# Managing conflicting values: Efficiency and equity trade-off in education reform

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# Abstract

Efficiency and equity trade-off reflects the tension between the different sets of competing values in education policy. Despite a substantial body of research on the efficiency–equity trade-off, empirical studies reach little consensus on whether efficiency and equity as policy goals are conflicting in the process of public service provision. Using cost function and student performance data from New Jersey, we examine whether there is any trade-off between the two different values affected by the No Child Left Behind Act. Results reveal that there is efficiency–equity trade-off for eleventh grade, but not for eighth grade. This suggests that the relationship of the two goals can be determined by the function of the educational system, even within a school district.

Keywords: efficiency, equity, efficiency-equity trade-off, No Child Left Behind, education reform



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## Introduction

Public policy reflects choices regarding the values that a government seeks. Easton (1965) described public policies as the means through which politics allocate values, which are often competing and contradictory to some extent. Education policy is one of the domains that reflect the tension between different sets of competing values. Among them, the efficiency and equity trade-off is one of the revolving questions in policy areas. A trade-off can be referred to as a "situation in which one has to choose or balance between two goals that cannot be had at the same time" (Fernández-Gutiérrez & Van de Walle, 2019, p. 25). Okun (1975) also claimed that "the conflict between equality and economic efficiency is inescapable" (p. 120). Since Okun's seminal work (1975), a substantial body of research has contributed to the literature on the efficiency–equity trade-off in a variety of policy areas, which have helped to establish a theoretical background.

However, empirical studies have failed to provide a consensus on whether efficiency and equity as policy goals are conflicting in the process of public service provision, especially in education policy (Berg & Ostry, 2011 [complementary]; Björklund et al., 2004 [trade-off]; Blank, 2002 [complementary]; Bookallil & Rolfe, 2013 [trade-off]; Bradley & Taylor, 2004 [no trade-off]; Gershberg & Schuermann, 2001 [conditional trade-off]; Heckman, 2006 [conditional trade-off]; Schutz, 2008 [no trade-off]; West & Peterson, 2006 [complementary]). This study aims to fill this gap of the extant research in education policy by taking advantage of the nationwide education reform, No Child Left Behind (NCLB). The case of NCLB offers the unique opportunity to test the trade-off between efficiency and equity. As a far-reaching education reform initiative, the main feature of NCLB was to enhance student performance through competition, and thus it was an efficiency-oriented reform. Specifically, it was legislated to "conduct annual student assessments linked to state standards, to identify any "failing" schools for the standard of adequate yearly progress (AYP), and to institute sanctions and rewards based on each school's AYP status" (Dee & Jacob, 2011, p. 418). In addition, its objectives also shared the dimension of the equity perspective by focusing on test scores for disadvantaged students.

Previous empirical literature on NCLB offers mixed findings. Advocates argued that NCLB could deliver a variety of benefits to schools and students (Dee & Jacob, 2011; Hanushek & Raymond, 2001). Critics were skeptical, claiming that a test-oriented accountability policy could bring about unintended consequences, such as teaching to the test and cream skimming (Griffith & Scharmann, 2008; Groen, 2012). In addition, some scholars have pointed out that the mechanism of NCLB employed an inefficient allocation of resources to meet the adequate level of performance (DeBray, 2006; W.Duncombe et al., 2008). As such, the case of NCLB presents a valuable opportunity to unpack the relationship between efficiency and equity.

The main contributions of this study are twofold. First, we empirically explore the efficiency–equity trade-off, which is a theoretically well-grounded argument using the case of NCLB. Prior empirical studies have reached little consensus on the efficiency–equity trade-off. This will inform policymakers weighing the benefits and potential unintended consequences of education policy. Second, the implementation of NCLB has encouraged other countries to adopt efficiency-oriented educational reforms. Despite their widespread popularity across the world, we still know little about the benefits and pitfalls of educational reforms. This study will be a step toward reaching a better understanding of

accountability reform, through rigorous assessment of NCLB from the perspective of the efficiency-equity trade-off.

The following section begins by reviewing the literature on equity, efficiency, and its trade-off related to NCLB. Then, we describe the data and methods employed in our study. Next, we provide the results and conclusions on the efficiency–equity trade-off.

## Literature review

Efficiency is generally defined as input minimization given a certain level of output, or output maximization given a certain level of input, while equity is more concerned with how to distribute resources fairly based on the conditions.<sup>1</sup> From an economic perspective, these two concepts are regarded as zero-sum relations of trade-off in that the pursuit of one inevitably threatens the other in the delivery of public service. In his seminal book, *Equality and Efficiency: The Big Trade-off*, Okun (1975) articulated the concept of the efficiency–equity trade-off, and since then, how to allocate scarce resources for equity or efficiency has been a perennial topic in public policy.

Given Okun's (1975) argument, this issue is salient in education policy where policy makers have to find a balance between efficient allocations and equitable distribution of resources. In that sense, the pursuit of each goal becomes a political choice beyond any scientific evaluation, and it is not appropriate to focus on the sole achievement of either efficiency or equity in education policy. However, empirical studies lend little support of Okun's argument, even providing inconsistent results. For instance, Bookallil and Rolfe (2013) asserted that an increase in the equity of their educational programs led to a bigger trade-off between equity and economic efficiency. Gershberg and Schuermann (2001) found the equity and efficiency trade-off in schooling outcomes, but the result could differ depending on each state's situation. Other researchers have argued not only that increasing equity does not reduce efficiency and but that the two values could be placed in a win-win situation (Berg & Ostry, 2011; Blank, 2002). Heckman (2006) showed that early interventions on impoverished families and children induce high benefit-cost rates of return, based on his evidence showing how equity and the efficiency can work together. He notes that early interventions for disadvantaged children in preschool (Perry Preschool Project) or at home led to substantial economic benefits by promoting successful schooling and later workforce productivity, as well as reducing crime and welfare dependency. Based on the studies above, this section starts by reviewing the concepts of efficiency and equity. Then, we introduce the efficiency and equity trade-off related to NCLB.

#### Efficiency

The definition of efficiency is relevant for the relationship between input and output. Any system can be efficient when output is maximized from a given input or input is minimized to a given output. On the output side, efficiency in education considers more how to measure outputs such as achievement scores and completion rates within an education system; employment and earnings return as goals outside the education system on the labor market. The input side in education has a different perspective on efficiency. First, technical efficiency in education has more concerns on how to best use the given inputs. Technical efficiency is explained through the concept of utility: "one's perception of one's own well-being" (Weimer & Vining, 2004, p. 55). Deller and Rudnicki (1993) criticized that education policymakers who enhance student achievements misunderstand the educational process because their examination provides the failure of technical efficiency achievements. Based on the concept of technical efficiency, the expansion of education budgets, however, has not increased student achievement as much (Chakraborty et al., 2001). The definition of input-output determines the measurement of technical efficiency in education.

Second, allocative efficiency is more concerned with how to allocate different types of resources as a mix in inputs. Unlike technical efficiency, ideas on how to spend that money and what incentives should be offered to students have differed widely in education (Greenwald et al., 1996). Allocative efficiency of student achievements is more likely to increase in metropolitan areas due to the market concentration (Borland & Howsen, 1992; Hoxby, 1996). Hoxby (1996) emphasized how to define diverse concepts of efficiency in education budgets, analyzing the mechanism of allocative efficiency through property tax and the Tiebout process. Banker et al. (2004) examined the shifts and trends in technical and allocative efficiency, finding that allocative inefficiency remains while technical efficiency increases. However, the extant research provides no clear systematic evidence of an increase in efficiency: that the expansion of input amounts spent on schools has a positive effect on student achievement (Gundlach et al., 2001; Hanushek, 2003; Wößmann, 2003, 2005).

#### Equity

Equity is evasive because it largely has to do with the issues of fairness and justice. Friedman (2002) defined equity as "fairness in the distribution of goods and services among the people in an economy" and argued that fairness, impartiality and equality should be considered for public service delivery (p. 58). Since the 14th Amendment 'Equal Protection Clause' was adopted, equity has been a long-term issue in education. Equity in education, understood in terms of equal opportunity, looks for equal access of a student to education regardless of the socio-demographics of the student. The Coleman Report (1966) described that budget size has little effect on the increase of student achievements, and that students' socio-economic status (SES) mainly influences student achievement. A pure local system provides educational opportunity for students, and local budgets within the same state are independent of their districts and students. Following the report, numerous studies have suggested that student achievement depends on a wide range of individual, family and peer groups rather than school-related factors (Haveman & Wolfe, 1995; Loeb & Bound, 1996). Hanushek (1992, 2003) asserted that the quantity and quality of school inputs have no effect on student achievement, and school inputs are not important to student achievement. The aforementioned studies motivated a stronger focus on an increase in equity in education.

Analysis on equity in education has focused on three principles: equal opportunity, horizontal equity and vertical equity.<sup>2</sup> Equal opportunity does not necessarily follow the equalized level of output in education (Berne & Stiefel, 1984). Berne and Stiefel (1994) attempted to measure quantitatively the three principles in education equity and found that unbalanced tax capacity is not a major issue at the school district level, although equal opportunity with respect to ability to pay is the most important. Furthermore, another study

(Berne & Stiefel, 1999) asserted that horizontal and vertical equity are determined by recognizing equally situated students and identifying the differentially situated, respectively. Equity in education is concerned with how to distribute education budgets fairly, and relies on how to spend limited educational budgets. Education equity can be compared among three groups: states, school districts, and schools (Augenblick et al., 1997).

However, the federal government does not necessarily require equity among states; moreover, equity among schools within a district is thought to be rarely possible because school districts do not have their own budget systems. State litigations have raised the expenditures in low-spending districts but have had no effect on high-spending districts (Murray et al., 1998). Financial resources for students are assumed to increase student achievement, but the resources should be focused on the equity of education for students (Knoeppel et al., 2007). Therefore, the concerns of equity shift from inter-district to intra-equity within states and their school districts (Fernandez & Rogerson, 2003; Rubenstein et al., 2008).

#### No Child Left Behind

In a decentralized education system, local education budgets are determined by the local property tax system, while federal and state education budgets depend on diverse taxation and have different programs and goals. States are more concerned with equity issues; budgets are provided more for poor school districts by litigation and the flexibility that state governments control. Since the 1990s, however, the federal government has shifted its focus toward the increase of school performance through efficiency and accountability. Performance presumably guides the decisions of human and financial resource allocation. U.S. education was reformed in the 2000s with NCLB, which aimed to complete four pillars (U.S. Department of Education, 2010). The main properties of the four pillars came from market logic. First, the capacity of a school was subject to whether it met the demands of stronger accountability for results. Second, states and communities had more authority to control financial resources within their schools. Third, a school was required to follow a proven educational method. Fourth, parents had more choices of schools for their children.

The No Child Left Behind Act, enacted as an education reform plan in 2001, changed the federal government's role in public education in order to improve student achievement and to close the achievement gap. Consequently, NCLB expanded federal influence over more than 90,000 public schools based on four principles: 1) stronger accountability for results, 2) increased flexibility and local control, 3) expanded options for parents, and 4) an emphasis on teaching methods that have been proven to work (U.S. Department of Education, 2010). NCLB especially focused on how to ensure that states and schools boosted the educational achievement of certain groups of students.<sup>3</sup> Furthermore, states were required to report the results of standardized tests in reading and math, and public schools were required to meet a proficient level through the mechanism of 'adequate yearly progress (AYP).' A public school that failed AYP for two or three consecutive years was required to transfer students to a better-performing public school in the same district and offer free tutoring, both of which affected the fiscal condition of the school. In addition, NCLB not only required each state to ensure that their teachers were highly qualified, but also expected that the highly qualified teachers were evenly distributed across schools, regardless of the wealth of a school's district. Evaluations of the effects of NCLB have been split into positive and negative stances.

NCLB was premised on the hope that by annually publishing 'school report cards' that included the details of school performance, parents could send their children to the 'right' school and in turn, this choice increased allocative and productive efficiency in schools.<sup>4</sup> Supporters of NCLB note that it attained the main goal of increasing student achievement and closing the gap in achievement. According to the U.S. Department of Education (2006), early grade students targeted in NCLB showed improvement in National Assessment of Educational Progress (NAEP) results, which demonstrated that NCLB worked. Dee and Jacob (2011) argued that NCLB contributed to an increase in test scores in math in the case of fourth and eighth graders, but not in reading scores. Hanushek and Raymond (2001) insisted that accountability policies including NCLB would produce "innovation, efficiency, and fixes to any observed performance problems" through definite incentives (p. 369). Furthermore, the requirement of highly qualified teachers in NCLB decreased the rate of uncertified teachers (Loeb & Miller, 2007).

In spite of the efforts that the federal government made to improve student achievement, other aspects of NCLB have been criticized. The increases in efficiency accelerated wealth in better performing schools, but diluted it in worse performing schools (Bradley & Taylor, 2002), which increased the disparity in equity across schools. NCLB provided federal funding for all public schools and required annual standardized testing. Although the dedicated budget of over \$21.2 billion increased to NCLB major programs in 2014 (U.S. Department of Education, 2015), NCLB has been criticized as a barrier to improvement in public education, and public schools have failed to meet NCLB requirements (Berliner, 2004). In NCLB, the proficiency level determines the federal funded/unfunded mandates, and its emphasis on efficiency distorts the equitable distribution of budgets. Accordingly, much research has asserted that the gap in student achievement could be widened through the distribution of funds this way (Alexander, 2003; Izraeli & Murphy, 2007; Mullin & Honeyman, 2008; Rolle & Liu, 2007; Verstegen & Driscoll, 2009). Furthermore, NCLB aimed to close the gap between higher- and lower-achieving student groups. Reports have described greater discrimination against the lower-achieving groups (Kober et al., 2008; Taylor et al., 2010).

Another critical point is that NCLB placed too much emphasis on achievement and standardized tests, and that this fundamental direction induced negative effects on curriculum, pedagogy, and social efficiency. First, the stress on the outcomes and measurements created an imbalance in the curriculum. NCLB caused a dramatic increase in instructional time for math and literacy while decreasing time for social studies, science, physical education, art, and music, as well as lunch and recess (Griffith & Scharmann, 2008; Groen, 2012). Many researchers nevertheless have reported that no significant effect on math and reading scores was found after NCLB (Fuller et al., 2007; Lee & Reeves, 2012; Reback et al., 2014). In addition, NCLB did not suggest national standards; each state had their own standards, and differences from low standards to high proficiency were observed between states. It is thus unfair to compare the achievements of individual states based on their own standards and assessments under NCLB (Groen, 2012). Above all, NCLB accelerated and strengthened competitive ideology in education based on the test-taking atmosphere and scores. Under NCLB, "academic success is defined quite narrowly as one's ability to score well on standardized tests" (Paul, 2004, p. 651). Educational goals include whole develop ment, mental health, moral values, and other significant elements. However, those aims were underestimated or disappeared under NCLB.

The narrow educational goals of NCLB also affected teaching and teacher education. The policy reforms pursuing accountability and efficiency such as NCLB have limited the meaning of teaching to simply quantifiable elements in a linear understanding of causal relationships (Cochran-Smith, 2003; Strom, 2015). Current studies state that teaching is considered complicated and ever-changing work in various contexts (Opfer & Pedder, 2011; Strom & Martin, 2017). NCLB particularly emphasized the "highly qualified" teacher for better achievement. Under this condition, most states requiring highly qualified teachers maintained teacher evaluation systems through students' test scores and quantified quality indicators (Paufler & Amrein-Beardsley, 2016). Under the linear perspective of teaching, a discourse of blaming teachers for achievement obviously emerges in society (St. Pierre, 2006). In the accountability system, teachers gain job insecurity and helplessness because their ability and contracts are decided not by their own efforts but by standardized tests and indicators; this ends up increasing teacher burnout (Dworkin & Tobe, 2014). Contemplating the significant roles of teachers in teaching and learning, the myopic approach of NCLB toward teaching is problematic in schools.

Regarding financial and social efficiency, NCLB has been criticized as a failed policy. DeBray (2006) asserted that NCLB led to inefficiency by spending more money developing tests and administration systems (p. 105), citing the New York Times "The plan [NCLB] doesn't seem to be leaving no child behind. It seems more like 'leave no child untested'" (Wilgeren, 2001). W. Duncombe et al. (2008) also raised an incentive issue in that many states tried to maintain low standards to avoid penalties from NCLB. The federal government could afford enough financial support to states with very low standards but could not afford support to states with high standards (W. Duncombe et al., 2008). The main goal of NCLB was to identify schools with disadvantaged students and to incentivize them, but NCLB imposed more pressure on them without any actual support (Ladd, 2017). However, Hoxby (1996) asserted that decentralization improves both efficiency and equity because households can make optimal decisions through their investment in their children's education; she disagreed with the ideas that efficiency harms equity and that SES is not a priority in education finance.

#### Public education in New Jersey

New Jersey is one of the most heavily populated states in the U.S. and has an economically and socially dynamic demography. New Jersey public education has 692 school districts, and the New Jersey Department of Education (NJDoE) classifies the school districts into groups A to J according to their socioeconomic status, which it calls District Factor Groups (DFGs) (New Jersey Department of Education, 2020).<sup>5</sup> The DFGs are mainly used for 1) analysis of student performance on statewide assessment examinations, 2) Abbott district classification, and 3) provision of state education aid (New Jersey Department of Education, 2004). The "Abbott" districts are named after the historic case, Abbott v. Burke, which led to the redistribution of school financing in New Jersey and is considered one of the most significant pieces of education litigation for disadvantaged students (Education Law Center, 2018). The Abbott districts are poorer areas where disadvantaged families reside, and most Abbot districts are in categories A to D. A recent resource from the NJDoE shows that it has 31 Abbott districts.

According to the NJDoE, the Abbott decisions include a milestone judicial stance "that

the urban poor are capable, that given sufficient attention in an adequately financed system using the best knowledge and techniques available, a thorough and efficient education is achievable" (Librera, 2005). Under the ruling, schools in New Jersey intend to provide students with a "thorough and efficient" education by removing funding inequities through the state's offering of more financial supports for poorer urban districts than the wealthier ones (Firestone et al., 1997). In addition, compared to NCLB law, the Abbott decision does not simply label schools as failed. Abbott X, for instance, continuously offers low performing schools necessary remedies such as adequate funding, special programs, and external technical assistance and offers outperforming schools the rewards that NCLB overlooks (Education Law Center, 2018).

### Method

This paper investigates the trade-off between efficiency and equity using the case of NCLB. The first step is to estimate the efficiency  $(E_{it})$  in each school district (*i*) at year (*t*) using the stochastic frontier cost model (W. Duncombe & Yinger, 2007b). Next, we estimate the change in efficiency and equity induced by NCLB, respectively, and then we compare the results. This provides the opportunity to examine whether there is any trade-off between the two different values affected by policy changes.

#### Effect of NCLB on efficiency

Cost function literature stems from a pioneering paper (Bradford et al., 1969), which finds that the cost of public services are influenced by uncontrollable environmental factors as well as input prices. Since then, numerous scholars have analyzed the issues in education public finance using cost functions (W. Duncombe & Yinger, 1997, 2007b; W. D. Duncombe & Yinger, 1998; Imazeki & Reschovsky, 1999). The basic framework of the cost function model is as follows:

$$C(S) = f(S, W, N, P)$$
 (1)

where C(S) = cost of educational services, S = student outcomes, W = teacher salaries, N = enrollments, and P = environmental factors that the school district cannot control.

The underlying logic of this cost function equation is that it shows the minimum level of costs to achieve a certain level of performance under the best practices. However, because we cannot observe the real cost of public services, school expenditure (Y) is introduced in the model with efficiency (e).

$$Y = f(S, W, N, P, e)$$
 (2)

Efficiency here means when school districts spend less than necessary to achieve a certain level of student performance. Based on the above framework, our empirical model uses the translog cost function in the following equation (3) (Gronberg et al., 2012).

$$\ln(Y) = \beta S + \gamma W + \delta N + \theta P + v_{it} + u_{it}$$
(3)

In equation (3), drawn from the logic of prior studies in cost functions, the environmental factors include the share of students with limited English proficiency, the share of students enrolled in free meal programs and the share of students in poverty.  $V_{it}$  is random noise in explaining the variation of the dependent variable.  $u_{it}$  is a one–sided error term that reflects the efficiency. Results of equation (3) produce the efficiency that is assigned to each school district (*i*) at given year (*t*). The cost efficiency is defined as  $\exp(-u_{it}) < 1$ . Inefficiency increases as the cost rises above the minimum cost (Gronberg et al., 2012).

Previous studies have addressed the endogeneity of cost functions in equation (3). Specifically, student outcomes (S) are endogenous to school expenditures (Y) because school districts make decisions on both factors and have an influence on spending and student outcomes. A common approach to alleviating these biased estimates is to use instrument variables, which are correlated with student outcomes but exogenous to school spending. Drawn from the "copycat" theory and tax competition literature (Besley & Case, 1995), we use characteristics of neighboring school districts as instrument variables, such as the share of students who receive free lunch, the share of students who are in the limited English program, and the per pupil tax rate (W. Duncombe & Yinger, 2007a).<sup>6</sup>

With the efficiency measure for each school district (*i*) at year (*t*) established, the next step is to decompose the efficiency factors. The primary interesting variable in the model is the adoption of NCLB. The growing body of literature has documented that inefficiency results from insufficient incentives for public schools. (Grosskopf et al., 2001, p. 453). Among other factors, previous studies have indicated that voter or citizen monitoring would enhance the efficiency of public school districts. For example, Davis and Hayes (1993) argued that when bearing a higher tax price burden, homeowners are more likely to monitor the provision of public services. W. Duncombe and Yinger (2001) and W. Duncombe et al. (2008) employed factors that could be conceptually linked with efficiency, such as tax share, fiscal capacity, and the share of owner-occupied housing units. We also add fixed effects at the school district in order to control for time-invariant unobserved heterogeneity at the district level.

The basic empirical model to estimate the effects of NCLB on efficiency is as follows:<sup>7</sup>

Efficiency<sub>*it*</sub> = (NCLB<sub>*t*</sub>, % State Aid, Property Revenue / Pupil, School District Fixed Effect<sub>*it*</sub>, Time Trend). (5)

#### Effect of NCLB on equity

Next, we estimate the equity effect of NCLB based on the education production function at the school district level. The measure of equity was operationalized in two aspects: 1) racial and 2) socioeconomic disparities in academic achievements. The racial test score gap have been revolving policy goals for educational policy. In particular, a great volume of studies has documented that there is a clear pattern between Black–white achievement gaps and Hispanic–white achievement gaps (Bond & Lang, 2013; Card & Rothstein, 2007; Fryer & Levitt, 2004; Gaddis & Lauen, 2014; Stiefel et al., 2007). On average, Black students and Hispanic students perform well below the average white student in math and reading skills. In addition, the gap between lower-income and high-income families is also identified (Reardon et al., 2008).

Focusing on the role of NCLB in reducing racial inequality, we define equity as racial difference in passing rate on exams. Then, the interaction term between NCLB and the percent of white students captures how much the NCLB weakens the difference between the share of the passing rate for white students and the average student performance at the school district level. As such, a negative interaction implies that NCLB has enhanced disparity across school districts.

Passing Rate for All Students = f(NCLB<sub>t</sub>, Per Pupil Spending, NCLB \* %White, %White, %FRM, %LEP, Avg Teacher Salary, School District Fixed Effect) (6)

For the socioeconomic achievement gap, we employ the interaction terms between NCLB and %FRM to identify the effect of NCLB on equity as following equation (7).

Passing Rate for All Students = f(NCLB<sub>t</sub>, Per Pupil Spending, NCLB \* %FRM, %White, %FRM, %LEP, Avg Teacher Salary, School District Fixed Effect) (7)

#### Data

Table 1 presents the descriptive statistics of the variables that this study employs in each equation from 2000 to 2009. For the performance measure in all equations, we use the passing rate for reading and math on the NJ state exam at eighth grade (Grade Eight Proficiency Assessment [GEPA]) and in high school (High School Proficiency Assessment [HSPA]).

In the model estimating the effect of NCLB on efficiency, the dependent variable is the efficiency from the estimates in the cost function. A number of potential indicators reflecting competition and monitoring activity are included in our analysis of school district efficiency, such as state aid and per pupil local revenue.

	Varia bles (HSPA)	Obs	Mean	Std. Dev.
	Efficiency	1,996	0.0022	0.0077
Efficiency	Efficiency (GEPA)	2,557	0.0238	0.0184
equation	Per pupil Exp	2,557	9,357.09	9,051.72
	State aid	2,557	0.3457	0.1999
Equity equation	GEPA	2,437	73.76	14.51
	HSPA	2,267	80.67	11.52
	% White (GEPA)	2,437	0.7308	0.2433
	% White (HSPA)	2,267	0.6778	0.2454
	Average teacher salary	2,437	5,341.27	3,355.91
	Enrollment	2,437	7.304	1.131
	Per pupil expenditure	2,437	14,667.86	11,540.2
	% LEP (HSPA)	2,267	0.0122	0.0351
	% Poverty (HSPA)	2,267	0.1411	0.1805
	% LEP (GEPA)	2,437	0.0071	0.0326
	% Poverty (GEPA)	2,437	0.1471	0.2048

Table	1.	Descriptive	statistics
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*Note.* We estimated efficiency and equity equation in each test score separately. We report the descriptive statistics for common control variables such as per pupil expenditure, state aid, enrollment, and average teacher salary based on GEPA equation model.

# Results

Figures 1 describes the share of the passing rate for each ethnicity group at GEPA (grade 8 in the upper panel) and HSPA (grade 11 in the lower panel). Before the implementation of NCLB, the passing rate for white students was greater than for other ethnic groups. After the passage of NCLB, it appeared that the average passing rate would increase and the gap between different groups of students would diminish at GEPA. However, a similar occurrence was not clear for the HSPA score. The average passing rate for the whole population seemed to increase, but additional in-depth analyses with controlling variables are required.



Note. X-axis reflects years in the 2000s. For instance, 2 and 4 refers to 2002 and 2004, respectively. Figure 1. Passing rate across group at GEPA and HSPA

#### Efficiency estimates

Table 2 reflects the impact of NCLB on efficiency in New Jersey school districts across different tests with school district fixed effects. Models 3 and 4 add the time trend variable, which allows us to control for any unobserved trend related to the introduction of NCLB. Our main variable is the dichotomous variable capturing the introduction of NCLB in 2003, and is statistically significant in all four models. Interestingly, NCLB has a positive relation with GEPA but a negative relation with HSPA. Other control variables, such as per pupil local revenue and state aid, show inconsistent results across empirical models. For instance, per pupil local revenue is negative and statistically significant for models 1 and 4. State aid is negative and statistically significant only for the HSPA score. This is somewhat consistent from the previous finding that NCLB has had a positive effect on elementary student performance, particularly at the lower grades (Dee & Jacob, 2011).

Variable	GEPA	HSPA	GEPA	HSPA
NCLB	0.02097***	-0.00129***	0.0253***	-0.00522***
	(0.0008)	(0.00035)	(0.00067)	(0.00037)
Per pupil local revenue	-0.0005**	0.0021***	-0.0001	-0.0017***
	(0.0002)	(0.0002)	(0.0001)	(0.0005)
State aid	0.00179	-0.00699*	-0.00269	-0.00633**
	(0.0023)	(0.00368)	(0.00196)	(0.00313)
Time trend			-0.0016***	0.00273***
			(0.00008)	(0.00033)
District fixed effects	Yes	Yes	Yes	Yes
Adj R-square	0.872	0.154	0.886	0.199
N	2557	1996	2557	1996

Table 2. Effect of NCLB on efficiency

Note. Statistical significance is \*\*\*p < 0.01. \*\*p < 0.05. \*p < 0.1.

#### Equity estimates

Table 3 shows that NCLB reduced the test score gap between white students and other minority groups. We used the fixed effect at the school district level in order to avoid any bias resulting from time-invariant characteristics. The main independent variable is the interaction term between NCLB and the share of the passing rate for white students. Its coefficient is -2.12 and -3.62 at GEPA and HSPA, respectively, and is statistically significant at the 5 percent significance level. Considering that the share of the passing rate for white students is positive, the negative coefficient reflects that NCLB reduced the test score gap. It implies that due to NCLB, the test score gap between white students and those of other races was reduced to 2.12% and 3.62%, respectively. Among other control variables,

enrollment was positively associated with the passing rate for all students. Per pupil expenditure was statistically significant only for the HSPA score.

From the perspective of equity, we conducted additional analysis; test score for low-income students and racial test score gap. First, we explored the relation between NCLB and the share of students in poverty. This interaction term will capture to the extent that NLCB moderates the relation between the share of students in poverty and the GEPA test score. The positive coefficient from interaction terms in Table 4 shows that NCLB served a role in enhancing test score for students at the poverty level.

Second, the results confirm consistent findings with regard to test score gap across race. NCLB has narrowed test score gap between white and Black students for GEPA, but not for HSPA. Interestingly, the test score gap between white and Hispanic students had little influence on test score gap (see Appendix).

Taken together, we can infer that from the perspective of efficiency, NCLB had a positive effect on eighth graders but had a negative influence on high school students. From the equity perspective, the introduction of NCLB was positively associated with a reduction in the test score gap between advantaged and disadvantaged students. There was no trade-off between efficiency and equity from NCLB. The policy design could matter in achieving the multiple policy goals.

Variables	(1)	(2)	
variables	GEPA	HSPA	
NCLB	3.23***	2.819**	
	(1.0069)	(1.15)	
NCLB*%White	-2.122*	-3.627**	
	(1.2243)	(1.443)	
% White	4.147	10.01***	
	(3.2874)	(2.84)	
Average teacher salary	0.0002	-0.0008**	
	(0.0007)	(0.0003)	
Per pupil expenditure	0.0001	0.0007***	
	(0.0001)	(0.0001)	
% LEP	-7.434	-17.28***	
	(5.6858)	(5.0202)	
% Poverty	-6.188**	4.689***	
	(2.7704)	(1.5767)	
Enrollment	5.592**	6.354***	
	(2.6468)	(1.7859)	
District fixed effect	Yes	Yes	
Adj. R-squared	0.875	0.901	
N	2437	2267	

Table 3. Effect of NCLB on equity: Interaction with the share of White student

*Note.* Statistical significance is \*\*\*p < 0.01. \*\*p < 0.05. \*p < 0.1.

Variables	GEPA	HSPA	
NCLB	1.0849***	0.3706	
	(0.3711)	(0.3645)	
NCLB*Poverty	4.2082***	1.5522	
	(5.7645)	(2.2354)	
% Poverty	-9.6443***	3.0923	
	(0.0847)	(2.5266)	
% White	2.4680	3.0492	
	(7.1344)	(2.3864)	
Average teacher salary	0.0002	0.0007	
	(0.0008)	(0.0003)	
Per pupil expenditure	0.0002	0.0001	
	(0.0007)	(0.0001)	
% LEP	-7.9835	5.8263	
	(16.9015)	(5.0574)	
Enrollment	5.8570****	2.6277	
	(6.8050)	(1.7811)	
District fixed effect	Yes	Yes	
<i>R</i> –Squared	0.901	0.913	
N	2437	2267	

Table 4. Impact of NCLB on equity: Interaction with students at poverty

Note. Statistical significance is \*\*\*p < 0.01. \*\*p < 0.05. \*p < 0.1.

## Discussion and conclusion

This study aims to explore the shape of the efficiency–equity trade-off in education policy induced by NCLB across New Jersey school districts, using the dataset of the academic year prior to NCLB and the eight academic years after the beginning of NCLB, AY2001–02 through AY2008–09, for empirical analysis. Okun (1975) emphasized the efficiency–equity trade-off, which is often defined as a zero–sum game (Stone, 2002). It appears that the trade-off is an indispensable issue for policy makers, and they should consider both economic concepts in the provision of public goods and services.

However, with regard to the evaluation of education reform, empirical studies show mixed findings, such as no relationship (Bradley & Taylor, 2004; Schutz, 2008), a complementary relationship (West & Peterson, 2006), and a trade-off relationship (Björklund et al., 2004). Specifically, Schütz et al. (2008) found that the level of student performance is not associated with the distribution of the outcome. In order to test this trade-off issue empirically, we took the case of NCLB, which has received much attention as a recent education reform. As the GPRA of 1993 led governments to emphasize efficiency in the delivery of public service, the major concern of NCLB of 2001 was to enhance nationwide educational quality. Specifically, NCLB was an act that distributed federal budgets according to student achievements, proficiency level, and AYP and that allowed state governments to distribute their budgets flexibly in order to reduce the test score gap across the groups. In this vein, the case of NCLB offers a unique opportunity to examine the trade-off between efficiency and equity.

Based on the results for eighth graders, both equity and efficiency for New Jersey school districts could be achieved with the introduction of NCLB. The accountability education reform, with a focus on disadvantaged students, could be well suited to promote efficiency and equity together. However, we also found that there could be a trade-off for high school students even within the same district. This is similar to the divergent findings regarding the effect of NCLB on student achievements (Dee & Jacob, 2011; Lee & Reeves, 2012). Previous literature on efficiency in the education sector has pointed to two main mechanisms of inefficiency: monitoring activity and competition. Thus, an alternative explanation for the heterogeneous effect is that high schools even within the same district face different levels of competition and monitoring. Results-oriented reforms might induce differential incentives for agents at high schools compared to those in elementary schools. The contrasting findings in the effect of NCLB on efficiency need more discussion; GEPA test scores with a focus on eighth grade show an enhancement in efficiency while HSPA test scores in eleventh grade appear to generate more inefficiency. From the stochastic function approach, the efficiency is defined as the achievement of output from a given amount of input. This might address each school's heterogeneous and strategic behavior in response to external accountability mechanisms within a school district. For instance, with the same level of resources, schools focus more on lower grades to fulfil the requirements of NCLB. This is exemplified by several anecdotes in the process of implementing NCLB, such as focusing on students near the passing cutoff, teaching to the test and skim creaming (Griffith & Scharmann, 2008; Groen, 2012).

In sum, we actually failed to find solid evidence whether a trade-off between efficiency and equity exists in a change in education policy. While a potential trade-off was observed in high schools, NCLB was shown to improve equity and efficiency in the eighth graders in New Jersey public schools. From the efficiency perspective, NCLB expanded the federal role of controlling school funding and ensuring public school quality, whereas from the equity perspective, it increased the state's role in closing student achievement gaps in New Jersey through the Abbott decision (Education Law Center, 2018). Therefore, the findings are still mixed and it is hard to generalize the empirical results followed by the efficiency– equity trade-off. Rather, the mixed findings suggest that the multiple layers of governments in the U.S. should establish a consistent policy trend. Furthermore, it need to have a different policy focus between efficiency and equity based on the ages of the students.

Despite the limitation here, our study envisions several avenues for future research. For instance, we employ the New Jersey state standardized exam in reading and math, which is affected by NCLB. However, when a high-stakes exam is regulated by NCLB, there could be behavior changes at schools in response, such as teaching to the test and bubble effects (Jacob & Levitt, 2003). Future studies should incorporate exams that are not directly influenced by NCLB.

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# Footnotes

- 1. According to Stone (2002), equality means a uniform distribution. That is, allocating each party the same resources, regardless of the party's condition. Equity means allocating resources according to need, bringing each party to the same level. Thus, equality does not mean equity.
- 2. According to Berne and Stiefel (1984), the three principles are equal opportunity, horizontal equity and vertical equity. Equal opportunity means that education should be equally provided for students. Horizontal equity concerns the overall distribution of budgets across school districts, and vertical equity concerns school districts and students who require special needs.
- 3. They were students who had limited English proficiency, belonged to low income and minority groups, and needed special education services.
- 4. NCLB publicizes "detailed information on school-specific performance and linking that high-stakes test performance to the possibility of meaningful sanctions can improve the focus and productivity of public schools" (Dee & Jacob, 2011, p. 418). As educational accountability policy NCLB gives incentives to schools—face sanctions under NCLB—to use their available resources efficiently to improve performance. A number of scholars pointed this out. For instance, Hanushek and Raymond (2001, pp. 368-369) argue that accountability policy rests on "assumption that a focus on student outcomes will lead to behavioral changes by students, teachers, and schools to align with the performance goals of the system" and that "explicit incentives [...] will lead to innovation, efficiency, and fixes to any observed performance problems." Valenzuela et al. (2007) also state that "the roots of NCLB are planted in an efficiency model that begs for evidenced-based research that has long veiled educational decisions"(p. 2).
- 5. The poorest schools belong to category A, while the wealthiest schools to category J. The DFGs represent a significant method of categorization in the New Jersey public education system.
- 6. Two criteria are required to the validity of instrument variables: exogeneity and relevance. Exogeneity is tested with the overidentifying restrictions test, an approach to test the hypothesis that additional instruments are exogenous. For the relevance test, we computed the F-statistics testing the hypothesis that the coefficients of instrumented variables are all zero in the first-stage regression. Based on results of checking validity of instrument variables, we do not completely handle the endogeneity issue in cost function.
- 7. Equation (3) is used to estimate the efficiency that each school district has at given year (t). The produced efficiency measure is employed to analyze the impact of NCLB on efficiency in Equation (5).

	Test score gap in GEPA		Test score ga	Test score gap in HSPA	
Variables	White and	White and	White and	White and	
	Hispanic	Black	Hispanic	Black	
NCLB	0.1887	-1.8685*	1.0013	-0.3215	
	(1.1138)	(1.0465)	(0.9657)	(0.9143)	
Average teacher salary	0.0004	-0.0016	0.0016***	0.0003	
	(0.0021)	(0.0023)	(0.0005)	(0.0004)	
Per pupil expenditure	-0.0008	0.0001	-0.0013***	-0.0004*	
	(0.0006)	(0.0007)	(0.0002)	(0.0002)	
School district fixed effect	Yes	Yes	Yes	Yes	
R-squared	0.795	0.873	0.586	0.688	
N	1081	898	1503	1139	

# Appendix. Impact of NCLB on Equity: Test score gap