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Intradistrict equity of public education resources and performance

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Abstract

This paper presents empirical evidence on input and output equity of expenditures, teacher resources, and performance across 840 elementary and middle schools in New York City. Historically, researchers have studied interdistrict distributions, but given the large numbers of pupils and schools within many urban districts, it is important to learn about intradistrict distributions as well. The empirical work is built on a framework of horizontal, vertical, and equal opportunity equity. The results show that the horizontal equity distributions are more disparate than what would be expected relative to results of other studies, vertical equity is lacking, especially in elementary schools, and equality of opportunity is at best neutral but more often absent. Middle schools exhibit more equity than elementary schools. The paper is one of the first to measure output equity, using levels and changes in test scores to do so.

JEL classification: I; 12; 122

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1. Introduction

Most US states organize their K-12 school system into a large number of districts that vary greatly with respect to enrollment and numbers of schools.[2] While data on resources and performance across districts are generally plentiful, such information within districts is scarce. This lack of intradistrict resource and performance data is a significant shortcoming considering that large urban districts account for a sizable proportion of students, education spending, and low performing schools in many states.[3]

Until recently researchers interested in school finance equity have relied on district-level data and analyses, focusing primarily on the relationship between fiscal capacity and educational needs on the one hand and

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[2] Twenty-three of the states have more than 250 school districts (National Center for Education Statistics, 2000).

[3] For example, New York City's 1.1 million students account for about one third of New York State's public school population, while its $11 billion in spending across 1100 or so schools accounts for roughly 33% of education spending across the entire state. In fact, New York City educates more pupils than 38 states (U.S. Census Bureau, 2000). Although New York City represents one extreme it is by no means the only such case. States with sizable numbers of districts some of which are quite large include: Illinois (Chicago), California (Los Angeles and San Diego), Texas (Houston and Dallas), Pennsylvania (Philadelphia and Pittsburgh), and New York State (New York City, Buffalo, Rochester, Syracuse, and Yonkers).

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resources on the other hand. They find that inter-district resource disparities within states decreased from the 1980s to the 1990s, but between-state differences in per-pupil resources remained large, and relative rankings of states changed little (Hussar & Sonnenberg, 2000; Parrish & Hikido, 1998; Wyckoff, 1992). Rubenstein and Moser (2002) find that the distribution of resources is more equal in states with fewer districts relative to students and in states with higher proportions of revenues provided by state governments, while Evans, Murray and Schwab (1997) and Murray, Evans and Schwab (1998) show that court ordered education finance reforms have contributed to decreases in dispersions in the states where they took place by increasing spending in poor relative to less poor districts.

With the advent of school-level resource data in the early 1990s, researchers have been able to analyze school-level resource distributions, often ignoring district boundaries and using all schools in a state. These school-level analyses reveal wide disparities (Betts, Reuben & Dannenberg, 2000; Burke, 1999; Hertert, 1996; Nakib, 1996; Owens & Maiden, 1999; Schwartz, 1999). Researchers focusing on school-level data within large urban districts find significant disparities in resources and in some cases in the relationship between resources and poverty (Berne & Stiefel, 1994; Rubenstein, 1998; Stiefel, Rubenstein & Berne, 1998).

School finance equity researchers often focus exclusively on the input or resource side of the educational process, ignoring issues of output equity. A notable exception is the volume edited by Berne and Picus (1994), which consists of 12 papers all devoted to exploring ways to analyze output equity. In more recent years, the attention of state courts to the goal of adequacy in school finance has led economists such as Reschovsky and Imazeki (1998) and Duncombe and Yinger (2000) to estimate district cost functions that can be used to predict the amount of resources needed to produce adequate outcomes. Even with these adequacy studies, however, little has been documented on the distribution of outputs within large urban areas.

This paper adds to our knowledge by analyzing the distribution of resources and performance across New York City elementary and middle schools.[4] Particularly notable is our inclusion of performance measures along with traditional measures of spending and resources. The paper is organized as follows. In Section 2, we develop a conceptual framework for measuring intradistrict equity, while in Section 3 we describe the data and variables. In Section 4, we present empirical results and in Section 5 we conclude.

2. Measuring equity in intradistrict resource allocation and performance

While there are a variety of ways to conceptualize and measure *intra*district equity in school financing, here we adapt Berne and Stiefel's (1984) *inter*district framework in which three equity concepts are analyzed: horizontal equity, vertical equity, and equal opportunity. Horizontal equity specifies that equally situated students should be treated equally and, therefore, in our analyses of spending, we study general education operating revenue, separating it from categorical revenue, which is directed to specific student groups (English language learners, immigrants, poor, low performers, special education students etc.).[5] The operating revenue is intended to be allocated as a base upon which resources for special needs are added or supplemented and, as such, we expect the base to exhibit a high degree of horizontal equity across students. Many statistical measures can be used to identify the degree of horizontal equity in resources per pupil; here we present the range and coefficient of variation (with other possibilities yielding the same general conclusions).[6]

Vertical equity focuses on the treatment of differently situated students, implicitly assuming that students require different amounts of resources to achieve set levels of performance. In order to measure vertical equity in spending, we include categorical revenue with general education operating revenue and we specify school and student characteristics that have been identified with higher costs of learning, such as poverty status, limited English proficiency classification, high mobility, and learning disability status. (See Coleman et al., 1966, for one of the first studies to document some of these associations and Betts et al., 2000, for a more recent study with similar findings.) We use multiple regression analysis, with total spending per pupil as the dependent variable and characteristics of pupils as the independent variables, to measure vertical equity.

We conceptualize equal opportunity in resource allocation in two ways. A neutral formulation posits that equal opportunity exists if there is a *lack* of association between per pupil resources and characteristics associa-

[4] High schools are not included because comparable performance measures across the schools are not available. This will change after 2005 when passing grades on five Regents examinations will be required to graduate from New York State high schools.

[5] General education operating revenue accounts for the largest portion of most school financing and, in New York City specifically, it is approximately two-thirds of total funding.

[6] For example, other measures include the 95th to 5th percentile range, the Gini coefficient, the Theil coefficient, Atkinson's Index, and the McCloone Index (see Berne and Stiefel, 1984 for details).

ted with historically disadvantaged groups, while an affirmative action formulation posits that equal opportunity is achieved if there is a *positive* association in the relationship. We characterize disadvantaged groups at the school level in New York City as the percentage of non-white students and the geographic location of the school.[7] For both formulations, multiple regression analyses are used again to measure the extent to which characteristics of students or schools explain variations in resources.

Equity in the distribution of performance is not as commonly measured as equity of resource distributions. Such measures are useful, however, because ultimately concern over resource distribution is tied to a concern over the distribution of performance. In this study, we apply the concepts of horizontal, vertical, and equal opportunity equity to two measures of school-level performance — the *level* of performance (measured by test scores in reading) and the *change* in performance between two years (or value-added as it is commonly called). While we can easily predict that performance levels will be highly unequal, we cannot predict how value added in performance will look.

3. Data and variables

Our analyses use three sources of data published by the New York City Board of Education (BOE): *School Based Expenditure Reports, Fiscal Year 1997–98*; *Annual School Reports, 1997–98*; and *CTB Reading Tests By Quartile*. All spending is coded by source of funds, by function, and by student type. In the analyses, we report school-level distributions and regressions by the instructional level, elementary or middle as classified by the BOE, which results in approximately 660 elementary schools and 180 middle schools. All analyses are pupil weighted in order to account for differences in school sizes.

Table 1 displays the names, definitions, and descriptive statistics for all variables. Two per-pupil expenditure variables allow us to pair funding sources with student numbers. The funding sources cover *revenues for operation*, which are funds that provide for the basic education of students, and *total revenues*, which are funds that provide for basic education plus additional or extra education needs of students. The student numbers are general education students (all students except full-time special education) and all students. Revenues for operation are paired with general education students (operating funds per GE student) for horizontal equity analyses and total revenues are paired with all students (all funds per all students) for vertical equity analyses. In general, middle schools spend more per pupil than elementary schools ($7141 versus $7076 for all funds and all students, direct services).

In addition to the two expenditure measures, three input measures are analyzed: pupil/teacher ratios, average teacher salaries, and percentage of teachers who are licensed and certified.[8] As shown in Table 1, in elementary schools the average pupil/teacher ratio is 16.36 (15.19 for middle schools), the average salary is $43,099 ($45,185), and the average percent certified is 86.82% (81.42%).

Two performance measures are included for analyses of output equity — the standardized reading test score and the change in that score across two years.[9] In these analyses we present only elementary school results to conserve space.[10] The reading test score is the percentage of New York City test takers at or above the 50th percentile on national norms in the 4th grade (percent passing) and the change is the difference in the percentage above the 50th percentile from 3rd grade in 1996–1997 to 4th grade in 1997–1998 (change in percent passing). The change provides a ‘quasi-cohort’ number, since many of the students are present in the same school over the two years.

The other variables in Table 1 are used as independent variables in the vertical equity and equal opportunity regressions and their means are consistent with expectations for a large urban school district. The last listed variable is a location dummy, representing geographic location of sub-districts,[11] and it equals one if a sub-district borders a county other than one of the other counties within New York City or borders another state. As in most urban settings with extensive public transit, the borders of New York City are often socio-economically and racially distinct from the inner city, and the borders are

[7] At the district level, the most important independent variable historically has been fiscal capacity as measured by property wealth per pupil, which has been used to measure the degree of interdistrict wealth neutrality. Fiscal capacity cannot be used at the school level because schools within districts do not have taxing authority and thus their fiscal capacity is not a relevant concept.

[8] Percent of teachers with Masters degrees as well as those with more than five years of teaching experience show the same results as the percent licensed, and thus those analyses are not shown here.

[9] The scores are from the McGraw Hill Test of Basic Skills (CTB version of reading).

[10] Middle schools show similar patterns and results are available from the authors.

[11] The governance structure of New York city’s public elementary and middle schools comprises of 32 sub-districts, known as community school districts. Each sub-district has supervisory authority over staffing, budgeting and resource allocation for the schools in their sub-district.

Table 1
Definition and descriptive statistics of variables, 1997–1998

Name	Brief definition	Mean (SD) (pupil weighted)	
		Elementary	Middle
Operating funds per GE student, direct service expenditures	Expenditures from city and state operating revenues for general education students, direct services	$4704 (594)	$4985 (778)
All funds per all students, Direct service expenditures	Expenditures from all revenues for general, part-time and full-time education students, direct services	7076 (1354)	7141 (1393)
Pupil/teacher ratio	All students divided by all full-time equivalent teachers	16.36 (2.18)	15.19 (2.19)
Teacher salary	Expenditures on salaries plus preparation periods per full-time equivalent teacher (no fringe)	43,099 (3764)	45,185 (3637)
Percent certified	Percent of all teachers who are licensed and certified	86.82 (11.42)	81.42 (11.18)
Percent passing CTB reading test	Percent of test takers 4th grade at or above the 50% national norm	55.28 (17.53)	Not used in analyses
Change in percent passing CTB reading test	Change from 3rd grade previous year to 4th grade current year	6.09 (8.18)	Not used in analyses
Percent free lunch (%FL)	Percent of students eligible for reduced or free lunch program	77.28 (22.52)	71.02 (21.52)
Percent limited English proficiency (%LEP)	Percent of students testing below city cutoff on English language test	17.46 (13.35)	15.26 (12.29)
Percent immigrants (%IMM)	Percent students immigrating to US within past three years	8.50 (6.09)	9.03 (6.59)
Percent mobile (%MOB)	Percent students not in school for full year	8.06 (3.37)	6.83 (3.10)
Percent special education (%SE)	Percent all students who are part-time or full-time special education	10.66 (6.13)	14.09 (5.79)
Percent part-time special education (%PTSE)	Percent of general education students who are part-time special education	5.69 (2.36)	7.31 (3.00)
Percent non-white (%NW)	Percent of students who are not white	84.39 (23.28)	82.55 (22.10)
Location dummy (outer)	Categorical variable, schools in districts on outer geographical boundary of New York City	0.39 (0.49)	0.41 (0.49)

readily accessible (to teachers, for example) from outlying suburban areas.

4. Empirical results

4.1. Input equity

Table 2 displays horizontal equity results. In order to assess what these numbers say about how equitable spending and resources are in New York City, a comparative perspective is essential, since there is no absolute answer to the question, "what is fair and equitable?" Several kinds of comparisons are possible: to studies of interdistrict distributions in various years across the states (Hertert, Busch & Odden, 1994; Hussar & Sonnenberg, 2000; Wyckoff, 1992), to studies of intracity distributions (Berne & Stiefel, 1994; Rubenstein, 1998), to standards developed by experts (Odden & Picus 2000), and to comparisons between various types of resources and between elementary and middle schools in this analysis. Interdistrict studies for all states find that, over time, disparities are decreasing in most states, and coefficients of variation are mostly above 0.10 in any one year (about 80% of the states in the early 1990s) with most coefficients between 0.10 and 0.20. In his study of intradistrict equity in Chicago in 1995, Rubenstein (1998) finds that elementary schools had coefficients of variation between 0.12 and 0.27 depending on the dollar measure and 0.16 for pupil/teacher ratios. Berne and Stiefel (1994) find lower coefficients, but their analyses are for the 32 subdistricts in New York City rather than the 840 schools. Odden and Picus (2000), in their textbook on school finance, state that "…an absolute standard of about 10 percent for the coefficient of variation is generally used throughout this text [for interdistrict equity]".

Using these previous studies as a comparison, distributions in New York City schools are somewhat inequitable, with coefficients of variations above 0.10 (see Table 2). Across resources, operating funds per GE student (column 1) should be the most evenly distributed since these resources provide base funding for the majority of pupils. This measure has a coefficient of variation above 0.10. All funds per ALL students (column

Table 2
Horizontal input equity 1997–1998

	Operating funds per GE student: direct service ($) (1)	All funds per all student: direct service ($) (2)	Pupil/teacher ratio (3)	Teacher salary ($) (4)	Percent certified (5)
Elementary schools (pupil weighted)					
Mean	4704	7076	16.36	43,099	86.82
Minimum	2594	3807	6.63	32,181	41.20
Range	8942	14,741	16.97	21,244	58.80
Coef. var.	0.126	0.191	0.133	0.087	0.131
N schools	664	664	663	663	659
N pupils	519,668	548,799	548,748	548,748	546,482
Middle schools (pupil weighted)					
Mean	4985	7141	15.19	45,185	81.42
Minimum	2129	3961	7.73	28,205	35.70
Range	10,385	13,563	14.29	25,694	64.30
Coef. var.	0.156	0.195	0.144	0.08	0.136
N schools	186	186	186	186	180
N pupils	176,620	190,620	190,620	190,620	186,191

2) are less equitably distributed than operating funds per GE student as they should be because they include funds targeted to students with special learning needs and to schools with high percentages of students receiving free lunch, and these sources of funds would not be expected to flow equally to all students. In general the middle schools are less horizontally equitable than the elementary schools on the basis of both measures of expenditures per pupil.

As compared to other studies and norms, New York City's elementary and middle schools have high levels of disparity in per pupil spending for two out of the three teacher resource variables. Thus, as expected, disparities increase when all funds for all students are included in the resource measure. These findings on disparities lead directly to the question of whether some of the horizontal variation is related to factors associated with vertical equity.

Table 3 displays vertical equity results for the five resource variables. There are four independent variables in the vertical equity regressions, representing factors that are commonly cited as raising the costs of achieving learning standards for students and, therefore, all would be expected to have positive signs if resources are distributed in a vertically equitable way.[12] In columns 2 through 5, the percentage of special education students (%SE) is included as a control because there are large, dedicated funding sources for the student counts used in the resource measures (all students), and we intend here to isolate the independent effect of the other factors.

Perhaps most striking feature in Table 3 is that the percent free lunch variable (%FL) has a negative and statistically significant sign in column 1 for elementary schools, even though operating resources measured in column 1 are intended to be provided equally to general education students. This vertical inequity is not found at the middle school level where the same variable is statistically insignificant. The sign on %FL is positive for all funds for both elementary and middle schools (column 2), and thus is consistent with a distribution that is vertically equitable. Also of note is that the sign on the percentage of immigrant students variable (%IMM) consistently shows fewer dollar resources and higher pupil/teacher ratios devoted to schools with higher percents of immigrants, although salaries and characteristics of teachers are higher. (See Schwartz and Gershberg, 2001), for more detail on immigrants in New York City.) Third, the relationship between pupil/teacher ratios and teacher salaries and characteristics shows that while more teachers per pupil are allocated to schools with harder-to-educate students (with the exception of %IMM), teacher salaries and other teacher characteristics are lower. This tradeoff is similar to findings from earlier studies of Chicago, and also showed up after California's recent class size reduction efforts. To the extent that certification is an indication of teacher quality, our analyses show that lower quality teachers are located in needier schools.

Finally, middle schools appear to make larger vertical equity compensations than elementary schools. For example, middle schools show lower pupil/teacher ratios

[12] The regressions are used in the equity analyses to describe resource patterns, not to develop causal relationships and, thus, only those variables pertinent to vertical equity are included in the results presented in Table 3.

Table 3
Vertical input equity 1997–1998 (absolute values of t in parentheses)

Dependent variable:	Operating funds per GE student: direct service ($) (1)	All funds per all student: direct service ($) (2)	Pupil/teacher ratio (3)	Teacher salary ($) (4)	Percent certified (5)
Elementary schools (pupil weighted)					
Intercept	5219.64	4867.18	21.23	48928.31	102.26
	(59.19)∗	(32.69)∗	(83.16)∗	(87.83)∗	(70.84)∗
%FL	−8.18	2.81	−0.03	−73.89	−0.21
	(6.88)∗	(1.59)	(9.18)∗	(11.20)∗	(12.59)∗
%LEP	4.95	14.30	−0.04	−15.27	−0.37
	(2.26)	(4.41)∗	(6.74)∗	(1.26)	(11.78)∗
%IMM	−19.83	−20.37	0.05	149.42	0.94
	(4.42)∗	(2.92)∗	(4.22)∗	(5.72)∗	(13.92)∗
%MOB	24.61	16.37	−0.03	−98.36	−0.11
	(3.30)∗	(1.47)	(1.55)	(2.37)∗	(1.00)
%SE		167.15	-0.21	−30.70	0.04
		(29.11)∗	(21.61)∗	(1.43)	(0.76)
R^2	0.09	0.62	0.57	0.31	0.50
F	15.83∗	212.32∗	171.20∗	58.29∗	130.46∗
N schools	658	658	657	657	655
N pupils	518,126	547,215	547,164	547,164	545,337
Middle schools (pupil weighted)					
Intercept	4883.06	4571.51	20.69	50650.54	98.04
	(24.46)∗	(15.43)∗	(44.93)∗	(53.27)∗	(36.73)∗
%FL	0.68	3.95	−0.04	−95.43	−0.31
	(0.21)	(0.90)	(6.16)∗	(6.81)∗	(7.87)∗
%LEP	9.76	17.30	-0.02	15.65	−0.12
	(1.40)	(1.90)	(1.26)	(0.52)	(1.49)
%IMM	−50.48	−37.70	0.04	88.11	0.55
	(4.13)∗	(2.22)∗	(1.65)	(1.62)	(3.63)∗
%MOB	53.36	43.16	−0.10	−128.62	−0.61
	(2.37)∗	(1.40)	(2.04)∗	(1.30)	(2.21)∗
%SE		146.61	−0.14	82.81	0.45
		(10.52)∗	(6.50)∗	(1.85)∗	(3.59)∗
R^2	0.11	0.52	0.54	0.29	0.42
F	5.35∗	38.59∗	41.45∗	14.84∗	25.26∗
N schools	184	184	184	184	179
N pupils	176,365	190,364	190,364	190,364	186,030

∗Significant at 5% or lower level.

when the percentage of free lunch pupils increases and distribute general education operating funds neutrally with respect to poverty.

Table 4 displays equal opportunity results for the five resource variables. Here the elementary schools distribute their base funds inversely to the percent non-white (%NW), but the middle schools do not (column 1). While higher percent non-white schools have fewer pupils per teacher (column 3), teacher salaries and percentage certified are lower (and these regressions have higher R squares) for both the elementary and middle schools.[13]

The outer sub-districts receive more funds per pupil for the base and all funds and the coefficient is significant for elementary schools, although this relationship does not hold for the middle schools, where the outer sub-districts receive less but not significantly so. The geographic location of sub-districts does not seem to matter for middle schools on any of the resource measures except the pupil/teacher ratio. On the other hand

[13] The percent non-white variable and percent free lunch variable are correlated (0.81 for elementary schools and 0.75 for middle schools), so some of these results are predictable once the results of the vertical equity analysis are known. The equity analyses, however, are meant to document disparities statistically and not to model causality, so the different regressions are informative in an equity context.

Table 4
Equal opportunity input equity 1997–1998 (absolute values of t in parentheses)

Dependent variable:	Operating funds per GE student: direct service ($) (1)	All funds per all student: direct service ($) (2)	Pupil/teacher ratio (3)	Teacher salary ($) (4)	Percent certified (5)
Elementary schools (pupil weighted)					
Intercept	4920.45	4456.50	21.30	50237.44	110.15
	(56.32)∗	(31.15)∗	(79.13)∗	(90.21)∗	(66.32)∗
%NW	−4.02	7.23	−0.03	−76.25	−0.25
	(4.23)∗	(5.05)∗	(11.42)∗	(14.14)∗	(15.68)∗
Outer	315.47	203.36	0.09	1214.24	2.09
	(6.95)∗	(2.98)∗	(0.75)	(4.73)∗	(2.71)∗
%SE		171.59	−0.23	−110.17	−0.25
		(31.90)∗	(23.11)∗	(5.44)∗	(4.03)∗
R^2	0.10	0.61	0.49	0.29	0.30
F	38.09∗	345.23∗	212.88∗	88.71∗	92.96∗
N schools	662	662	661	661	659
N pupils	519,258	548,360	548,309	548,309	546,482
Middle schools (pupil weighted)					
Intercept	4958.58	4373.52	20.29	51876.87	106.14
	(21.45)∗	(13.27)∗	(38.39)∗	(49.76)∗	(36.74)∗
%NW	0.94	6.63	−0.03	−83.01	−0.32
	(0.36)	(1.97)∗	(6.39)∗	(7.81)∗	(10.91)∗
Outer	−123.30	−179.14	0.88	456.26	0.93
	(1.05)	(1.20)	(3.69)∗	(0.05)	(0.71)
%SE		162.89	−0.19	−2.00	0.99
		(12.78)∗	(9.12)∗	(0.05)	(0.88)
R^2	0.01	0.50	0.48	0.27	0.41
F	0.67	60.48∗	55.41∗	21.97∗	40.89∗
N schools	186	186	186	186	180
N pupils	176,620	190,620	190,620	190,620	186,191

∗Significant at 5% or lower level.

location does matter for elementary schools, and the difference in average teacher salaries between inner and outer sub-districts is $1214.

4.2. Output equity

The top panel of Table 5 displays horizontal output equity results for two reading test scores. Because this is the first time outputs have been analyzed in this framework, there are no existing studies for comparison. Certainly one would not expect much horizontal equity in outputs because we know that performance varies widely among students and schools. Nevertheless, the results in Table 5 are interesting because they establish a baseline against which to measure how disparate performance is and to gauge the results of future studies. The dispersions in percent passing (column 1) are quite high, most strikingly exhibited by the range of 81.8 percentage points. The high coefficients of variation confirm that the dispersion is wide and not confined to the tails of the distribution.

The change in percent passing (column 2) is even more widely dispersed than the Percent Passing, showing a coefficient of variation of 1.350. If such high dispersion in the change in performance leads to less disparity in the level of performance, then this type of result need not be viewed as inequitable. The horizontal equity results, which show vast disparities, raise the question of whether there is a relationship between vertical equity factors and the performance measures.

The second panel of Table 5 displays the vertical equity results,[14] where the percent passing regressions

[14] All output equity regressions control for the percentage of part-time special education students (%PTSE) because these students are included in the testing and differential percentages of students across schools could influence the results independently of the vertical equity factors. Full-time special education students are not a control because until very recently they are almost universally exempt from the tests and their test results are not included in the database. Two R squares are presented; the first is from a regression with the 4th grade level as the

(column 1) show that schools with higher percentages of students eligible for free lunch, classified as LEP, and exhibiting high mobility score lower, while schools with higher percentages of special education students display no differences and schools with higher percentages of immigrant students perform better. These results confirm that performance varies with factors usually associated with higher levels of educational need, except possibly in the case of immigrant students.

The results of regressions with the change in percent passing as the dependent variable (column 2) differ from those with percent passing as the dependent variable. The only statistically significant variables are %LEP (negative coefficient) and %IMM (positive coefficient).[15] These results imply that over time LEP student scores will become lower and IMM student scores higher, increasing the dispersion with respect to these groups, if LEP student scores are toward the bottom and IMM student scores are toward the top of the distribution.

The third panel of Table 5 displays equal opportunity output equity results. These regressions demonstrate that schools with higher percentages of students who are nonwhite perform at lower levels, while schools in the outer border sub-districts do better. It is notable that change in performance is unrelated to either variable, implying little change over time in the distribution of scores of these students.

The above output equity results confirm, for New York City, the findings reported for most urban areas — students who are poor, mobile, and English language learners perform at lower levels than those who are not. Unfortunately, the negative results in the analysis of vertical equity for level performance variables are not balanced by positive significant results in the analysis of change in performance. Thus, until the vertical equity and equal opportunity findings for the change in performance across years are significant, there may be little improvement in equity for the level of performance.

Table 5
Output equity 1997–1998

Dependent variable: Elementary schools (weighted by test takers)	Percent passing CTB reading test	Change in percent passing CTB reading test
Horizontal equity		
Mean	55.3	6.1
Minimum	16.3	−25.9
Range	81.8	67.9
Coef. var.	0.317	1.350
N schools	634	626
N tested	68,207	67,586
Vertical equity (absolute values of t in parentheses)		
Intercept	94.39	5.59
	(46.84)∗	(3.37)∗
%FL	−0.47	0.02
	(22.16)∗	(1.01)
%LEP	−0.23	−0.131
	(5.68)∗	(3.87)∗
%IMM	0.10	0.28
	(12.25)∗	(4.14)∗
%MOB	−1.10	−0.18
	(7.84)∗	(1.36)
%PTSE	−0.001	0.04
	(0.01)	(0.29)
R^2	0.69	0.03 (0.79)
F	274.19∗	461.13∗
N schools	632	624
N tested	68,097	67,476
Equal opportunity (absolute values of t in parentheses)		
Intercept	103.43	6.08
	(39.87)∗	(3.53)∗
%NW	−0.52	0.00
	(24.34)∗	(0.16)
Outer	2.71	0.30
	(2.65)∗	(0.45)
%PTSE	−1.01	0.01
	(4.47)∗	(0.06)
R^2	0.50	0.00 (0.78)
F	213.03	739.60
N schools	634	626
N tested	68,207	67,586

∗Significant at 5% or lower level; the R^2 reported in parentheses is from the regression with lagged scores as an independent variable (coefficient constrained to 1.0) and level as a dependent variable.

5. Conclusions

Spending per pupil is horizontally inequitable at both the elementary and middle school levels (coefficients of variation greater than 0.10), vertically inequitable at the elementary level (negative coefficient on percent free lunch), and inequitable for equal opportunity at the elementary level (negative coefficient on percent nonwhite and outer districts). Especially important are the vertical equity and equal opportunity results for elemen-

dependent and the 3rd grade level as an independent variable, where the coefficient on the third grade level is constrained to one. The second, lower *R* square, is from the regression with the change as the dependent variable. Both regressions give exactly the same estimates for coefficients and standard errors. Since some find low *R* squares on change regressions disconcerting, the statistic for the identical regressions with the lags are also reported.

[15] %IMM and %LEP are not overlapping variables. Their correlation is 0.56 for elementary schools and 0.68 for middle schools.

tary schools, results that are not replicated for middle schools.

One of the most consistent findings in this study is the lack of vertical equity and equal opportunity in the distribution of teacher resources (teacher salary and certification). There appears to be a tradeoff between salary and/or certification of teachers and pupil/teacher ratios — schools with lower salaries and lower proportions of certification have more favorable pupil/teacher ratios. The likely explanation for this result is that the system allocates more teacher resources to schools with needier students but the union contract and regulations allow teachers with seniority the right to transfer to desirable schools, which makes it difficult for low performing schools to retain experienced and licensed teachers. In addition, a uniform pay scale makes it difficult to hire licensed or experienced teachers to work in poorly performing schools. Solutions to this problem could include a differential pay scale, which offers more to teachers working in schools with needier pupils, more amenities (e.g. secure parking) at less attractive schools, or renegotiation of union transfer policies.

Difficulty in drawing conclusions regarding output equity stems from a lack of comparable analyses of outputs, although horizontal equity dispersions are high. Vertical equity and equal opportunity analyses show predictable inequities with schools that educate needier and nonwhite students scoring lower. This study provides a baseline for analyses of New York City and a comparative measure for other urban school systems.

State education departments often seek to understand disparities in large urban districts. While data on school-level expenditures are publicly accessible in New York City, they are not in other districts. This leaves open the questions of what the disparities are in other districts and whether New York City is any different than other districts. Different or not, this study demonstrates that New York City has significant room for improvement in providing resources equitably as well as in achieving an equitable distribution of performance.

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