 4: Marginal Effects- ELA Exam

	1999		2006		2014	
Variable	QML	OLS	QML	OLS	QML	OLS
Log Per Capita Spending	-0.103***	-0.111***	-0.226***	-0.220***	-0.091**	-0.084***
	(0.028)	(0.034)	(0.065)	(0.055)	(0.045)	(0.038)
Total Enrollment	0.000***	0.000***	0.000***	0.000***	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Student Teacher Ratio	0.001	0.001	0.003	0.001	0.002	0.001
	(0.002)	(0.002)	(0.005)	(0.004)	(0.001)	(0.001)
Attendance Rate	1.320***	1.382***	1.120***	1.070***	2.086***	2.278***
	(0.179)	(0.180)	(0.225)	(0.224)	(0.345)	(0.296)
Percent ELL	0.085	0.079*	-0.107*	-0.112*	-0.304***	-0.327***
	(0.056)	(0.047)	(0.063)	(0.063)	(0.053)	(0.055)
Percent FRPL	-0.014	-0.015	-0.158***	-0.094***	-0.219***	-0.124***
	(0.013)	(0.014)	(0.042)	(0.033)	(0.038)	(0.038)
Percent Black	-0.030*	-0.030*	-0.264***	-0.255***	-0.173***	-0.154***
	(0.017)	(0.018)	(0.034)	(0.032)	(0.034)	(0.034)
Percent Hispanic	-0.003	-0.002	-0.238***	-0.230***	-0.169***	-0.152***
	(0.022)	(0.021)	(0.045)	(0.038)	(0.036)	(0.038)

[4] The full maximum likelihood estimation results are included in the Appendix in tables C to H.

Percent Asian	-0.018	-0.025	0.081*	0.059	0.014	0.022
	(0.029)	(0.030)	(0.045)	(0.042)	(0.037)	(0.039)
5-year Turnover Rate	0.013	0.014	-0.035	-0.028	0.015	0.011
	(0.015)	(0.016)	(0.035)	(0.035)	(0.024)	(0.023)
Percent Masters	0.017	0.014	-0.001	0.002	-0.043	-0.008
	(0.020)	(0.016)	(0.051)	(0.044)	(0.038)	(0.040)
Percent No Certification	-0.181***	-0.209***	-0.197	-0.254*	0.469	0.376
	(0.068)	(0.069)	(0.169)	(0.150)	(0.516)	(0.497)
Percent < 3 Years'	-0.013	-0.012	-0.118	-0.103*	-0.026	-0.013
Experience	(0.027)	(0.028)	(0.073)	(0.065)	(0.066)	(0.062)
N	600		582		591	

standard errors in parentheses
Margins are significant at: 1%(***), 5%(**), 10%(*)

Table 5: Marginal Effects- Math Exam

	1999		2006		2014	
Variable	QML	OLS	QML	OLS	QML	OLS
Log Per Capita Spending	-0.207***	-0.192***	-0.196***	-0.211***	-0.100**	-0.096***
	(0.049)	(0.047)	(0.052)	(0.052)	(0.048)	(0.041)
Total Enrollment	0.000***	0.000***	0.000***	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Student Teacher Ratio	0.002	0.002	-0.002	-0.003	0.001	0.001
	(0.003)	(0.003)	(0.004)	(0.004)	(0.001)	(0.001)
Attendance Rate	3.734***	3.450***	1.150***	1.135***	2.814***	3.121***
	(0.339)	(0.252)	(0.221)	(0.210)	(0.344)	(0.318)
Percent ELL	-0.395***	-0.360***	-0.193***	-0.209***	-0.305***	-0.326***
	(0.068)	(0.066)	(0.054)	(0.059)	(0.058)	(0.060)
Percent FRPL	0.012	0.013	-0.037	-0.000	-0.156***	-0.048
	(0.020)	(0.020)	(0.030)	(0.031)	(0.039)	(0.041)

Percent Black	-0.315***	-0.290***	-0.294***	-0.274***	-0.290***	-0.269***
	(0.028)	(0.026)	(0.030)	(0.030)	(0.034)	(0.037)
Percent Hispanic	-0.210***	-0.193***	-0.240***	-0.215***	-0.202***	-0.175***
	(0.035)	(0.030)	(0.036)	(0.035)	(0.037)	(0.041)
Percent Asian	0.005	0.006	0.080**	0.049	0.039	0.018
	(0.046)	(0.042)	(0.035)	(0.033)	(0.040)	(0.042)
5-year Turnover	0.026	0.025	-0.054	-0.051	0.010	0.004
Rate	(0.022)	(0.022)	(0.035)	(0.033)	(0.027)	(0.024)
Percent Masters	-0.051*	-0.047	0.005	0.001	-0.114***	-0.072*
	(0.031)	(0.097)	(0.047)	(0.041)	(0.043)	(0.043)
Percent No	-0.141	-0.145	0.086	-0.015	0.636	0.486
Certification	(0.107)	(0.097)	(0.148)	(0.141)	(0.628)	(0.533)
Percent <3 Years'	0.031	0.029	-0.108	-0.092	-0.063	-0.051
Experience	(0.042)	(0.039)	(0.069)	(0.059)	(0.067)	(0.066)
N	600		582		591	

standard errors in parentheses
Margins are significant at: 1%(***), 5%(**), 10%(*)

The marginal effect of the log of per capita spending, the primary variable of interest, is essentially zero for all years for both exams. Since per capita spending is in log form, a one percent increase in total per capita spending at the mean would result in ELA exam scores 0.10 percentage points lower in 1999, 0.23 percentage points lower in 2006 and 0.09 percentage points lower in 2014 using the average partial effects. With the OLS model, a one percentage point increase in total spending would have 0.11, 0.22 and 0.08 percentage point decrease on ELA exam pass rates in 1999, 2006 and 2014, respectively. The math exams are no different. A one percent increase in total per pupil spending at the mean will decrease the exam pass rates between 0.10 and 0.21 percentage points, depending on the year or model. All these results are statistically significant, at the 5 percent confidence level.

This is a somewhat counterintuitive result, however. It is commonly believed that increased spending should lead to increased student results and these results suggest that increased spending has almost no effect, and that if anything, increased total per pupil spending slightly decreases exam pass rates. This may be explained by the fact that this variable is aggregated; it captures all school spending including that on line items which probably have no effect on student test scores. One can think of schools spending more on custodial or administrative staff, debt payments, or central admin. All of these are important yet likely have little effect on student pass rates on standardized tests. This corresponds with the literature which suggests that often aggregated spending categories are not statistically different between successful and unsuccessful schools (see Chellman and Weinstein 2005).

The other explanatory variables which produce significant (statistically) results are: total enrollment, attendance rate, the percent of English Language Learners, the percent of students receiving free or reduced-price lunch, the racial markup of the student body, the percent of teachers with no valid certification, and the percent of teachers with Masters degrees. Although student enrollment is statistically significant, it has zero effect on student pass rates for both exams, in every year, in every model. Attendance, however, has larger effects and is statistically significant in every year for both exams. A one percent increase in a school's attendance above the mean attendance rate has large positive effects on student pass rates—between 1.1 and 3.7 percentage points gain depending on the year, model and exam. This result is expected for two reasons. First, intuitively, if students are at school more it seems likely that they will have better test scores. Second, attendance is a good proxy for school environment which the literature suggests is an important driver of student success. Student are more likely to want to attend school if there is a positive environment and students who go to schools with positive environments are more likely to achieve.

Student demographics are also significant in explaining exam pass rates. For instance, the percentage of English Language Learners has a negative effect on exam scores and is significant in 2006 and 2014 for the English exam and in all years for the math exam. In 2006, if the mean ELL population increases by 1 percent, ELA exam pass rates would decrease 0.11 percentage points. The same increase translates to a decrease in pass rates by 0.3 percentage points in 2014. This result makes sense since it is reasonable to believe that as the percentage of students who are not fluent in English increase the pass rate on an English exam would go down.

The result is the same for the math exam—that is, as the mean percentage of English Language Learners increase, the pass rate on the math exam decreases. The result is significant in all years with a 1 percent increase in mean ELL population leading to a 0.40, 0.19, and 0.31 percentage point decrease in pass rate for 1999, 2006, and 2014, respectively. Although we might expect the decline in math pass rates to be smaller than the decline in ELA rates, it makes little difference. Classroom instruction and both exams are still in English which means English Language Learners are likely to perform worse than native English speakers. These results are mirrored for both exams in the OLS results.

The percentage of students on free and reduced-price lunch, a proxy for a school's poverty status, is highly statistically significant for the ELA exam in 2006 and 2014 and the math exam in the QML model for math in 2014. In 2006, as the mean population of FRPL students increases by 1 percent, the ELA exam pass rate decreases 0.16 percentage points. The effect is larger for both exams in 2014: an increase in FRPL students of 1 percent decreases pass rates by 0.22 percentage points for ELA and 0.16 percentage points for math. This result is consistent with the literature which shows that socioeconomic status is still one of, if not the most important contributor to student success.

Student's race/ethnicity is also highly statistically significant for both exams. As the percent of black and Hispanic students increases, the ELA exam pass rates reliably decrease between 0.03 and 0.26 percentage points while the math exam pass rates decrease is more, between 0.18 and 0.32 percentage points. Conversely, the percent of Asian students is only significant in 2006 where it positively correlated with both ELA and math exam pass rates—around 0.08 percentage points for each 1 percent increase in the mean population. Interestingly, although the percent of black and Hispanic students is statistically significant and negative in every year, the marginal effects are larger for the math exams. This may be due to stereotype threat which the literature shows can negatively affect minority and female performance on standardized tests (see Holme et al. 2010).

Teacher characteristics are generally not statistically different from zero with two exceptions: the percent of teachers with a master's degree or more for the 1999 and 2014 math exam and the percent of teachers with no valid certification in 1999 and 2006 for the ELA exam. Both show negative relationships. A one percent increase in teachers without certification at the mean reduces exam scores between 0.18 and 0.25 percentage points. This is an expected result as teachers with no form of valid certification are the least educated in quality teaching strategies and generally have the least experience in the classroom. These teachers are also the cheapest to hire and probably work in the poorest school districts. A one percent increase in teachers with higher education reduces math exam pass rates between 0.05 and 0.11 percentage points. This result is less expected as it is conventionally thought that more educated teachers will have better results. However, there are two possible explanations. First, more educated teachers may spend less time on test prep and more time on actual instruction that may not translate into higher test pass rates. Second, the data does not distinguish between teachers with a master's in education and master's in other subjects.

The remainder of the variables—the student-teacher ratio, the five-year turnover rate, and the percent of teachers with less than three years of experience are not statistically different from zero for both exams.

4.2 Marginal Explanatory Value Results

Table six presents the measures of the marginal explanatory value of each independent variable. The larger the value, the more the variable explains the variance in student exam pass rates. The main variable of interest, the log of per pupil spending, never explains the most variance in outcome but it is in the top four variables with most marginal explanatory power in 1999 and 2006 for both exams. In 2014, the log of per pupil expenditure has little marginal explanatory value.

From these results, the two most important variables for explaining the variance in exam pass rates are attendance rate and student race. Attendance explains the most variance in the outcome in 1999 and 2014 while in 2006, race, particularly the percent of black and Hispanic students, explains the most variance in outcome. In some years for some tests, the percentage of English Language Learners also explain a large amount of the variance. The percent of teacher with no certification has relatively high marginal expletory value in the 1999 ELA exam but not for other years or exams.

Table 6: Marginal Explanatory Values (Mexval)

	1999		2006		2014	
	ELA	Math	ELA	Math	ELA	Math
Log Per Pupil Expenditure	0.912	1.401	1.389	1.452	0.418	0.473
Enrollment	0.574	0.874	0.658	0.170	0.057	0.011
Student Teacher Ratio	0.008	0.062	0.012	0.056	0.103	0.014
Attendance Rate	4.891	14.840	1.988	2.530	4.991	8.005
Percent ELL	0.240	2.499	0.278	1.095	2.977	2.565
Percent FRPL	0.099	0.039	0.691	0.000	0.915	0.120
Percent Black	0.232	10.429	5.595	7.271	1.721	4.508
Percent Hispanic	0.001	3.451	3.333	3.302	1.388	1.594
Percent Asian	0.060	0.001	0.180	0.137	0.027	0.015
5-Year Turnover Rate	0.064	0.107	0.059	0.216	0.021	0.003
Percent Masters	0.034	0.184	0.000	0.000	0.004	0.244
Percent No Certification	0.774	0.189	0.251	0.001	0.050	0.072
Percent < 3 Years' Expr.	0.015	0.048	0.233	0.211	0.003	0.051
Constant	0.115	0.194	0.793	0.857	0.080	0.374

These results generally reflect the findings from both the quasi maximum likelihood and the OLS estimation. In both these models, attendance and race was highly statistically significant in all years for all exams. The high marginal explanatory values of these variables reiterate that both student race and attendance rate is important in explaining the variance of student exam pass rates. Per pupil expenditure was also highly significant in the QML and OLS model. The mexval results show that this variable does explain some of the variance in test pass rates, though not as much race, attendance rate, and often the percent of English Language Learners.

4.3 Counterfactual Results

Table seven reports the counterfactuals for the ELA exam pass rates in each year while table eight reports the same for the math exam. Results from both the QML and OLS are reported. Along the diagonal in each table—formatted in bold—are the actual average exam pass rates in each year. For example, on average, the ELA exam pass rate in 2006 was 59.84 percent. The rest of the percentages show various counterfactuals. The rows apply different years of per capita spending[5] to the remaining characteristics in the column years. This shows what the exam pass rates would have been with different funding structures from different years. For instance, the average 2006 ELA exam pass rate would have been 72.39 in the QML model or 73.56 percent in the OLS model if all the characteristics from 2006 remained the same but the per capita spending was that observed in 1999.

Table 7: ELA Exam Pass Rates

	1999		2006		2014	
	MLE	OLS	MLE	OLS	MLE	OLS
PP Spending 1999	**35.49%**	**35.49%**	72.39%	73.56%	75.15%	75.22%
PP Spending 2006			**59.84%**	**59.84%**	71.48%	71.37%
PP Spending 2014					**68.56%**	**68.56%**

Table 8: Math Exam Pass Rates

	1999		2006		2014	
	MLE	OLS	MLE	OLS	MLE	OLS
PP Spending 1999	**51.93%**	**51.93%**	81.86%	83.75%	77.09%	77.51%
PP Spending 2006			**72.16%**	**72.16%**	73.15%	73.12%
PP Spending 2014					**69.98%**	**69.98%**

Comparing the counterfactuals to the actual exam pass rates shows some counterintuitive results. It is commonly believed that more per pupil spending will lead to better student achievement. The data shows that this is not always the case. For both exams and models, the pass rates would have been slightly higher in 2014 if per capita spending remained at the 2006 or 1999 level.

There are explanations for this. First, as mentioned previously, my variable of interest is total per pupil spending. This level of detail makes it impossible to tell whether schools are consistently spending their increased funds on classroom instruction or ancillary services, regional or system-wide costs. If the latter is true, it would not be unreasonable to expect that the student exam scores may be higher using a previous year's funding structure.

[5] Although the per capita spending from each individual school was used to create the counterfactuals, for reference, the average per capita spending per school in New York City was $9,770.65 in 1999, $15,868.33 in 2006, and $21,398.37 in 2014.

Second, my model is incomplete. I accounted for everything I believed would impact student exam pass rates but was limited by my access to data. Beyond the lack of disaggregated spending data, I have no information about parent involvement which could be important especially with elementary school students. I also have limited data on student socioeconomic status such as parent's education, employment, etc. One of the significant variables in my model was the percent of students receiving free or reduced-price lunch which I used as a proxy for poverty. Perhaps if this was more fully modeled we would see different results. Lastly, to model the intangible "school environment," I used proxies such as student attendance and staff turnover. Better variables to use here may have come from qualitative surveys of student and staff but this was unavailable to me at the school level in each year I wished to study.

6. CONCLUSION

Given the substantial amount of money spent on public education in country it is vital to understand the effects of such spending on student achievement. Since the 1970s, per pupil school spending has risen significantly—much of this in response to court-ordered school finance reform. Reforms from the 1970s to the 1980s aimed to reduce resource disparity across districts and increase equity. Since the 1990s, reforms have been adequacy reforms aimed to achieve sufficient funding in low income districts.

Such reforms are necessary as schools across socio-economic landscape and neighborhood are still not funded equally. Districts with a large proportion of poor students continue to receive less revenue than districts with wealthier students. In districts with the most intra-district inequality, students of color and poor students receive between $300 and $500 less than their non-poor, white counterparts (Ejdemry and Shores 2017, 2). Additionally, schools with fewer low-income, high-need students often get the most experienced teachers and staff while high-need schools are stuck with inexperienced and uncertified teachers.

New York State attempted to level the playing field in the landmark case the *Campaign for Fiscal Equity v. The State of New York* which found that New York City was not funding its schools at such a level as to provide all students with the opportunity to obtain a sound basic education. In 2006, the court ordered New York State to provide an additional $1.93 billion to

New York City schools. This number was arrived at by looking at the minimum spending levels of "successful schools" in the region—those which had 80 percent or more of their students passing the 4th grade ELA and math exam or five or more high school Regents exams. The money was meant to be phased in over a four-year period. However, due to fiscal constraints placed on the state because of the Great Recession, the CFE money was not fully phased in until 2014.

The purpose of this paper was to examine the effects of this increased spending in New York City schools on the 4th grade ELA and math exam pass rates. On average, New York City elementary schools are still not "successful" in 2014 as the average pass rate on these state exams was only seventy percent. However, the average pass rates have been rising since 1999 though total per pupil spending seems to have played little role.

Results from both fractional probit models and OLS models show that total per pupil spending has marginally small, negative effects on student exam pass rates. A one percent increase in total per pupil spending at the mean will decrease the exam pass rates between 0.1 and 0.3 percentage points, depending on the year and model. The percent of English Language Learners, the percent of students receiving free or reduced-price lunch, the percent of black and Hispanic student and the percent of teachers with no valid certification are also all negatively correlated with exam pass rates and statistically significant. The only statistically significant explanatory variable which had a positive effect on student pass rates is the average attendance rate. This may be because attendance reflects school environment which reflects achievement; the higher the attendance, the more positive the environment, the greater the student achievement.

Through creating counterfactual estimates, I was able to see what the average exam pass rates would have been in 2014 with per pupil spending remaining unchanged at either the 1999 or 2006 level. The ELA exam pass rates in 2014 would have been roughly 2.8 percentage points higher with the spending structure from 2006 and roughly 6.5 percentage points higher with the funding from 1999. For math the results are similar: with the funding from 2006 pass rates would have been roughly 3.2 percentage points higher, and 7.3 percentage points higher using 1999 funding.

This may be a counterintuitive result, but it is not necessarily out of line with past research. In a review of 163 studies of total per pupil expenditure on student performance, Hanushek (1997) found that only 27 percent of studies found positive, statistically significant marginal effects. Twenty six percent of studies found negative relationships, both significant and not (7 percent significant, 19 percent insignificant). The remainder had either unknown signs or positive, though statistically insignificant results. This is because there is no guarantee that a school with more funds will use that money effectively. Others have also shown that how the money is spent is more important than how much funding a school receives (Boser 2011, Greene et. al 2007, Wenglinsky 1997).

Thus, my results seem to confirm inefficiency in school spending and are a call for further research. My analysis is my limitation in data access and the subsequent use of total per pupil spending instead of more disaggregated spending. The literature, and my results, have confirmed that aggregated levels of spending do not have the best explanatory power on student achievement. More research is needed at the individual school level in New York City with finer levels of school expenditure. It is imperative to see where increased funding is being spent to make any claims regarding the value of increased educational funding. Perhaps all the increased funding between 2006 and 2014 was spent on ancillary, regional or system-wide costs. This would explain why there is a negative relationship between this increased funding and student exam pass rates.

Further, more research is needed in defining what a "successful school" truly is. This analysis used the court's definition that a successful school is one in which at least 80 percent of students pass the 4th grade math and ELA exams. However, there is a large body of literature (see Seegol et al. 2013; Holme et al. 2010; Geiser and Santelices 2007; and Rumberger and Palardy 2005) which suggests that standardized tests are not the best measure of student success. These exams show us what students can do in a one-sitting, multi-hour, high-stress environment. Students suffer from tremendous test anxiety on standardized tests. Plus, minorities and girls often face stereotype threat and perform disproportionately worse on these types of exams. Similar analysis needs to be done with other metrics of student learning—GPA, graduation rate, drop-out rate, etc. to find if the increased funding had positive effects in other important areas of student achievement.

The aim of this analysis was to determine the effects of increased state funding because of the *Campaign for Fiscal Equity v. The State of New York* on New York City students. My results suggest that simply throwing money at the problem has little positive effect on student and school success which has opened more doors for further investigation. With more than 1.1 million students taught in over 1,700 public schools, it remains vitally important to continue research into what can make New York City schools as successful as possible.

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APPENDIX

Table A: Imputation Results for 1999 Student Demographics Compared to Education Demographic and Geographic Estimates (EDGE) data from 2000 Census by NYC Community School District

	% Hispanic		% White		% Black		% Asian		% Am. Indian	
District	EDGE	Impute	EDGE	Impute	EDGE	Impute	EDGE	Impute	EDGE	Impute
1	55.52	67.55	5.79	2.14	13.64	21.05	22.88	10.2	0.38	0.84
2	22.66	24.93	34.03	31.82	9.5	15.11	29.64	32.28	0.08	0.4
3	34.37	52.68	21.18	16.11	37.85	31.64	2.63	4.5	0.03	0.29
4	61.59	61.92	0.93	0.79	33.97	34.42	0.8	2.71	0.13	0.67
5	31.14	12.06	0.54	0.63	64.79	88.5	1.24	0.98	0.21	0.25
6	81.81	91.7	4.58	0.53	10.71	7.54	0.8	0.7	0.38	0
7	67.1	67.02	0.62	0.31	29.8	32.96	0.4	1.58	0.7	0
8	60.66	58.48	8.6	4.55	26.96	33.78	1.41	3.35	0.44	0.55
9	60.44	60.88	1.07	0.72	35.2	36.78	0.71	1.28	0.69	0.69
10	66.41	65.21	6.07	9.93	21.27	19.09	3.66	5.49	0.12	0.5
11	34.75	27.33	7.57	5.6	49.32	62.08	3.79	4.99	0.41	0.58
12	63.43	67.76	2.02	0.67	30.72	30.76	0.96	0.9	0.71	0.21
13	19.78	16.74	4.22	0.92	69.98	85.49	1.72	1.01	0.08	0.7
14	60.26	63.05	14.75	11.71	18.14	23.92	2.99	2.23	0.05	0.24
15	51.52	55.86	20.46	15.06	10.16	24.68	13.01	7.64	0.31	0.99
16	15.15	8.66	0.26	1	82.24	90.44	0.63	0.5	0.22	1.44
17	10.77	3.09	2.42	0.81	83.16	95.41	0.57	0.6	0.13	1.14
18	7.41	4.69	3.53	1.35	83.64	92.5	2.48	1.24	0.26	0.43
19	39.6	39.54	2.01	0.81	51.99	54.99	2.85	5.43	0.43	0.33
20	21.71	13.89	42.19	45.79	2.24	2.93	27.82	37.29	0.08	0.61
21	18.45	16.21	43.67	41.32	14.5	14.53	19.88	28.04	0.19	0
22	11.92	11.36	29.41	31.54	45.39	47.88	8.72	9.38	0.18	0.29
23	19.31	15.25	0.15	0	77.41	83.63	0.64	1.88	0.15	1
24	57.25	54.39	20.05	22.37	2.71	3.42	16.8	19.45	0.16	0.07
25	24.31	23.8	27.8	30.14	5.49	7.42	36.37	38.97	0.14	0.26
26	10.21	9.51	37	35.32	4.11	7.99	43.88	48.42	0.45	0.26
27	30.87	33.96	15.53	9.01	33.61	36.63	9.32	22.46	0.95	0.72
28	20.1	24.04	16.76	19.98	37.6	31.64	16.41	28.49	0.49	0.24
29	11.99	11.35	2.69	2.64	69.5	77.24	8.24	9.83	0.51	0.24
30	47.4	49.38	16.34	14.79	11.68	9.74	18.35	26.27	0.44	0.4
31	18.84	15.35	58.28	61.37	14.77	16.36	5.51	7.58	0.2	0.77
32	69.55	71.88	1.39	1.19	24.35	24.9	1.96	2.18	0.18	0.43

Table B: Imputation Results for 1999 Teacher Statistics Compared to Personnel Master File (PMF) data from 2001 by NYC Community School District

District	Percent No Certifcation		Percent Years of Experience		Percent Masters		Percent Turnover	% Outside Cert.
	Impute	PMF	Impute (less than 3)	PMF (less than 5)	Impute	PMF	Impute	Impute
1	6.70	17.90	24.05	24.10	32.36	34.00	-5.89	25.29
2	3.22	12.80	27.91	20.00	27.63	39.80	21.24	14.56
3	5.09	19.70	20.55	34.40	35.20	39.90	41.77	15.88
4	4.75	22.30	-2.50	44.90	21.58	32.50	22.50	23.08
5	9.61	19.90	14.75	36.60	28.05	34.30	24.30	15.92
6	8.00	19.70	15.54	35.50	24.13	27.60	31.46	28.80
7	13.17	20.30	14.58	43.20	21.06	28.10	51.50	19.67
8	11.25	19.40	29.48	38.60	21.10	32.60	37.77	22.32
9	16.63	20.70	15.78	36.40	18.99	33.10	39.95	34.13
10	9.83	20.70	30.61	28.80	20.74	2.90	39.72	30.68
11	4.75	15.80	21.77	25.60	23.04	30.50	22.30	14.53
12	11.46	21.50	25.49	20.50	12.19	32.00	19.83	27.31
13	6.85	17.10	18.08	18.70	12.51	33.40	28.68	22.54
14	5.39	16.00	16.51	35.60	22.14	31.20	25.89	17.42
15	6.61	17.30	25.23	33.70	25.00	32.60	25.98	19.19
16	15.06	14.70	23.22	41.60	8.06	35.60	38.75	25.91
17	9.86	15.70	14.46	27.70	22.84	27.00	27.00	27.19
18	3.24	15.70	19.73	37.50	12.55	26.40	24.22	13.84
19	11.25	19.00	32.88	39.00	8.51	27.90	32.42	26.27
20	3.42	14.50	18.98	27.70	21.39	26.30	7.69	16.99
21	2.91	17.60	11.60	27.70	31.46	25.60	19.62	20.12
22	3.29	13.20	23.58	32.10	13.85	28.90	12.64	14.79
23	18.75	18.40	46.88	40.40	-0.50	30.20	52.50	31.25
24	3.89	14.70	16.95	34.90	23.68	31.30	11.38	14.19
25	2.86	13.40	5.13	22.10	53.78	24.10	14.54	9.42
26	1.94	13.20	15.95	19.70	46.09	25.20	9.49	8.76
27	4.09	13.50	22.78	32.60	21.92	30.20	19.44	15.60
28	3.38	12.00	17.42	23.10	33.92	32.00	22.37	14.02
29	3.13	15.20	17.62	24.50	28.08	27.90	30.56	8.31
30	3.17	15.30	18.35	20.30	36.43	32.40	20.87	16.84
31	3.41	13.50	11.41	21.80	43.71	25.00	3.31	12.79
32	5.97	17.70	18.04	33.80	12.78	29.90	22.89	18.25

Tables C-H: Fractional Probit Regression Output Tables

Table C: ELA Proficiency- 1999

Variable	Coefficient	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
Log Per Pupil Spending	-0.368	0.102	-3.620	0.000	-0.567	-0.169
Student-Teacher Ratio	0.004	0.006	0.640	0.524	-0.008	0.016
Total Enrollment	0.000	0.000	-3.010	0.003	0.000	0.000
Attendance Rate	4.742	0.641	7.400	0.000	3.486	5.997
Percent ELL	0.306	0.202	1.520	0.130	-0.090	0.701
Percent FRPL	-0.051	0.046	-1.100	0.273	-0.142	0.040
Percent Black	-0.109	0.061	-1.790	0.073	-0.228	0.010
Percent Hispanic	-0.011	0.080	-0.130	0.895	-0.167	0.146
Percent Asian	-0.063	0.104	-0.610	0.542	-0.266	0.140
Percent No Certification	-0.649	0.244	-2.660	0.008	-1.128	-0.170
Percent < 3 Yrs. Exper.	-0.045	0.097	-0.470	0.640	-0.235	0.145
Percent Masters	0.061	0.073	0.830	0.408	-0.083	0.205
Percent Turnover	0.046	0.054	0.860	0.389	-0.059	0.152
Constant	-0.405	1.265	-0.320	0.749	-2.884	2.074

Number of obs = 600
Wald chi2(13) = 364.20
Prob > chi2 = 0.0000
Pseudo R2 = 0.0206

Table D: ELA Proficiency- 2006

Variable	Coefficient	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
Log Per Pupil Spending	0.168	-3.350	0.001	-0.894	-0.234	-0.234
Student-Teacher Ratio	0.008	0.014	0.570	0.566	-0.020	0.036
Total Enrollment	0.000	0.000	-3.100	0.002	0.000	0.000
Attendance Rate	2.920	0.586	4.980	0.000	1.772	4.068
Percent ELL	-0.279	0.163	-1.710	0.088	-0.600	0.041
Percent FRPL	-0.346	0.105	-3.310	0.001	-0.551	-0.141
Percent Black	-0.687	0.090	-7.640	0.000	-0.864	-0.511
Percent Hispanic	-0.620	0.109	-5.710	0.000	-0.834	-0.407
Percent Asian	0.210	0.118	1.790	0.074	-0.020	0.440
Percent No Certification	-0.513	0.439	-1.170	0.243	-1.374	0.348
Percent < 3 Yrs. Exper.	-0.307	0.191	-1.610	0.107	-0.681	0.067
Percent Masters	-0.003	0.132	-0.020	0.983	-0.262	0.256

Percent Turnover	-0.091	0.091	-1.000	0.316	-0.270	0.087
Constant	3.639	1.966	1.850	0.064	-0.215	7.493

Number of obs = 582
Wald chi2(13) = 1212.93
Prob > chi2 = 0.0000
Pseudo R2 = 0.0696

Table E: ELA Proficiency- 2014

Variable	Coefficient	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
Log Per Pupil Spending	-0.262	0.131	-2.000	0.046	-0.519	-0.005
Student-Teacher Ratio	0.005	0.003	1.530	0.127	-0.001	0.012
Total Enrollment	0.000	0.000	-1.460	0.143	0.000	0.000
Attendance Rate	6.039	0.998	6.050	0.000	4.082	7.996
Percent ELL	-0.880	0.153	-5.760	0.000	-1.180	-0.581
Percent FRPL	-0.633	0.109	-5.800	0.000	-0.847	-0.419
Percent Black	-0.502	0.097	-5.170	0.000	-0.692	-0.312
Percent Hispanic	-0.489	0.105	-4.670	0.000	-0.694	-0.284
Percent Asian	0.042	0.107	0.390	0.698	-0.169	0.252
Percent No Certification	1.358	1.494	0.910	0.364	-1.571	4.287
Percent < 3 Yrs. Exper.	-0.075	0.191	-0.390	0.695	-0.449	0.300
Percent Masters	-0.125	0.110	-1.130	0.258	-0.342	0.091
Percent Turnover	0.043	0.071	0.600	0.548	-0.096	0.182
Constant	-1.928	1.757	-1.100	0.273	-5.371	1.516

Number of obs = 591
Wald chi2(13) = 1161.61
Prob > chi2 = 0.0000
Pseudo R2 = 0.0759

Table F: Math Proficiency- 1999

Variable	Coefficient	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
Log Per Pupil Spending	-0.519	0.123	-4.220	0.000	-0.760	-0.278
Student-Teacher Ratio	-0.006	0.008	-0.780	0.434	-0.021	0.009
Total Enrollment	0.000	0.000	-3.520	0.000	0.000	0.000
Attendance Rate	9.378	0.852	11.000	0.000	7.708	11.048
Percent ELL	-0.993	0.171	-5.810	0.000	-1.328	-0.658
Percent FRPL	0.029	0.050	0.590	0.557	-0.069	0.127

Percent Black	-0.791	0.070	-11.250	0.000	-0.929	-0.653
Percent Hispanic	-0.527	0.088	-5.990	0.000	-0.699	-0.354
Percent Asian	0.012	0.116	0.100	0.919	-0.215	0.238
Percent No Certification	-0.355	0.270	-1.320	0.188	-0.884	0.174
Percent < 3 Yrs. Exper.	0.078	0.105	0.740	0.459	-0.128	0.284
Percent Masters	-0.128	0.077	-1.670	0.096	-0.280	0.023
Percent Turnover	0.065	0.055	1.170	0.241	-0.044	0.173
Constant	-3.725	1.611	-2.310	0.021	-6.882	-0.567

Number of obs = 600

Wald chi2(13) = 1251.65

Prob > chi2 = 0.0000

Pseudo R2 = 0.0875

Table G: Math Proficiency- 2006

Variable	Coefficient	Robust Std. Err.	z	P>z	[95% Conf. Interval]	
Log Per Pupil Spending	-0.608	0.160	-3.810	0.000	-0.921	-0.295
Student-Teacher Ratio	-0.005	0.012	-0.400	0.686	-0.027	0.018
Total Enrollment	0.000	0.000	-1.860	0.062	0.000	0.000
Attendance Rate	3.561	0.684	5.210	0.000	2.220	4.901
Percent ELL	-0.597	0.168	-3.560	0.000	-0.926	-0.268
Percent FRPL	-0.116	0.094	-1.230	0.219	-0.300	0.069
Percent Black	-0.911	0.092	-9.920	0.000	-1.091	-0.731
Percent Hispanic	-0.744	0.112	-6.660	0.000	-0.962	-0.525
Percent Asian	0.247	0.121	2.040	0.041	0.010	0.484
Percent No Certification	0.267	0.458	0.580	0.560	-0.631	1.165
Percent < 3 Yrs. Exper.	-0.334	0.214	-1.560	0.118	-0.753	0.085
Percent Masters	-0.016	0.145	-0.110	0.912	-0.300	0.268
Percent Turnover	-0.166	0.109	-1.520	0.128	-0.379	0.048
Constant	3.901	1.914	2.040	0.042	0.149	7.653

Number of obs = 582

Wald chi2(13) = 1202.24

Prob > chi2 = 0.0000

Pseudo R2 = 0.0724

Table H: Math Proficiency- 2014

Variable	Coefficient	Robust Std. Err.	z	P>z	[95% Conf.	Interval]
Log Per Pupil Spending	-0.300	0.144	-2.090	0.037	-0.582	-0.018
Student-Teacher Ratio	0.004	0.004	0.970	0.332	-0.004	0.011
Total Enrollment	0.000	0.000	-1.120	0.261	0.000	0.000
Attendance Rate	8.473	1.038	8.160	0.000	6.438	10.507
Percent ELL	-0.918	0.175	-5.260	0.000	-1.260	-0.576
Percent FRPL	-0.470	0.118	-3.970	0.000	-0.701	-0.238
Percent Black	-0.873	0.103	-8.500	0.000	-1.074	-0.672
Percent Hispanic	-0.608	0.111	-5.460	0.000	-0.826	-0.390
Percent Asian	0.116	0.120	0.970	0.333	-0.119	0.352
Percent No Certification	1.916	1.890	1.010	0.311	-1.788	5.619
Percent < 3 Yrs. Exper.	-0.189	0.202	-0.940	0.349	-0.585	0.207
Percent Masters	-0.344	0.131	-2.630	0.009	-0.600	-0.087
Percent Turnover	0.030	0.082	0.370	0.710	-0.130	0.191
Constant	-3.761	1.956	-1.920	0.054	-7.595	0.072

Number of obs = 591

Wald chi2(13) = 1567.46

Prob > chi2 = 0.0000

Pseudo R2 = 0.1057