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An Analysis of Student Achievement and Measures of Growth under *No Child Left Behind*

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An Analysis of Student Achievement and Measures of Growth under *No Child Left Behind*

by

Alexis Yusim

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The report of the investigation undertaken as a
Senior Thesis, to carry two courses credit in
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Abstract

With the passing of the *No Child Left Behind* Act (NCLB) has come a wave of economic analyses of education production functions attempting to explain what factors affect pass rates and achievement gaps. Recent legislation has also increased its emphasis on yearly growth in pass rates. This paper will examine the extent to which school and community characteristics affect growth in student performance in several academic subjects and grades. Using standardized test data from the Illinois State Board of Education over the period of *No Child Left Behind*, I argue that there are ways to empirically re-define growth and student success that more effectively capture NCLB's accountability goals. The results show that there are inherent differences between the growth definitions employed in this paper, and between the grades analyzed – specifically, several community characteristics have reversed effects in grade 11 from in grades 3 and 8.

In loving memory of Papa

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Table of Contents

I. Introduction

Over the last fifty years, federal education reform in the United States has focused on improving student achievement overall and closing the achievement gap, the markedly lower test score performance of students from minority ethnic, racial, linguistic and lower socioeconomic groups as compared to white, middle class counterparts. The reported goal of such legislation has been to increase public confidence in the nation's schools through an objective measure of achievement (test scores) and more transparency about school performance (report cards, letters home to parents about performance on tests). Federal involvement in education reform began with the passing of the Elementary and Secondary Education Act of 1965 (ESEA) and the development of a cabinet post and a Department of Education. Initially, this legislation was a response to the negative effects of the segregated education system of the mid-twentieth century on student learning, illuminated in "The Coleman Report," and has been reauthorized and revised over the last half century with the goal of equalizing educational opportunity and improving the outcomes of public education in general. Indeed, today, ESEA is still being debated and revised again. The current reform conversation about ESEA continues to focus on accountability measures: who or what to hold accountable, what to implement as accountability measures, and how to reward or punish when achievement goals are or are not met. All of the recent reauthorizations of ESEA have attempted to address these accountability issues, but none have developed a measurement system that has escaped criticism.

One reauthorization of ESEA, the Improving America's Schools Act of 1994, used grants as incentives when districts met standards and innovated to improve education. In contrast, the most recent reauthorization of ESEA, the No Child Left Behind Act of 2001 (NCLB), threatened a withholding of funds if standards were not

met, dramatically changing the tone of the accountability movement. NCLB raised the stakes on student achievement, moving from rewarding federal funding for achievement to withholding funding as punishment for failure to achieve. Educators, political organizations, and even some legislators are concerned about the serious repercussions on curriculum, school access, student and teacher motivation and morale, and student, parent, and teacher relationships as well as the continuing concern about the public's confidence in the nation's schools.

NCLB, like previous ESEA reauthorizations, has employed standardized tests as the mechanism for measuring student performance. The Act mandated that states individually set standards for students to aim to achieve, holding school districts accountable for student performance. These standards were most commonly enforced through state-administered tests, given to students on a yearly basis in academic subjects such as mathematics, English, and science, with certain scores serving as indicators of "passing the test." NCLB also defined Adequate Yearly Progress (AYP) as a yearly increase in the pass rate, or proportion of students who pass the standardized tests, and added funding and reporting repercussions for school districts that did not meet AYP.

The use of AYP as the measure of student performance is controversial because it had several shortcomings. First of all, AYP did not account for the previous year's pass rate of a district, or a district's pass rate at the beginning of NCLB, which could have led to unfairly penalizing districts who started with already high pass rates and had less room to grow than others. Even though NCLB was aimed particularly at districts with low pass rates, every district, including the high-achieving ones, was subject to potential sanctions for not making AYP. Thus, districts with high pass rates that did not grow from year to year, for example, were deemed failures by NCLB. In addition, although copious education literature has shown that school characteristics are not the only contributors to

student educational performance, school districts were the only entity held accountable for student success. Because of these issues, NCLB has failed to capture growth in student performance comprehensively and is too narrow in its consideration of accountability. For these reasons and more, NCLB and AYP have received widespread criticism, which is a reason why the Act has not been easily reauthorized and continues to be debated and revised.

Given the current public appetite for school accountability, it is time for better empirical measures than AYP for capturing achievement in progress outcomes. Thus, in this paper, I propose several new definitions of growth in pass rates over the period of NCLB's enforcement, in order to make recommendations for future education policy.[1] I also execute linear regressions of various community and school characteristics on these growth definitions for Illinois school districts in order to more holistically capture the factors that affect student educational improvement. This will provide further insight as to whether NCLB has correctly placed accountability on school districts. Through these analyses, I hope to answer two questions: (1) how should growth be measured to assess educational progress? (2) What community and school factors can be measured to address both accountability and improvement in student achievement outcomes?

The remainder of the paper is organized as follows. Section II details an educational legislative history in the United States and various econometric studies of determinants of student educational outcomes in order to motivate the empirical work in this paper. Section III outlines the various definitions of growth and variables used in regressions, and section IV outlines the regression strategy employed. Section V summarizes the results of the analysis related to pass rates, and section VI details the

[1] I do this using aggregate data from two school years at the beginning and end of NCLB.

results of the analysis related to high school graduation rates. Finally, Section VII contains policy implications, conclusions, and proposals for future research.

II. The Relationship of Education Reform and the Accountability Movement

A. Federal Legislation and Closing the Achievement Gap

The achievement gap, or the measurable disparity between the educational performance of different subgroups of the student population, has been a prevalent topic of national concern for the last half a century. Researchers have conducted studies pertaining to causes of the achievement gap between genders, races, and levels of socio-economic status since the 1966 report "Equality of Educational Opportunity," published by the US Department of Education. Led by James Coleman of Johns Hopkins University, this report, commonly referred to as "The Coleman Report," presented the results of a national survey performed by the National Center for Educational Statistics of the US Department of Education on 650,000 American students. The report addressed four main research questions: (1) exploring to what extent students were segregated by racial and ethnic groups within schools, (2) whether schools offer equal educational opportunities, (3) how much students learn as measured by standardized achievement tests, and (4) what role the type of school one attends plays in one's educational achievement (Coleman, 1966, pp. iii-iv). Coleman found that both school- and community-related characteristics contributed to academic performance in students. Many of the results in the report also pertained to racial differences in student achievement, since this report was published during the heat of the civil rights movement, and the majority of American youths attended recently desegregated schools with an overwhelming majority of white students (Coleman, 1966, p. 3). Specifically, Coleman's

results indicated that black students in particular performed better in desegregated educational settings (Coleman, 1966, p. 29).

The findings in the Coleman Report contributed greatly to the conversation about the achievement gap, which has persisted in American education. Policy makers and scholars have identified gaps in achievement based on race (primarily between white and non-white students), economic standing, sex, English language proficiency, and learning disabilities. These gaps have persisted in the form of standardized test performance, high school graduation rates and dropout rates, college completion rates, and other measures (Education Week). Federal legislation has aimed specifically to increase the achievement of the lower-performing subgroups and close the existing achievement gaps; legislation has held educational institutions accountable for achieving these objectives. Furthermore, since the Coleman Report, questions surrounding determinants of individual student achievement and educational achievement over various racial subgroups of the population have captured the attention of economists and policy makers at the federal and state level, who are challenged to comprehensively explain and, ideally, improve the educational outcomes of all American students through legislation.

B. The Accountability Movement and *No Child Left Behind*

Prior to the Coleman Report, President Lyndon B. Johnson passed the Elementary and Secondary Education Act of 1965 (ESEA), which focused on the authorization of grants for school programs for children from low-income households, library resources for students, and supplementary education services, including a platform for bilingual education programs. Additionally, ESEA started a precedent of accountability in education that has evolved through its reauthorizations. Still in effect today, this legislation set the stage for decades of federal investment in education reform.

One crucial section of ESEA was the implementation of Title I – entitled "Improving the Academic Achievement of the Disadvantaged" (ESEA) – which aimed to ensure that all children have an equal opportunity to obtain a high-quality education and achieve, at minimum, proficiency on "challenging State academic achievement standards and state academic assessments" (Elementary and Secondary Education Act of 1965). This goal was to be achieved in twelve ways, one of which was through closing the achievement gap between high- and low-performing students, especially those "between minority and nonminority students, and between disadvantaged children and their more advantaged peers" (Elementary and Secondary Education Act of 1965), as part of President Johnson's War on Poverty initiative.[2] Through the federal government, Title I still provides resources to states and school districts and is the largest federal program providing education to address the educational needs of economically disadvantaged children (National Center for Education Statistics, p. 417). To this day, schools are identified as "Title I schools" due to the racial makeup of their student populations and socioeconomic claims that such students qualify for certain federal funding and attention. Some critics of Title I would say Title I schools are under more federal scrutiny than others because the federal government wants to ensure that they earn the funds allocated through enforcing accountability practices.[3] Though the original focus of Title I revolved around creating federal funding requirements, both Title I and ESEA have been amended in the following decades to place greater emphasis on student achievement and accountability measures, creating disproportionate pressures on schools and districts serving minorities and the economically disadvantaged.

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[2] Another act in Johnson's War on Poverty was Head Start, launched by the United States Department of Health and Human Services in 1956, which provided early childhood education and school preparation programs (Head Start).

[3] Since the original implementation of Title I, accountability practices have extended to all schools, not just the ones receiving federal Title I grants.

Motivation to improve American education for all has been reinforced since the original installation of ESEA by international factors as well as factors within the US. For example, due to the impending "information age" in the early 1980s (A Nation At Risk, 1983, p. 10) and the US' engagement in the Cold War and an arms race with the Soviet Union, the United States felt pressure to outperform global competitors. With this as motivation, in 1983, the National Commission on Excellence in Education under the Reagan Administration published "A Nation at Risk,"[4] to raise awareness about the failure of the American education system, and therefore the failure of the American workforce, relative to those of other countries. As the report states, "if only to keep and improve on the slim competitive edge we still retain in world markets, we must dedicate ourselves to the reform of our educational system for the benefit of all--old and young alike, affluent and poor, majority and minority" (A Nation At Risk, 1983, p. 10). Part of the risk that the report highlights is rooted in a threat against the promise to all citizens, regardless of economic status, of "a fair chance and to the tools for developing their individual powers of mind and spirit to the utmost" (A Nation At Risk, 1983, p. 11). The Commission made several recommendations in pursuit of the twin goals of "equity and high-quality schooling" (A Nation At Risk, 1983, p. 14) in areas such as content requirements, lengthening the school day and year, and raising educational standards for students to meet. Through its recommendations, "A Nation at Risk" certainly served as an influential report in the federal push to raise educational standards and the educational performance of all students through legislation, such as reauthorizations of ESEA.

ESEA has been reauthorized seven times since its enactment, in the form of some notable federal laws. One significant reauthorization came in the form of President Bill

[4] Other presidential education commissions include *The Truman Report* of 1947, Eisenhower's Committee on Education Beyond High School, Kennedy's Task Force on Education, and George W. Bush's Commission on the Future of Higher Education.

Clinton's Improving America's Schools Act of 1994, which reinforced aspects of Title I, provided provisions for drug-free initiatives in schools and communities, made available professional development programs, and implemented provisions to promote school equity, or the notion that every student should have access to a quality education, offering federal funding and grants to support these initiatives (National Center for Education Statistics, p. 417, Roach & Elliott, 2009). It also mandated that states must set standards and establish assessments by 1999 in order to measure achievement starting in 2000, thereby increasing pressures for accountability in school districts (Bryant, Hammond, Bocian, Rettig, Millerm, & Cardullo, 2008). It further required that the same standards be enforced for Title I and non-Title I schools, thereby raising expectations for all students (Improving America's Schools Act). Through its various components, the Improving America's Schools Act certainly continued the accountability movement and the practice of associating federal funds with progress in education legislation.

Although the Improving America's School Act made strides in accountability and improving educational standards, the Bush administration decided to take this initiative even further with the next reauthorization of ESEA. In response to both calls for increased accountability in public school performance and a perceived lack of progress on the achievement gap, President George W. Bush signed the *No Child Left Behind* Act into law as another notable reauthorization of ESEA and Title I In January of 2002. Public Law 107-110, known as the *No Child Left Behind* Act (NCLB), was enacted in order "to ensure that all children have a fair, equal, and significant opportunity to obtain a high-quality education and reach, at a minimum, proficiency on challenging State academic achievement standards and state academic assessments." The Act aimed to do so through creating and enforcing more demanding state standards aligned with "high-quality academic assessments [and] accountability systems…so that students, parents,

and administrators can measure progress against common expectations for student academic achievement" (NCLB, p. 15-16). Among NCLB's many goals was also the goal of "closing the achievement gap between high- and low-performing children, especially the achievement gaps between minority and nonminority students, and between disadvantaged children and their more advantaged peers," a goal that has been at the forefront of federal educational legislation since the original installment of the Elementary and Secondary Education Act in 1966 (NCLB, p. 16).

Among the many statutes implemented by NCLB was the notion of "adequate yearly progress," or AYP, as an accountability measure. According to NCLB, individual states were supposed to define AYP in a way that would capture the standards enacted, result in "continuous and substantial academic improvement for all students," and measure improvement "based primarily on the academic assessments" administered by state governments (NCLB, p. 22). Each state was then to establish a timeline for AYP that would "ensure that not 12 years after the end of the 2001-2002 school year, all students" in elementary and secondary schools, including those with disabilities, those with limited English proficiency, those who are economically disadvantaged, and those from major racial and ethnic groups must meet or exceed the proficient levels of achievement that states set (NCLB, p. 23). Furthermore, at least 95 percent of the students in a school were required to take the standardized tests in order for the school to make AYP. On a standardized test, a student can receive one of four scores: exceeds standards, meets standards, below standards, or academic warning, with the former two indicating "passing the test" and the latter two indicating "failing the test." A district's "pass rate," therefore, as defined in this paper, is the percent of students in the district who meet or exceed standards (i.e. the percent of students who pass the test). Thus, AYP could be achieved through yearly growth in a district's pass rate.

NCLB enforced its requirements through sanctions that increased in severity with the number of consecutive years of failing to make AYP. For example, school districts that failed to meet AYP for two consecutive years would be identified as schools needing improvement, with provisions required by NCLB to do so. Further consecutive years of missing AYP would result in a range of federal mandates from the replacement of teachers to the complete restructuring of the internal organization of the school, in which the school could be overtaken by the state or a private management company (NCLB, p. 60). According to Linn (2003), the severity of the NCLB sanctions for schools that continue to fall into the "needs improvement" category may actually have hindered improvements in education because they "implicitly encourage states to water down their content and performance standards in order to reduce the risk of sanctions for their schools" (Linn, 2003, p. 8). The requirements for Title I schools were even more strict and more strongly enforced because they received federal funding.[5] With so much at stake for failure to meet AYP or state-set proficiency goals by the deadlines implemented, school districts across the country faced a situation that demanded significant improvements in academic performance with very serious consequences related to accountability.

Linn (2003) lists several criticisms of the system of accountability implemented by NCLB. For example, he argues that because school districts could fall short of AYP in multiple ways (by not having enough students take the test, failing in any academic subject, or failing by subgroup), it was easy for states to inadvertently label too many schools as needing improvement, which had serious repercussions for states and individual districts. Also, steady improvements in educational performance in schools

[5] The distribution of funds under Title I has also been criticized. For further information, see "Federal Education Funding Under NCLB: Fairness Contributor or Inhibitor?" (2011).

were not recognized under NCLB unless those improvements constituted meeting AYP. Essentially, districts could be sanctioned for improving, but not improving enough in the eyes of the law. Furthermore, Linn criticizes NCLB's system of accountability because while accountability should be accompanied by high aspirations, the Act's goal of 100 percent proficiency for all was unrealistic and likely unattainable. Because of this, NCLB invoked sanctions on districts for not achieving a goal that essentially could not be achieved. Furthermore, according to Kim and Sunderman (2005), the "disparate impact of NCLB on high-poverty schools" has generated a lot of the criticism of NCLB's accountability requirements (Kim and Sunderman, 2005, p. 4; Orfield, Tracey, & Sunderman 2005).

Many educational researchers and reformers strongly oppose NCLB for various reasons in addition to criticisms of AYP. Some oppose the concept of high-stakes testing, in which so much rides on performance on a yearly exam (Guisbond & Neill, 2004; Karp , 2003; Lee, 2008). Others believe NCLB has not adequately closed the achievement gap, and has actually, in some cases, widened it. Teachers' unions and education agencies have also expressed speculation as to how to best get students to reach the high-reaching goals of NCLB. There is also some belief that improvement and success are not accurately captured through AYP, and that there are other metrics that can more effectively measure them (Guisbond & Neill, 2004). In this paper, I aim to answer whether there are better empirical ways to capture student improvement than what NCLB has implemented.

While the goal of educating America's youth is one that does deserve national attention, abundant research suggests that federal government has not gone about achieving this in the best possible way. For example, Murnane and Papay (2010) suggest that teachers are concerned that some incentives created by certain provisions of NCLB

have resulted in a reduction in the quality of education provided to students. Also, Bryant et al. (2008) suggest that testing pressure placed on schools and school districts may distract from the intentions of NCLB to induce greater student achievement. This distraction, they believe, could manifest itself in schools focusing on higher-achieving students rather than lower-achieving ones, or focusing most on students just below the passing threshold, in order to meet the required proportion of students passing standardized tests. Essentially, there is unease that AYP is defined in such a way that does not ensure greater achievement for all students, but rather causes gains for already higher-performing students, and, ironically, leaves the lower-achieving students behind, which does not at all achieve what NCLB sought out to achieve (see Choi, Seltzer, Herman, & Yamashiro, 2007; Guisbond & Neill, 2008). Critics also express concern that requirements revolving around test performance will cause "teaching to the test" throughout schools, which could inadequately prepare students for further education in subjects like mathematics and science (Bruning, 2006; Linn, 2003). NCLB's emphasis on student test scores could also negatively affect the way we define school quality. Questions have arisen about whether school quality is now defined by the quality of teachers and resources, or by student success on standardized tests (Price, 2010; Chambers, 2009).

In order to improve upon some of the aspects of NCLB that have been widely criticized, legislators have made efforts to write new education acts. For example, in June of 2013, the Senate Health, Education, Labor, and Pensions Committee introduced the Strengthening America's Schools Act. This bill aimed to support educators in providing high-quality instruction, encourage disadvantaged students to get the help they need in order to succeed, assist low-performing schools, and close achievement gaps by placing greater emphasis on early childhood education, encouraging equity through transparency

and fair federal distribution of resources, and allowing schools flexibility in their efforts toward improvement (News From the Senate Health, Education, Labor and Pensions Committee, 2013). There is no timetable as to when this bill will reach the Senate floor. Also, in July of 2013, the House of Representatives passed an attempt at another ESEA reauthorization, the Student Success Act. This bill would give states more autonomy, limiting federal involvement in state education policy, and providing support for charter schools. The bill failed in the Senate and was also opposed by teachers unions such as the National Education Association (National Education Association, 2013). There has certainly been a surge of innovative legislation since NCLB aiming to more effectively complete the objectives of achieving higher educational standards and closing achievement gaps, hopefully compensating for the shortcomings of NCLB.

President Obama has echoed the criticisms of NCLB and made his own efforts at improved education legislation throughout his presidency. As the Obama administration has stated, "NCLB has created incentives for states to lower their standards; emphasized punishing failure over rewarding success; focused on absolute scores, rather than recognizing growth and progress; and prescribed a pass-fail, one-size-fits-all series of interventions for schools that miss their goals" (The White House). In order to make up for these perceived shortcomings of NCLB, President Obama has taken action in accord with the trend of legislation to improve student achievement, with a specific goal of raising standards in order to improve college and career readiness among American students (The White House).

Among attempts to reform NCLB, President Obama launched Race to the Top as part of the Recovery and Reinvestment Act of 2009. Race to the Top is a contest administered by the US Department of Education that rewards states for innovative educational reforms in four key areas: development of rigorous standards, improvement

of data systems to inform educators and parents about student progress, support for educators and administrators, and increased resources for lower-performing schools. Rewards in the form of grants go to those states "leading the way with ambitious yet achievable plans for implementing coherent, compelling, and comprehensive education reform" (U.S. Department of Education, 2014). While 19 states have received federal funding so far through the program, a total of 48 states have participated in reforming state education laws and creating standards and reform plans (The White House). Race to the Top also extended to the district level in 2012, offering grants to districts that make further efforts to personalize learning for students "so that they can engage their interests and take responsibility for their success" (The White House). In this way, Race to the Top has relied on a different strategy to drive school improvement from that of NCLB, through reward rather than threatened withholding of funds, while still maintaining a reliance on accountability of school districts.

Recently, state leaders from every state collaborated to develop a new set of national academic standards through the Common Core Standards Initiative. Sponsored by the National Governors Association and the Council of Chief State School Officers, the Common Core Standards were developed in 2009 in order to clearly express college- and career-readiness standards and standards in mathematics and language arts for students in each grade from kindergarten to 12th grade. A perceived need by legislators to establish a consistent, standardized national definition of educational proficiency, instead of allowing individual states to establish their own standards, motivated the development of these standards. As of 2014, 43 states have adopted the Common Core Standards, with the possibility of Race to the Top grants offered as an incentive to do so. Sources such as the National Education Association endorse them, with three-fourths of members in support (NEA Today).

Like previous reforms to NCLB, this initiative still uses test scores; the Partnership for the Assessment of Readiness for College and Careers, or PARCC test, the new national assessment set to replace previous ones implemented in individual states by NCLB in spring of 2015, has received wide criticism. The PARCC test is a computerized, adaptive exam that tests students' attainment of the new, more rigorous Common Core Standards (The Partnership for Assessment of Readiness for College and Careers, 2015). Nonprofit organizations have established strong stances against the Common Core Standards Initiative for an array of reasons, and parents have widely opted their children out of taking the PARCC test.[6] This newest national education initiative is still imperfect and widely criticized. Legislators still have not found the answer to the question of how to properly assess American students and capture student improvement, implement educational reforms, and, in general, improve confidence in public schools.

C. Illinois: A Case Study for Testing Accountability Reform

Illinois has been in the forefront of educational reform, making it an interesting state on which to focus when analyzing of educational data. In 2010, Illinois became one of the 43 states to adopt the Common Core Standards, and is one of 11 states that serve on the governing board of the Partnership for the Assessment of Readiness for College and Careers, the newly developed online assessment system that accompanies the Common Core Standards (Illinois State Board of Education, New Illinois Learning Standards).

Illinois also received a Race to the Top grant in 2011, with half of the grant money allocated to the 35 participating school districts that lead the way in implementing reforms aimed at improving student achievement and overall school performance. Illinois

[6] One example of an opposing organization in Illinois is Stop Common Core Illinois.

has implemented various state projects to support its participating districts in the four areas that Race to the Top emphasizes (Illinois State Board of Education, Illinois Race To The Top).

Among Illinois' many education initiatives is the Performance Evaluation Reform Act, passed under Governor Pat Quinn in 2010. This Act established the Performance Evaluation Advisory Council in order to advise the Illinois State Board of Education on how to most effectively evaluate student and school performance. It also insists that "performance evaluations of the principals/assistant principals and teachers of that school district or other covered entity must include data and indicators of student growth as a "significant factor,"" which remains consistent with the national trend of quantifying student achievement and growth (Illinois State Board of Education, Performance Evaluation Reform Act).

Because of the state's participation in education reform and its richness of data, researchers have established interest in Illinois in the frame of the education production function. For example, William Sander published a paper in 1992 that analyzed the effects of various determinants such as expenditures on various outcomes, including ACT scores, high school graduation rates, and the percent of high school students planning to attend college from the 1989-1990 school year. His results indicate that expenditures, particularly those pertaining to the quality and quantity of teachers, do have significant effects on educational outcomes. Sander makes an important contribution to the literature because he innovatively proposes alternative measures of student educational outcomes that do not involve state-administered standardized test scores, which is an objective of this paper as well.

D. What's Missing From the Education Production Function

Since the Coleman Report's evidence that community and school factors contribute to the performance of students, economists have tirelessly attempted to understand what particular factors affect student educational success through education production function estimates. Empirical estimates of the education production function commonly include a combination of both school factors and community factors. School factors usually consist of variables like instructional expenditures, teacher experience, teacher education, class size, minutes of instruction, and mobility rates. Researchers include these different school traits in production function estimates in order to capture the ways that schools affect student success as completely as possible. Community factors include racial makeup of the student body and indicators of socio-economic status (SES), such as average household income or the percent of students who receive free or reduced lunch, which are seen as the strongest predictors of educational outcomes (Boggess, 1998; Coleman, 1966; Hanushek, 1986; Ferguson & Ladd, 1996; Krueger, 1999; Coates, 2003; Kinnucan, Zheng, & Brehmer, 2006; Balfanz, Legters, West, & Weber, 2007; Neal & Schanzenbach, 2007; Sander 1993).

Much research over the past decade has been conducted in an attempt to evaluate the effects of NCLB through the lens of an education production function. For example, Heather Price in 2010 analyzed whether NCLB's labeling process accurately captures school quality through alternative measures of school quality, standardized testing results, and subgroup test failure. For further examples, see Borg, Plumlee, & Stranahan, (2007); Neal & Schanzenbach (2007); Dee & Jacob (2011); Kinnucan, Smith, Zheng & Llanes (2012); Flaherty (2013).

Plenty of research indicates little to no relationship between school qualities and student success, while other research indicates a very significant relationship. For example, while Eric Hanushek in his 1986 paper finds no strong positive relationship between expenditures, teacher quality measures, or pupil-to-teacher ratios and student performance, others such as David Card and Allen Krueger (1992) do find significant relationships between indicators of school quality (captured by pupil-to-teacher ratio, relative teacher pay, and average term length) and the relative rate of return to education (Hanushek, 1986; Card & Krueger, 1992; Campbell & Lopez, 2008). Kane, Taylor, Tyler, & Wooten (2010) also find a relationship between measures of teacher effectiveness and student academic performance. Through these opposing pieces of research, it is clear that economists have not yet agreed on what explains student success – while there are some common variables that economists employ to explain educational outcomes, there is not a definitive list of variables that do so. Therefore, part of the motivation of this research is to more accurately capture student educational success and its determinants.

Educational attainment of the adult population of the community is one variable that has rarely been featured as a SES indicator by researchers. Relatively few have decided to include it in their studies. For example, Gyimah-Brempong and Gyapong (1991) show that the local level of adult educational attainment does play an important role in estimating the relationship between SES characteristics and student performance. It would seem that communities consisting of adults with high levels of educational attainment would encourage their children to aim for high levels of educational attainment and academic achievement as well. Therefore, this variable should be an appropriate component of the education production function, and is included in regressions in this study.

Much of the literature on education production functions aims to estimate the effects of characteristics on either test scores or pass rates, expressed on a scale from 0 to 100 percent passing (see Lemke, Hoerandner and McMahon, 2006; Primont and Domazlicky, 2006; Flaherty 2013). Some also aim to do so based on the achievement gap itself (Chung & Konstantopoulos, 2009). A section of the literature estimates the effects of characteristics on growth in pass rates or test scores (Driscoll, Halcoussis & Svorny, 2006). In this paper, I focus on growth in pass rates as the metric for student performance, rather than a metric like pass rates that only accounts for one year of testing, in order to more robustly capture student improvement than previous research.

In a further attempt to understand improvement in student performance, economists have recently increased their interest in growth models. Over the past several years, researchers have expressed heavy interest in exploring various projection models that the federal government has allowed some states to implement through the NCLB Growth Model Pilot Program (Dunn, & Allen, 2009; Weiss, & May, 2012). Several papers investigate value-added assessment as an alternative way to measure student learning (see Hanushek, & Taylor, 1990; Harris, 2009; Misco, 2008; Ehlert, Koedel, Parsons, & Podgursky, 2013). Value-added assessment essentially asks "whether a particular school, classroom, and teacher did what they were supposed to do for the achievement growth of individual students" rather than assess achievement growth using school or district data (Misco, 2008, p. 11). Value-added assessment could be administered at the school or teacher level. This proposed method of accountability faces both support and opposition due to implications this type of evaluation could have for individual teachers and its statistical validity (Misco, 2008; Harris, 2009). Murphy (2012) analyzes arguments for and against the use of value added assessment. Researchers view value added models favorably against attainment-based accountability systems, such as

AYP, because they portray a "clearer picture of student learning," following a cohort of students over time (Murphy, 2012, p. 5). Also, evidence shows that these models depict teachers has having significant, lasting effects on student learning. However, value added models are criticized for many reasons, including widespread doubt about model specification and the ways in which teachers can be unfairly criticized because of the students they teach. For example, teachers who teach the neediest students would likely be evaluated very harshly under this system due to factors that they do not control, such as student background variables, which value added measurements ignore.

Neal (2010) criticizes value-added models through an economic lens, suggesting that value-added models rely on an underlying assumption that test scores are reported such that a one point gain for a student "is of equal value to society regardless of the student's prior level of skill," (Neal, 2010, p. 129). He continues to argue that an increase in a student's math score from 120 to 122 should not be valued the same way as an increase from 220 to 222, for example, and that the way that value added models incorrectly weight student gains equally harm their validity as measures of school quality and performance. Due to this scrutiny, value-added assessment is arguably not the most appropriate way to evaluate the effectiveness of schools and teachers; it is not right to evaluate the quality of individual teachers based on the performance of individual students on standardized tests because teachers are not the only factor affecting student educational performance. Thus, other methods of assessing student growth over time are necessary – this motivates the definitions of growth proposed in this paper, which account for progress relative to how well students were performing at the beginning of the period of analysis.

In addition to questions surrounding how to best measure growth, economists question whether test scores are even the best measure of student achievement. As Card

and Krueger suggest, "one can argue that test scores are an imperfect measure of school performance" (Card & Krueger, 1992, pg 2). Wenger (2000) also hypothesizes that schools actually face a trade-off between test scores and graduation rates in that schools may have to sacrifice the former in order to use resources to increase the latter. To compensate for this, a portion of the literature sees high school graduation rates as the best educational output measure, rather than a measure based solely on test scores (Boggess, 1998; Goldin, 1998; Chen, 2011; Heckman & LaFonatine, 2012; Iatarola & Reubenstein, 2007; Murnane, 2013). Thus, this paper also features regressions using growth in high school graduation rates over time as an output variable, as an alternative measure of student improvement that does not involve standardized test pass rates.

Economists have conducted studies pertaining to the education production function at the individual, school, and district level in order to capture the effects of inputs on educational success at various levels. For example, May and Weiss chose to do a study at the individual level as an alternative performance measure due to a belief that "school-level changes in proficiency rates are statistically unreliable and do not reflect true school improvement, in part because they compare different cohorts of students," which results in natural sampling variability, among other consequences (May & Weiss, 2012, p. 45). Because the data from the Illinois State Board of Education gives data at the school and district level, but only presents expenditure data at the district level, I have conducted a district level analysis.

Another area of interest in this paper is the own-race effect, or the extent to which the presence of a particular subgroup in a district affects that subgroup's educational outcomes (Lemke & Yusim, 2014). Including this will illuminate even more about the determinants of educational success among various subgroups of the population, particularly the role of diversity in student educational performance.

Economic research has painted an incomplete picture of student educational success because researchers still have not collectively determined how to best capture student educational success or what affects it – this is why economists still participate in ongoing research attempting to explain it. While I follow the literature by incorporating common school and community variables, I also contribute to the literature by introducing a seldom-used variable to capture socio-economic status, the local BA rate, and various measures of growth as output variables to capture student achievement in my production function estimate.

III. Data

The analyses in this paper use data from Illinois public school districts of all types (i.e. elementary, middle school, high school, and unit). The data comes in aggregate from the Illinois State Board of Education (ISBE) for the 2002-2003 and 2011-2012 school years.[7] The ISBE assesses Illinois students using two different standardized tests: the Illinois State Achievement Test (ISAT) and the Prairie State Achievement Examination (PSAE). The ISAT is administered to students in grades 3 through 8, while the PSAE is given to students in grade11. The ISAT tests reading and mathematics in grades 3 through 8 and tests science in grades 4 and 7 (Illinois State Board of Education, Illinois Standard Achievement Test). The PSAE includes the ACT plus Writing (for which a student could choose to submit his/her score to colleges), a science assessment developed by the ISBE, and two sections in Reading for Information and Applied Mathematics (Illinois State Board of Education, Prairie State Achievement Examination). Both exams are administered to students in the spring of the academic year. In this paper, I analyze

[7] These years were chosen for this study because they reflect the first year of NCLB's implementation and the most recent year of data I could obtain, thus spanning almost the entire duration of the Act.

performance on the reading and mathematics sections of the ISAT for third and eighth graders, and of the PSAE for eleventh graders as my measure of student academic outcomes.

Data for this paper was assembled from a few sources. The first is the Illinois State Report Cards for the 2002-2003 and 2011-2012 school years, which the Illinois State Board of Education produced under mandate from NCLB. The second is the United States Census Bureau's American Community Survey, which provides a five-year estimate from 2008 for the percent of adults in each school district with a bachelor's degree (from now on referred to as the local BA rate). While most of the data reported in the Illinois state report cards is given at the state, district, and school level, expenditure data is only given at the state and district level. Due to this, and because the local BA rate is also given at the district level, I found a district-level analysis most appropriate.

This analysis uses data from every district in Illinois in the 2002-2003 and 2011-2012 school years, with a few exceptions. Most notably, the Chicago Public School (CPS) district is not included. The CPS is much larger than any other district in Illinois, as over twenty percent of Illinois' population resides in Chicago. Also, the demographics of the residents of the district makes it very different from every other district in Illinois, and the presence of these differences make it logical not to include CPS in the analyses in this paper.

For various reasons, a handful of school districts closed or were created over the period in question. Sometimes districts merged or consolidated with others; other times, districts that closed were not replaced at all. Those districts in the latter category are not included in this analysis. Of the districts that closed, only those that existed in 2003 and could be traced to a district that existed in 2012 were included.

After excluding the various categories of districts as noted above, and outlying districts with extremely small (under 100) or large (over 100,000) enrollments, there are 758 districts remaining to analyze. Of these, 320 are elementary districts that serve kindergarten through eighth grade; 93 are high school districts; and 345 are unit districts that serve kindergarten through twelfth grade. In total, 114 districts are located in rural areas, 621 in suburban areas, and 23 are in major metropolitan areas (excluding Chicago). It is possible that the school districts that closed over the period had relatively low pass rates, which could lead to a biased selection of districts. However, this does not appear to be the case, since the average pass rates of the full sample and the sample excluding the aforementioned districts are similar.

The most commonly used measure of AYP is the percent of students in a district who meet or exceed state-determined standards (i.e. the district's pass rate). Illinois State Report Cards categorize test scores into four categories: exceeds standards, meets standards, below standards, or academic warning. The former two groups signify "passing the test," while the latter two denote "failing the test." The pass rate, therefore, reflects the percent of students who "pass the test." This paper reports pass rate data for the entire student body, and the white, black, and Hispanic subgroups.

According to NCLB, states determine an "*n* size," or a threshold for the number of students in various subgroups that would require districts to incorporate them into their data. The worry was that calculating AYP for very small groups could fluctuate and therefore be unreliable due to changes in student composition every year. Most states used an *n* size of 30 to 40 students as a minimum threshold for factoring subgroups into AYP calculations. The *n* size in Illinois during the period in question was 45 students (U.S. Department of Education, 2010). Thus, in Illinois, 137 and 155 districts were required to report results for their black and Hispanic students in grade 3 respectively in

both years. Likewise, 140 and 142 districts reported grade 8 test results for their black and Hispanic students respectively, while 86 and 94 districts reported grade 11 test results for their black and Hispanic students respectively. Overall, pass rates for Illinois school districts increased for all students from 2002-2003 to 2011-2012, and for white, black, and Hispanic subgroups of students in reading and math in grades 3 and 8. The pass rates decreased in grade 11 for all students and all subgroups except for Hispanic students in math. Table 1 displays all of these trends.

Additional trends also emerge from this data. In general, pass rates for white students in both 2003 and 2012 exceeded those for black and Hispanic students. Although the pass rates of the black and Hispanic subgroups never exceed those of the white students, the black and Hispanic subgroups typically experience greater margins of change in pass rates.

In order to confirm that the 2012 pass rates are statistically different from those in 2003, I conducted paired t-tests on the pass rates for both years. Reading and mathematics pass rates are different with 1 percent statistical significance in 2012 from their 2003 values in all races, grade levels, and subjects, except for grade 11 white students in math and grade 11 Hispanic students in reading (see Table 1).

Table 2 shows trends related to the closing of the achievement gap, or the disparity between the achievement of subgroups of the population, measured by the difference in their pass rates. The table is split into two panels: the first contains data pertaining to the closing of the achievement gap between the black and white subgroups, and the second concerns that between the Hispanic and white subgroups. For example, in 2003, the difference between the grade 3 reading pass rates of the white and black subgroups was 26.70 percentage points. This difference decreased by roughly 9.49 percentage points to 16.59 percentage points. The negative difference in differences indicates that the

achievement gap between black and white students in grade 3 reading shrunk in size. This decrease in the achievement gap was statistically significant at the 10 percent level. As Table 2 shows, the achievement gaps, as measured by differences in pass rates, decreased between black and white students in all grades and subjects except for grade 11 math, and between Hispanic and white students in all grades and subjects. These differences in the differences in pass rates were all statistically significant with the exception of those for Hispanic and white students in grade 11.

Along with closing the achievement gap between subsets of students, an objective of NCLB was to improve educational outcomes for all students, ideally to 100 percent proficiency on standardized tests in all districts. Thus, although Table 1 includes pass rates in 2003 and 2012, the analysis in the paper is primarily focused on *growth* in those pass rates. The existence of growth in student performance, reflected by growth in pass rates, more consistently follows the objectives of NCLB than simply using student performance in one year as a measure of educational success, and is thus the metric under analysis here.[8] The question that remains, though, is how to most effectively define growth while staying true to the ideals of NCLB. Because of the wide criticism of AYP as an accountability measure, it is necessary to find an alternative, more meaningful empirical definition of student achievement.

One measure that arises intuitively out of the concept of defining growth is approximation of the raw gap, defined as a district's pass rate in 2012 less its pass rate in 2003. However, this metric may not tell the full story of a district's pass rate growth

[8] The literature presents arguments for and against using variables related to standardized tests as the representative of student outcomes (I will address this further in Section VII). I choose to employ growth in pass rates in order to remain consistent with NCLB's chosen metric. The aspect that I change is the way I empirically define growth in pass rates.

because it does not account for a district's pass rate at the beginning of the period under analysis.

To illustrate this, consider, for example, three suburban elementary districts in Illinois. Ford Heights School District began in 2003 with a 24.6 percent reading pass rate and increased to an 81.8 percent pass rate in 2012. Chicago Ridge School District began with a 59.3 percent reading pass rate that increased to 75 percent. Winnetka School District began with a 94.6 percent reading pass rate that increased to 99.5 percent. By solely using the raw gap to illustrate growth, Ford Heights would seem to have demonstrated the most growth over the period of NCLB, with a 57.2 percentage-point margin of pass rate growth, while Chicago Ridge and Winnetka only experienced respective 15.7 and 4.9 percentage point increases. However, though the margins of growth for Ford Heights and Chicago Ridge exceed that of Winnetka, Winnetka ended the period closest to 100-percent proficiency. Considering NCLB's overarching goal of having every district proficient by the end of the period, Winnetka should therefore have favorable progress compared to the other two from the perspective of NCLB. Furthermore, if the margin of growth is deemed the only metric of value, then Winnetka would be viewed unfavorably against these other districts since it simply had less room to grow than the other two. In terms of AYP, there just isn't much more progress to be made once a school has reached 99.5 percent passing. Due to situations like this, other metrics of growth are necessary in order to reflect progress.

In order to account for this and to provide alternative ways to best measure growth in order to assess progress on standardized tests, this paper employs two additional measures of growth in addition to the raw gap: the percentage of the gap closed, and the percent gain from 2003. Thus, we have the following summary of measures of growth:

(1) $$\text{Raw Growth} = \text{Pass Rate}_{2012} - \text{Pass Rate}_{2003}$$

(2) $$\text{Percent Gain} = \frac{\text{Pass Rate}_{2012} - \text{Pass Rate}_{2003}}{\text{Pass Rate}_{2003}} \times 100$$

(3) $$\text{Percent Gap Closed} = \frac{\text{Pass Rate}_{2012} - \text{Pass Rate}_{2003}}{100 - \text{Pass Rate}_{2003}} \times 100$$

The above measures reflect, in their own ways, progress relative to where district pass rates started at the beginning of the period and can shed more light on improvement than just the raw gap.

In addition to raw pass rates, Table 1 displays the district averages for the above measures of growth in both reading and math for grades 3, 8, and 11. The table displays these measures for all races, and for the white, black, and Hispanic cohorts. For example, as shown in Table 1, the grade 3 reading pass rate for black students was 46.87 percent in 2003 and 67 percent in 2012. The pass rate grew by 19.85 percentage points from 2003 to 2012, as shown in the "Grow" column, resulting in a percentage gain of 53.61 percent ("Gain" column) and 34.82 percent of the gap closed ("Gap" column). Generally, these measures are positive for all grades, and subjects in third and eighth grade, indicating student improvement over the period of NCLB. Contrarily, with the exception of Hispanic students in grade 11 mathematics, grade 11 pass rates move in the opposite direction for all races and subjects, showing decreasing pass rates by at the least 0.14 percentage points (grade 11 math for white students) and at the most 8.29 percentage points (grade 11 reading for black students). That grade 11 behaves in an opposite fashion to grades 3 and 8 is an interesting result, and one that leaves the question of what

is so different about grade 11. I am interested in exploring what factors influence this behavior.[9]

I am also interested in what factors determine student improvement in general, as measured by the various empirical definitions of growth. That is, I want to see how the common factors in the literature that affect pass rates also affect measures of growth. I use a combination of community and school characteristics to explain pass rate growth, percent increase in pass rates, and the percent of the gap closed through weighted linear regression analysis. The descriptive statistics for all of the variables used in the regression analysis are reported in Table 3, which is split by districts that report ISAT scores for grades 3 and 8 and districts that report PSAE scores for grade 11. For the most part, values are relatively similar across the two district types, which share 345 unit districts.

In Table 3, the BA rate, or percent of adults over 25 years of age with a bachelor's degree, serves as a representative socio-economic status variable. Socio-economic status is commonly represented by variables pertaining to the household, such as household income or family structure, and even sometimes the educational attainment of parents (Bogess, 1998; Sander, 1992; Wenger, 2007). In this paper, I use the educational attainment of the entire adult population of a school district, to examine how a more educated population, not just more educated parents, affects growth in student achievement. On average, just over 21 percent of adults in Illinois districts have bachelor's degrees, and this value ranges from 3.1 to 88.7 percent. As this measure is a five-year estimate, I assume it is constant over the entire period in question.[10] The other

[9] Recall that students in grade 11 take a different standardized test (the PSAE). Inherent differences between the PSAE and the ISAT could account in part for the difference in pass rate growth between grade 11 and grades 3 and 8.

[10] Recall that this estimate is from 2008, the most recent year for which the American Community Survey offered this figure. As the other variables used are from the 2011-2012 school year, I wanted to remain consistent and use a BA rate estimate from the most

community characteristic that I employ in my model is the racial makeup of the population, represented by the percentage of students in the district who are white, black, and Hispanic. This variable has multiple dimensions of importance, as achievement gaps have been identified between white students and both of these minorities. A presence of mixed achievement levels in a district could have interesting effects on the educational achievement of all students. Moreover, the effects of the presences of different races in a district could have important implications regarding diversity in schools.

I chose several variables to represent school district characteristics; one of which is curricular minutes of instruction, which the ISBE only reported for grades 3 and 8. In both grades, English minutes of instruction decreased and math minutes of instruction increased by slight increments over the period. This variable will measure how the volumes of instruction in math and reading affect math and reading standardized test performance. The district mobility rate, or the rate at which students enter or leave a district after the first day of school, is another important district characteristic in this model, as it reflects the level of consistency in a student's learning environment, which is likely an important determinant of educational success. Urbanicity is another reflection of the learning environment, represented in this study by the percentages of districts in rural, suburban, and urban (omitted) areas. This could also be interpreted as a measure of district size, with urban districts serving the largest populations, and likely being the greatest in size. The final reflection of the learning environment is the average class size. Although it is widely believed by educators and parents that smaller class sizes positively affect student outcomes, the literature often finds that this effect is not significant (Hanushek, 1989; Wenger, 2000). Moreover, Wenger (2000) suggests that a school

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recent year possible. Averages from other years did not differ significantly from the 2008 value.

environment with a lower pupil-to-teacher ratio (conceptually a similar measure to class size) is more of a comfort for students than a determinant of their educational success, which is likely why parents prefer sending their children to schools with small class sizes.

Per pupil instructional expenditures are another school input used in this study. Schools incur lots of costs, but this variable solely captures the costs of instruction, such as teacher salaries and classroom supplies. Thus, this variable can accurately reflect a district's monetary commitment to academic instruction.[11] Finally, NCLB mandated that districts employ highly qualified teachers, or teachers who were sufficiently certified in their area of instruction. In Illinois, over 99 percent of teachers were highly qualified in 2003, and this proportion increased by about half a percent by 2012. This variable is meant to reflect the quality of instruction, which is thought to be a major determinant of student educational outcomes.

The growth measures, namely raw growth, percent gain, and percent of gap closed, are all measured on a 0 to 100 scale. Likewise, so are the BA rate, percent of students who are white, black, and Hispanic, the district mobility rate, or rate at which students enter or leave a school district after the start of a school year, and the percent of teachers who are highly qualified. Also reported as a percentage are the percent of districts located in center cities, suburban areas, and rural areas. The average class size is measured in the number of students. The curricular minutes of instruction is measured in minutes per day. The per pupil instructional expenditures variable is measured in thousands of dollars.[12]

[11] It is possible, of course, that districts underreport their expenditures in order to qualify for need-based grants, or overreport their expenditures to make the public believe they spend more on instruction than in they actually do. This dataset includes data reported by districts, and a limitation is that any bias in this variable from inaccurate reporting is unknown.

[12] Per pupil instructional expenditures do not vary positively with pass rate growth. This should eliminate suspicion of bias in that variable. Figure 1 illustrates this.

IV. Identification Strategy

Weighted least squares regressions were conducted in this study in order to examine the effects of school district and community characteristics on the measures of growth defined in Section III. These regressions were done in reading and math for grades three, eight, and eleven:

$$\text{Growth Definition}_i = \beta_0 + \beta X_{1,i} + \phi X_{2,i} + \varepsilon_i \quad (4)$$

For districts $i = 1, 2, \ldots, n$, X_1 is a vector of community characteristics with coefficient β, X_2 is a vector of school district characteristics with coefficient ϕ, and ε_i is a district-specific error term. The community characteristics, represented by X_1, are the BA rate, which is the variable reflecting socio-economic status, and the racial makeup of the community, decomposed into the percent of students who are white (omitted), black, and Hispanic.[13] The district characteristics, represented by X_2, include class size, curricular minutes of instruction, the district mobility rate, the percent of teachers who are highly qualified, and the per-pupil instructional expenditures. All independent variables are for the 2011-2012 school year, except for the local BA rate, which is a five-year average assumed constant over the period.[14] In order to control for heteroskedasticity that exists when the dependent variable is an average, all regressions are weighted by the square root of district enrollment. Extreme outliers were also dropped from the analysis.[15]

The regressions in this study are conducted on all students, and the subgroups of white, black, and Hispanic students for every growth measure, subject, and grade level.

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[13] Dummy urbanicity variables for whether a district is located in a rural area, suburban area, or central city are also included in the regressions, but omitted from the tables.

[14] I executed regressions using average values of the independent variables, and I did not find statistical significance in the results. So, I use the 2011-2012 values to examine how current district and community conditions affect growth in student performance.

[15] For example, districts that experienced over 500% pass rate gain in reading were dropped. Regressions were conducted additionally dropping all outliers (i.e. districts three standard deviations from the mean), and the results did not significantly differ from those presented.

These regressions include the same school and community characteristics, but the regressions on the various racial subgroups pay particular attention to the own-race effects, or the effect of increases in the population of the subgroup under analysis on that subgroup's educational outcomes (Lemke & Yusim, 2014). So, for example, in the regressions on the Hispanic subgroup, I observe the effects of increases in the percentage of Hispanic students in the district on Hispanic pass rate raw growth, percent pass rate gain, and percent of gap closed.

Tables 4 through 6 display the results of the above regressions with results for both subjects and all definitions of growth for all students in grade 3 in Table 4, grade 8 in Table 5, and grade 11 in Table 6. As curricular minutes of instruction were not given for grade 11, that variable is left out of the results reported in Table 5. Other than that, the three tables are structured identically, with standard errors reported in parentheses below the coefficient estimates. Tables 7 through 9 display the results for students in the white subgroup; Tables 10 through 12 for the black subgroup; and Tables 13 through 15 for the Hispanic subgroup.

V. Results

The discussion of the results begins with Tables 4, 5, and 6, which display the results of the regressions on all students for grades 3, 8, and 11, respectively. The discussion continues focusing on the regressions on the white subgroup (Tables 7, 8, and 9), followed by the black subgroup (Tables 10, 11, and 12), and finally the Hispanic subgroup (Tables 13, 14, and 15).

A. All Students

1. Grade 3

This subsection begins with a surprising result: the percent of adults in a school district with a bachelor's degree (BA rate), actually has a negative effect on almost every definition of growth in reading and mathematics. For example, with statistical significance, a one percentage point increase in a district's BA rate has a negative 0.08 and negative 0.23 percentage point effect on the district's growth rate and percent gain rate in reading, respectively. While this may seem counterintuitive at first glance, this effect is actually quite logical, as it is likely that students in districts with a high BA rate at the start of NCLB already performed at a high level, reflected in high 2003 pass rates. Thus, these high BA rate districts, on average, had less "room to grow" from the start. Considering the previous example, Winnetka's pass rate of 94.6 percent only left it with a maximum possible growth rate of 5.4 percentage points and a maximum gain rate of 5.7 percent (=5.6/94.6), while Ford Heights' 2003 pass rate of 24.6 percent left it with a maximum growth of 75.4 percentage points and a maximum gain rate of 306.5 percent (=75.4/24.6). The data support this; for example, while third graders overall had a 2003 average reading pass rate of 71.30 (Table 1), the 50 districts with a BA rate over 50 percent had a higher pass rate of 84.53, and the 613 with BA rates below 50 percent had a slightly lower pass rate of 70.22, leaving them relatively more room to grow. By 2012, these pass rates increased to 80.36 overall, 90.96 for the districts with BA rates over 50 percent, and 79.50 for the districts with BA rates under 50 percent. This resulted in raw pass rate growth of 9.07, 6.42, and 9.28 percentage points for each of the respective groups. In the eyes of NCLB, this result reflects relatively better on those districts with lower BA rates and more growth than those with higher BA rate since those districts improved their pass rates comparatively more over the period.

The effects of race on student improvement seem to vary by racial subgroup. For example, for every 1-percentage point increase in the percent of black students in the district, the raw growth in reading pass rates for all students was 0.20 percentage points. This result is statistically significant and positive at varying magnitudes for all definitions of growth in grades 3 and 8. From Table 1, we see that the average black reading pass rate in 2003 was 46.87 – lower than the all-student average, and the averages for whites and Hispanics. Black students also experienced greater raw growth in pass rates over the period than the other subgroups, with a 19.85 percentage-point increase in reading pass rates. So, it seems like the greater black growth relative to the other subgroups that contribute to a district's overall growth has had a heightened effect on a district's overall growth. Namely, black improvement in reading has increased the magnitude of the district's overall improvement in reading. The same is true for percent gain and percent of gap closed in math and reading with the same rationale, with the exception of the math gap. In this case, the percent of the gap closed by black students is not always higher than that of the other subgroups – in fact, it is only higher than that for Hispanics (Table 1). However, its effect on the percent of the gap closed for all races is still statistically significant.

Both the local BA rate and the percent of students who are black have opposite, statistically significant effects on the percent of gap closed from the raw pass rate gain and percent of gap closed. For example, a one-percentage point increase in the percent of adults with a bachelor's degree negatively affects reading raw growth and percent gain at respective magnitudes of 0.08 and 0.23 percentage points, but positively affects the percent of gap closed at a magnitude of 0.19 percentage points. For the percent of students who are black, the effects on raw growth and percent gain in math and reading are positive, while the effects on the percent of gap closed in both subjects are negative.

This trend shows evidence that there are, in fact, inherent differences between the proposed definitions of growth.

The percent of Hispanic students in the district also positively affects grade 3 percent pass rate gain, but not raw growth or percent of gap closed, at very small magnitudes. This is significantly negative for the percent of the gap closed, with a 1-percentage point increase in the percent of students who are Hispanic resulting in a widening of the gap of 0.21 percentage points in reading and 0.37 percentage points in math. This result corresponds to the relatively smaller percent of gap closed by Hispanics (21.88 percent in reading and 20.64 percent in math) than by all other subgroups (23.75 and 36.84 percent for white students and 34.82 and 25.10 percent for black students in reading and math respectively), shown in Table 1. With this exception, diversity has positive effects on the overall standardized test performance of third graders in both subjects.

According to Table 4, a one-student increase in average class size negatively affects every growth definition, but this effect is not statistically significant when explaining the percent of gap closed. The negative effect of class size on growth intuitively makes sense, as students are likely to respond better to more individualized attention through smaller class sizes.[16] The effects of a one-minute increase in curricular minutes of instruction are extremely minimal in third grade, and are usually positive, with the exception of math raw growth (0.01 percentage point decrease) and percent gain (0.05 percentage point decrease).

The mobility rate, or rate at which students leave a school district and enroll in a district after the start of the school year, can be interpreted through its effect on a child's educational experience. If there is a high mobility rate, that would indicate lots of change

[16] This negative but non statistically significant trend is supported by the literature (Wenger, 2000).

in the makeup of classes, with students coming and going throughout the school year. If children benefit from consistency in the learning environment, then increases in a district's mobility rate would negatively affect student outcomes.[17] The data support this hypothesis – the district mobility rate always negatively affects all three definitions of growth in both subjects for grades 3, 8, and 11 (except for grade 8 reading percent gain), usually with statistical significance.

The percent of teachers who are highly qualified are associated with the definitions of growth that are not consistently positive or negative; in third grade, these effects are negative for the percent of the gap closed, and positive for the other definitions in both subjects, but none of these estimated effects are statistically significant. This result is not surprising considering the lack of significant change in the percent of teachers who are highly qualified in Illinois over the period. Illinois non-high school districts were already hiring 99.27 percent of teachers who were highly qualified across districts in 2003, and this increased minimally to 99.87 percent in 2012 (Table 3). Since the percent of teachers who were highly qualified did not change much over the period – as there was just over half a percentage point increase –the effect of having a highly qualified teacher is not significant in any measure of growth in pass rates over the period in either subject. This is also true for grades 8 and 11, shown in Tables 5 and 6.

Interestingly, per pupil instructional expenditures always has a negative effect on growth, which is not statistically significant except for raw pass rate growth in reading. There is more to follow analyzing this result, which has serious implications associated with NCLB's funding-related sanctions.

[17] The literature supports this; as Price (2010) states, "high mobility rates work against administrator and teacher efforts to establish positive school learning environments" (pg 786).

2. Grade 8

The effects of many of the school and community characteristics are similar in grade 8 to grade 3. For example, BA rate, again, has negative effects on both reading and math raw growth and percent gain, and positive effects on the percent of gap closed in both subjects. All of these results are statistically significant.

In terms of race, the percent of black and Hispanic students both have generally positive and usually statistically significant effects of varying magnitudes on growth rates and the percent gain in both subjects. For example, a one-percentage point increase in the percent of black students is expected to result in raw growth in math pass rates of 0.16 percentage points. For every additional percent of students who are Hispanic, the percent gain in math pass rates is expected to increase by 0.75 percentage points. However, for the percent of students who are Hispanic in math, and the percent of students who are black and the BA rate in both subjects, the results for raw growth and percent gain are again reversed for percent of gap closed. These discrepancies in results between outcome measures give further support that the growth definitions are inherently different – particularly that percent of gap closed is different from raw growth and percent gain.

The effects of average class size and per pupil instructional expenditures on the grade 8 outcome measures are similar to those for grade 3, with varying statistical significance. In grade 8 math, a one minute increase in daily curricular minutes of instruction is expected to produce a percentage point increases of 0.18 in raw growth, 0.55 in percent gain, and 0.24 in percent of gap closed, all significant at the 1 percent level. Much smaller effects are found for reading. This result indicates that minutes of mathematics instruction have stronger effects on student improvement on standardized tests in mathematics than reading instruction does on reading tests.

Similar to grade 3, the district mobility rate negatively affects all three definitions of growth in reading and math in grade 8. Furthermore, increasing per pupil instructional expenditures again has a negative effect on all three definitions of growth in both subjects, with frequent statistical significance. In grade 8 math, for example, a one thousand dollar increase in per pupil instructional expenditures results in a 2.32 percent decrease in percent pass rates.

3. Grade 11

The grade 11 results show several trends that are often opposite of those for grades 3 and 8. For every growth measure in both subjects, the local BA rate has a positive effect, while the percent of students who are black and Hispanic both have negative effects. Taking into account where grade 11 pass rates started in 2003, this result makes sense. In every racial subgroup and overall, grade 11 pass rates in 2003 were lower than those in grades 3 and 8 for both reading and math (Table 1). Therefore, grade 11 students collectively had more "room to grow" at the start of the period, so it is not surprising that influences such as the presence of college-educated adults in the community would positively affect their educational progress.

The negative effects of the percent of students who are black and Hispanic on total district improvement make sense considering the measures of growth displayed in Table 1. As shown in Table 1, grade 11 students overall actually had negative growth, showing declining standardized test performance over the period in question. Black students experienced the greatest decrease in pass rates, with pass rate gain in reading of negative 21.82 percent and negative 6.44 percent in math. Because of the subgroup's amplified decrease in pass rates in both subjects, the percent of students who are black negatively

affects every measure of growth in grade 11. The same could be inferred for Hispanics in grade 11, who also experienced negative pass rate growth in reading.

Increasing the average class size has the expected negative effects on raw growth and percent gain, with positive effects on the percent of gap closed. None of these results are statistically significant. The district mobility rate and per pupil instructional expenditures show results consistent with those of the other grades as well. For per pupil instructional expenditures, these effects happen to be negative and statistically significant in grade 11 math with relatively large magnitudes: namely, for every thousand dollar increase in per pupil instructional expenditures, math growth, percent gain, and percent of gap closed are expected to decrease by 0.59, 1.33, and 1.15 percentage points. So, if the effect of expenditures is significant at all, it is significantly negative. Increasing expenditures actually affects student improvement negatively. This result is true for all three grade levels in this study, as increasing per pupil expenditures has negative effects in every grade, subject, and growth definition. This could have important policy implications, especially with respect to NCLB, which links educational outcomes and funding.

4. General Patterns in Growth Measurements for All Students

Overall, the results show that average class size, the mobility rate, and per pupil instructional expenditures negatively affect the raw growth in pass rates, the percent pass rate gain, and the percent of gap closed in reading and math. While those effects are consistent for all three grades, some effects are actually reversed between grades 3 and 8 and grade 11. Namely, the effects of the community characteristics, local BA rate, percent of students who are black, and percent of students who are Hispanic, are reversed from the grades 3 and 8 regressions to the grade 11 regressions. Based on the results shown, it can be inferred that there are inherent differences between grades 3 and 8 and

grade 11. Moreover, this trend gives even further reason for having various empirical definitions of growth. As a large reason for the reversed effects of these variables on grade 11 student improvement is due to where the student pass rates began in 2003, this reinforces the importance of accounting for where students started through a definition like percent pass rate gain, and not just using their raw growth as the only representation of progress.

In all three grades and both subjects, R^2 increases in value in the following order: percent of gap closed, raw growth, percent gain. Therefore, this model explains the least amount of variation in the percent of gap closed, while this model best explains that in the percent gain. The different explanatory power of the various definitions of growth, along with the observed differences in the magnitudes and signs of coefficients between regressions, suggests that the definitions of growth are actually inherently different. This may have implications for which growth measures most effectively capture student improvement as well.

Furthermore, the R^2 values for all regressions are quite low, implying that the proposed model does not fully explain growth in general, no matter how growth is defined. This has very important policy implications. The data shows that we cannot completely capture growth in student performance solely using these variables, which suggests that more factors contribute to student performance than what has been included in this model. One of the major downfalls of NCLB, therefore, is that it assumed that student performance could be fully explained by factors that clearly do not completely capture it. Policy makers, therefore must take these factors into account when deciding who and what to hold accountable for student performance.

B. Own-Race Effects for White Students

Overall, the regressions on the growth measures for the white subgroup present results analogous to those of the regressions for all students. Similar to the results for all students, the local BA rate negatively affects white raw pass rate growth and percent pass rate gain but positively affects the percent of gap closed for both subjects in grades 3 and 8. This result is statistically significant for all categories but the percent of gap closed in third grade math. The local BA rate again positively affects all definitions of growth in both subjects for grade 11 with statistical significance. Also similar to the results for all students, the mobility rate negatively affects all measures of growth in all three grades for white students, except for grade 8 reading percent pass rate gain. This is statistically significant in grades 3 and 8, but not in grade 11. The percent of teachers who are highly qualified again exhibits mixed effects on the measures of growth in both grades 3 and 8, and negative effects for all grade 11 measures of growth. In grade 8, per pupil instructional expenditures negatively affect all three measures of growth in both subjects, which is again consistent with the results for all students. However, this result is reversed in third grade; per pupil instructional expenditures positively affect measures of growth in both subjects with the exception of the percent of gap closed in math. These positive effects are not statistically significant, though. Per pupil instructional expenditures negatively affect grade 11 raw growth and percent gain, but positively affects the percent of the gap closed in both subjects.

With the exception of reading percent pass rate gain, the own-race effect for white students is positive for every measure of growth in grade 3. This effect is not consistently positive or negative for grade 8, but it is almost always statistically significant. In grade 11, the own-race effect is positive for every measure of growth except for math percent pass rate gain, and is statistically significant in reading.

C. Own-Race Effects for Black Students

The results for the subgroup of black students show both similarities to and differences from the results of all students and white students. For example, the local BA rate affects the definitions of growth differently by grade. In grade 8, the results are the same as for all students and white students: the local BA rate negatively affects raw growth and percent pass rate gain, and positively affects the percent of gap closed. However, in grade 3, the local BA rate only has a negative effect on percent gain, and has a positive effect on the other growth definitions. Also contrary to previous results, the local BA rate negatively affects every definition of growth in both subjects.

The effect of the district's mobility rate on the definitions of growth for grade 3 is always negative and statistically significant at varying levels, which is consistent with the results for all races and for white students. In grades 8 and 11, though, the results begin to differ from previous results. In eighth grade, the mobility rate displays very mixed effects on the growth definitions, and in grade 11, the effects are always positive. Per pupil instructional expenditures also has a varying effect on the definitions of growth by subject. In grade 3, the effects on the definitions of growth in math are negative, which is consistent with previous results, but the effects in reading are positive. The results are sporadically mixed again in grade 8, and positive across all definitions of growth except for math percent pass rate gain in grade 11. These results are quite different from those for all races and white students, for whom the effect of per pupil expenditures is almost always negative.

Similar to the white subgroup, increasing the percent of students who are black generally positively affects all three definitions of growth for both subjects in grades 3, 8, and 11 for black students.

D. Hispanic Students

Like the result for all students and the white and black subgroups, the local BA rate negatively affects grade 3 growth definitions in both subjects. However, the effects on the various growth definitions in grade 8 are mixed, and are all negative in grade 11, similar to the results for black students. So, the presence of adults who have bachelor's degrees in a school district positively affects white students and students overall, but negatively affects the black and Hispanic subgroups. This suggests that community characteristics may affect these groups of students differently.

The effects of the district mobility rate and per pupil instructional expenditures on the various growth definitions are relatively consistent with that for all students, with mostly negative effects for all three grade levels. The own-race effects for each grade do vary for the Hispanic subgroup. Increases in the percent of students who are Hispanic decrease all three definitions of growth in grade 3 except for math percent of gap closed, and in grade 11 except for reading percent of gap closed. The own-race effect is positive except for reading percent pass rate gain in grade 8. The effect of increases in the proportion of students who are Hispanic is different in grades 3 and 11 than for the white and black subgroups.

E. Overall Patterns in Own-Race Effects for All Subgroups

In general, the own-race effects for the white, black, and Hispanic subgroups are all positive, indicating that increases in the percent of students who belong to one of these subgroups improve the educational outcomes of the students in that subgroup. The positive effect of increased populations of these subgroups on their own performance does not imply that districts should consist of an extremely high proportion of one subgroup – this would only benefit that specific subgroup. Rather, the implication of this

for districts is that diversity matters in school districts. The presence of white, black, and Hispanic students is not enough; in order to maximize the performance of these subgroups on standardized tests, each of these groups should be well represented in school districts.

Figures 2 and 3 display scatter plots for the black own-race effect on math and reading growth and percent pass rate gain for grades 3, 8, and 11 with quadratic best fit curves. The best fit quadratic shows that although overall black pass rate growth increases with increased presence of that subgroup, there does seem to be an optimal percent of black students that maximizes pass rate growth in most cases when defined by raw growth or percent gain.[18] Based on the data, this trend could be true for the Hispanic and white subgroups as well. The data show, therefore, that a "healthy mix" of each of racial groups in school districts will generally increase the pass rate growth of each of the subgroups more than an under- or overrepresentation of a subgroup in a school district, which could translate to increased educational performance of all students in the district overall.

However, diversity is a difficult concept to capture empirically, and the data analyzed here likely do not tell the full story of diversity effects on student educational success.[19] These results, though, could certainly serve as a platform for future policy about diversity in schools.

[18] The exceptions to this trend include the graphs of grade 3 reading raw growth, grade 3 math raw growth, and grade 11 math percent gain versus the percent of students who are black.

[19] Section VII will detail plans for future empirical exploration of diversity.

VI. Graduation Rate Analysis

A. Identification Strategy and Motivation

In addition to measuring student improvement with pass rates, a section of the literature supports using high school graduation rates as an alternative metric for student success (Boggess, 1998; Goldin, 1998; Chen, 2011; Heckman & LaFonatine, 2012; Iatarola & Reubenstein, 2007; Murnane, 2013). Arguments for using graduation rates as an accountability measure usually contend that since high school graduation actually translates into real-world outcomes, such as college attendance, employment, and earnings, it may be a more telling representation of student success. As Hanushek (1986) states, "existing empirical evidence is inconclusive about the strength of the link between test scores and subsequent achievement outside of schools," (p 1154), supporting the idea of using a representation of student achievement that does not involve standardized test performance (Hanushek, 1986).

In contrast, a section of the literature also includes evidence against using graduation rates because of the way they are currently reported under NCLB. Because NCLB vaguely defines the high school graduation rate as "the percentage of students who graduate from secondary school with a regular diploma in the standard number of years," high school districts have the ability to overreport their graduation rates, thereby "gaming the system" (Alliance for Excellent Education, 2008). Due to the disparities in the ways states report high school graduation rates, some see them as a more unreliable outcome measure than those related to standardized tests. However, it is important to consider alternative accountability measures in order to create a more holistic understanding of student academic achievement; thus, this paper studies the effects of the above school and community characteristics on raw growth in graduation rates (defined in equation 5) in

order to see whether the characteristics affect growth in high school graduation rates differently than they do grade 11 pass rate growth.

(5) $$\text{Graduation Rate Growth} = \text{Graduation Rate}_{2012} - \text{Graduation Rate}_{2003}$$

Several papers argue that test scores and high school graduation rates somewhat oppose each other in education. For example, Wenger (2000) argues that schools actually face multiple outputs in education, test scores and graduation rates, which act like perfect substitutes. Carnoy (2005) argues that NCLB's initiative to improve student academic performance could potentially have negative effects on high school graduation rates. Although efforts to improve performance in elementary schools are likely to translate into high academic achievement in high schools, Carnoy suggests that if accountability measures include raising minimum requirements for high school graduation in the form of exit exams, which many states do, this could lower graduation rates by placing a barrier on high school graduation for lower-achieving students (Carnoy, 2005, p. 20). Thus, these are reasons to consider measures of student educational success that do not involve test scores as alternative accountability measures. As with the pass rate-related growth variables, I am interested in estimating the effects of community and school characteristics and test score-related variables on graduation rate growth.

(6) $$\text{Graduation Rate Growth} = \beta_0 + \beta X_{1,i} + \phi X_{2,i} + \gamma \text{Test Score}_i + \varepsilon_i$$

The regressions using the graduation rate as the outcome variable use the same input variables as the regressions related to pass rates and pass rate growth; $X_{1,i}$ is a vector of school characteristics again and $X_{2,i}$ is a vector of community characteristics. In addition to those variables, I also include one input variable relating to test scores, following Wenger (2000), captured in the model by $\gamma \text{Test Score}_i$. There are four models used for

these regressions. The first includes the 2012 pass rate as an independent variable; the second includes raw pass rate growth; the third includes percent pass rate gain; the fourth includes percent of gap closed. If the coefficients on the pass rate-related variables are zero, then this indicates that test scores have no effect on graduation rates.

Tables 17, 18, 19, and 20 show the results for the above regressions. Table 17 displays results for the four models in math and reading for growth in high school graduation rates for all students; tables 18, 19, and 20 display results for white, black, and Hispanic subgroups, respectively.

B. Results

The regressions on graduation rates display very interesting trends, especially when compared to the results of the regressions on grade 11 pass rate growth. In particular, as with the regressions on pass rate growth, the local BA rate positively affects graduation rate growth for all students and for the subgroup of white students and negatively affects that of the Hispanic subgroup. The local BA rate also positively affects growth in black high school graduation rates but negatively affects all definitions of black pass rate growth in both subjects.

The effect of the percent of black students in a district on high school graduation rate growth is negative, while that of Hispanic students is positive. This effect can be explained by the growth in high school graduation rates from 2003 to 2012 by these respective subgroups, shown in Table 15. As the table shows, for all students and all three subgroups under analysis, high school graduation rates actually declined over the period. The Hispanic subgroup experienced the smallest decline, 3.93 percentage points, and the black subgroup experienced the largest decline of 7.42 percentage points. This large decrease for black students likely negatively affected the all-student average, while the

relatively small decrease for Hispanics probably positively affected the all-student average.

The own-race effects for the three subgroups under analysis are quite similar. For example, increases in the percentage of white students in a district decrease graduation rate growth at very small magnitudes. The same is true for the black and Hispanic subgroups. Since each subgroup experienced a decline in pass rates over the period, it is no surprise that increased representation of that subgroup results in a negative effect on that group's overall growth in graduation rates. This result could also have implications about diversity in school districts. Perhaps this again asserts that diversity in districts is important for student success, and that an overwhelming representation of one subgroup of students negatively affects that group's overall educational achievement.

The effects of the percentage of highly qualified teachers on growth in high school graduation rates compare very interestingly to the effects on pass rate-related variables. The effects of the percentage of highly qualified teachers on raw pass rate growth, percent pass rate gain, and percent of gap closed are relatively indiscernible for all grades, subjects, and subgroups; sometimes the percent of highly qualified teachers positively influences the growth definitions, and other times it affects the growth definitions negatively, and this effect is rarely statistically significant. But this variable always has a positive effect on growth in high school graduation rates for all students and each of the subgroups under analysis. This is often statistically significant for all students and white students, and is often statistically significant for black students. That teachers do not have a definitive effect on student performance when measured using standardized test pass rates but have an always positive, often significant effect on student performance when measured with high school graduation rates could have several implications.

First, this result may suggest that the growth in graduation rates may be more indicative of student success than pass rate-related variables. As it is widely recognized that teachers are a crucial component in the educational success of students, one would hope that, instead of having an indiscernible effect on educational outcomes, teachers would always positively shape student success, and this does occur when measuring student success with growth in high school graduation rates (though still not usually with statistical significance).[20] Furthermore, that teachers have mixed effects on pass-rate related variables but always positively affect graduation rates may say something about their priorities with respect to education. Maybe this indicates that teachers, on average, have mixed opinions about standardized testing, but have positive opinions of graduation as a measure of student success, and work harder towards students achieving the latter than the former. This may support the notion of competing outcomes in education.

In contrast, the above results could actually provide evidence that growth in pass rates is actually a more reliable measure than growth in high school graduation rates. If teachers do, in fact, prioritize students graduating over students improving standardized test performance, this trend could constitute an argument for using standardized test scores as a measure of student success over graduation rates. If teachers are more impartial towards standardized tests than high school graduation, pass rate-related variables could be more unbiased accountability measures.

Another trend that shows evidence of competing outcomes in education is the effects of pass rate-related variables on high school graduation rates. For all students and the subgroup of white students, the effects of the 2012 grade 11 pass rate, raw pass rate growth, percent pass rate gain, and percent of gap closed are all negative for reading and

[20] This is one argument for directly estimating the impact of teachers on student achievement through value added models. This form of accountability still relies on test scores.

positive for math with rare statistical significance. For black and Hispanic students in both subjects, the effect of 2012 pass rates on growth in high school graduation rates is negative, but the effects of all three growth definitions are positive. The positive effects of the growth variables reflect that increases in pass rate growth positively affect graduation rates; if we think of improved standardized pass rates as indications of student learning, then this result makes sense. It is also possible that the absence of statistical significance for the effects of the pass rate-related variables on growth in high school graduation rates indicates a lack of relationship between the variables.

Finally, Table 15 shows the change in high school graduation rates over the period of 2003 to 2012 for all students and the white, black, and Hispanic subgroups. For all four groups of students, high school graduation rates decreased with statistical significance over the period. This trend is quite alarming, as grade 11 pass rates also decreased over the period in math and reading for all students and subgroups, except for Hispanics in math. With these trends, Illinois districts are showing decreases in student success as measured by the two conventional measures in place. This is not to say that all districts exhibited decreases in graduation rates and pass rates over the period – actually, 124 districts experienced positive growth in high school graduation rates and 8 experienced no change. However, an overwhelming majority of districts did experience a decline in graduation rates overall. This is quite contrary to the objective of education legislation, which aims to improve student skills (and therefore hopefully educational outcomes), not make outcomes like high school graduation more difficult to attain.[21]

[21] This decrease in graduation rates could also be due to the implementation of graduation requirements that are more difficult to attain. Carnoy (2005) addresses this, suggesting that raising requirements could encourage lower-achieving students to not graduate, and pursue GEDs or other alternative programs instead, and therefore lower the graduation rate.

Perhaps the greatest implication of these results is that there is evidence of competing outcomes in education, and we need to consider this when choosing a metric to best evaluate student success. The above results at times support using growth in graduation rates as a measure, but there are viable reasons to not do so as well. Ultimately, policy makers must be more mindful of how they empirically evaluate student progress over time, carefully choosing the proper accountability measure to employ in future legislation.

VII. Conclusion and Future Research

Several trends that have emerged from the above analyses have serious policy implications. First of all, the results show that empirical measures used to define student growth should take into account where students started at the beginning of the period in question. In terms of the standardized test-related definitions of growth used in this paper, one may consider using percent pass rate gain or percent of gap closed instead of raw pass rate growth, as they actually account for the original pass rate, and are therefore more informative. Measuring how students have improved relative to where they started would be better for NCLB as well. Perhaps instead of using AYP, which is just a raw amount of growth from year to year, policy makers should employ a more revealing accountability measure such as percent gain or percent of gap closed in order to more accurately and holistically measure student progress. Based on the regression results, it is clear that policy makers could employ a more appropriate measure of pass rate growth. Because federal funding is at stake for districts that do not meet the requirements of AYP, it is imperative to use the most appropriate measure of growth in order for the Department of Education to correctly impose funding sanctions. That percent gain and percent of gap closed better capture improvements in student outcomes than raw growth

shows evidence that the current system of evaluating student progress is problematic, and should change.

Changing the current system of evaluation does not have to involve the development of new standardized tests or defining success with respect to standardized test performance at all. This paper suggests that using high school graduation rates as an additional outcome variable in the education production function actually better captures the effects of certain determinants of student educational success, such as the effect of the percent of highly qualified teachers, than the pass rate regressions. Furthermore, some scholars believe that test score-related variables are not the best measures of student educational success because they do not directly translate into real life outcomes, such as access to employment and higher income opportunities, the way a variable like graduation rates does. One could consider using variables, such as the percent of students planning to attend college or earnings after graduating high school as alternative outcome measures as well. Future policies could use other accountability measures that are not related to standardized test performance in order to better understand education, or at the very least, consider the metric chosen to better represent improvements in student outcomes.

With new accountability measures, policy makers can better address the combination of school and community factors that impact student outcomes – something that the current version of NCLB does not account for. One way to begin a practice of accounting for community influences on student educational improvement would be to include community data on the annual report cards that NCLB required districts to produce. Because school districts may not be able to completely control for community characteristics that influence educational success of students, it is possible that all of the responsibility for student outcomes should not rest completely on the school districts in

terms of the academic services they provide. The statistically significant effects of the local BA rate and the racial makeup of the school district on both outcome measures related to pass rates and to high school graduation rates have provided evidence of this in this paper. School districts themselves might not be best equipped to overcome factors that pre-exist in a community in order to produce student success; legislators must understand this when formulating future education policy, so that they can more accurately capture determinants of student success and correctly impose school district funding sanctions.[22]

One implication that arises out of this study is that racial make-up of a school district is imperative to student success, especially in addressing the achievement gap. As shown in the results from the own-race effects, white, black, and Hispanic students generally benefit from an increased presence of other students of their race in school districts. This could powerfully influence federal education policy because the government could mandate that districts exhibit a "healthy mix" of students in order to maximize student educational performance. However, it may not be that simple, as diversity is a difficult concept to capture empirically. More work should certainly be done to determine what constitutes a "healthy mix." Figures 2 and 3 do show some evidence that a quadratic best fit curve could be more appropriate for the percent of black students than a line, and I would like to further explore this by adjusting the functional form of race variables. In particular, I would like to vary the own-race regressions by squaring the race variables in order to see if there is, in fact, a percentage of black, Hispanic, and white students in a district that would maximize student performance of that race and of all races. If the

[22] For example, instead of firing teachers in districts that repeatedly do not meet AYP, the federal government could mandate that districts engage more with their communities, taking advantage of community characteristics that should positively affect student educational achievement.

white and Hispanic subgroups display similar trends to black students, this could have important consequences regarding optimal levels of diversity in schools, and could lead to policy that calls for school districts increasing racial integration.[23]

Furthermore, threatening a reduction of federal funding for districts that do not meet AYP may not be the most effective policy based on the above results. In all three grades, the effects of increases in per pupil instructional expenditures on all three measures of growth are negative, suggesting that throwing money at the problem of a lack of improvement in certain areas—such as math and reading that are heavily assessed in current tests – does not necessarily solve the problem of improving educational outcomes. Perhaps the federal solution for districts that are not improving enough should encompass more than just a threatened withholding of funds, as expenditures are clearly not the only variable that affects student outcomes. The results of this paper have shown that there are many significant determinants of student educational success that actually do not involve per pupil expenditures. Perhaps, the federal government should turn its focus to addressing those factors by working in concert with state and local governments and school boards. Since community factors significantly influence student success, local- or state-level reform or legislation, rather than federal legislation, might lead to better results. For example, policy could require the implementation of tutoring programs in the communities of lower-achieving districts or the implementation of new school integration efforts.

[23] Because diversity and own-race effects are so difficult to empirically capture, it is important to consider other race-related factors that could affect educational outcomes. The above model could suffer from omitted variable bias because other race-related variables that were not included could contribute to educational outcomes. For example, adding the percent of teachers in a district who are Hispanic as an independent variable in the Hispanic own-race regressions may yield results that further explain the influence of race on student performance.

The above analyses have produced results that suggest that a combination of school district and community characteristics do affect student educational outcomes, a conclusion that is consistent with the literature. However, the results still leave questions about how to most effectively capture student improvement, since certain inputs in the education production function produce very different effects on different definitions of student improvement. Perhaps that is why there are so many education production function estimates – there does not seem to be one widely accepted "best" way to capture student educational performance and its determinants. Due to this, there is much more that I would like to explore in regard to the education production function.

A useful follow up study would include more data to analyze student performance at the school level, rather than the school district level. I restricted this study to the school district level because expenditure data was only reported at the district level. By foregoing this variable, student performance across Illinois schools could be analyzed, which would increase sample size substantially. Data from at least one intermediate year between 2003 and 2012 would help understand trends in pass rates found in this study. One question this additional data would answer would be if grade 11 experienced a steady decline in pass rates from 2003 to 2012 or if pass rates increased until a certain year and decreased after that. Obtaining more data would definitely enhance understanding of trends.

An examination of differences in pass rates between racial subgroups over the period of NCLB would assess whether the Act's goal of closing the achievement gap, or increasing the performance of low-achieving subgroups relative to higher-achieving subgroups, was achieved. Additional studies should explore whether reductions in the achievement gap can be explained using the education production function model employed in this paper.

In addition to performing regressions on the closing of the achievement gap, additional investigations should be done on the effects of district and community characteristics on subgroups of the population other than racial ones. For example, because American education legislation has targeted disadvantaged students (Title I, NCLB), it is important to see how the variables in this paper's proposed education production function estimate affect the subgroup of low-income students. Other subgroups that should be analyzed include Limited English Proficient students and students with Individualized Education Programs.

Finally, with the recent expiration of NCLB and the implementation of the new Common Core Standards Initiative has come a shift from state-set standards to national standards. This shift should motivate other studies using similar data in other states and investigate whether the variables used in this paper have similar effects on student outcomes in states other than Illinois. Proving that community characteristics are useful in measuring student success extend in other states could then influence federal action and a more just and useful revision to NCLB.

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Appendix

Table 1
Pass Rates

	Reading						Math					
	N	2003 Pass Rate	2012 Pass Rate	Grow[ai] (pp)	Gain[ii] (%)	Gap[iii] (%)	N	2003 Pass Rate	2012 Pass Rate	Grow[ai] (pp)	Gain[ii] (%)	Gap[iii] (%)
All Races												
Grade 3	663	71.30	80.36	9.07	15.72	22.41	663	84.67	91.37	6.70	9.40	33.38
Grade 8	653	67.31	87.02	19.71	32.78	59.39	653	59.48	86.34	26.86	55.03	66.04
Grade 11	427	57.06	52.97	-4.08	-6.30	-12.07	427	53.30	51.53	-1.76	-1.98	-5.59
White												
Grade 3	630	74.78	83.17	8.33	12.90	23.75	630	87.36	93.39	5.93	7.68	36.84
Grade 8	628	69.94	88.60	18.55	29.33	60.98	628	63.02	88.40	25.16	45.84	68.05
Grade 11	424	59.44	56.74	-2.71	-3.41	-9.16	424	55.46	55.34	-0.14	-1.40	-1.79
Black												
Grade 3	137	46.87	67.00	19.85	53.61	34.82	137	64.89	77.93	13.19	25.34	25.10
Grade 8	140	47.72	76.94	27.36	68.96	50.39	140	27.86	71.34	41.98	189.93	58.13
Grade 11	86	33.91	27.12	-8.29	-21.82	-15.97	86	25.00	23.06	-3.85	-6.44	-7.42
Hispanic												
Grade 3	155	57.02	71.36	12.73	29.51	21.88	156	77.18	85.94	8.16	13.58	20.64
Grade 8	142	49.79	84.40	33.90	83.41	64.54	142	40.72	82.97	41.20	131.39	68.70
Grade 11	94	39.42	38.92	-1.05	-3.15	-4.48	94	36.41	49.09	3.80	20.69	3.51

[a] This is the only growth variable being statistically tested. Pass rate growth is statistically significant at the 1% level for all grades, subgroups, and subjects except for grade 11 white math and grade 11 Hispanic reading.

[i] Corresponds to equation (1) in section III

[ii] Corresponds to equation (2) in section III

[iii] Corresponds to equation (3) in section III

Table 2
Difference in Differences in Pass Rates Between Races

	Reading			Math		
	2003	2012	Diff-in-Diff	2003	2012	Diff-in-Diff
	White and Black Subgroups					
Grade 3	26.70	16.59	-9.49***	20.60	15.62	-4.90***
Grade 8	23.23	11.42	-10.77***	34.57	16.05	-17.25***
Grade 11	29.33	34.25	-6.00***	33.87	38.49	6.25***
	White and Hispanic Subgroups					
Grade 3	16.92	13.46	-1.69	9.71	7.53	-1.65*
Grade 8	21.29	5.70	-15.61***	22.32	6.31	-16.42***
Grade 11	25.23	23.29	-0.39	25.21	23.67	-1.00

*** signifies statistical significance at the 1% level
** signifies statistical significance at the 5% level
* signifies statistical significance at the 10% level

Table 3
Descriptive Statistics

	2003				2012			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Districts with Grade 3 and 8 ISAT Scores[a]								
Local BA Rate	23.78	14.91	3.1	88.7	23.78	14.91	3.1	88.7
Percent Students White	83.03	23.84	0	100	75.47	27.14	0	99.6
Percent Students Black	8.43	18.93	0	100	8.7	18.98	0	100
Percent Students Hispanic	6.15	11.35	0	94.2	10.07	15.34	0	94
Grade 3 Average Class Size	20.68	3.80	5	36	20.6	3.97	5	35
Grade 8 Average Class Size	21.51	4.71	8.9	40	20.3	4.75	7.3	39.4
Grade 3 Daily Minutes of Eng. Inst.	142.19	27.76	40	220	138.63	27.15	43	230
Grade 3 Daily Minutes of Math Inst.	58.14	9.82	30	100	61.77	11.1	30	120
Grade 8 Daily Minutes of Eng Inst.	86.83	20.67	15	282	86.08	18.14	37	151
Grade 8 Daily Minutes of Math Inst.	46.47	11.92	23	235	49.21	11.26	38	105
District Mobility Rate	14.18	7.39	0.6	40.9	12.88	7.66	0.7	55
Percent of Teachers who are Highly Qualified	99.27	3.35	31.6	100	99.87	0.83	88.6	100
Per Pupil Instructional Expenditures	4.30	0.90	2.33	10.45	5.94	1.45	3.41	15.09
Center City Districts	3.32	17.92	0	100	3.32	17.92	0	100
Suburban Districts	80.54	39.62	0	100	80.54	39.62	0	100
Rural Districts	16.14	36.81	0	100	16.14	36.81	0	100
Districts with Grade 11 PSAE Scores[b]								
Local BA Rate	21.52	12.41	3.1	79.4	21.52	12.41	3.1	79.4
Percent Students White	88.51	17.98	0.2	100	82.47	21.44	0.5	99.5
Percent Students Black	5.59	13.35	0	98.7	5.88	13.54	0	98.4
Percent Students Hispanic	4.43	9.20	0	76.8	7.44	12.51	0	87.7
Grade 11 Average Class Size	17.89	3.83	7.9	31	16.51	4.18	7.1	31
District Mobility Rate	12.82	5.97	1.9	40.1	12.47	6.33	0.9	55
Percent of Teachers who are Highly Qualified	99.29	2.47	73.1	100	99.86	0.89	88.6	100
Per Pupil Instructional Expenditures	4.52	1.06	2.86	9.42	6.09	1.53	3.72	12.67
Center City Districts	2.58	15.86	0	100	2.58	15.86	0	100
Suburban Districts	74.71	43.52	0	100	74.71	43.52	0	100
Rural Districts	22.72	41.95	0	100	22.72	41.95	0	100

[a] After dropping extreme outliers, there are 663 elementary and unit districts in the grade 3 analysis and 653 districts in the grade 8 analysis.
[b] There are 427 high school and unit districts in the grade 11 analysis.

Table 4
Grade 3 Growth in Pass Rates by Subject: All Races

	Reading			Math		
	Grow	Gain	Gap	Grow	Gain	Gap
Local BA Rate	-0.08***	-0.22***	0.21*	-0.14***	-0.21***	-0.21
	(0.03)	(0.05)	(0.12)	(0.05)	(0.03)	(0.15)
Percent Students Black	0.21***	0.54***	0.31***	0.20***	0.36***	0.40***
	(0.02)	(0.04)	(0.09)	(0.02)	(0.03)	(0.11)
Percent Students Hispanic	-0.02	0.03	-0.22***	-0.01	0.02	-0.37***
	(0.02)	(0.03)	(0.08)	(0.01)	(0.02)	(0.09)
Grade 3 Average Class Size	-0.28**	-0.58**	-0.45	-0.20**	-0.33**	-0.74
	(0.13)	(0.23)	(0.53)	(0.01)	(0.15)	(0.67)
Grade 3 Curricular Minutes of Instruction	0.02*	0.02	0.10	-0.01	-0.05	0.18
	(0.01)	(0.03)	(0.06)	(0.03)	(0.04)	(0.17)
District Mobility Rate	-0.29***	-0.52***	-0.93***	-0.29***	-0.37***	-1.66***
	(0.06)	(0.10)	(0.24)	(0.04)	(0.07)	(0.29)
Percent of Teachers who are Highly Qualified	0.11	0.28	-0.27	0.24	0.53	-0.55
	(0.34)	(0.62)	(1.42)	(0.27)	(0.41)	(1.78)
Per Pupil Instructional Expenditures	-0.53*	-0.65	-1.23	-0.28	-0.32	-2.50
	(0.32)	(0.59)	(1.38)	(0.26)	(0.40)	(1.74)
Constant	9.45	8.01	13.29	-4.39	-25.89	140.87
	(33.81)	(61.86)	(143.17)	(27.19)	(41.78)	(179.93)
R^2	0.1671	0.2997	0.0901	0.2613	0.3173	0.0854

N = 663 elementary and unit districts
*** denotes statistical significance at the 1% level
** denotes statistical significance at the 5% level
* denotes statistical significance at the 10% level

Table 5
Grade 8 Growth in Pass Rates by Subject: All Races

	Reading			Math		
	Grow	Gain	Gap	Grow	Gain	Gap
Local BA Rate	-0.19***	-0.47***	0.17***	-0.25***	-0.95***	0.13**
	(0.02)	(0.05)	(0.05)	(0.03)	(0.09)	(0.04)
Percent Students Black	0.03	0.13***	-0.18***	0.17***	1.08***	-0.10***
	(0.02)	(0.04)	(0.04)	(0.02)	(0.08)	(0.04)
Percent Students Hispanic	0.17***	0.54***	0.06*	0.16***	0.74***	-0.02
	(0.01)	(0.03)	(0.03)	(0.02)	(0.06)	(0.03)
Grade 8 Average Class Size	-0.21***	-0.57***	-0.06	-0.20**	0.47*	0.15
	(0.06)	(0.14)	(0.14)	(0.08)	(0.26)	(0.13)
Grade 8 Curricular Minutes of Instruction	0.01	-0.004	0.06	0.21***	0.60***	0.25***
	(0.02)	(0.04)	(0.04)	(0.03)	(0.09)	(0.04)
District Mobility Rate	-0.02	0.07	-0.31***	-0.19***	-0.59***	-0.44***
	(0.04)	(0.10)	(0.10)	(0.06)	(0.19)	(0.09)
Percent of Teachers who are Highly Qualified	-0.03	0.45	0.71	-0.10	-0.44	0.76
	(0.29)	(0.65)	(0.67)	(0.37)	(1.22)	(0.59)
Per Pupil Instructional Expenditures	-0.67***	-1.29**	-0.17	-1.29***	-2.48**	-1.13**
	(0.24)	(0.55)	(0.57)	(0.32)	(1.05)	(0.50)
Constant	38.12	22.99	-13.22	45.48	111.99	-16.48
	(31.44)	(64.92)	(66.90)	(37.09)	(122.08)	(58.91)
R^2	0.4506	0.5833	0.1753	0.4808	0.6201	0.1826

N = 653 elementary and unit districts
*** denotes statistical significance at the 1% level
** denotes statistical significance at the 5% level
* denotes statistical significance at the 10% level

Table 6
Grade 11 Growth in Pass Rates by Subject: All Races

	Reading			Math		
	Grow	Gain	Gap	Grow	Gain	Gap
Local BA Rate	0.08**	0.18***	0.06	0.11***	0.23***	0.20**
	(0.03)	(0.06)	(0.09)	(0.04)	(0.07)	(0.09)
Percent Students Black	-0.12***	-0.36***	-0.16**	-0.08***	-0.31***	-0.12*
	(0.02)	(0.04)	(0.07)	(0.03)	(0.06)	(0.07)
Percent Students Hispanic	-0.05**	-0.13***	-0.09	-0.02	-0.04	-0.06
	(0.02)	(0.04)	(0.06)	(0.03)	(0.05)	(0.07)
Grade 11 Average Class Size	-0.04	-0.08	0.20	-0.05	-0.22	0.23
	(0.12)	(0.21)	(0.33)	(0.14)	(0.28)	(0.33)
District Mobility Rate	-0.08	-0.12	-0.16	-0.09	-0.14	-0.14
	(0.06)	(0.11)	(0.16)	(0.07)	(0.14)	(0.17)
Percent of Teachers who are Highly Qualified	-0.40	0.29	-1.68*	-1.22***	-2.49***	-2.56**
	(0.38)	(0.67)	(1.03)	(0.43)	(0.89)	(1.06)
Per Pupil Instructional Expenditures	-0.25	0.57	-0.49	-0.55**	-1.27**	-1.07*
	(0.23)	(0.41)	(0.63)	(0.26)	(0.54)	(0.65)
Constant	36.67	-29.93	152.81	119.63	249.84	243.11
	(37.57)	(67.03)	(102.48)	(42.61)	(88.16)	(105.55)
R^2	0.1921	0.3469	0.0682	0.1645	0.2191	0.1094

N = 427 high school and unit districts
*** denotes statistical significance at the 1% level
** denotes statistical significance at the 5% level
* denotes statistical significance at the 10% level

Table 7
Grade 3 Growth in Pass Rates by Subject: White Students

	Reading			Math		
	Grow	Gain	Gap	Grow	Gain	Gap
Local BA Rate	-0.07***	-0.20***	0.38***	-0.12***	-0.18***	0.19
	(0.03)	(0.04)	(0.14)	(0.02)	(0.03)	(0.17)
Percent Students White	0.004	-0.04*	0.08	0.01	0.01	0.32***
	(0.02)	(0.02)	(0.08)	(0.01)	(0.01)	(0.09)
Grade 3 Average Class Size	0.03	-0.07	0.60	-0.10	-0.18	-1.09
	(0.13)	(0.20)	(0.63)	(0.09)	(0.12)	(0.78)
Grade 3 Curricular Minutes of Instruction	0.05***	0.05	0.23***	-0.03	-0.08*	0.25
	(0.01)	(0.02)	(0.07)	(0.03)	(0.04)	(0.21)
District Mobility Rate	-0.20***	-0.32***	-0.80***	-0.13***	-0.14***	-1.38***
	(0.05)	(0.08)	(0.25)	(0.04)	(0.05)	(0.31)
Percent of Teachers who are Highly Qualified	-0.62*	-0.25	-2.60	-0.003	0.24	-1.85
	(0.35)	(0.57)	(1.76)	(0.26)	(0.35)	(2.17)
Per Pupil Instructional Expenditures	0.28	0.28	2.32	0.19	0.21	-1.85
	(0.33)	(0.54)	(1.68)	(0.25)	(0.33)	(2.17)
Constant	69.14	46.61	232.96	15.51	0.51	231.14
	(33.93)	(56.20)	(174.60)	(26.07)	(34.98)	(217.04)
R^2	0.0590	0.0686	0.1278	0.0976	0.1176	0.1002

N = 630 elementary and unit districts
*** denotes statistical significance at the 1% level
** denotes statistical significance at the 5% level
* denotes statistical significance at the 10% level

Table 8
Grade 8 Growth in Pass Rates by Subject: White Students

	Reading			Math		
	Grow	Gain	Gap	Grow	Gain	Gap
Local BA Rate	-0.28***	-0.63***	0.26***	-0.30***	-0.89***	0.25***
	(0.03)	(0.06)	(0.06)	(0.03)	(0.08)	(0.05)
Percent Students White	0.07***	0.22***	-0.06*	-0.04**	-0.19***	0.01
	(0.01)	(0.03)	(0.03)	(0.02)	(0.05)	(0.03)
Grade 8 Average Class Size	-0.03	-0.14	0.23	-0.17**	-0.60***	0.15
	(0.08)	(0.18)	(0.17)	(0.08)	(0.23)	(0.13)
Grade 8 Curricular Minutes of Instruction	0.01	0.004	0.03	0.12***	0.37***	0.15***
	(0.02)	(0.05)	(0.04)	(0.03)	(0.08)	(0.05)
District Mobility Rate	-0.17***	0.31***	-0.56***	-0.26***	-0.63***	-0.57***
	(0.05)	(0.12)	(0.11)	(0.06)	(0.15)	(0.09)
Percent of Teachers who are Highly Qualified	0.92**	3.40***	1.20	-0.47	0.47	-.062
	(0.43)	(1.01)	(0.96)	(0.47)	(1.30)	(0.76)
Per Pupil Instructional Expenditures	-0.63**	-1.47**	-0.23	-1.22***	-2.36***	-1.51***
	(0.30)	(0.71)	(0.67)	(0.33)	(0.92)	(0.54)
Constant	-52.43	-258.77	-57.28	96.69	61.22	130.71
	(42.00)	(98.66)	(93.79)	(36.53)	(127.55)	(74.59)
R^2	0.2868	0.2971	0.1754	0.3547	0.3764	0.2000

N = 628 elementary and unit districts
*** denotes statistical significance at the 1% level
** denotes statistical significance at the 5% level
* denotes statistical significance at the 10% level

Table 9
Grade 11 Growth in Pass Rates by Subject: White Students

	Reading			Math		
	Grow	Gain	Gap	Grow	Gain	Gap
Local BA Rate	0.11**	0.18***	0.30***	0.15***	0.21***	0.37***
	(0.03)	(0.05)	(0.09)	(0.04)	(0.07)	(0.10)
Percent Students White	0.06***	0.09***	0.15***	0.0001	-0.002	0.02
	(0.02)	(0.03)	(0.06)	(0.02)	(0.04)	(0.06)
Grade 11 Average Class Size	0.27**	0.39*	0.90**	0.17	0.13	0.86**
	(0.12)	(0.22)	(0.35)	(0.14)	(0.28)	(0.40)
District Mobility Rate	-0.04	-0.07	-0.07	-0.04	-0.10	0.01
	(0.06)	(0.10)	(0.16)	(0.07)	(0.13)	(0.19)
Percent of Teachers who are Highly Qualified	-1.18**	-1.77**	-3.52**	-0.88	-1.47	-2.10
	(0.50)	(0.87)	(1.42)	(0.58)	(1.13)	(1.63)
Per Pupil Instructional Expenditures	-0.05	-0.16	0.28	-0.34	-0.86	0.06
	(0.25)	(0.43)	(0.70)	(0.29)	(0.55)	(0.81)
Constant	101.62	153.10	300.44	80.87	141.57	174.25
	(48.91)	(84.50)	(137.94)	(56.44)	(109.17)	(157.82)
R^2	0.1359	0.1146	0.1358	0.1254	0.0788	0.1325

N = 424 high school and unit districts
*** denotes statistical significance at the 1% level
** denotes statistical significance at the 5% level
* denotes statistical significance at the 10% level

Table 10
Grade 3 Growth in Pass Rates by Subject: Black Students

	Reading			Math		
	Grow	Gain	Gap	Grow	Gain	Gap
Local BA Rate	0.0001	-0.32	0.16	0.24	-0.02	0.21
	(0.07)	(0.20)	(0.14)	(0.08)	(0.25)	(0.40)
Percent Students Black	0.19***	0.53***	0.30***	0.23***	0.42***	0.69**
	(0.05)	(0.14)	(0.10)	(0.05)	(0.10)	(0.27)
Grade 3 Average Class Size	-0.80*	-1.43	-1.22	-1.27***	-2.58***	-3.14
	(0.43)	(1.21)	(0.85)	(0.47)	(0.86)	(2.34)
Grade 3 Curricular Minutes of Instruction	0.05	0.07	0.08	0.01	-0.02	0.08
	(0.05)	(0.13)	(0.09)	(0.10)	(0.18)	(0.48)
District Mobility Rate	-0.37***	-0.98***	-0.66**	-0.50***	-0.85***	-1.31*
	(0.13)	(0.37)	(0.26)	(0.14)	(0.26)	(0.72)
Percent of Teachers who are Highly Qualified	-0.90	1.14	2.18	0.92	1.59	1.06
	(0.69)	(1.92)	(1.35)	(0.75)	(1.39)	(3.78)
Per Pupil Instructional Expenditures	0.75	2.20	1.46	-1.96*	-3.86*	-4.29
	(1.03)	(2.88)	(2.01)	(1.12)	(2.07)	(5.63)
Constant	-65.13	-49.92	-182.40	-38.95	-50.88	12.29
	(69.10)	(193.38)	(135.45)	(76.46)	(141.21)	(384.36)
R^2	0.2033	0.1918	0.1883	0.2193	0.2261	0.0824

N = 137 elementary and unit districts
*** denotes statistical significance at the 1% level
** denotes statistical significance at the 5% level
* denotes statistical significance at the 10% level

Table 11
Grade 8 Growth in Pass Rates by Subject: Black Students

	Reading			Math		
	Grow	Gain	Gap	Grow	Gain	Gap
Local BA Rate	-0.15**	-0.89***	0.06	-0.07	-1.67***	0.11
	(0.08)	(0.24)	(0.15)	(0.08)	(0.57)	(0.10)
Percent Students Black	-0.07	-0.30*	-0.07	0.06	0.41	0.05
	(0.05)	(0.18)	(0.11)	(0.06)	(0.41)	(0.07)
Grade 8 Average Class Size	-0.25	-1.00	-0.45	0.23	0.41	0.34
	(0.24)	(0.79)	(0.50)	(0.25)	(1.73)	(0.31)
Grade 8 Curricular Minutes of Instruction	-0.02	0.03	-0.11	0.18**	-0.10	0.27***
	(0.06)	(0.20)	(0.13)	(0.08)	(0.53)	(0.09)
District Mobility Rate	0.05	0.26	-0.07	-0.29**	-1.15	-0.40**
	(0.14)	(0.45)	(0.28)	(0.14)	(1.01)	(0.18)
Percent of Teachers who are Highly Qualified	-0.55	-2.67	0.21	-0.01	-10.45*	1.13
	(0.79)	(2.56)	(1.61)	(0.82)	(5.77)	(1.02)
Per Pupil Instructional Expenditures	-0.46	0.35	-0.48	0.09	-3.80	0.71
	(0.96)	(3.13)	(1.96)	(1.01)	(7.09)	(1.25)
Constant	102.75	405.04	55.43	37.87	1351.22	-77.13
	(78.68)	(255.27)	(160.34)	(82.30)	(577.43)	(101.83)
R^2	0.1702	0.3102	0.0329	0.1366	0.2437	0.1730

N = 140 elementary and unit districts
*** denotes statistical significance at the 1% level
** denotes statistical significance at the 5% level
* denotes statistical significance at the 10% level

Table 12
Grade 11 Growth in Pass Rates by Subject: Black Students

	Reading			Math		
	Grow	Gain	Gap	Grow	Gain	Gap
Local BA Rate	-0.25***	-0.29	-0.74***	-0.12	-0.002	-0.35**
	(0.10)	(0.24)	(0.21)	(0.08)	(0.31)	(0.16)
Percent Students Black	0.03	-0.05	0.11	0.03	-0.08	0.09
	(0.08)	(0.19)	(0.17)	(0.07)	(0.25)	(0.13)
Grade 11 Average Class Size	0.96*	1.68	2.47**	0.62	0.95	1.42*
	(0.49)	(1.22)	(1.08)	(0.43)	(1.57)	(0.83)
District Mobility Rate	0.06	0.03	0.18	0.03	0.33	0.06
	(0.18)	(0.46)	(0.41)	(0.16)	(0.59)	(0.31)
Percent of Teachers who are Highly Qualified	0.29	2.58	-0.23	-0.62	-0.91	-1.11
	(0.94)	(2.36)	(2.10)	(0.84)	(3.05)	(1.61)
Per Pupil Instructional Expenditures	0.63	0.64	1.91	0.07	-0.14	0.46
	(0.81)	(2.02)	(1.80)	(0.72)	(2.61)	(1.38)
Constant	-54.01	-303.30	-35.86	47.98	60.21	80.37
	(94.12)	(235.44)	(209.32)	(83.40)	(303.54)	(160.05)
R^2	0.1164	0.0607	0.1933	0.0725	0.0198	0.1167

N = 86 high school and unit districts
*** denotes statistical significance at the 1% level
** denotes statistical significance at the 5% level
* denotes statistical significance at the 10% level

Table 13
Grade 3 Growth in Pass Rates by Subject: Hispanic Students

	Reading			Math		
	Grow	Gain	Gap	Grow	Gain	Gap
Local BA Rate	-0.29***	-0.60***	-0.63**	-0.21**	-0.33**	-1.43**
	(0.10)	(0.21)	(0.26)	(0.08)	(0.13)	(0.60)
Percent Students Hispanic	-0.13**	-0.22*	-0.29*	-0.05	-0.07	0.29
	(0.06)	(0.13)	(0.16)	(0.05)	(0.08)	(0.36)
Grade 3 Average Class Size	-1.01**	-2.16**	-2.00	-0.18	-0.37	-2.03
	(0.46)	(1.01)	(1.25)	(0.40)	(0.62)	(2.83)
Grade 3 Curricular Minutes of Instruction	0.10*	0.20	0.19	-0.04	-0.10	-0.37
	(0.06)	(0.12)	(0.15)	(0.09)	(0.14)	(0.64)
District Mobility Rate	-0.47***	-0.79**	-1.27***	-0.33***	-0.36*	-3.03***
	(0.14)	(0.31)	(0.38)	(0.12)	(0.19)	(0.86)
Percent of Teachers who are Highly Qualified	-0.68	-1.29	-1.58	-0.22	0.10	-2.08
	(0.84)	(1.85)	(2.28)	(0.73)	(1.14)	(5.11)
Per Pupil Instructional Expenditures	-1.62	-3.56	-3.17	-1.11*	-1.43	-10.70
	(1.16)	(2.55)	(3.14)	(1.01)	(1.56)	(7.17)
Constant	118.80	235.90	265.67	57.70	64.25	456.44
	(85.33)	(187.36)	(231.15)	(75.01)	(116.83)	(524.28)
R^2	0.1710	0.1568	0.1223	0.1089	0.0983	0.1351

N = 155 elementary and unit districts
*** denotes statistical significance at the 1% level
** denotes statistical significance at the 5% level
* denotes statistical significance at the 10% level

Table 14
Grade 8 Growth in Pass Rates by Subject: Hispanic Students

	Reading			Math		
	Grow	Gain	Gap	Grow	Gain	Gap
Local BA Rate	-0.03	-0.38	0.12	0.12	0.35	0.20**
	(0.09)	(0.30)	(0.12)	(0.09)	(0.53)	(0.10)
Percent Students Hispanic	0.17***	-0.61***	0.12*	0.18***	0.99***	0.07
	(0.05)	(0.19)	(0.08)	(0.06)	(0.34)	(0.06)
Grade 8 Average Class Size	-0.27	-1.10	-0.09	-0.28	-2.17	0.20
	(0.24)	(0.82)	(0.33)	(0.25)	(1.41)	(0.26)
Grade 8 Curricular Minutes of Instruction	-0.11*	-0.45**	-0.04	0.21***	0.97**	0.22***
	(0.06)	(0.21)	(0.09)	(0.08)	(0.45)	(0.08)
District Mobility Rate	-0.04	-0.30**	-0.06	-0.14	-0.81	-0.16
	(0.13)	(0.45)	(0.18)	(0.14)	(0.80)	(0.14)
Percent of Teachers who are Highly Qualified	-0.23	-3.26	1.31	-0.40	-7.20	1.35
	(0.84)	(2.88)	(1.16)	(0.86)	(4.89)	(0.89)
Per Pupil Instructional Expenditures	-0.47	-1.37	-0.17	-3.22***	-16.99***	-2.49**
	(0.96)	(3.30)	(1.32)	(1.01)	(5.73)	(1.04)
Constant	71.51	477.30	-67.30	91.04	923.24	-72.13
	(84.51)	(289.37)	(116.11)	(87.03)	(495.28)	(89.71)
R^2	0.1890	0.2840	0.0450	0.2396	0.2590	0.1717

N = 142 elementary and unit districts
*** denotes statistical significance at the 1% level
** denotes statistical significance at the 5% level
* denotes statistical significance at the 10% level

Table 15
Grade 11 Growth in Pass Rates by Subject: Hispanic Students

	Reading			Math		
	Grow	Gain	Gap	Grow	Gain	Gap
Local BA Rate	-0.11	-0.24	-0.34	-0.27**	-0.79*	-0.55***
	(0.10)	(0.26)	(0.22)	(0.11)	(0.42)	(0.19)
Percent Students Hispanic	-0.06	-0.25	0.08	-0.07	-0.21	-0.14
	(0.08)	(0.20)	(0.17)	(0.08)	(0.32)	(0.14)
Grade 11 Average Class Size	0.38	0.12	1.47	0.80*	3.04	1.51*
	(0.45)	(1.16)	(0.97)	(0.48)	(1.86)	(0.83)
District Mobility Rate	0.11	0.09	0.33	-0.53***	-1.17*	-0.87***
	(0.16)	(0.43)	(0.36)	(0.17)	(0.68)	(0.30)
Percent of Teachers who are Highly Qualified	0.04	1.24	-0.62	-2.18**	-6.64*	-3.64**
	(0.98)	(2.55)	(2.13)	(1.04)	(4.02)	(1.80)
Per Pupil Instructional Expenditures	-0.25	-2.79	0.95	-0.25	-3.37	0.51
	(0.68)	(1.79)	(1.49)	(0.73)	(2.85)	(1.27)
District is in a Rural Area	0.29	1.24*	0.51	0.07	0.23	0.13
	(0.25)	(0.66)	(0.55)	(0.27)	(1.04)	(0.47)
District is in a Suburban Area	0.08**	0.21**	0.20	0.01	0.06	0.04
	(0.03)	(0.08)	(0.07)	(0.03)	(0.13)	(0.06)
Constant	-14.75	-110.38	11.11	220.80	679.21	357.56
	(97.92)	(255.78)	(213.34)	(103.79)	(403.26)	(180.40)
R^2	0.0897	0.1319	0.1232	0.2238	0.1725	0.2313

N = 94 high school and unit districts
*** denotes statistical significance at the 1% level
** denotes statistical significance at the 5% level
* denotes statistical significance at the 10% level

Table 16
Growth in High School Graduation Rates

	2003	2012	Growth
All Students (427)	90.40	85.59	-4.81***
White Students (427)	90.96	86.45	-4.31***
Black Students (181)	83.68	76.25	-7.42***
Hispanic Students (214)	85.09	81.16	-3.93**

*** denotes statistical significance at the 1% level
** denotes statistical significance at the 5% level
* denotes statistical significance at the 10% level

Table 17
Growth in High School Graduation Rates by Subject: All Races

	Reading				Math			
	Model I	Model II	Model III	Model IV	Model I	Model II	Model III	Model IV
Local BA Rate	0.10**	0.05	0.06*	0.05	0.02	0.04	0.05	0.04
	(0.05)	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)
Percent Students Black	-0.06	-0.03	-0.05*	-0.02	-0.0002	-0.02	-0.02	-0.02
	(0.04)	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)
Percent Students Hispanic	0.0005	0.03	0.02	0.03	0.04	0.03	0.03	0.03
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Grade 11 Average Class Size	0.08	0.09	0.08	0.10	0.09	0.10	0.09	0.09
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
District Mobility Rate	-0.25***	-0.24***	-0.24***	-0.23***	-0.22***	-0.22***	-0.23***	-0.22***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Percent of Teachers who are Highly Qualified	2.29*	2.24*	2.29*	2.25*	2.28*	2.32*	2.25*	2.32*
	(0.46)	(0.46)	(0.45)	(0.46)	(0.46)	(0.46)	(0.46)	(0.46)
Per Pupil Instructional Expenditures	-0.18	-0.24	-0.27	-0.23	-0.26	-0.19	-0.23	-0.20
	(0.28)	(0.28)	(0.28)	(0.28)	(0.29)	(0.28)	(0.28)	(0.28)
2012 Grade 11 Pass Rate	-0.11				0.05			
	(0.07)				(0.06)			
Grade 11 Raw Pass Rate Growth		-0.07				0.05		
		(0.06)				(0.05)		
Grade 11 Percent Pass Rate Gain			-0.08**				-0.01	
			(0.03)				(0.03)	
Grade 11 Percent of Gap Closed				-0.01				0.03
				(0.02)				(0.02)
Constant	-222.89	-227.07	-231.95	-228.00	-233.54	-235.55	-228.04	-235.26
	(45.57)	(45.62)	(45.36)	(45.75)	(45.86)	(45.96)	(46.04)	(45.82)
R^2	0.1897	0.1883	0.1963	0.1858	0.1866	0.1873	0.1854	0.1881

N = 427 high school and unit districts
*** signifies statistical significance at the 1% level
** signifies statistical significance at the 5% level
* signifies statistical significance at the 10% level

Table 18
Growth in High School Graduation Rates by Subject: White Students

	Reading				Math			
	Model I	Model II	Model III	Model IV	Model I	Model II	Model III	Model IV
Local BA Rate	0.06	0.05	0.05	0.05	-0.00	0.03	0.04	0.03
	(0.05)	(0.03)	(0.03)	(0.03)	(0.05)	(0.03)	(0.03)	(0.03)
Percent Students White	-0.03	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03	-0.03
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Grade 11 Average Class Size	0.23*	0.26*	0.25**	0.26**	0.22	0.22	0.23*	0.22
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
District Mobility Rate	-0.29***	-0.29***	-0.29***	-0.29***	-0.28***	-0.29***	-0.29***	-0.29***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Percent of Teachers who are Highly Qualified	1.85***	1.76***	1.79***	1.76***	1.93***	1.93***	1.91***	1.92***
	(0.56)	(0.56)	(0.56)	(0.56)	(0.56)	(0.56)	(0.56)	(0.56)
Per Pupil Instructional Expenditures	-0.32	-0.35	-0.35	-0.33	-0.38	-0.33	-0.33	-0.34
	(0.28)	(0.27)	(0.27)	(0.27)	(0.28)	(0.27)	(0.28)	(0.27)
2012 Grade 11 Pass Rate	-0.03				0.06			
	(0.07)				(0.05)			
Grade 11 Raw Pass Rate Growth		-0.09*				0.04		
		(0.05)				(0.05)		
Grade 11 Percent Pass Rate Gain			-0.05				0.01	
			(0.03)				(0.02)	
Grade 11 Percent of Gap Closed				-0.03*				0.01
				(0.02)				(0.02)
Constant	-187.71	-181.21	-183.46	-180.93	-197.71	-195.97	-194.45	-195.20
	(54.03)	(53.85)	(53.83)	(53.89)	(53.91)	(53.89)	(53.89)	(53.84)
R^2	0.1942	0.1993	0.1979	0.1991	0.1951	0.1941	0.1932	0.1940

N = 424 high school and unit districts
*** denotes statistical significance at the 1% level
** denotes statistical significance at the 5% level
* denotes statistical significance at the 10% level

Table 19
Growth in High School Graduation Rates by Subject: Black Students

	Reading				Math			
	Model I	Model II	Model III	Model IV	Model I	Model II	Model III	Model IV
Local BA Rate	0.06	0.02	-0.003	0.06	0.09	0.005	-0.01	0.03
	(0.13)	(0.14)	(0.14)	(0.14)	(0.13)	(0.14)	(0.14)	(0.14)
Percent Students Black	0.05	-0.01	-0.01	-0.02	0.04	-0.01	-0.01	-0.02
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Grade 11 Average Class Size	0.84	0.74	0.84	0.60	0.79	0.77	0.86	0.69
	(0.64)	(0.70)	(0.70)	(0.70)	(0.64)	(0.70)	(0.69)	(0.70)
District Mobility Rate	0.10	0.13	0.15	0.11	0.07	0.13	0.14	0.13
	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)
Percent of Teachers who are Highly Qualified	1.99	2.59*	2.62*	2.64**	2.03	2.69*	2.60*	2.73**
	(1.34)	(1.33)	(1.35)	(1.32)	(1.33)	(1.34)	(1.33)	(1.33)
Per Pupil Instructional Expenditures	-1.53	-1.78	-1.74	-1.90*	-1.57	-1.72	-1.71	-1.76
	(1.08)	(1.14)	(1.14)	(1.14)	(1.07)	(1.14)	(1.14)	(1.13)
2012 Grade 11 Pass Rate	-0.06				-0.14			
	(0.15)				(0.14)			
Grade 11 Raw Pass Rate Growth		0.11*				0.11		
		(0.16)				(0.18)		
Grade 11 Percent Pass Rate Gain			0.03				-0.02	
			(0.07)				(0.05)	
Grade 11 Percent of Gap Closed				0.10				0.10
				(0.07)				(0.09)
Constant	-223.18	-277.73	-283.70	-279.94	-225.46	-288.70	-282.17	-291.73
	(133.89)	(132.89)	(134.96)	(131.41)	(132.59)	(132.95)	(132.86)	(132.16)
R^2	0.1245	0.2082	0.2110	0.2228	0.1311	0.2075	0.2056	0.2161

N = 86 high school and unit districts
*** denotes statistical significance at the 1% level
** denotes statistical significance at the 5% level
* denotes statistical significance at the 10% level

Table 20
Growth in High School Graduation Rates by Subject: Hispanic Students

	Reading				Math			
	Model I	Model II	Model III	Model IV	Model I	Model II	Model III	Model IV
Local BA Rate	-0.04	-0.23*	-0.23*	-0.22*	-0.18	-0.19	-0.18	-0.21
	(0.12)	(0.12)	(0.12)	(0.12)	(0.13)	(0.13)	(0.13)	(0.13)
Percent Students Hispanic	-0.07	-0.15	-0.15	-0.15	-0.19*	-0.14	-0.13	-0.14
	(0.09)	(0.09)	(0.09)	(0.09)	(0.10)	(0.10)	(0.09)	(0.10)
Grade 11 Average Class Size	1.05**	1.12**	1.14**	1.07*	1.27**	1.06*	0.96*	1.11*
	(0.52)	(0.55)	(0.55)	(0.55)	(0.56)	(0.57)	(0.55)	(0.57)
District Mobility Rate	-0.04	0.03	0.04	0.02	-0.01	0.11	0.12	0.07
	(0.19)	(0.20)	(0.20)	(0.20)	(0.20)	(0.21)	(0.20)	(0.21)
Percent of Teachers who are Highly Qualified	2.01*	1.56	1.56	1.59	1.48	1.85	2.00*	1.70
	(1.22)	(1.19)	(1.19)	(1.19)	(1.20)	(1.24)	(1.20)	(1.24)
Per Pupil Instructional Expenditures	0.12	0.32	0.32	0.27	0.43	0.36	0.56	0.30
	(0.82)	(0.84)	(0.85)	(0.84)	(0.85)	(0.85)	(0.84)	(0.86)
2012 Grade 11 Pass Rate	-0.17				-0.23			
	(0.13)				(0.17)			
Grade 11 Raw Pass Rate Growth		0.04				0.15		
		(0.13)				(0.13)		
Grade 11 Percent Pass Rate Gain			0.002				0.07	
			(0.05)				(0.03)	
Grade 11 Percent of Gap Closed				0.05				0.04
				(0.06)				(0.07)
Constant	-227.51	-182.01	-182.40	-183.13	-170.97	-213.57	-229.44	-197.57
	(121.93)	(119.70)	(119.88)	(119.33)	(120.72)	(124.07)	(120.30)	(124.34)
R^2	0.1906	0.1829	0.1820	0.1877	0.1990	0.1951	0.2282	0.1859

N = 94 high school and unit districts
*** denotes statistical significance at the 1% level
** denotes statistical significance at the 5% level
* denotes statistical significance at the 10% level

Figure 1

Percent Pass Rate Gain vs. Per Pupil Inst. Exp.

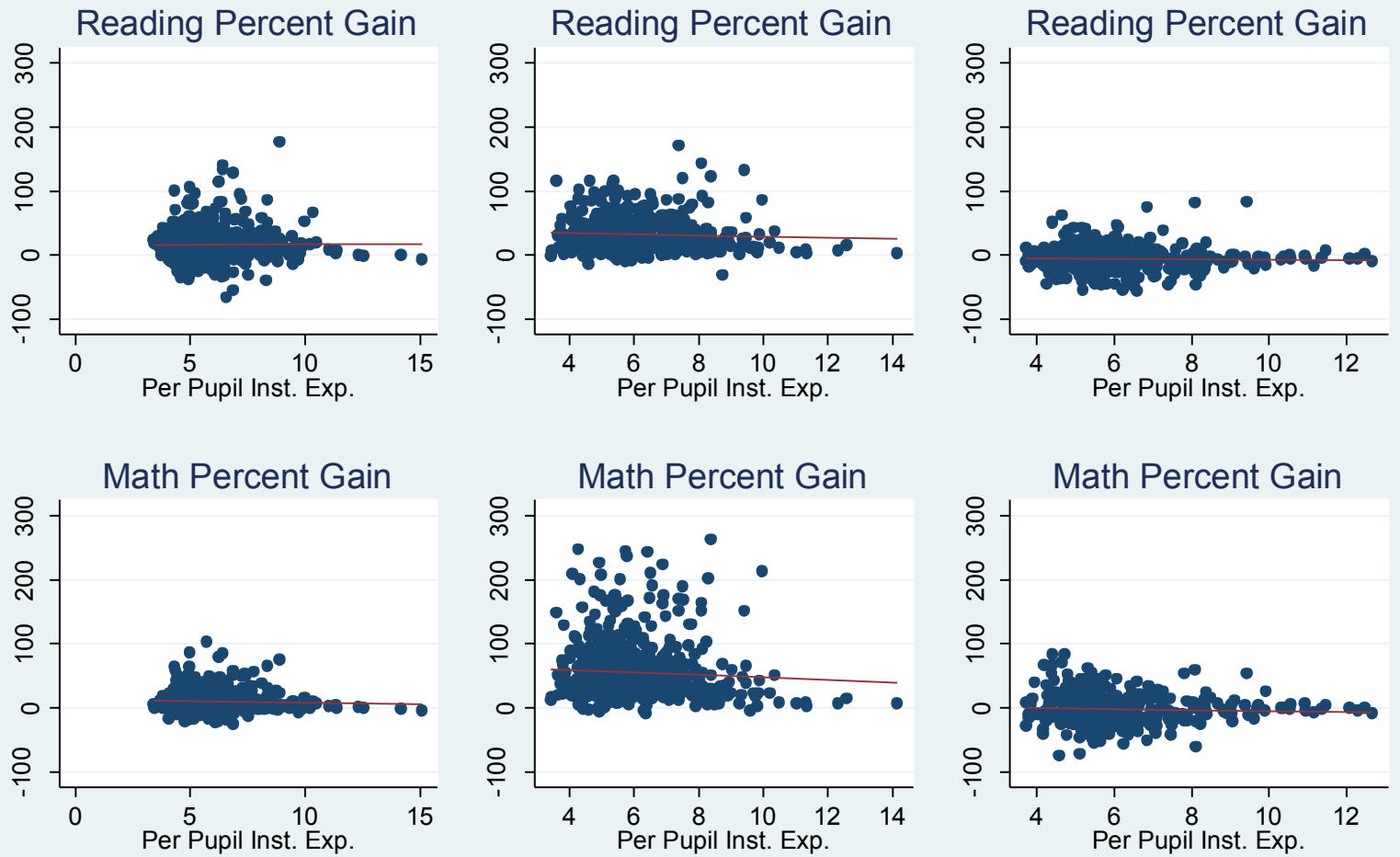

Figure 2

Reading Own-Race Effects: Black

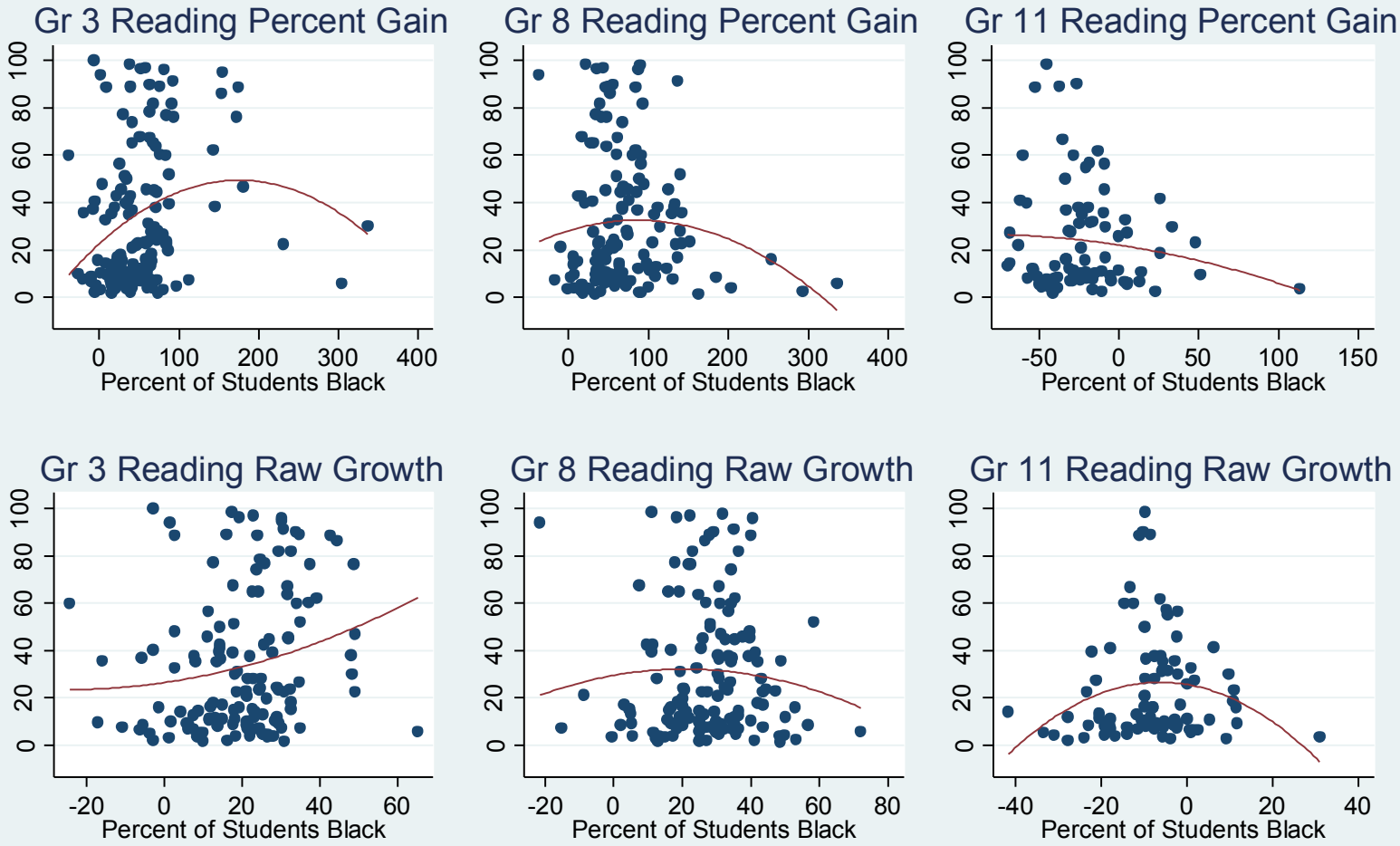

Figure 3

Math Own-Race Effects: Black