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From districts to schools: The distribution of resources across schools in big city school districts

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Abstract

While the distribution of resources across school districts is well studied, relatively little attention has been paid to how resources are allocated to individual schools inside those districts. This paper explores the determinants of resource allocation across schools in large districts based on factors that reflect differential school costs or factors that may, in practice, be related to the distribution of resources. Using detailed data on school resources and student and school characteristics in New York City, Cleveland and Columbus, Ohio, we find that schools with higher percentages of poor pupils often receive more money and have more teachers per pupil, but the teachers tend to be less educated and less well paid, with a particularly consistent pattern in New York City schools. We conclude with implications for policy and further research.

JEL classification: I22

Keywords: Educational finance; Resource allocation

1. Introduction

Due to the political reality that school districts are the primary funding units for K-12 education, as well as a general lack of data on resources at the school level, the processes and patterns of school-level (intradistrict) resource allocation have received relatively scant attention among researchers, policymakers and the public. While almost 75% of school districts in the United States have fewer than five schools, the largest 100 school districts enroll almost one-quarter of total public school students and average 158 schools each (US Department of Education, Institute of Education Sciences, 2003). Resources have been shown to vary across schools within these larger districts, driven, in part, by differences in students, teachers, or politics (Schwartz & Stiefel, 2004; Iatarola & Stiefel, 2003;

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Rubenstein, 1998; Betts, Rueben & Dannenberg, 2000). Thus, intradistrict allocation is a key component of overall resource distribution. Moreover, there is some concern that the within-district variation is pernicious, for example, allocating more resources to schools with fewer poor children, fewer minority children or fewer immigrants. A 2006 report released by the Thomas B. Fordham Institute (2006) and signed by former Secretaries of Education Rod Paige and William Bennett, among many others, asserts that "even within school districts, there are often vast disparities between schools—disparities that generally favor schools with savvier leaders and wealthier parents" (p. 2). Since it is schools per se as much as districts that actually "produce" education, and since the federal *No Child Left Behind Act* holds schools accountable for improving student academic performance, it is critical to move beyond district-level analyses to more accurately assess the resources available to students in their schools. This is the first step toward developing school finance policies that appropriately target resources to the schools with the neediest or costliest students.

In this paper, we review the literature on the distribution of resources across schools within districts, identify its limitations, and study the intradistrict distribution of resources in three large urban school districts using relatively new, detailed information on school resources, performance, and student characteristics. The paper is organized as follows. The literature review is in Section 2 and school-level allocation information for cities of New York, Columbus and Cleveland, Ohio in Section 3. Section 4 discusses implications for practice and research.

2. What do we know about intradistrict resource allocation?

Although researchers have been examining the intradistrict distribution of resources since at least the 1970s (Summers & Wolfe, 1976; Ginsburg, Moskowitz, & Rosenthal, 1981), the research base has been slow to accumulate, hampered, in part, by a dearth of school-level resource data. The available evidence, though, provides some insight into the distribution of resources across schools, which is often masked in analyses using district-level averages. The available studies use a variety of methods and approaches. For example, some focus on the distribution of resources across schools in different districts while others focus solely on schools within a single district. The objects of analysis (e.g., expenditures versus teacher resources) often differ as well. Despite these differences in approach though, some common themes emerge.

First, focusing exclusively on the distribution of resources across districts is likely to hide substantial variations across schools within districts. Studies conducted at the national, state and district level consistently find large resource disparities across schools. While the evidence directly comparing intradistrict and interdistrict disparities is limited and results vary depending on the object of analysis and sample used, these studies often find larger disparities within than across districts (see for example, Hertert, 1995; Burke, 1999). While no generally accepted benchmark exists for an "acceptable" dispersion, many studies have adopted a standard of .10 or below for the coefficient of variation (Odden & Picus, 2000).[1] Most available studies report coefficients of variation that exceed that benchmark, leading to the conclusion that the distribution of spending across schools within districts is unambiguously uneven.

Second, while the results across studies are somewhat mixed, it is common to find significantly higher per-pupil expenditures in schools with students who may be more expensive to educate (e.g. poor children) and in schools that have higher proportions of minority students. On the other hand, studies consistently find less experienced and educated teachers along with lower average teacher salaries in high poverty, high minority, and low performing schools (see for example, Ginsburg et al., 1981 in New York State; Stiefel, Rubenstein & Berne, 1998 in Chicago, New York City, Rochester and Fort Worth; Rubenstein, 1998 in Chicago; Roza & Hill, 2004, in Baltimore City, Baltimore County, Cincinnati and Seattle; Iatarola & Stiefel, 2003, in New York City; Lankford, Loeb & Wyckoff, 2002; Clotfelter, Ladd & Vigdor, 2005). At the same time, these studies often find that schools with costlier students have *more* teachers relative to pupils. Thus, the positive relationship between expenditures and poverty almost certainly reflects a larger number of teachers offsetting

[1] The coefficient of variation is the standard deviation divided by the mean. Lower values indicate a more equal distribution across schools. See Berne and Stiefel (1984) for more detail on calculating and interpreting measures of dispersion.

lower salaries—and less experienced or credentialed teachers—in high poverty schools.

Third, school-level disparities often appear to result not from purposeful policy decisions, but rather from policies governing the distribution of teachers across schools. Since most large districts have uniform teacher salary schedules and union contracts, the salary differences described above result from the sorting of more experienced and educated teachers into schools with fewer poor children or "easier to educate" students. Teacher transfers and quits may exacerbate these differences as the most skilled teachers are more likely to leave urban schools with many poor students (Lankford et al., 2002; Roza & Hill, 2004).

Interestingly, while a large body of research has examined the effects of state-to-district funding formulae, little scholarly research has examined the methods that large districts use to distribute resources to school sites and the ways that the various formulae and policies translate into school-level resource allocations.

3. New evidence on the allocation of resources within school districts: New York City, Cleveland and Columbus, Ohio

We follow the research on intradistrict resource allocations and estimate a set of multivariate regression models linking school resources to a set of school characteristics. Our work supplements previous research in several ways. First, we make use of unique data sets containing an unusual amount of detail on the level and deployment of resources across individual schools. Second, we compare several large urban districts across states to explore the consistency of resource distribution patterns across multiple jurisdictions. Third, while much of the early work on intradistrict allocations has relied upon univariate measures of dispersion (such as the coefficient of variation), and subsequent work typically focused on bivariate relationships, few analyses focus on more complex multivariate relationships between school characteristics and resources (notable exceptions include Betts et al., 2000; Schwartz, 1999). Finally, our analyses may be particularly relevant from a policy perspective because we examine the New York City public schools, which have been the subject of an ongoing school finance court case. (See *Campaign for Fiscal Equity* (*CFE*) versus *State of New York.*)

The New York State Court of Appeals ruled in the CFE case in 2003 that New York State was not meeting its constitutional obligation to provide a "sound, basic education" to students in New York City public schools, a decision that is almost certain to result in substantial increases in education funding for New York City (Searcy, 2004). The decision, though, largely focused on the distribution of resources at the district rather than school level. Thus it is important to determine whether significant resource disparities exist across individual schools. If so, a large influx of resources could actually serve to exacerbate inefficient disparities across *schools* while reducing inadequacies across *districts.*

As in most large city districts, student enrollments and maximum class sizes drive the allocation of a large portion of resources in New York City. In FY 2005, for example, the district distributed 82% of school-level allocations through the Base Instructional Allocation,[2] which consisted of three components:

(1) a school overhead allocation to fund a principal, guidance counselors and selected other administrative personnel;
(2) a base teacher allocation, which divides each school's general and special education register by maximum class sizes for each grade and program to calculate the number of teachers required[3]; and
(3) a per capita allocation to fund other basic needs such as assistant principals, paraprofessionals, aides and instructional supplies.

Additional funding was provided through a series of specialized formulas targeting students with special needs (e.g., students with limited English proficiency and those eligible for free lunch), specific types of schools (e.g., new schools and schools under registration review [SURR][4]), certain grades (e.g., early grades class size reduction) and specific

[2]See http://www.nycenet.edu/offices/d_chanc_oper/budget/DBOR/allocationmemo/fy04-05/am.html for more details on New York City Department of Education allocation formulas.

[3]The base teacher allocation also includes adjustments for such factors as teacher prep and lunch periods, frequency of course offerings, and "breakage" (additional teachers needed when the student register does not divide evenly by the maximum class size).

[4]SURR schools are ones with low-test scores over several years that are targeted by the state for special attention and increasingly harsh sanctions if they do not improve over time.

types of expenditures (e.g., school-based support teams for special education testing and services).[5]

These formulae are not all-inclusive, however, and do not fully explain the distribution of resources across schools. For example, while the formulae distribute teacher positions, they do not distribute specific teachers. Thus, the sorting of teachers (and their salaries) across schools will have a large effect on school-level spending. Moreover, some resource allocation decisions may be based on less readily-observable factors, such as the political influence and lobbying efforts of a school's constituents (Schwartz & Stiefel, 2004).

Using data on New York City's public schools we estimate a set of spending equations that summarize the distribution of resources across schools in the district, specifically with an eye toward understanding how that distribution is shaped by school and student factors often used in school finance formulae or suggested for use in interdistrict funding (see Stiefel, Schwartz, Berne & Chellman, 2005, for a review of public finance literature examining such common factors). We use a parsimonious set of variables in order to capture the main features of the distributions. While we focus on the New York City results for 2001, we performed similar analyses for 1999 and estimated spending models for two comparison cities—Columbus and Cleveland, Ohio—in order to assess the extent to which the New York City results are unique.

School-level resource data are rare. In fact, no city in New York State makes such data publicly available except New York City. Such data are available in the State of Ohio, however, and we take advantage of this availability to investigate the distribution of resources in Columbus and Cleveland. Both are large urban districts that may, in some respects, be more similar to the large urban districts in upstate New York than is New York City.[6] Thus, we can examine whether the same relationships obtain in large cities in Ohio as in New York City and gain insight into the generalizability of results.

More specifically, we estimate spending models for two expenditure variables: total expenditures per pupil and direct classroom expenditures per pupil. Since previous research suggests that overall expenditure patterns may differ from teacher distribution patterns we also model differences in pupil–teacher ratios[7], the percentage of teachers who are licensed, the percentage of teachers with masters' degrees and average teacher salaries (which reflect, in part, the teacher characteristics) as a function of school-level factors. While there is much debate over the relationship of these teacher factors to student performance, these are the commonly used variables available to represent differences in teacher characteristics. Note that we do not aim to replicate an exact formula, but rather to capture the relationship between funding and observable school and student factors that may be related to the distribution of resources.

Specifically we estimate the following equation:

$$Yi = B_0 + B_1\mathrm{Prog}_i + B_2\mathrm{Socio}_i + B_3\mathrm{Perf}_i + B_4\mathrm{Size}_i + e_i, \quad (1)$$

where i indexes schools, Y is a school level resource measure; Prog is a vector of variables capturing the percentage of students served by programs which impose higher costs on schools such as part-time or full-time special education and English language services; Socio is a vector of variables capturing the socioeconomic characteristics of students that have been associated with higher costs at the district level, such as the percentage of students who are poor, the racial/ethnic composition of the student body, and the percentage of students who are immigrants; Perf is a vector of test scores (fourth or eighth grade reading test scores)[8] that could imply more resources for lower performing schools[9]; Size is a vector of variables representing school size and capturing the impact of returns to scale (enrollment, indicators for 'small', 'medium' and 'large' schools[10]); and e is an error term with the usual properties.

[5]Note that this description refers primarily to base funding, not to categorical programs, which may focus on particular groups of students and have specialized funding formulae or requirements.

[6]Data from the Ohio Department of Education (ODE). Data are for school year 1996–1997, the most recent year for which teacher characteristics data are reported at the school level.

[7]We use this as a rough proxy for class size since no class size data are available.

[8]We define a school as 'elementary' based on the presence of a fourth grade; middle schools are defined by the presence of an eighth grade. New York State administered statewide tests in fourth and eighth grades in these years.

[9]For example, low performing schools in New York identified as Schools Under Registration Review are eligible for state funding.

[10]We define small school as having fewer than 500 students, medium sized schools as having 500–1000 students and large schools as having more than 1000 students. These variables are included as a straightforward method to capture non-linearities

For New York City we pool data on elementary schools and middle schools and interact each independent variable with a categorical variable representing middle schools. This allows us to estimate separate coefficients for elementary and middle schools and assess potential differences in the relationships across schooling level. We do the same in Ohio. In addition, we pool Columbus and Cleveland schools and include a categorical variable for Cleveland.

The spending models examine the question "what characteristics of schools tend to be associated with resources such as funding and teacher characteristics?" Thus, we present unweighted estimates using schools, rather than students, as the unit of analysis. Weighting the data would focus on which students receive higher or lower funding, a related, but conceptually distinct issue.

3.1. The distribution of school resources in New York City

In the 2000–2001 school year, New York City educated more than 725,000 students in 846 schools with fourth or eighth grades.[11] Of these, 249 included eighth grade. As shown in Table 1, in 2000–2001 the average New York City school in the sample enrolled around 850 students. Schools spent about $11,000 per student on average, with just over half of total spending on direct classroom instruction. Appendix Table A contains definitions of each variable. As indicated by the standard deviations, there is considerable variation in spending across schools. While 83% of teachers are licensed and three-quarters hold masters' degrees in the average school, many schools have considerably lower proportions of teachers with these qualifications.

On average 14% of the students in elementary schools and 18% of the students in middle schools perform at the lowest performance level (level 1). The range in performance is also quite wide. While some schools have no fourth graders performing at level 1 in reading, in others, all students perform at that level.[12]

As is well known, New York City schools educate large populations of poor (measured by eligibility for free lunch) and minority students. What is less well known, however, is the wide variation in the demographics of individual schools within the City. Some schools are almost entirely black, Hispanic, or poor, for example, and others have virtually no students from these groups. Further, there is substantial variation in the percentage of limited

Table 1
Descriptive statistics, NYC elementary and middle schools, 2001

Variable	Mean	Std. Dev
Total expenditure per pupil	$10,853	2574
Classroom expenditure per pupil	$5777	1223
Percent licensed teachers	83	13
Percent teachers with MA	75	11
Pupils per teacher	13	2
Teacher salary	$43,880	4908
Enrollment	857	386
Small school	0.17	0.37
Medium size school	0.51	0.50
Large school	0.32	0.47
Percent at level 1 in grade 4 reading	13.59	10.00
Percent at level 1 in grade 8 reading	18.34	12.41
Percent free lunch	74.21	23.86
Percent resource room	6.13	2.64
Percent special education	5.67	5.18
Percent immigrants	6.66	5.79
Percent limited English proficiency	12.65	10.08
Percent black	35.43	30.66
Percent Hispanic	37.27	26.09
Percent other nonwhite	11.11	15.37
Percent female	49.12	3.03
Middle school	0.29	0.46

Number of schools = 846 for all variables with the following exceptions: percent licensed teachers and teachers with a master's degree, $N = 844$; pupil-teacher ratio, $N = 845$; percent at level 1 in grade 4 reading, $N = 650$; percent at level 1 in grade 8 reading, $N = 262$; percent LEP, $N = 832$.

(*footnote continued*)
in the allocation of resources in which schools receive base allocations related to enrollment ranges.

[11]We define small school as having fewer than 500 students, medium sized schools as having 500–1000 students and large schools as having more than 1000 students. These variables are included as a straightforward method to capture non-linearities in the allocation of resources in which schools receive base allocations related to enrollment ranges.

[12]The number of schools reporting test scores in Table 1 reflects the fact that most schools do not have both fourth and eighth grades. No schools are missing test scores at both grade levels. For our regression models, test scores are re-coded with missing values as zero. We also include dummy variables that take the value 1 if a test score is not missing, 0 otherwise. Thus the coefficients on the re-coded test scores capture the relationships between test scores and the dependent variables for the schools that report tests scores at a particular grade level, and the coefficient on the dummy variable indicates whether there is a systematic difference between schools that report test scores and schools that do not.

Table 2
Selected coefficients: correlates of resource allocation, NYC, 2001 (standard errors)

	1 Total expenditure per pupil	2 Classroom expenditure per pupil	3% Licensed teachers	4% Teachers with MA	5 Teacher salary	6 Pupil-teacher ratio
Pct. resource room	130.66***	52.12**	0.96***	0.85***	286.41***	−0.08**
	(39.93)	(21.04)	(0.21)	(0.18)	(97.17)	(0.03)
Interaction with the	−51.16	−41.51	−1.01***	−0.84***	−456.98***	0.00
middle school dummy	(56.92)	(30.00)	(0.30)	(0.26)	(138.51)	(0.05)
Pct. special education	222.35***	75.69***	−0.12	−0.06	−105.16***	−0.17***
	(16.21)	(8.54)	(0.09)	(0.07)	(39.44)	(0.01)
Interaction with the	13.10	21.72	0.40**	−0.02	185.95**	0.03
middle school dummy	(32.88)	(17.33)	(0.17)	(0.15)	(80.00)	(0.03)
Pct. limited English	26.75*	14.05*	−0.35***	−0.14**	2.81	−0.03**
proficient	(14.64)	(7.71)	(0.08)	(0.07)	(35.62)	(0.01)
Interaction with the	161.26***	66.83***	0.21	0.05	64.86	−0.03
middle school dummy	(31.49)	(16.60)	(0.17)	(0.14)	(76.64)	(0.03)
Pct. free lunch eligible	14.89**	10.57***	−0.05	−0.11***	−52.90***	−0.04***
	(6.06)	(3.20)	(0.03)	(0.03)	(14.75)	(0.01)
Interaction with the	−33.16***	−13.64**	−0.09	−0.04	−4.94	0.00
middle school dummy	(11.34)	(5.98)	(0.06)	(0.05)	(27.60)	(0.01)
Pct. immigrant	−17.50	−2.02	0.50***	0.37***	−111.75**	−0.02
	(23.33)	(12.30)	(0.12)	(0.11)	(56.79)	(0.02)
Interaction with the	−101.71***	−34.87*	−0.19	−0.03	59.52	0.03
middle school dummy	(37.13)	(19.57)	(0.19)	(0.17)	(90.36)	(0.03)
Pct. Black	−0.92	0.31	−0.11***	−0.10***	8.68	0.01
	(5.84)	(3.08)	(0.03)	(0.03)	(14.22)	(0.01)
Pct. Hispanic	−6.35	−2.39	−0.08**	−0.04	14.97	0.02***
	(6.73)	(3.55)	(0.04)	(0.03)	(16.37)	(0.01)
Pct. Other Non-White	−3.19	0.26	0.09**	0.09***	77.29***	0.02***
	(7.47)	(3.94)	(0.04)	(0.03)	(18.17)	(0.01)
Pct. level 1, 4th grade	17.96*	15.24***	−0.03	−0.03	11.08	−0.03***
reading	(9.73)	(5.13)	(0.05)	(0.04)	(23.68)	(0.01)
Pct. level 1, 8th grade	1.30	3.30	−0.04	−0.15**	−4.51	−0.01
reading	(13.34)	(7.03)	(0.07)	(0.06)	(32.46)	(0.01)
Enrollment	−1.98***	−0.90***	0.00	−0.00	0.39	0.00***
	(0.50)	(0.26)	(0.00)	(0.00)	(1.22)	(0.00)
Medium school size	−651.39**	−273.99*	−2.66*	−0.90	−462.32	0.31
	(277.46)	(146.23)	(1.46)	(1.26)	(675.21)	(0.23)
Large school size	−378.23	−143.14	−2.86	0.72	262.29	0.42
	(500.47)	(263.76)	(2.62)	(2.27)	(1217.90)	(0.41)
Middle school[a]	2053.45*	932.13	16.38***	5.15	6107.50**	0.60
	(1122.43)	(591.55)	(5.91)	(5.12)	(2731.47)	(0.93)
Constant	9329.67***	4837.17***	87.47***	85.56***	48,589.06***	15.77***
	(621.15)	(327.36)	(3.25)	(2.82)	(1511.58)	(0.51)
Number of schools	846	846	844	844	846	845
R^2	0.51	0.40	0.47	0.49	0.21	0.57

Standard errors in parentheses.
*, **, *** indicate significance at the 10, 5 and 1 pct., respectively. Models include interactions between the middle school indicator and the size and race variables, as well as dummy variables indicating missing test scores.
[a]Elementary schools (those with 4th grade) are the omitted category.

English proficient, immigrant, and part-time special education students.[13]

The key question we examine is: to what extent do observable differences in school and student characteristics explain the variation in spending and other resources? Table 2 presents the results of the regression analyses aimed at answering this

[13]Authors' calculations.

question. Columns (1) and (2) show results for models focusing on total and classroom expenditures per pupil. Columns (3), (4) and (5) present results for teacher characteristics.

To begin, note that this relatively limited set of independent variables explains a significant amount of the variation in the resources across schools. The model explains 51% of the variation in total expenditures across schools and 40% of the variation in classroom expenditures. The model explains roughly half of the variation in the percentage of licensed teachers and the percentage with Master's degrees, and even more of the variation in the pupil–teacher ratio. In contrast, the variation in average teacher salary is not well explained by these regressors—the R^2 is only .21. This may reflect the absence of variables that describe the process by which these salaries are attained, such as the respective bargaining power of the city and teacher unions, or, more generally, the less systematic nature of the process by which teachers sort along salary lines to schools within the district.

Turning to spending, the results indicate that higher spending is associated with a higher percentage of students who are in special education and resource room (i.e., receive part-time special education services), and there is no significant difference between the elementary and middle schools in this regard. As an example, a one percentage point difference in the percentage of students in special education implies $222 more in total spending per pupil in elementary schools, including $76 more in classroom spending per pupil.[14] Both total and classroom spending increase with the representation of limited English proficient students, but the response in middle schools is much larger than in elementary schools. To be specific, a one percentage point increase in the limited English proficient population is associated with an increase in elementary school spending of roughly $27 per pupil, and middle school spending of $188 per pupil. This is consistent with the hypothesis that addressing language needs is less expensively accomplished in early grades than later, though this analysis does not provide a direct test.

Interestingly, the representation of immigrants is not related to spending in elementary schools but is associated with lower spending in middle schools. Thus, the spending increase associated with limited English proficiency is dampened for immigrant students.[15] At the same time, the impact of poverty on spending in middle and elementary schools differs—elementary school spending is higher in schools with greater poverty, while middle school spending decreases with the percentage of the students who are poor. Race is unrelated to spending and more money flows to schools with higher percentages of low-performing fourth grade—though not eighth grade—students.[16] Finally, per-pupil spending is lower in schools with higher enrollments.

Turning next to teacher characteristics, the results are more mixed. Elementary schools with higher percentages of part-time special education (resource room) students tend to have more teachers, with better credentials and higher salaries. Middle schools with more part-time special education students also have more teachers but differences in qualifications are small and average salaries are lower. The representation of full-time special education students is also associated with more teachers in both types of schools, and with higher rates of licensed teachers and higher salaries in middle schools. Teachers in schools with higher proportions of limited English proficient students are less likely to be licensed or have a master's degree, while schools with more immigrants have higher proportions of teachers with these qualifications.

Schools with a higher proportion of poor children have lower percentages of teachers who hold masters' degrees and their teachers are paid less on average. In contrast to our spending results, race is also significantly related to teacher characteristics. Higher representations of black and Hispanic students are correlated with lower teacher qualifications, while the presence of other non-white

[14]Note that the coefficient for each main effect measures the effect in elementary schools, while the main effect coefficient combined with the middle school interaction coefficient measures the effect in middle schools. If either (or both) of these coefficients is insignificant, the coefficient is set to zero when analyzing the effect of its variable.

[15]This result differs, to some degree, with Schwartz and Stiefel (2004), which found little difference due to the presence of immigrants. Their analyses, however, focused on the population of foreign-born students, while the data we use here measure only the size of the recent immigrant population, because of their special treatment in school funding formulae.

[16]Interactions between the middle school indicator and the size and race variables are not reported in the tables because they are generally insignificant. The exception is that the estimates indicate that middle schools with higher representations of black students have somewhat higher total spending.

students (largely Asians) is associated with higher teacher qualifications and higher salaries.

Importantly, we find that the pupil–teacher ratio has the opposite relationship to student characteristics than is observed for teacher characteristics. Schools with higher percentages of poor students, students receiving special education services, students with limited English proficiency and low performing fourth graders have fewer pupils per teacher, while those with more Hispanic students and other non-white students have more pupils relative to teachers.

Taken together, our results provide an answer to a question of particular interest: do schools with greater percentages of poor students receive a different level and mix of resources as compared to schools serving fewer low-income students? Our results suggest that the answer is 'yes'. Overall, elementary schools with higher proportions of poor pupils receive more money and have fewer pupils per teacher but the teachers tend to be less educated and less well paid. In middle schools, we also find more teachers with lower qualifications, though we do not find the same positive relationship between the representation of poor students and spending. These additional staff members in high-poverty schools could play a role in maintaining discipline and an orderly school environment, as well as providing instruction. Finally, as school size increases spending per pupil decreases, suggesting economies of scale in the provision of education.

3.2. The distribution of school resources in Cleveland and Columbus

Table 3 presents descriptive statistics for Columbus and Cleveland schools in 1997. Although undoubtedly large by Ohio standards, both are substantially smaller than New York City with about 103,000 students in 217 schools, 101 in Cleveland and 116 in Columbus. On average, schools in the Ohio cities are noticeably smaller at roughly 475 students than the average 800-student New York City school. Per pupil spending is much lower in Columbus and Cleveland ($6208) in 1997 than in New York City, even adjusting for inflation between 1997 and 2001, and there is much less variation.[17] Notice, however, the share of per pupil spending for instruction is much higher in these two Ohio districts than in New York City. While the percentage of teachers with masters' degrees is much lower in Columbus and Cleveland, the average salary (about $42,000) is not too different than that in New York City (about $44,000).

Table 3
Descriptive statistics, Cleveland and Columbus elementary and middle schools, 1997

Variable	Mean	Std. dev
Total expenditure per pupil	$6208	1265
Instructional expenditure per pupil	$4205	1129
Percent teachers with MA	39.57	13.66
Teacher salary	$42,456	3204
Enrollment	475	172
Small school	0.62	0.49
Medium size school	0.36	0.48
Large school	0.01	0.12
Percent passing grade 4 reading	30.66	14.94
Percent passing grade 6 reading	21.18	16.70
Percent free lunch	70.85	20.35
Percent black	61.16	30.12
Percent other nonwhite	6.52	9.68
Middle school	0.22	0.41
Cleveland school	0.47	0.50

$N = 217$ except percent passing 4th grade reading ($N = 170$) and percent passing 6th grade reading ($N = 49$).

Overall performance in these Ohio districts is low. Roughly 31% of the students pass the fourth grade reading test while about 21% pass the sixth grade reading test, and there is as wide a range of performance as in New York City.[18] The representation of poor students in Columbus and Cleveland is almost as high as in New York (71%) and there is a wide range in poverty across schools. Minority students are fewer in Ohio, and, in contrast to New York City, the non-white population in both Ohio districts is predominantly black.

Turning to the regression results in Table 4, spending in Ohio schools is not related to the proportion of poor students, in contrast to our New York City findings. As in New York City, though, schools with high proportions of poor students tend to have teachers who are less educated and paid less. We find the opposite pattern for student performance in sixth grade, with higher salaries and education in schools with higher test scores.[19] We

[17]Total expenditure includes spending on instruction, operations, administration, pupil support and staff support.

[18]There were no eighth grade tests available in Ohio schools in these years.

[19]In New York City performance is defined as the percent of students at the lowest level but in Ohio is defined as percent passing or above.

Table 4
Selected coefficients: correlates of resource allocation, Columbus and Cleveland, 1997

	1 Total expenditure per pupil	2 Instructional expenditure per pupil	4% Teachers with MA	5 Teacher salary
Pct. free lunch eligible	8.80	5.30	−0.26***	−33.37*
	(6.06)	(5.29)	(0.08)	(18.54)
Interaction with the middle school dummy	−2.72	−6.87	0.02	−20.17
	(12.19)	(10.63)	(0.16)	(37.29)
Pct. Black	4.10	3.45	0.03	−9.17
	(3.28)	(2.86)	(0.04)	(10.02)
Pct. other Non-White	3.99	0.95	0.20	29.70
	(9.42)	(8.22)	(0.12)	(28.82)
Interaction with the middle school dummy	49.91*	45.70**	−0.07	−0.48
	(25.75)	(22.46)	(0.33)	(78.79)
Percent passing grade 4 reading	0.37	−3.39	−0.04	19.22
	(6.80)	(5.93)	(0.09)	(20.81)
Percent passing grade 6 reading	−5.71	−13.92	0.35**	70.30*
	(13.64)	(11.90)	(0.18)	(41.75)
Enrollment	−3.82***	−1.56*	−0.00	1.52
	(0.96)	(0.84)	(0.01)	(2.94)
Medium school size	226.05	1.10	2.63	−544.88
	(283.89)	(247.71)	(3.64)	(868.82)
Large school size	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Middle school[a]	3375.31***	2421.28**	21.70	14,002.62***
	(1195.65)	(1043.25)	(15.34)	(3659.12)
Cleveland school	1438.84***	1465.48***	13.61***	1475.90**
	(200.33)	(174.80)	(2.57)	(613.08)
Constant	6067.82***	3699.24***	50.59***	43,685.34***
	(655.61)	(572.05)	(8.41)	(2006.41)
Number of schools	217	217	217	217
R^2	0.46	0.48	0.24	0.21

Standard errors in parentheses.
*, **, *** indicate significance at the 10, 5 and 1 pct., respectively. Models include interactions between the middle school indicator, the size variables, and the percent black, as well as dummy variables indicating missing test scores.
[a]Elementary schools are the omitted category.

find no relationship, though, between the representation of minority students and any of the resource variables, with the exception of higher expenditures in middle schools with higher proportions of other non-white students.

The relationships between school characteristics and resources tend to be similar to those in New York City. For example there is a negative relationship between enrollment and spending but no consistent relationship between enrollment and teacher characteristics. Ohio schools are also similar to New York City schools in that middle schools have higher spending and salaries than do elementary schools, and there is no difference in teacher education across school types. Interestingly, Cleveland schools spend significantly more than do Columbus schools, with more educated teachers and higher teacher salaries.

Overall, the comparison of the three cities confirms that there is often a trade-off in which, as poverty increases, schools exhibit lower observable teacher quality measures as well as lower teacher salaries, though overall spending sometimes increases. No clear pattern emerges in the relationship between higher performing students and the dependent variables, though there is some evidence of higher spending in New York City schools with more low performing students, and lower paid teachers in these schools in Ohio. As might be expected, given economies of scale, larger schools

tend to have lower spending. These results suggest that although there are common traits across the two very different states compared here, New York City does have some unique features. Considering that New York City is the largest and possibly most diverse school system in the country, the observation of some inconsistencies across cities may not be particularly surprising.[20]

3.3. How large are resource differences?

While the coefficients in the regression analyses provide an indication of direction and magnitude of the relationships between school resources and various student and school characteristics, simulating differences between illustrative schools can provide additional context for judging the importance of these differences. Consider two New York City schools, one with 50% of students eligible for free and reduced price lunch, the other with 100% of students eligible (these schools would be approximately one standard deviation above and below the district mean for free lunch eligibility). Holding other factors constant, the elementary school with a higher proportion of poor students will have approximately $528 higher classroom expenditures per-pupil, with almost two fewer pupils per teacher, as compared to the school with a lower percentage of free lunch-eligible students. Conversely, a middle school with more poor children would have almost $153 lower classroom spending per-pupil than a middle school with fewer poor children. Again, the school with a higher percentage of poor students would have approximately two fewer pupils per teacher.

Teacher characteristics present a different story, however. Using the same illustrative schools, we estimate that the higher poverty school would have approximately 5% points fewer teachers with master's degrees and teachers who earn over $2600 less per year on average, as compared to the lower-poverty school. Similarly, a difference of 50% points would translate into a gap of approximately 5.5% points in the teacher licensure rate and a 4.75% point difference in the proportion of teachers with master's degrees.

These estimates using the regression coefficients hold other factors constant, but in practice, these other factors are not held constant. Instead, the relatively high correlation between student factors such as race and poverty may magnify resource disparities identified in the multivariate analysis. To illustrate this point, Table 5 presents data for New York City elementary schools in the highest and lowest quintile of free lunch eligibility.

The difference in the percentage of poor students here (65% points) is larger than the previous 50% point illustration. As might be expected, the resource differences are even more dramatic. Total and classroom spending in schools with the highest percentage of free lunch-eligible students are over a thousand dollars higher per pupil as compared to spending in the bottom quintile. Schools with the highest proportions of students from poverty, though, have teachers with average salaries almost $4600 lower than those in schools with the lowest proportions of poor students. Similarly, the difference in the proportion of teachers with full licenses and master's degrees is 19% points. This trade-off between teacher quantity and qualifications can be seen clearly in the difference in pupil–teacher ratio. While the lowest poverty schools average almost 15 students per teacher, the highest poverty schools average only 12 students per teacher.

We also observe differences in school characteristics across the two groups. High-poverty schools are larger (806 students on average) than lower-poverty schools (712 students) although the large standard deviations in both cases indicate that there are small and large schools in both groups. Not surprisingly, there is much lower performance in the highest poverty group (20% at level 1 in fourth grade and 23% in eighth grade) than in the lowest poverty schools (4% and 6%, respectively). The high and low poverty schools also differ markedly in the racial makeup of students, with over 95% black and Hispanic students in high poverty schools and only 31% in the schools with the lowest representation of poor students. Thus, we find that both student race and poverty are strongly related to the level and mix of resources at the school level. Poor and minority students receive higher funding on average, which translates to more teachers relative to students, but teachers with lower observable qualifications.

[20]To more directly compare New York City and Ohio results, we re-estimated the New York City models using the variables that are available in Ohio. We first compared these New York City results to the previous ones for 2001, in order to confirm that the relationships described above still hold with a smaller set of variables. The relationships between the resource variables and school characteristics are largely the same, although the school size results are inconsistent.

Table 5
Descriptive statistics, top and bottom quintiles for percent free lunch in elementary schools, NYC 2001 (standard errors)

	Top quintile high poverty	Bottom quintile low poverty
Total expenditure per pupil	11741.65	10164.17
	(2229.25)	(1604.15)
Classroom expenditure per pupil	6279.56	5256.03
	(1109.27)	(815.34)
Percent licensed teachers	75.18	94.58
	(13.47)	(4.55)
Percent teachers with MA	67.29	85.85
	(10.49)	(7.33)
Pupil-teacher ratio	11.93	14.66
	(1.94)	(2.08)
Teacher salary	42047.91	46508.43
	(3940.85)	(5429.85)
Enrollment	805.76	711.91
	(304.1)	(272.31)
Percent at level 1 in grade 4 reading	19.91	3.98
	(8.2)	(3.9)
Percent at level 1 in grade 8 reading	23.31	5.84
	(12.58)	(4.01)
Percent free lunch	96.99	31.9
	(1.91)	(14.48)
Percent resource room	5.43	6.59
	(2.1)	(1.97)
Percent special education	6.97	4.19
	(5.92)	(4.61)
Percent immigrants	4.78	6.27
	(3.71)	(4.54)
Percent limited English proficiency	17.32	7.2
	(10.96)	(5.02)
Percent White	1.04	50.01
	(1.63)	(23.83)
Percent Black	41.78	13.33
	(27.61)	(18.61)
Percent Hispanic	54.43	17.72
	(27.35)	(11.47)
Percent other non-White	2.74	18.93
	(8.47)	(17.29)

Number of schools = 130.

Table 6
Descriptive statistics, top and bottom quintiles for percent free lunch in middle schools, NYC 2001 (standard errors)

	Top quintile high poverty	Bottom quintile low poverty
Total expenditure per pupil	13,154.56	9126.57
	(5143.24)	(1452.97)
Classroom expenditure per pupil	6673.12	4782.55
	(1919.91)	(488.17)
Percent licensed teachers	71.87	86.28
	(13.28)	(8.32)
Percent teachers with MA	64.69	81.32
	(10.42)	(8.27)
Pupil-teacher ratio	11.52	15.82
	(2.16)	(1.86)
Teacher salary	43,126.65	47,320.46
	(5537.31)	(5838.86)
Enrollment	789.41	1110.49
	(430.68)	(482.33)
Percent at level 1 in grade 8 reading	29.06	6.83
	(10.93)	(6.)
Percent free lunch	96.08	34.36
	(2.59)	(12.48)
Percent resource room	7.49	7.29
	(3.46)	(4.62)
Percent special education	9.64	4.11
	(5.36)	(3.44)
Percent immigrants	7.06	4.19
	(14.39)	(3.08)
Percent limited English proficiency	20.23	5.03
	(14.91)	(4.15)
Percent White	1.09	41.72
	(1.41)	(23.14)
Percent Black	38.98	22.60
	(27.76)	(24.52)
Percent Hispanic	55.64	17.66
	(27.34)	(10.15)
Percent other non-White	4.28	18.02
	(13.67)	(14.57)

Number of schools = 41 in top quintile and 39 in bottom quintile.

Middle schools (Table 6) exhibit even larger spending disparities across the quintiles despite a slightly smaller gap in the percentage of poor students, with a difference of over $4000 for total spending and almost $1900 in classroom spending. The differences in teacher characteristics are in the same direction—though of slightly smaller magnitude—as compared to the elementary school differences. The differences in pupil–teacher ratio are even larger, though, with high-poverty schools averaging more than four fewer students per teacher. Once again there are stark differences in student race and performance, as schools with larger proportions of black and Hispanic students, and higher proportions of low-performing students, receive substantially higher expenditures and more teachers, but teachers with lower qualifications.

Taken together, these quintile comparisons and multivariate analyses illustrate that the relationships between student characteristics and school resources such as spending and teachers are both statistically significant and of practical importance.

The multivariate analyses demonstrate that, even controlling for numerous covariates, schools with higher proportions of low-income students tend to have higher spending and more teachers, but the students in these schools are more likely to be taught by less educated, less experienced teachers with lower salaries. Because of the high correlation between student characteristics such as poverty, race and low performance, the typical differences between high and low poverty schools even in the same district can be quite dramatic.

4. Conclusions and discussion

Our analyses demonstrate the magnitude of intradistrict resource disparities, the relationships between resources and school and student characteristics, and the consistency of these relationships across multiple large school districts. As both the literature review and the empirical work make clear, intradistrict resource disparities are present in New York City and are common in other large school districts. We find consistent evidence of important resource trade-offs, with schools serving high proportions of poor and minority students receiving higher funding, enabling them to hire more teachers, but less experienced and educated teachers. While our analyses do not attempt to identify—or disentangle—the underlying causes of these patterns, they are likely due to a combination of factors, including uniform teacher salary schedules that provide little incentive for teachers to teach in high-need schools, collective bargaining agreements that provide senior teachers with considerable flexibility to transfer to more desirable schools, and budget allocations that charge schools for an average teacher salary rather than the actual salary of teachers in the school. The patterns also suggest that resource allocation in large city school districts results from a complex interaction of multiple policies and constraints, rather than a directed effort to target a certain level and mix of resources to schools based on the specific needs of students in each school.

Our models offer insight on the types of factors currently related, in practice, to resource distribution in several large districts, but whether these disparities represent efficient or inefficient ways to use resources depends on the underlying reasons for their existence. Current allocation patterns appear to center largely on the factors that may be most within districts' control, namely the level of funding and number of teachers allocated to individual schools. More research is needed, though, to directly assess the effects of these de facto trade-offs between resource quantity and quality within school districts. If resource intensity (in the form of more teachers) can adequately compensate high-poverty schools for the greater difficulties and higher costs associated with serving high proportions of poor students, then current intradistrict resource allocation mechanisms may be appropriate and sufficient to improve student performance. Examination of differences in student performance across the highest and lowest-poverty schools in New York City suggests that they are not. Providing more equitable and adequate opportunities for high student performance across all schools may, therefore, require fundamental rethinking of the ways in which resources are allocated to schools and to students, not simply to school districts.

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Appendix A

Table A1 contains definitions of each variable.

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Table A1
Variable definitions

Variable	Definition
Total expenditure per pupil (NYC)	Direct services to schools (e.g., classroom instruction, instructional support services, school leadership), district and system-wide costs allocated to the school-level and pass-through funds
Classroom expenditure per pupil	Teachers and other educational and classroom staff, textbooks, librarians and library books, instructional supplies, curriculum development, contracted instructional services and summer and evening school
Total expenditure per pupil (Ohio)	Sum of instructional expenditure, expenditure on operations, administrative expenditure, expenditure on pupil support and expenditure on staff support
Instructional expenditure per pupil (Ohio)	Teachers, teacher aides, paraprofessionals, materials, computers, books and other consumable materials that are used with students in the classroom
Pct. licensed teachers	Percentage of teachers who are fully licensed or permanently assigned
Pct. teachers with MA	Percentage of teachers with a masters degree or higher
Pupils per teacher	Number of pupils per teacher
Teacher salary	Average teacher salary
Enrollment	Number of students
Small school	School with fewer than 500 students
Medium size school	School with 500–1000 students
Large school	School with more than 1000 students
Pct. level 1, grade 4 reading	The percentage of students scoring in level 1 on the 4th grade City and State reading tests (this is the lowest performance level of four)
Pct. level 1, grade 8 reading	The percentage of students scoring in level 1 on the 8th grade City and State reading tests (this is the lowest performance level of four)
Pct. passing grade 4 reading	Percentage of students passing the 4th grade proficiency reading test, Ohio
Pct. passing grade 6 reading	Percentage of students passing the 6th grade proficiency reading test, Ohio
Pct. free lunch	The percentage of students eligible for a free school lunch
Pct. resource room	The percentage of students receiving part-time special education services
Pct. special education	The percentage of students receiving full-time special education services
Pct. immigrants	The percentage of students arriving in US fewer than three years ago
Pct. limited English proficiency	The percentage of students whose first language is not English, and whose command of English is insufficient to succeed in an English-speaking setting
Pct. White	The percentage of students who are white
Pct. Black	The percentage of students who are black
Pct. Hispanic	The percentage of students who are Hispanic
Pct. other non-White, NYC	The percentage of students who are Asian or other races
Pct. other non-White, Ohio	Percentage of Hispanic, Asian, Native American, and multi-racial students
Pct. female	The percentage of students who are female
Elementary school	School that serves a grade 4 and does not serve a grade 8
Middle school	School that serves a grade 8 and does not serve a grade 4
Elementary/middle school	School that serves a grade 4 and a grade 8

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